How does National Pension Reform affect household economic behaviors? Evidence from Taiwan

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This paper studies the causal effect of National Pension Reform on household economic behaviors at Taiwan in 2018 to test the permanent income hypothesis. Using difference-in-differences method, I find the phenomenon of consumption smoothing does exist, particularly in the high income households, and the change of consumption expenditure mainly comes from "transport", "communication", and "recreation and culture". However, the current changing scale is much smaller than the future income shock.

In July 2018, Taiwan Legislative Yuan passed the National Pension Reform targeting at public employees, including soldiers, civil servants, and teachers, in order to avoid bankruptcy. Though there are many complex details in this reform, such as decreasing the income replacement ratio or changing the calculation method of the pension, it is certain that the majority of these people will get less pension income after getting retired.

According to the permanent income hypothesis (PIH), people tend to smooth their consumption when facing a future income shock; however, it remains to be an empirical question under what situation people would smooth their consumption. There have been many essays studying the phenomenon of consumption smoothing so far. For instance, Levenson (1995) found no empirical evidence that consumption increases in response to the windfall gain in future earnings in Taiwan, while Filipski et al. (2019) proposed that some deadly shocks that lead people to reflect on their own mortality may prompt them not to smooth the consumption and even save less. Nevertheless, as far as I know, there has not been any empirical study about the relation between the negative future income shock and the phenomenon of consumption smoothing in Taiwan. This reform should be an potential one investigating this topic for the reason that public employees in Taiwan are famous for stable salaries, and thus they are more likely to have the ability to allocate their spending in advance to respond to the reform.

This study may contribute to Taiwan in two aspects. First, we could gain a more profound understanding of consumption smoothing in Taiwan and it is beneficial for any related studies in the future. Second, it is claimed that the National Pension targeting at public employees would be reformed once again in 2023 due to the widespread dispute over the reform in 2018. Therefore, it is vital to realize how people respond to the ongoing reform; otherwise, it is impractical for the government to adjust the policy towards a mutually acceptable direction.

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Table 1—: The Size of the Treatment and Control Group

| | Income | year | | | | | Total |
		2016	2017	2018	2019	2020	
Control	low	5,711	5,530	5,647	5,455	5,074	27,147
	high	4,722	5,094	5,129	5,281	5,506	25,782
Treatment	low	43	36	44	35	36	194
	high	355	360	366	376	373	1,830
	Total	10,881	11,020	11,186	11,147	10,989	55,223

Note: In this table, whether the income of household is high or low is determined by the median of TR per capita.

I. Data and Sample

A. Data

The data was derived from Report on the Survey of Family Income and Expenditure from 2016 to 2020. These surveys are conducted by the Directorate-General of Budget, Accounting and Statistics (DGBAS), and the targets of the surveys are Taiwanese who live in Taiwan as well as their family. The unit of observation is household, and the unit of money is NT dollars. The universal sampling rates are about 0.20%; therefore there are nearly 16,000 observations each year. The items of the surveys include: (i) household members, (ii) household facilities and housing conditions, (iii) income and outlay, and (iv) consumption expenditure. This study is mainly focused on the information about (i) insurance expenditures, (ii) total receipts (TR), (iii) total consumption expenditure (TCE) and its components, and (iv) some demographic variables. In the following context, TR per capita means TR per income recipients, and each expenditure per capita means that expenditure per household persons.

B. Sample and Descriptive Statistics

To perform causal inference, I divide all the households into two groups, the treatment group and the control group, based on insurance expenditures. Specifically, a household whose total expenditure on GEI or SI is not zero implies there is at least one public employee, and thus it would be assigned to the treatment group.[1] In the remaining households, the household whose total expenditure on LI is not zero implies there is at least one worker, and thus it would be assigned to the control group.[2] As for those whose all of these expenditures are not zero, they would be dropped to keep away from the disturbance. Following this classification rule, Table 1 shows there are usually 400 observations in the treatment group and over 10,000 observations in the control group each year. Consequently, the sample size should be large enough to conduct a robust analysis.

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[1]GEI represents Government Employee Insurance, while SI represents Serviceman Insurance.
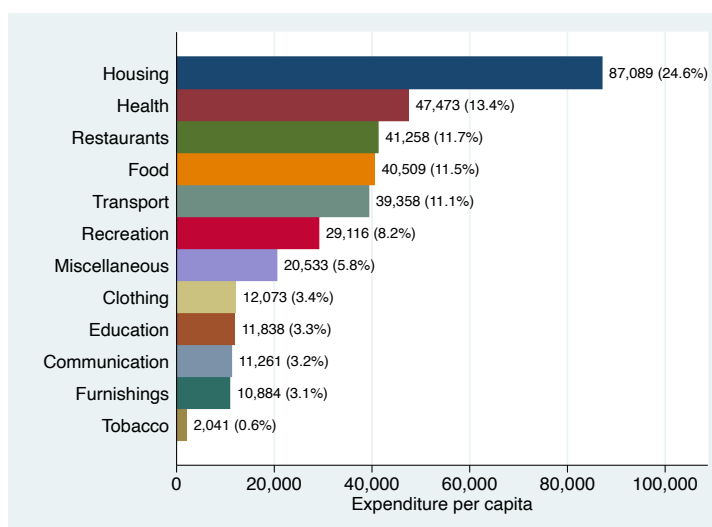[2]LI represents Labor Insurance.

Figure 1. : Descriptive Statistics of TCE and TR per capita
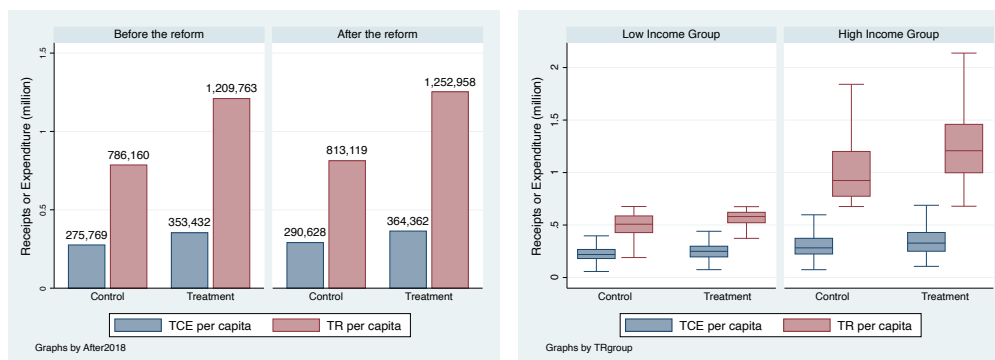
(a) The Sample Mean

(b) The Distributions Before 2019

(c) The Component Expenditures for the Treatment Group Before 2019

In this study, the baseline analysis concentrates on the change of TCE and TR per capita. Figure 1 (a) displays the sample mean of these two variables before and after the reform. Among them, the numbers representing the sample means of TCE and TR per capita in the treatment group before the reform (353,432 and 1,209,763) would be the most important ones for interpretation.

Next, there is a subgroup analysis for different income groups. Figure 1 (b) shows in both low and high income groups, the distributions of TCE per capita between the public employee households and the other households have slight differences, but there are great gaps with regard to TR per capita, particularly in the high income group. In addition, since most of the public employee households have strong earning abilities, the number of them who earn more than the median

of TR per capita is almost 10 times larger than the number of them who do not. Therefore, as shown in Table 1, the size of the treatment group with low income is tiny, which decreases the statistical power of the subgroup analysis.

Finally, a components analysis for the change of TCE per capita is conducted. TCE per capita is consisted of twelve components in total. Figure 1 (c) illustrates all the components, their sample mean, and their proportions of TCE per capita for the treatment group before 2019. Notably, the labels on the figure only take the first word of each expenditure for simplicity (see Appendix for full name).

II.   Empirical Method

A.   Regression Model

This study aims to explore the causal effect of the reform on household economic behaviors, and the models adopt difference-in-difference structures as follows:

$$Y_i = \alpha + \beta_1 treat_i + \beta_2 post_i + \beta_3 (treat\_post_i) + \mathbf{Control}_\mathbf{i}^{'} \gamma + \epsilon_i$$

where the dependent variable, Y_i, refers to the expenditure or the receipt for household i (detailed later); $treat_i$ is a dummy indicating whether the household i belongs to the treatment group or not; $post_i$ is a dummy indicating whether the household i is the observation after 2018 or not; $treat\_post_i$ is the interaction term of $treat_i$ and $post_i$; $\mathbf{Control}_\mathbf{i}^{'}$ is a vector of controls which help to mitigate the potential selection bias (detailed later); ϵ_i refers to the error term. Notably, though the reform is occurred at July 2018, given that TCE and TR per capita have no huge change in 2018, I choose to take "2019" as the the first year of the reform to cope with the data I use.

Y_i is TCE per capita or TR per capita in different models. To make sure the common trend assumption of DiD regression model is satisfied with these two

Figure 2. : Examine the Common Trend
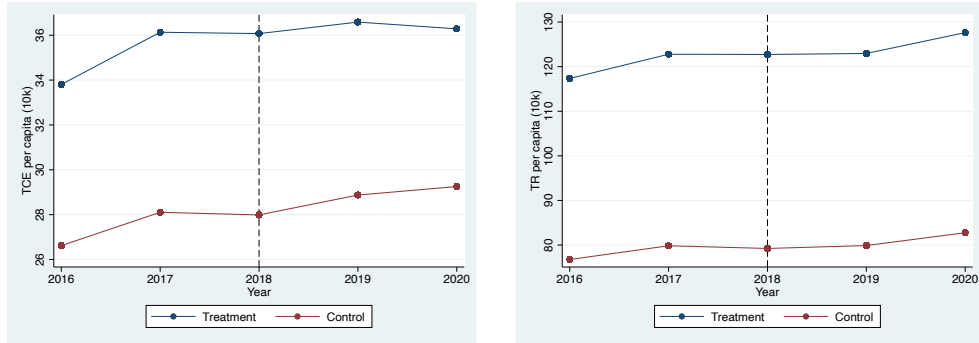
(a) The trend of TCE per capita

(b) The trend of TR per capita

variables, Figure 2 (a) depicts the trends of TCE per capita for the treatment and control group from 2016 to 2020, while Figure 2 (b) depicts the same thing for TR per capita. In both plots, the trends for two groups look almost the same before 2019; therefore, the assumption should not be violated.

The key coefficient of interest is β_3, which represents the causal effect of the reform. When Y_i is any consumption expenditure per capita, it could be interpreted as the average amount of money the target households choose not to spend at once for the sake of their future well-beings. When Y_i is TR per capita, it could be interpreted as the additional amount of money the target households earn on average to prevent the overall consumption from decreasing too much.

B.   Control Variables

In terms of $\mathbf{Control}'_i$, I would control the regression model by four classes of variables listed in Table 2: (i) Number of elders. It is intuitive that people who are about to get retired in short time should be more sensitive to this reform, and hence they may behave in a particular way. (ii) Receipts. The pension should be less valuable for those who are able to earn a lot before getting retired, since they do not need the pension to enjoy their retirement life. Moreover, the more the receipts are, the more the household is able to consume. Hence, it is necessary to control them when regressing on TCE per capita. (iii) Expenditure. The households with higher expenditure per capita have incentive to earn more to remain the quality of life; therefore they should be controlled when regressing on TR per capita. (iv) Education level. Many researches, such as Tamborini et al. (2015), have shown the education would have a large impact on lifetime earnings, and then affect the expenditure. Besides, it is hard to pass the government exam to become a public employee without a certain level of education. Therefore, it is expected that education level is highly correlated with Y_i and the target variable.

Table 2—: The List of Control Variables

Control	Variable	Label
Elders	num_60up	Number of persons above 60 years old
	num_65up	Number of persons above 65 years old
Receipts	TR	Total receipts per income recipients
	CR	Current receipts per income recipients
	$TR2$	Total receipts per household persons
	$CR2$	Current receipts per household persons
Expenditure	TCE	Total consumption expenditure per household persons
	TNE	Total non-consumption expenditure per household persons
	$TCE2$	Total consumption expenditure per income recipients
	$TNE2$	Total non-consumption expenditure per income recipients
Education	ir_edu1	Number of earners whose education status are junior or below
	ir_edu2	Number of earners whose education status are between junior and college
	ir_edu3	Number of earners whose education status are college or above

III. Results

A. Analysis of TCE and TR per capita

I start my analysis by running the DiD regression model (equation in Section II Part A) and using TCE and TR per capita as the dependent variable. Table 3 shows the result, and I would only focus on the estimated coefficient of *treat_post*, which means how much TCE and TR per capita each household in the treatment group would change due to the policy.

In specifications (1) and (4), I do not include any control variable, and both results are statistically insignificant. In specifications (2) and (5), I try to include the control variables related to "number of elders", "receipts" and "expenditure" mentioned in Table 2, and the results become statistically significant at the 5% and 1% level respectively. In specifications (3) and (6), I further include the control variables related to "education level", and both of the t-statistics decline only a little bit. All these results follow the intuition of PIH, that is, when facing a negative future income shock, the households would lower their current expenditure to disperse the future shock. Meanwhile, they could try to increase their permanent incomes to cope with the loss of the pension income.

According to Figure 1 (a), the mean of TCE per capita for the treatment group before the reform is 353,432, indicating on average each member of the household in the treatment group spends over 350 thousand NT dollars on consumption expenditure each year before the reform. The estimated coefficient of *treat_post*

Table 3—: DiD Regression on TCE and TR

	(1)	(2)	(3)	(4)	(5)	(6)
	TCE	TCE	TCE	TR	TR	TR
post	14859.6***	4698.9***	4265.1***	26959.0***	14109.6***	13899.4***
	(12.25)	(5.47)	(5.06)	(5.64)	(5.33)	(5.36)
treat	77663.4***	-10633.1*	-17834.5***	423603.3***	109610.0***	106154.4***
	(16.25)	(-2.47)	(-4.41)	(28.11)	(6.61)	(7.14)
treat_post	-3930.2	-10966.4*	-10388.4*	16235.8	38401.1**	38109.4**
	(-0.55)	(-2.15)	(-2.04)	(0.65)	(2.66)	(2.64)
NumElders	no	yes	yes	no	yes	yes
Receipts	no	yes	yes	no	no	no
Expenditure	no	no	no	no	yes	yes
Education	no	no	yes	no	no	yes
N	55223	55223	55223	55223	55223	55223

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: In this table, TCE is TCE per household persons; TR is TR per income recipients.

Figure 3. : Leads and lags DiD Regression with Control Variables

(a) TCE per capita
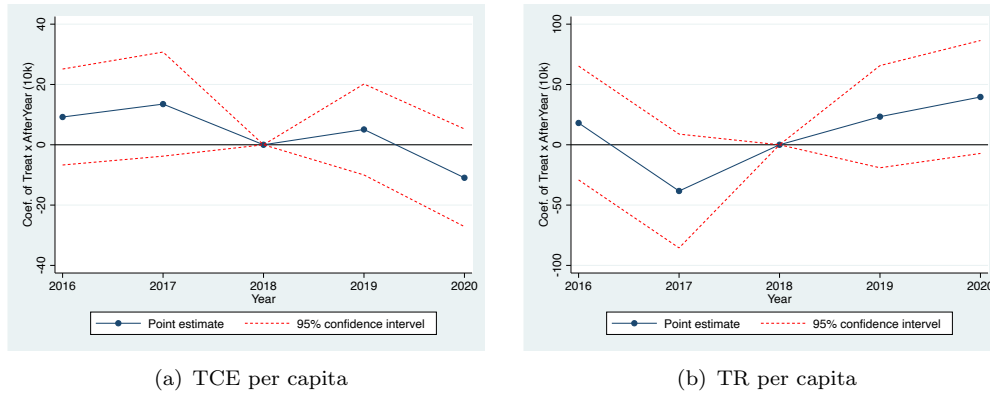
(b) TR per capita

in specification (3) is -10,388, and thus the change rate is about -2.93%. Likewise, according to Figure 1 (a), the mean of TR per capita for the treatment group before the reform is 1,209,763, and the estimated coefficient of *treat_post* in specification (6) is 38,109. Thus, the change rate is 3.1%, which is close to the absolute value of the change rate of TCE per capita. Huang (2018) points out though the change of pension for different public employees vary dramatically, most of the change rates in the first year are ranging from 10% to 20%, and they would constantly increase until ten years later. In the end, the range of the change rates would run up to 20% to 40%. From this perspective, the change of TCE and TR per capita may not be economically significant.

For a robustness check of this analysis, I run the "leads and lags" DiD regression with the control variables used in specifications (3) and (6). Figure 3 (a) shows the change of TCE per capita is not statistically significant before 2019, confirming the common trend assumption when Y_i is TCE per capita. By contrast, Figure 3 (b) shows the change of TR per capita is approaching significance in 2017, which means the reliability of the assumption is not high when Y_i is TR per capita, and therefore the result in specification (6) should be viewed under suspicion.

B. Subgroup Analysis of TCE per capita

In this paragraph, I conduct a subgroup analysis of TCE per capita to develop more insight into the economic behaviors for different income household groups. The classification of different income household groups depends on the median of TR per capita. Specifically, the households whose TR per capita are under the median would be assigned to the low income group, while the other households would be assigned to the high income group. The sizes of both groups are shown in Table 1, and the distributions of TCE per capita for both groups has been discussed in Section I Part B and displayed in Figure 1 (b).

Table 4—: DiD Regression on TCE by Two Subgroups

	Low Income Group			High Income Group		
	(1) TCE	(2) TCE	(3) TCE	(4) TCE	(5) TCE	(6) TCE
post	11898.2***	3682.4***	3135.5***	11359.0***	1799.2	1870.4
	(11.84)	(4.96)	(4.28)	(5.44)	(1.24)	(1.30)
treat	27747.3***	-14745.9*	-18199.3**	40193.7***	-18516.8***	-23366.8***
	(3.30)	(-2.18)	(-2.75)	(7.66)	(-4.36)	(-5.64)
treat_post	28720.1*	20150.5	20506.0	-5001.2	-10864.4*	-10911.8*
	(1.99)	(1.79)	(1.83)	(-0.64)	(-1.97)	(-1.98)
NumElders	no	yes	yes	no	yes	yes
Receipts	no	yes	yes	no	yes	yes
Education	no	no	yes	no	no	yes
N	27612	27612	27612	27611	27611	27611

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: In this table, TCE is TCE per household persons.

I separately run the DiD regression on TCE per capita by these two groups with the same control variables used in specification (3) in Table 3. The results are shown in Table 4. In specifications (1), (2), and (3), the sample is restricted on the low income group, and the estimated coefficient of *treat_post* is positive but statistically insignificant in specification (3). In specifications (4), (5), and (6), the sample is restricted on the high income group, and the estimated coefficient of *treat_post* is negative and statistically significant in specification (6).

It is conceivable that households in the high income group decrease their spending on TCE per capita, since this change is identical to the prediction of the PIH and the result in Section III Part A. As for the low income group, though the households surprisingly increase their spending on TCE per capita in a large scale in specification (1), the result is not statistically significant at all after adding the control variables into the regression.

Nevertheless, in specification (3), the t-statistic of *treat_post* is still high and the estimated coefficient is almost two times larger than the absolute value of that in specification (6); hence, it is worthy of more researches. One possible explanation may simply arise from the tiny sample size of the low income group. After all, a sample with less than 200 observations is hard to be the representative of the entire population. Another possible explanation is that the behaviors of low-income employee households are especially hard to be recognized completely, since the reform has no effect on the public employee whose pension is originally lower than NT\$ 32,160 to take care of the disadvantaged.

C. Components Analysis of TCE per capita

In this paragraph, I conduct a components analysis of TCE per capita with the same control variables used in specification (3) in Table 3 to unravel the details of change of TCE per capita due to the reform. In particular, I run the DiD regression on all kinds of expenditures illustrated in Figure 1 (c), and the results are shown in Table 5.

Among these component expenditures, only the key estimates in specifications (7), (8), and (9) are statistically significant; namely, only the expenditures about "Transport", "Communication" and "Recreation and culture" change significantly. According to Figure 1 (c), after ordering by size, the ranking of these three expenditures for the treatment group before 2019 are separately 5th, 6th, and 10th, which totally account for 22.5% of TCE per capita, and the mean of these three expenditures are separately 39,358, 11,261, and 29,116. Since the estimated coefficients of *treat_post* in Table 5 are separately -4,551, -638, and -3,682, the rates of change for these three expenditures are respectively -11.6%, -5.7%, and -12.6%. Comparing to the change of pension income described in Section III Part A, they are economically significant without doubt.

Table 5—: DiD Regression on Components of TCE per capita

| | (1) | (2) | (3) | (4) | (5) | (6) |
	Food	Tobacco	Clothing	Housing	Furnishings	Health
post	1241.2***	-3.244	-326.9***	791.7**	582.4***	3816.7***
	(9.62)	(-0.05)	(-5.35)	(2.65)	(4.53)	(10.21)
treat	-282.7	-1335.4***	-128.0	-8122.0***	-1229.9*	-2129.7
	(-0.52)	(-7.05)	(-0.38)	(-5.71)	(-2.40)	(-1.58)
treat_post	-250.7	-148.0	-764.7	833.8	308.9	-2258.7
	(-0.31)	(-0.49)	(-1.84)	(0.42)	(0.39)	(-1.14)
N	55222	50742	55128	55223	55220	55221

| | (7) | (8) | (9) | (10) | (11) | (12) |
	Transport	Communication	Recreation	Education	Restaurants	Miscellaneous
post	-572.1	-1270.7***	-2548.4***	46.35	3390.7***	-868.1***
	(-1.26)	(-31.75)	(-12.59)	(0.20)	(20.48)	(-5.09)
treat	-2496.7	-559.0**	412.9	-791.7	-1632.4*	-1969.4*
	(-1.34)	(-3.23)	(0.38)	(-0.99)	(-2.45)	(-2.37)
treat_post	-4550.5*	-637.8*	-3681.8**	1321.3	839.4	-1229.2
	(-2.05)	(-2.57)	(-2.64)	(0.98)	(0.85)	(-1.11)
N	55188	55207	54927	24055	55214	55222

t statistics in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: For simplicity, the name of Y_i is the first word of the expenditure (see Appendix for full name).

Figure 4. : Leads and Lags DiD Regression for All Expenditures per capita
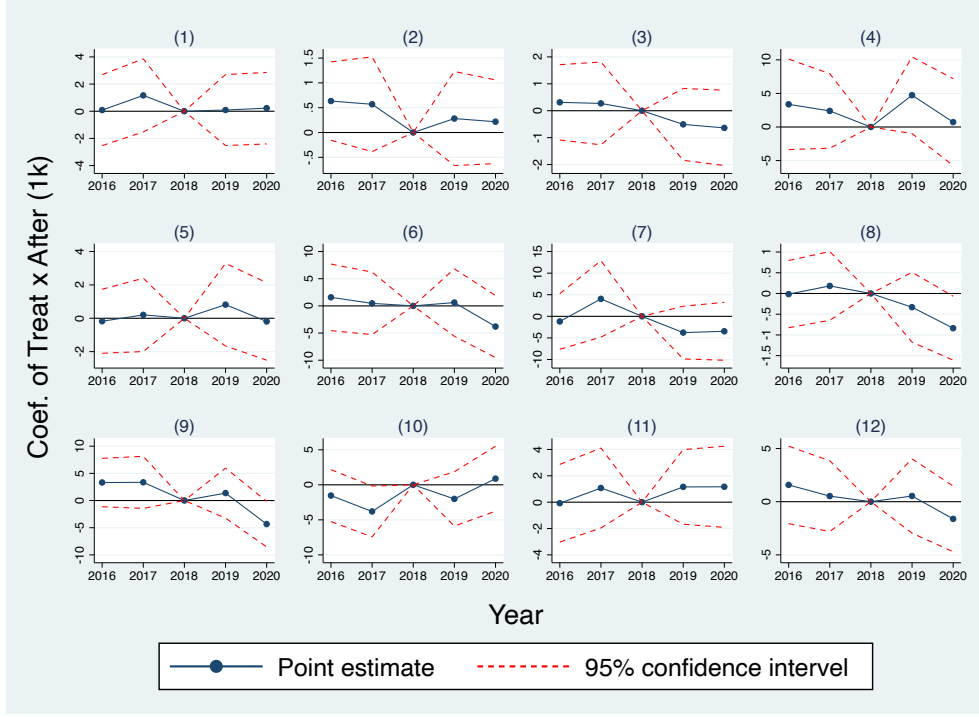
Note: the title of each subplot is the number of the specification in Table 5.

To check the robustness of this analysis, I run the "leads and lags" DiD regression with the same control variables used in the analysis. Figure 4 suggests that except "Education" (subplot (10)), the common trend assumption is not violated when Y_i is all the other component expenditures per capita, since all the changes of them are not statistically significant before 2019.

IV. Conclusion and Discussion

In this paper, I exploit the setting of National Pension Reform in 2018 to analyze the incidence of decreasing pension on household economic behaviors for public employee households. I combine the Reports on the Survey of Family Income and Expenditure from 2016 to 2020 to estimate the causal effect. I find the target households significantly lower their current TCE per capita and increase their TR per capita as a result of the reform. The latter finding may not be robust enough because of the near violation of common trend assumption.

When going through the subgroup analysis, with proper control variables, the high-income household group gets the similar result as above, while the causal effect on the low-income household group is uncertain. However, the finding on

the low-income household group is affected by the small sample size; therefore, it needs more data to validate the result further. When diving into the change of the components of TCE per capita, only three of them are confirmed to decrease significantly, that is "Transport", "Communication" and "Recreation and culture", and this result has passed the testing of robustness. As for the other nine component expenditures, the causal effect of the reform on them remains to be uncertain.

In summary, the phenomenon of consumption smoothing does exist in this case, but the changing scale is not as large as the negative future shock. Here are three hypotheses that can explain the results: First, the economic behaviors of the households would change gradually, maybe because it is infeasible to have an immediate lifestyle change or maybe because the decrease of the pension is also a step-by-step progress. Second, people are willing to sacrifice their current enjoyment for the future only when it would not make a huge difference instantly; otherwise, they would underestimate the shock temporarily. Data about people's feeling concerning their everyday life before and after the reform is required to test this hypothesis. Third, the retirement life is a too-distant-future for most of the people to take into account precisely. Indeed, this view could be justified by the evidence that households which exist with members who are close to the retirement age would change the household economic behaviors more. All in all, it is worthwhile to test these three hypotheses in the future research.

There are two important limitations in this study which are mainly due to the lack of data: First, the effect of the reform on public employees differ a lot by profession and job grade, but this study does not consider these differences since the existing data cannot clarify them. For example, some public employees would not be affected by the reform since their pensions had been lower than the lower limit (NT\$ 32,160), but I am unable to identify these people. Second, I only put emphasis on the change of consumption expenditure and receipts, but ignore the change of wealth, which may be the most influential factor in this topic since the impact of wealth is greater then that of receipts. Both of these limitations are important issues for the future research, and of course, more data is needed to sort them out.

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APPENDIX

The Full Name of the Component Expenditures

Abbreviation	Full name
Housing	Housing, water, electricity, gas and other fuels
Health	Health
Restaurants	Restaurants and hotels
Food	Food and non-alcoholic beverages
Transport	Transport
Recreation	Recreation and culture
Miscellaneous	Miscellaneous goods and services
Clothing	Clothing and footwear
Education	Education
Communication	Communication
Furnishings	Furnishings, household equipment and routine household maintenance
Tobacco	Tobacco, alcoholic beverages and betel nuts