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The Consumption Response to Seasonal Income: Evidence from Japanese Public Pension Benefits

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ABSTRACT

Japanese public pension benefits, which were distributed quarterly through February 1990 and every other month since then, induce substantial but predictable income fluctuations. The relative magnitude of the payments combined with the delay between payments yields a stronger test of the Life-Cycle/Permanent Income Hypothesis than in prior studies. Applying two identification strategies to monthly household panel data, we find that consumption significantly responds to quarterly benefit receipt. Additional analysis suggests that our findings cannot be explained by either liquidity constraints or precautionary savings motives.

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1 Introduction

The Life-Cycle/Permanent Income Hypothesis (LCPIH) is the primary lens through which economists view the impact of household spending decisions and government policies on the largest component of GDP, household consumption. The importance of the LCPIH is reflected in the longstanding tradition of testing empirical implications of the model, e.g., see the surveys of Browning and Lusardi (1996) and Jappelli and Pistaferri (2010). A central prediction of the LCPIH is that consumption changes should not be correlated with predictable changes in income. One approach used to test this implication is to identify anticipated permanent (Shea 1995; Stephens 2008) or transitory (Souleles 1999; Johnson, Parker, and Souleles 2006) changes in income. Contrary to the theory, these papers find that consumption systematically responds to anticipated income changes.[1]

The bulk of the tests of LCPIH in this vein, however, do not examine changes in the amounts of annual salary income or government transfers. Rather, these empirical analyses focus on whether the *timing* of income receipt affects the *timing* of consumption, holding annual income constant. Browning and Collado (2001) find that Spanish "bonus" workers, who receive payments from their employers in June and December that equal their usual monthly income, have similar quarterly consumption patterns as "non-bonus" workers who are paid a constant monthly income stream. Hsieh (2003) finds that Alaskan households smooth quarterly consumption in response to the state's annual oil revenue dividend payment which averages two-thirds of monthly pre-tax household income. Paxson (1993) finds no difference in monthly consumption patterns across Thai households with strikingly different seasonal income variation.

Not all tests of the LCPIH which examine the timing of income receipt yield evidence consistent with consumption smoothing behavior. Parker (1999) finds an increase in consumption among U.S. households upon reaching their annual maximum Social Security limit for tax contributions. Shapiro and Slemrod (1995) find that households expected to change their monthly spending in response to the 1992 reform in the U.S. income tax-withholding law that simply re-allocated the timing, but not the amount, of after-tax income receipt. At higher frequencies, Stephens (2003,

[1] A related literature finds consumption changes associated with changes in income at retirement (e.g., Bernheim, Skinner, Weinberg 2001; Haider and Stephens 2007) although the contemporaneous labor supply changes complicate the interpretation of these responses as violations of the LCPIH (Aguiar and Hurst 2005).

2006) finds a significant increase in weekly strictly nondurable consumption in response to monthly U.S. Social Security check receipt and UK employer paycheck receipt. Using an alternative measure of consumption, Shapiro (2005) finds that caloric intake falls by 0.3 to 0.4 percent *per day* between the monthly receipt of U.S. food stamps while Mastrobuoni and Weinberg (2009) find a 25 percent drop in weekly caloric intake between Social Security checks among those benefit recipients with low levels of savings.

In this paper we use the disbursement patterns of Japanese public pension benefits to test the relationship between the timing of income payments and household consumption. Until February 1990, Japanese public pension benefits were paid every third month. These payments comprise more than 90 percent of total income for the majority of retired households. Thus, a large number of these households are only receiving income once every three months which contrasts with the aforementioned studies of seasonal income variation in which households receive a certain payment once or twice a year *in addition to* a regular monthly income. We test whether households are able to smooth consumption between quarterly public pension benefit payments. Given the relatively long intervals (three months) between which little or no income is received, our analysis of Japanese public pension recipients during this period presents a rather strong test of household consumption smoothing between predictable but regular income receipt.

This test overcomes concerns about the interpretation of findings from prior studies which reject the LCPIH. Some predictable income changes previously examined in the literature are received infrequently, are associated with uncertainty in the amounts that the household will receive, and/or are small relative to annual household income. If households are boundedly rational, in the sense that any deviations of consumption from optimal decisions are relative small, then predictable income changes associated with any one of these three features (infrequent, uncertain, or small) will have relatively small welfare effects (Cochrane 1989; Parker 1999; Browning and Crossley 2003). Since the amounts and distribution dates of the quarterly Japanese public pension benefits are known well in advance of their disbursement and each of these payments represents roughly *one-quarter* of annual income, these concerns do not affect the interpretation of our analysis.

Since public pension benefits are paid to all households in the same calendar months, we cannot

separately identify the impact of benefit receipt from consumption preferences that vary by season if we only examine public pension recipients that are paid on the same quarterly cycle. Therefore, we rely on two complementary identification strategies to estimate the impact of benefit receipt on household consumption. Our first identification strategy relies on a subsequent change in the disbursement policy of public pension benefits. Beginning in March 1990, the distribution of public pension benefits changed from quarterly to being disbursed every other month. This policy change, which had been announced more than a year earlier, left the total annual public pension income received by households unchanged while increasing the number of benefit payments per year from four to six.[2] Under the assumption that any seasonal consumption preferences unrelated to check receipt (e.g., December holiday spending) do not change when the check disbursement policy changes, we can identify the impact of check receipt on consumption by comparing public pension recipients before and after the policy change.

A possible concern with the above empirical methodology is that our identifying assumption may be affected by the onset of Japan's "Lost Decade" which began in 1990 with a decline in land and stock prices. Although the retired households that we examine primarily receive a fixed income stream that is largely unaffected by the current state of the economy, it is possible that the changes in the general economic conditions coincidentally affected seasonal consumption patterns. Therefore, we employ a second identification strategy which is to compare public pension recipient households to households headed by employees ages 50 to 59 during the pre-policy reform period. This alternative comparison avoids the issues arising from using households from different time periods although we must assume that seasonal consumption preferences are the same for both public pension recipient and employee headed households.

We use the Japanese Family Income and Expenditure Survey (JFIES), which collects consumption and income information from households over a six-month survey period, to analyze the

[2] A January 5, 1989 article on page 5 of Nihon-Keizai Shin-bun, the most influential newspaper in Japan, stated

> "The Ministry of Welfare and Health has agreed to bi-monthly payment of public pension benefits. Until now, [these benefits] are paid every three months. While most recipients are eager for monthly payments just like salary since that makes the planning of spending easier, the ministry insisted that monthly payments would be difficult due to their processing ability. However, they have compromised on a bi-monthly payment policy..." (translation by the authors)

impact of quarterly public pension benefit receipt on monthly household consumption. For both of our identification strategies, we reject the LCPIH when payments are received quarterly since we find that household consumption is responsive to public pension benefit receipt during this period. Our point estimates for the increase in non-durable consumption range from four to eight percent across our two identification strategies. We find that consumption remains significantly higher in the month after check receipt and that these patterns exist across all of the consumption categories that we examine. These results contrast with the prior literature which finds no effect of large, seasonal income variation on household consumption (Paxson 1993; Browning and Collado 2001; Hsieh 2003). One possible explanation for the different findings in Japan is that, while these prior studies examine "large" predictable income changes, the consumption fluctuations we examine here are associated both with much larger payments (as a share of annual income) and with longer gaps between receipt of *any* type of income.

We also examine whether variants of the LCPIH can provide plausible explanations for the consumption response to quarterly benefit receipt. Liquidity constraints and precautionary savings motives, which have been found to be important in other contexts, are unlikely causes of our findings since we examine retired Japanese households with a constant and certain income stream. We find that our sample households hold fairly high levels of liquid assets, a finding which is inconsistent with explanations based either on a high rate of time preference or on liquidity constraints. However, the rather long interval between income payments increases the likelihood that credit market constraints might be binding relative to prior studies in which regular income is received more frequently. We find similar consumption responses to check receipt for both high and low income households which yields further evidence against an important role for liquidity constraints.

The paper is set out as follows. We next provide details on the Japanese retirement benefit system including the eligibility for and the timing of benefit payments. We then discuss the JFIES data and present initial results which demonstrate the magnitude of the predictable income patterns across households generated by public pension benefits and the resulting monthly consumption fluctuations. The theoretical and empirical frameworks for our analysis are then presented and are followed by our econometric findings. We conclude by discussing both how our results compare

with prior tests of the LCPIH using seasonal income changes and implications of our findings for future research.

2 The Japanese Retirement Benefit System

The Japanese public pension benefit system involves a variety of pension plans that are both publicly and privately managed.[3] The public pension system is comprised of two tiers: the national pension and the employee pension. Whether or not an individual receives both of these public pensions depends upon their sector of employment. The private pension system for employees consists of both firm-specific pensions and, in more recent years, personal pension plans. The firm-specific benefits are typically distributed as a lump sum at retirement.[4] There are also personal pension plans that are specifically available for self-employed workers who choose to make voluntary contributions to such a pension as well as personal savings plans that are available to the entire population.

The national pension (sometimes referred to as the basic pension) is a benefit available to those who are employed by either a private firm or a government (local or central) as well as the self-employed. The benefit amount received by each participant in the national pension depends only on the number of years the participant made contributions. Earnings levels are not factored into national pension benefit payments.[5] In addition, since 1985, dependent, non-working spouses are beneficiaries of the national pension.[6]

The employee pension is actually a system of multiple pension plans. One plan, the Employee's Pension Insurance, covers private sector workers. There is a separate plan for central government workers as well as one that covers local government employees. Dependent spouses are also covered by employee pensions. Self-employed workers, certain agricultural workers, and employees in small businesses are not eligible for the employee pension.[7] Benefit levels in the employee pension depend

[3] Much of discussion in this section is based on Casey (2004).

[4] Employers at large firms (over 500 employees) are able to offer firm specific pension benefits which can replace part of the employee pension payments. Any amount of the firm specific pension that exceeds the employee pension can be either paid out as an annuity or can be taken as a lump sum. Recent legislative changes have created corporate defined benefit and defined pension plans which will eventually replace these firm-specific pensions.

[5] In 2007, the annual national pension benefit is 792,100 yen.

[6] Prior to 1985, these spouses could voluntarily enroll in the national pension.

[7] Also, part-time employees as well as workers on temporary contracts are ineligible for the employee pension.

upon the individual's earnings while they were working.

The age of eligibility currently differs between the national pension and the employee pension. Before 2001, male public pension recipients were eligible to receive the national pension at age 65 while they could receive the employee pension at age 60.[8] In addition, men who were eligible to receive the employee pension could also receive a "bridge" national pension amount between ages 60 and 64 which equalled the full national pension amount that they would receive beginning at age 65.[9]

Until February 1990, public pension benefits were paid once every three months in February, May, August, and November.[10] The national pension and the employee pension both were paid on the eleventh of the benefit month. Public pension payments were subject to an age-related earnings test. The rules governing the earnings test differed somewhat between those ages 60-64 and those ages 65-69. No such test was imposed on workers ages 70 and above until April 2007. By law, public pension benefits during this period were automatically increased if inflation exceeded five percent. In practice, the government passed special laws each year to increase benefits at the rate of inflation if it did not meet this threshold.

Beginning with the benefits delivered after February 1990, public pension payments have been made on a bi-monthly basis (February, April, etc.). The annual benefit amount did not change which led to a reduction in the amount of each benefit check corresponding to their increased frequency of disbursement. The delivery date for national and employees pensions changed slightly, moving from the eleventh of the month to the fifteenth.[11] Moreover, the earnings test did not change at the time of the reform although it subsequently has been altered. In addition, automatic cost of living adjustments to benefit levels began in 1990.[12]

[8]The age of eligibility currently differs for men and women in Japan. Since our analysis will focus on male headed households, the discussion of benefit ages is limited to male benefit eligibility.

[9]Due to a reform announced in 1994, the eligibility age for the employee pension increased by one year every three years beginning in 2001 so that by 2013 men will have to be age 65 to receive their full employee pension. However, this reform also introduced a form of early retirement whereby men can begin receiving a reduced employee pension as early as age 60. In addition, the bridge national pension prior cannot be received prior to one's employee pension eligibility age.

[10]There were some exceptions to this disbursement pattern which we discuss in the next section.

[11]If the regularly scheduled benefit delivery date falls on a Sunday or Holiday, it was moved to next weekday before 1992, while it moves one or more days earlier after 1992.

[12]Between 1986 and 1994, the period we examine below, the annual Japanese inflation based on the CPI never exceeded 3.3 percent. Moreover, it fell below one percent in four years and was at or below two percent in seven of

3 Data

3.1 The Japanese Family Income and Expenditure Survey

The data we use are from the Japanese Family Income and Expenditure Survey (JFIES). The survey excludes agricultural workers and households of single individuals. The JFIES is a panel survey in which households participate every day for six consecutive calendar months. The panel is rotating meaning that in any given month approximately one-sixth of households are included for the first time, one-sixth are in their second month of participation, etc. The roughly 8,000 households that are interviewed in each month are expected to record all expenditure and income receipt every day of the month in a diary. These diaries are then collected twice a month during each of the six months that the households are a part of the survey. However, the microdata that have been made available for research purposes only identify the month in which each expenditure and income item is recorded in a diary. In addition, retrospective income is collected for the year preceding the first interview. Monthly household demographic and labor force information is also collected in the JFIES.

In order to examine the impact of the public pension payment frequency change, we use JFIES data from March 1986 through February 1994. Two factors influence the March 1986 starting date for our analysis. First, the JFIES did not record daily income data for non-working heads before October 1985 which means public pension receipt cannot be determined among such households prior to this date. Second, since the timing of the quarterly benefit payments changed in February 1986 from March, June, September, December to February, May, August, November, we begin after this initial switch in the benefit distribution date. Our sample period ends in February 1994 in order to use a symmetric temporal window around the March 1990 change in payment frequency.

For our first identification strategy which compares public pension recipients before and after the policy change, we impose some sample restrictions due to the public pension eligibility rules and the sampling scheme of the JFIES. First, we only use male-headed households where the male head is at least 65 years old since national pension benefit receipt begins at this age, regardless

these ten years. Information on the Japanese price index is available from the Japanese Statistics Bureau web page (http://www.stat.go.jp/english/data/cpi/index.htm).

of work status, for everyone who is eligible for these benefits. Second, we limit this sample to household heads that are not employed. This restriction raises the importance of public pension benefits as a source of income while eliminating the impact of other seasonal income fluctuations (such as annual bonus income) on our estimates. In addition, it circumvents the possibility that consumption changes are driven by contemporaneous labor force decisions since, as noted above, one is allowed to work while receiving public pension benefits.[13] Third, we restrict this sample to households that appear in the JFIES for all six months of the survey. Sample attrition in the JFIES is limited with over 90% of households completing all six JFIES interviews.

We limit the public pension recipient sample to "nuclear families" which we define as two person households with a husband and wife. By limiting this sample to nuclear families, we increase the importance of public pension income as the source of household income since we have eliminated the earnings of adult children as a potential source of income. While intergenerational households in which adult children reside with their parents are relatively more common in Japan than in the U.S., Casey (2004) notes that between 7 and 10 percent of couples ages 65 and up live in intergenerational households in Japan while the comparable figure is 1 percent in the United States.[14] Therefore, since the JFIES does not sample single person households and very few elderly couples have children under age 18, only fourteen percent of elderly couples are excluded by dropping those in intergenerational households.

Our second identification strategy compares public pension recipients before the policy change to "employee" households during the same time period where the latter households are headed by a male employee between the ages of 50 and 59, inclusive. We use households in this age range since we want to use comparison households that are not eligible for public pension benefits but for whom our assumption that the seasonal consumption preferences are the same as those of public pension recipients will hold. We exclude the self-employed since the JFIES does not collect monthly income information for these households. As with public pension recipient households,

[13]Focusing on the non-employed only eliminates eleven percent of the sample after imposing the other restrictions listed in this section.

[14]The co-residency figures are much greater for single elderly individuals in Japan with 10 percent of single people ages 65-74 and 35 percent of those ages 75 and above live in intergenerational households. The comparable numbers for the U.S. are 5 and 9 percent, respectively (Casey 2004).

our sample of employee households is limited to married male headed households with exactly two family members.

The summary statistics for the monthly variables, after imposing the above sample restrictions, are shown in Panel A of Table 1 under the heading of "Full Sample."[15] All income and consumption measures reported in the paper are inflated to the year 2000 Yen using the Japanese Consumer Price Index. The Table indicates that, on average, over 80 percent of income for public pension recipients is due to these benefits. It is important to note that the JFIES does not allow us to separate public pension income from other transfer income prior to 1995. However, tabulations using JFIES data from 1995-2005 for comparable households show that over 99 percent of their government transfer income is due to public pension benefits. Thus, we refer to income found in the government transfers category as public pension income for our sample throughout the paper. We also observe that public pension recipient households receive no income in nearly one-third the monthly observations. Our sample of employee households has much higher levels of income and consumption than the public pension recipients. Table 1 also shows that all households have positive consumption in every month for the four consumption categories that we discuss in more detail below.

3.2 Public Pension Income in the JFIES

Given the importance of public pension income in our analysis, we examine this measure in the JFIES to confirm that the reported monthly patterns of public pension benefits match the government's disbursement patterns before and after the change. In addition, we examine the importance of public pension payments as an income source for the public pension recipient households in our sample to highlight the extent to which these benefits are the primary, and many times only, source of income for recipient households. We also document the pattern of income receipt among our sample of employee households.

Figure 1 examines public pension income by calendar month before the pay frequency change for public pension recipient households. Panel A of the Figure presents the share of sample house-

[15] We discuss the wealth measures, total net financial assets and normal deposits, in Section 6.

holds reporting the receipt of public pension income and the share reporting any income at all. Eighty percent of households report receiving some form of income in the months when public pension income is distributed while 60 percent do so during the remaining months. Similarly, over 60 percent of households report receiving public pension income during the months it is distributed while roughly 20 percent of households report receiving these benefits in non-public pension months. Although this last figure may suggest a large degree of measurement error in reporting, some households could, in fact, receive public pension income payments outside of the main check disbursement months during this period. First, as part of the National Public Pension Law which became effective in 1959, a special means tested benefit is available once someone who failed to meet the full contribution requirement of 25 years reaches age 70 if they were born before 1912. This Old-age Welfare Pension System benefit has been distributed in April, August, and December since 1959. Second, public pension benefits, for those who only received the national pension (i.e., those who were self-employed when they were working) and who began receiving their benefits prior to April 1986, were distributed quarterly in March, June, September, and December prior to February 1988 at which point they switched to a bi-monthly disbursement system.[16] Thus, the patterns shown in Panel A of Figure 1 are consistent with the government's public pension disbursement policy. We take steps discussed below to account for these differing patterns across households prior to 1990.

The remaining panels in Figure 1 highlight the importance of public pension benefits as the primary, and in many cases only, source of income among these households. Panel B presents the pattern of average total and public pension income by calendar month prior to March 1990. Even though this Panel includes the small set of households that receive public pension income outside of the quarterly disbursement pattern, the dramatic spikes in total household income during the benefit payment months can be clearly seen. Panel C shows that the share of total income due to public pension benefits over the entire six month sample period exceeds 90 percent for the majority of these households. Finally, as a further check on the reporting of public pension benefits in the JFIES, Panel D shows that the modal household during this period reports receiving public pension

[16]Those only eligible to receive the national pension and began doing so after April 1986 received their checks in the same months as those who received both the national and employees pension both before and after the payment frequency change that we examine here.

benefits for exactly two months. Over fifteen percent of households report receiving public pension benefits for three months which is consistent with the aforementioned alternative bi-monthly pattern of public pension receipt for a subset of households before the pay frequency reform.

Figure 2 shows that, after the payment frequency change, the reported patterns of public pension receipt in the JFIES change accordingly. Panel A shows that over 75 percent of the sample households report receiving public pension benefits during these assigned benefit months while roughly 10 percent do so in the non-benefit receipt months. As Panel B indicates, households still report substantial fluctuations in average total monthly income following the payment frequency change although during different months than before the change. Public pension income remains the primary source of income following the change (Panel C), with over two-thirds of households reporting more than 90 percent of their income from public pensions. Finally, as shown in Panel D, over 60 percent of households report receiving exactly three public pension payments during their six month sample period.

Finally, Figure 3 compares the patterns of income receipt prior to the disbursement policy for our sample of households headed by employees ages 50 to 59 and public pension recipient households. As noted previously, household income is substantially larger among the employees. Multiple spikes in income are observed among employees which coincide with regularly scheduled bonuses paid by Japanese firms that are typically distributed twice a year in December and in either June or July. In addition, some government employees receive a spring bonus in March.[17]

Overall, these figures indicate that the reported monthly public pension income receipt found in the JFIES is consistent with the government's policy for public pension benefit disbursements both before and after the March 1990 payment frequency change. The figures highlight the stark differences in the seasonal income patterns of public pension benefits before and after the pay frequency change as well as between public pension recipients and employees. As can be seen in these figures, a large number of public pension recipient households receive little or no income either during the three month interval between their quarterly payments before the disbursement date

[17]Hori and Shimizutani (2009) provide a discussion of the Japanese bonus system and note that these bonus payments "have become largely institutionalized and are an integral and anticipated component of workers' compensation" (p.4).

change or during the non-benefit payment months following the change. These large, infrequent but predictable spikes in income provide a strong test of the LCPIH since, according to the theory, households should smooth consumption between benefit payments.

3.3 Consumption in the JFIES

We construct household consumption measures from the data recorded in the JFIES diaries. We first examine total household consumption which provides a general understanding of monthly consumption fluctuations although it contains spending on many durable items that are typically examined separately. As such, the primary consumption category that we use for testing the sensitivity to income receipt is non-durable consumption. This consumption category is comparable to the non-durable consumption measure examined in studies of quarterly consumption changes using the U.S. Consumer Expenditure Survey (Parker (1999), Hsieh (2003), and Stephens (2008)).[18]

Since we are examining monthly consumption changes as opposed to the quarterly changes, however, there is some concern that the standard non-durable consumption measure may contain some durable components at this higher frequency. Therefore, we examine two additional measures. First, we follow the approach of Lusardi (1996) which is to define a category of strictly non-durable consumption which restricts items that can be consumed within a quarter.[19] Second, we examine total food consumption, both at home and away from home. This measure is dominated by food at home consumption which comprises over ninety percent of average total food consumption in our sample. Whereas in the United States families may be able to store large quantities of food, household space is far more constrained in Japan. For example, we find that on average households in our sample report purchasing milk nearly five times per month which suggests that trips to stores are rather frequent. Thus, we examine total food consumption since it is a non-durable at monthly frequencies and it provides a useful point of reference since studies in this literature

[18] Non-durable consumption includes food at home and away from home, nutritional supplements, utilities (electricity, gas, water, and other fuel), communication (e.g., phone bills and postage stamps), domestic non-durables (e.g., kitchen items such as plastic wrap and dishwashing detergent), automotive maintenance, toiletries, tobacco, clothing services, medical goods and services, public transportation, recreational goods and services, personal care services, domestic utensils, clothing, footwear, reading, and personal effects.

[19] Strictly non-durables include food at home and away from home, nutritional supplements, utilities, communication, domestic non-durables, automotive maintenance, toiletries, tobacco, clothing services, medical services, public transportation, recreational services, and personal care services.

typically examine the food consumption response.

The monthly fluctuations in consumption induced by the varying seasonal income patterns are shown in Figure 4. This Figure plots the average change in the log of daily non-durable consumption by calendar month across the different groups used in our analysis.[20] The solid lines shown in both Panels of the Figure correspond to the quarterly paid public pension recipients before the payment frequency change. The dotted vertical lines represent the months in which quarterly public pension benefits are distributed. For these quarterly paid public pension recipients, average daily non-durable consumption increases the fastest in the months of benefit receipt. The rate of increase is lower during the remaining calendar months with the exception of December when consumption increases sharply during the holiday season.

The two Panels of Figure 4 separately demonstrate our two identification strategies. The dashed line in Panel A of Figure 4 is the average change in log daily non-durable consumption for public pension recipients after the policy change. The monthly consumption changes shown in the Panel are quite different across the two groups of public pension recipient throughout the calendar year except for the sharp consumption changes in both January and December. In fact, bi-monthly paid public pension recipients appear to have a slight consumption response to their check receipt in the even numbered calendar months. The dashed line in Panel B of Figure 4 shows the average consumption changes for employee headed households. Most notably, monthly consumption growth for employees is above that of quarterly paid public pension recipients only in June, July, and December which are when employee bonuses are paid.[21] Overall, Figure 4 suggests that there are different seasonal consumption patterns across Japanese households with large differences in seasonal income receipt associated with public pension benefit receipt.

4 Empirical Methodology

The basis for the empirical tests presented in this paper is the standard LCPIH in which utility is assumed to be intertemporally separable and households maximize expected discounted utility

[20] We plot average daily consumption to account for the variation in the number of days across months.

[21] Hori and Shimizutani (2009) find a "very small" but statistically significant response of consumption to bonus income receipt in Japan.

over the remainder of their life-cycle following

$$\mathcal{U}_t = \max_{\{C_t,\ldots,C_T\}} \mathrm{E}_t \left[\sum_{k=t}^{T} \beta^{k-t} U(C_k) \cdot \nu(\mathbf{z}_k) \right] \tag{1}$$

subject to the standard constraints. In (1), C_t is consumption in period t, $U(\cdot)$ is the period specific utility function, $\mathbf{z}_k$ is a vector of pre-determined characteristics that modify consumption through the function $\nu(\cdot)$, and β is the discount factor.

The Euler Equation corresponding to maximization of (1) is

$$U'(C_t) \cdot \nu(\mathbf{z}_t) = \mathrm{E}_t \left[\beta R_{t+1} U'(C_{t+1}) \cdot \nu(\mathbf{z}_{t+1}) \right] \tag{2}$$

where R_{t+1} is the gross interest rate between periods t and $t+1$. As with the prior literature, we assume a constant relative risk aversion utility function where σ is the coefficient of relative risk aversion. The log-linearized Euler Equation is

$$\Delta \log C_{t+1} = \frac{1}{\sigma} \log(\beta R_{t+1}) + \Delta \log \nu(\mathbf{z}_{t+1}) + \epsilon_{t+1} \tag{3}$$

where ϵ_{t+1} is the rational expectations error.

Estimation of equation (3) requires specifying both $\nu(\cdot)$ and the vector of characteristics that modify utility, $\mathbf{z}_{t+1}$. By allowing $\nu(\mathbf{z}_{t+1}) = \exp(\mathbf{z}_{t+1}\boldsymbol{\gamma})$, we replace $\Delta \log \nu(\mathbf{z}_{t+1})$ in equation (3) with $\Delta \mathbf{z}_{t+1}\boldsymbol{\gamma}$ where $\boldsymbol{\gamma}$ is a vector of parameters. The standard approach is to include time-varying characteristics in $\mathbf{z}_{t+1}$ since fixed household characteristics will be differenced out of $\Delta \mathbf{z}_{t+1}$. Since our sample uses monthly observations of two person families, however, characteristics such as family size and the number of children that are typically included in (3) are not changing between months. Following previous authors, we include both age and age squared in $\mathbf{z}_{t+1}$ which means that age appears in $\Delta \mathbf{z}_{t+1}$.

The use of monthly consumption data raises an additional issue concerning seasonal variation in preferences over the calendar year. For example, as shown in Figure 4, there is a sharp spike in consumption among Japanese households during December due to holiday purchases. In order to

separate such seasonal preferences from the effect of public pension receipt, we take an approach similar to Paxson (1993) in which we allow $\mathbf{z}_{t+1}$ to include a vector of calendar month indicators, $\mathbf{s}_{t+1}$. Consistent with this specification, the differenced term $\Delta\mathbf{z}_{t+1}$ in equation (3) contains the *difference* of the calendar month variables $\Delta\mathbf{s}_{t+1}$.

We also account for monthly variability in consumption that arises for a number of reasons. To account for differences in the number of days per month, we create average daily consumption measures by dividing reported consumption each month by the number of days. We also include a number of indicators, $\mathbf{m}_{t+1}$, which are associated with additional features that vary by month. We include month in the survey indicators to account for "survey fatigue," that is, a decline in monthly consumption associated with a household's duration in the survey which has been observed in prior studies using consumption data collected in diaries (Stephens 2003, 2006). Since consumption systematically varies by the day of the week, we also include indicators for whether a particular calendar month has a fifth day of the week for all seven days which could affect average daily consumption for the month.[22] In addition, we allow average daily consumption to depend upon the number of holidays within the month.[23] Finally, we control for the introduction of the national consumption tax in April 1989 by including indicators for March 1989 and April 1989 to account fluctuations in purchases immediately surrounding the implementation of the tax. We include the vector $\mathbf{m}_{t+1}$ in equation (3) as first differences since these characteristics are changing between months t and $t+1$.

In order to implement our first identification strategy, we include a set of indicators in $\mathbf{z}_{t+1}$ that allow the preference for consumption in month $t+1$ to depend upon how long it has been since the household received its public pension benefit. For the period when benefits are distributed quarterly, we include $CHECK\ MONTH_{i,t+1}^{PRE}$ which is a binary indicator for whether or not a check is received in month $t+1$ and $MONTH\ AFTER_{i,t+1}^{PRE}$ which is a binary indicator for whether or not month $t+1$ is the month immediately following the month of check receipt. When checks are delivered quarterly, the excluded category is the month prior to check receipt. For the period when

[22] Wilcox (1989) includes similar controls for the number of "trading days" within a month for each day of the week when using monthly aggregate consumption data.

[23] Since we also control for calendar month effects, the number of holidays coefficient is identified by changes in the number of holidays for a given calendar month during the sample period.

benefits are distributed bi-monthly, we include the variable $CHECK\ MONTH_{i,t+1}^{POST}$ is a binary indicator for whether or not a check is received in month $t+1$. Since equation (3) contains the *difference* of $\mathbf{z}_{t+1}$, we difference these check month variables in our empirical specification.

We test whether consumption responds to the receipt of public pension income by making the aforementioned substitutions into equation (3) and estimating

$$\begin{aligned}\Delta \log C_{i,t+1} &= age_i\delta_1 + \Delta \mathbf{s}_{i,t+1}\boldsymbol{\delta_2} + \Delta \mathbf{m}_{i,t+1}\boldsymbol{\delta_3} + \mathbf{y}_{t+1}\boldsymbol{\delta_4} \\ &+ \beta_1 \Delta CHECK\ MONTH_{i,t+1}^{PRE} + \beta_2 \Delta MONTH\ AFTER_{i,t+1}^{PRE} \\ &+ \gamma \Delta CHECK\ MONTH_{i,t+1}^{POST} + \epsilon_{i,t+1} \qquad (4)\end{aligned}$$

where the vector of year variables $\mathbf{y}_{t+1}$ is included to account for the gross interest rate, R_{t+1}, which assumed to change at an annual frequency.[24] The dependent variable is the change in the log of average daily consumption between months t and $t+1$.[25]

We can use equation (4) to test a number of hypotheses. Testing either null hypothesis $\beta_1 = 0$ or $\beta_2 = 0$ is a test of whether household consumption systematically depends upon the month of check receipt when checks are delivered quarterly. A test of the null hypothesis that $\gamma = 0$ indicates whether households smooth consumption when checks are delivered every other month. In addition, we can also directly test whether the magnitude of the consumption response due to check receipt is the same both before and after the frequency of payment by testing the null hypothesis $\beta_1 = \gamma$.

An alternative empirical specification is to use the check month indicators directly in equation (4) rather than the differences of the check month indicators that we include. Such a specification would ascertain whether consumption *growth* is different in the months in which checks are received relative to other months. However, it is difficult to directly interpret the magnitude of the response to check receipt using this alternative specification. For example, suppose that when checks are delivered on a bi-monthly basis, consumption is three percent higher in check receipt months relative

[24] Since our sample period runs from March 1986 to February 1994, we define our year variables, $\mathbf{y}_{t+1}$, on a March to February basis. For example, the "year" indicator corresponding to 1993 begins with March 1993 and ends with February 1994.

[25] Note that with the exception of the year indicators, $\mathbf{y}_{t+1}$, equation (4) is otherwise identical to the equation that is generated by first specifying a cross-sectional equation for $\log C_{i,t}$ and then differencing the observations.

to the months when checks are not delivered. The corresponding pattern of consumption growth is a three percent increase in the month of check receipt and a decrease of the same amount in the non-receipt months. Thus, the relative difference in consumption *growth* between check receipt and non-check receipt months would yield an estimate of a six percent or, more generally, twice the level difference in consumption between these months. This difficulty of interpretation only increases for the check indicators corresponding to when checks are delivered quarterly.[26] Therefore, our main results shown in the paper are based on equation (4) although we also present results using the alternative specification described here in Appendix Table 2.

Our second identification strategy compares public pension recipient households with employee headed households only using data from the period when public pensions are delivered quarterly. We proceed by making a similar set of substitutions as those we use to generate equation (4). There are three important differences from the previous empirical specification. First, we include fewer year dummies since we only use observations from March 1986 to February 1990. Second, although we maintain the identifying assumption that seasonal consumption preferences unrelated to check receipt are the same for both sets of households, we allow for a different intercept term for the employee households, $EMPLOYEE_i$. Third, corresponding to the shorten time period, we only include the differences of the check receipt indicators for the period before the pay frequency change, $\Delta CHECK\ MONTH_{i,t+1}^{PRE}$ and $\Delta MONTH\ AFTER_{i,t+1}^{PRE}$. The resulting equation is

$$\begin{aligned} \Delta \log C_{i,t+1} &= age_i\delta_1 + \Delta \mathbf{s}_{i,t+1}\boldsymbol{\delta_2} + \Delta \mathbf{m}_{i,t+1}\boldsymbol{\delta_3} + \mathbf{y}_{t+1}\boldsymbol{\delta_4} + \delta_5 EMPLOYEE_i \\ &+ \tilde{\beta}_1 \Delta CHECK\ MONTH_{i,t+1}^{PRE} + \tilde{\beta}_2 \Delta MONTH\ AFTER_{i,t+1}^{PRE} + \epsilon_{i,t+1} \qquad (5) \end{aligned}$$

Under the assumption that seasonal consumption preferences are the same for public pension recipient households and employee headed households, testing the null hypotheses $\tilde{\beta}_1 = 0$ and $\tilde{\beta}_2 = 0$ are tests of the implication of the LCPIH that consumption should not respond to check receipt.

[26] We can use the coefficients on the differences of the check indicators found in (4) to interpret the parameters of the alternative specification in which we instead use the check indicators themselves. Let the coefficients on the check indicators in this alternative specification be denoted as β_1^*, β_2^*, and γ^*. As discussed above, when checks are delivered bi-monthly the consumption growth in the month of check receipt is equal to twice the difference in the *level* of consumption between the receipt and non-receipt months. This relationship implies that $\gamma^* = 2\gamma$. When checks are delivered quarterly, it can be shown that $\beta_1^* = \beta_1 - (-\beta_2) = \beta_1 + \beta_2$ and that $\beta_2^* = (\beta_2 - \beta_1) - (-\beta_2) = 2\beta_2 - \beta_1$.

Testing these hypotheses requires further restrictions on our sample. First, we only use public pension recipient households that report receiving these benefits. Although we suspect that there is missing public pension income data in some households where the head is at least 65 years of age, we want to avoid incorrectly including households that are not eligible for these payments. Second, we exclude public pension recipient households which report receiving their benefits in months that do not match the primary government policy for check disbursement both before and after the payment frequency change. Thus, we only include households from March 1986-February 1990 that report public pension receipt in February, May, August, or November and do *not* report receiving these benefits in other months. Similarly, while we limit the households from March 1990-February 1994 to those that report receiving benefits in any of the six months of bi-monthly disbursement but do not report any benefits in any of the remaining months. This approach includes those who receive both the national pension and the employee pension both before and after the change in our sample. However, as discussed in the previous section, two subsets of households have a different payment frequency pattern prior to the change: recipients of the Old-age Welfare Pension and those individuals who only receive national pension benefits (but not employee pension benefits) and began doing so prior to April 1986. Thus, these two groups are excluded from our analysis due to this restriction. While we are not overly concerned that these exclusions have an appreciable impact on our results, we investigate this issue as part of our robustness checks presented below.

Third, we only use recipient households that report receiving public pension benefits in exactly two months before the change and in exactly three months after the change. We impose this last restriction since we want to exclude households that begin receiving public pension benefits during the sample period so that we do not falsely attribute other contemporaneous income changes, such as retirement, to the impact of public pension receipt. Thus, we are limiting our sample to households that receive quarterly public pension payments before the payment frequency change and those that receive bi-monthly payments after the change. We illustrate the robustness of results to this restriction below.

The sample statistics, after imposing these additional restrictions, are shown in Panel B of Table 1 under the heading of "Regression Sample." Observable household characteristics among

benefit recipient households are quite comparable before and after the change. Notice that while the average age of the household head is nearly identical both before and after the payment frequency change in the Full Sample, there is a slight gap between these two ages in the Regression Sample. This difference is most likely due to dropping the aforementioned subsets of households with different benefit disbursement patterns prior to the payment frequency change. However, this age difference is relatively small which suggests that the impact of this restriction is fairly minor. Moreover, the remaining observable characteristics are very comparable before and after the change in the Regression Sample. As before, the employee households have higher levels of income and consumption than the benefit recipients.

5 Results

5.1 The Impact of Public Pension Receipt on Monthly Household Income

The monthly income fluctuations are estimated for the regression sample in Table 2.[27] The first two columns in the Table present the results of estimating equation (4) except that the dependent variable is the monthly change for the income measure listed at the top of each column.[28] These columns use public pension recipient households both before and after the payment frequency change. Recall that since these specifications include a full set of calendar month indicators and that public pension benefits are distributed in the same four calendar months across all households prior to March 1990 and in the same six months across all households after February 1990, the coefficients on the check month indicators are identified by differences in the month of benefit receipt before and after the payment frequency change.

Column (1) of Table 2 shows the results for public pension income. The estimated coefficient on $\Delta CHECK\ MONTH_{i,t+1}^{PRE}$ reflects the level difference in public pension income of nearly 690,000 yen between the month of check receipt relative to the month prior to check delivery. The estimated coefficient on $\Delta MONTH\ AFTER_{i,t+1}^{PRE}$ indicates a rather economically small although statistically

[27] All of the results we present in the tables below report standard errors that are adjusted for arbitrary forms of serial correlation within households over time.

[28] Since both public pension income and total income equal zero in a large number of months, especially before the payment frequency change, we examine the impact of check receipt on the level of income rather than the log.

significant difference in the level of public pension income in the month after check receipt relative to the month prior to check receipt. This pattern is expected given the quarterly pattern of public pension income distribution during this period as well as the results previously shown in Panel B of Figure 1. For the period when public pension income is distributed bi-monthly, the results are consistent with the pattern shown in Panel B of Figure 2 with the estimated coefficient on $\Delta CHECK\ MONTH_{i,t+1}^{POST}$ indicating an increase in public pension income of roughly 500,000 yen in response to check receipt.[29] Nearly identical patterns are found for total household income in column (2) which reflects the extent to which income fluctuations among these households are driven by public pension benefits.

The final column of Table 2 presents estimates of monthly total income fluctuations for public pension recipients prior to March 1990 in comparison to those of employees based on equation (5). As shown in Figure 3, these two sets of households have quite different monthly income patterns. While the estimated coefficient on $\Delta MONTH\ AFTER_{i,t+1}^{PRE}$ again indicates that income is relatively higher for public pension recipients in the month the receive their checks, the negative coefficient on $\Delta MONTH\ AFTER_{i,t+1}^{PRE}$ indicates that the income of public pension recipients is relatively lower in the month following benefit receipt. This negative coefficient is generated by the bonuses paid to employees in June and December. In order for our maintained identification assumption regarding seasonal consumption preferences being constant across households to remain valid, these bonus income payments must have no contemporaneous effect on the consumption of employee households. As we noted above, Hori and Shimizutani (2009) find a statistically significant but economically very small effect of bonus income receipt on consumption.

5.2 The Impact of Public Pension Receipt on Household Consumption

The impact of public pension receipt on household consumption is shown in Table 3. The results presented in the Table are estimates of equation (4) which uses public pension recipients before and

[29]The magnitude of the estimated effects shown in Table 2 are larger than those found in Figures 1 and 2 since the full sample used to create the Figures while the regression sample used for the Table includes the restriction that households receive some public pension income.

after the payment frequency change.[30] The Table shows that consumption significantly increases in the month of check receipt prior to the payment frequency change. The estimated coefficient on $\Delta CHECK\ MONTH_{i,t+1}^{PRE}$ is statistically significant across all four consumption categories. Total consumption increases by six percent in the month of check receipt prior to the reform. In terms of testing the life-cycle model, the remaining consumption categories are more pertinent. Non-durable consumption increases by four percent in the month of check receipt while strict non-durable and food consumption both increase by over two percent when checks are received.

Consumption remains significantly higher in the month after check receipt relative to the month before check receipt since the coefficients on $\Delta MONTH\ AFTER_{i,t+1}^{PRE}$ are significant across all of the columns. Non-durable consumption is nearly three percent higher while both strict non-durable and food consumption are more than two percent higher in the month after check receipt. In addition, for both total and non-durable consumption, the consumption response appears to decline between the month of check receipt and the month after check receipt since the latter estimated coefficients are smaller in magnitude than estimated impact for the month of receipt. Surprisingly, this pattern is reversed for strict non-durable and food consumption although the point estimates on both of the check month variables are very similar when checks are delivered quarterly. However, F-tests for each of the four consumption categories cannot reject the equality of the coefficients on the check month indicators before the payment frequency change.[31] Overall, these results show that consumption significantly responds to check receipt when checks are delivered quarterly.

We use the results shown in Table 3 to perform two additional tests. First, we test whether consumption responds to bi-monthly check receipt after the payment frequency change. We find that consumption does not respond to public pension receipt after this change since the estimated coefficient on $\Delta CHECK\ MONTH_{i,t+1}^{POST}$ is insignificant across all of the consumption categories. Second, we test whether the response in the month of check receipt is the same when checks are paid

[30]The full set of results corresponding to the estimates found in Table 3 are presented in Appendix Table 1. Consistent with our findings in Figure 4, we find a pronounced consumption increase in December across all four consumption categories as well as a subsequent decrease in January. There is evidence of a change in consumption in the months surrounding the implementation of the consumption tax in April 1989 as well as evidence of survey fatigue. Nearly all of the indicators for the calendar year, for having a fifth day of the week, and for the number of holidays are insignificant.

[31]These F-test results are not shown here but are available from the authors upon request.

quarterly and when they are paid bi-monthly. Examining the estimated coefficients on $\Delta CHECK\ MONTH^{PRE}_{i,t+1}$ and $\Delta CHECK\ MONTH^{POST}_{i,t+1}$ shows that the estimated impact of check receipt on consumption decreases by at least 75 percent after the change across each consumption category. In addition, the F-statistics shown in the final row of Table 3 confirm that these parameters are statistically different across all four consumption categories. Thus, these findings suggest that the payment frequency change led to an improvement in household consumption smoothing behavior.

An important caveat to this last finding is that, as we mentioned above, benefit checks are received during the middle of the month of benefit receipt both before and after the change (although, as noted above, the date changes slightly at the time of the reform). Although the days in the latter half of a check receipt month are immediately after checks have been delivered, the days in the first half of these same months represent the longest that households will have gone without receiving income. Since the effects we estimate in the month of check receipt are an average of the response immediately following check arrival and the end of the interval between check receipt, the true magnitude of the response to check receipt is likely attenuated by our use of monthly consumption data.

A useful summary statistic which illustrates this point is derived by first computing the number of days since check arrival for each day in each month and then computing the averages of these measures for each month in the benefit receipt cycle. When checks are delivered quarterly, the average days since receiving check during our sample period are 37 in the month of check receipt, 35 in the month after check receipt, and 66 in the month before check receipt. Interestingly, even though the month of check receipt has a slightly larger average days since check receipt than the month after check receipt, there is a larger consumption increase in the month of check receipt. These calculations suggest that the consumption response to check receipt is non-linear in days since check receipt. When checks are received every other month, the average number of days since check receipt is 30 in the month of check receipt and 32 in the other months. This similarity in the average days since check receipt across months suggests that there may be too little variation in time since check receipt across months when checks are delivered bi-monthly in order to provide a powerful test of the life-cycle hypothesis. Therefore, we focus most of our remaining discussion on

tests that only involve the quarterly payment of public pension benefits.

Table 4 presents the results of implementing our second identification strategy in which we estimate equation (5) using both public pension recipient and employee households prior to the policy change. The estimated effect on consumption in the month of check receipt is substantially larger than that found in Table 3 across all four consumption categories. We find that the impact of check receipt on total and non-durable consumption is nearly twelve percent and eight percent, respectively. The estimated effects on strictly non-durable and food consumption are each roughly four percent. We also find that the estimated effects on consumption in the month after check receipt are virtually identical using this identification strategy relative to what we find in Table 3. These latter results are particularly striking given that in Table 2 we find that the employee households experience sharp income spikes due to the receipt of bonus income in these months. Overall, the results of this second identification strategy provide strong support for our results from the first identification strategy which uses households from multiple time periods.

The advantage of the empirical specifications we estimate in equations (4) and (5) is that we can directly interpret the estimated coefficients on the *differenced* check receipt variables as differences in the levels of consumption between months. In Appendix Table 2, we present the results of estimating these two specifications using the non-differenced check month variables indicators which yield estimates of the impact of check receipt on consumption growth. In Panel A of the Table which presents estimates of an equation that is analogous to (4) using public pension recipients before and after the policy change, we see that consumption growth is statistically significant in the month of check receipt when checks are delivered quarterly but is insignificant when checks are delivered every other month. For the equation analogous to (5) which uses recipient and employee households before the policy change, the results in Panel B also show that consumption growth is statistically significant in the month of check receipt when benefits are paid quarterly. Furthermore, a comparison of the results in Appendix Table 2 with those in Tables 3 and 4 demonstrates that the relationships we previously derived in footnote 26 between the parameters of the equations using the differenced check receipt variables and the level check receipt variables hold exactly. Therefore, we present results using equations (4) and (5) throughout due to the ease of interpreting the estimated

parameters on the check receipt variables.

We impose a number of exclusion criteria to generate the regression samples in order to limit the sample to recipient households that are dependent primarily on public pension benefits for their income as well as to minimize any contemporaneous fluctuations in income due to household labor market outcomes. We next show the robustness of the results to eliminating a number of these restrictions. First, we lift the restriction that only nuclear families appear in the sample which, due to the additional family members, increases the potential sources of household income. This sample change could increase the possibility of spurious consumption responses associated with other income sources such as December employment bonuses although any consumption spike due to such periodic income should be captured by the calendar month effects. Second, we relax the restriction that household heads in the recipient sample cannot work which may potentially could induce spurious results if labor market entry or exit is correlated with the check distribution months. Similarly, we allow household heads in the employee sample to leave the labor force although we require them to be employed in at least one of their sample months. Third, we only require recipient households to report receiving public pension benefits in one month during their six month panel period rather than in all possible check distribution months.[32] Although these households may simply underreport public pension benefit receipt, they may include new beneficiaries that have recently left the labor force and concurrently experience a large change in income.

Table 5 presents the results of estimating equations (4) and (5) after relaxing all three of the assumptions mentioned above. For our comparison using recipient households before and after the change shown in Panel A, the resulting sample is nearly 70 percent larger. The sample increases by roughly 250 percent when comparing the recipient and employee households (Panel B) primarily due to the lifting of the household size restriction on the employee sample. Our estimates remain very similar in magnitude to those found in Tables 3 and 4 although the estimates are much more precisely estimated due to the larger sample. Overall, the set of results in Table 5 indicates that our findings are generally robust to a number of sample selection criteria.

As we discussed earlier, two subsets of households had different disbursement patterns prior to

[32]However, we still require that all reported checks are received only in the months that match the check disbursement policy.

the payment frequency change which led them to be excluded from our analysis. The first group consists of Old-age Welfare Pension recipients who are at least age 70 and failed to meet the full contribution requirement for public pension receipt. The second group is comprised of individuals who only receive national pension benefits and began doing so prior to April 1986. Notice that households under age 70 are not members of the first group and therefore are not affected by this exclusion. Moreover, more recent, relatively younger retirees are not subject to the second exclusion even prior to the reform. As such, separately examining the results for households under age 70 provides a test which, to a large extent, circumvents concerns about excluding households with different payment frequencies prior to the payment frequency change.

The results from splitting the sample by those under age 70 and those age 70 and above are shown in Table 6. For both sets of households, the patterns we find are comparable to those shown in Table 3. For the younger households, the estimated responses, especially before the change, are somewhat larger than for the full sample. The response to check receipt after the change, however, remains insignificant. For the older households, the response to check receipt is statistically significant for total and non-durable consumption prior to the change while the responses for strict non-durable and food consumption are positive but insignificant. Overall, the findings in Table 6 for households under age 70 indicate that the exclusion of households with different payment frequencies prior to the change does not affect our results.

6 Explanations Based on Variants of the LCPIH

While the basic LCPIH model predicts that consumption does not react to predictable income fluctuations, variants of the LCPIH predict that consumption changes occur contemporaneously with income fluctuations. Zeldes (1989) and Deaton (1991) show that liquidity constraints cause consumption to respond to predictable income changes since households that desire to borrow from future income to raise current consumption are unable to do so. Numerous studies have found evidence that consumption tracks income for constrained households but does not for unconstrained households (e.g., Zeldes 1989; Jappelli, Pischke, and Souleles 1998). Models that allow for precau-

tionary savings, or saving for a rainy day, also generate consumption growth that is faster than predicted by the basic LCPIH. Carroll (1997) shows that among buffer stock consumers, those with higher predictable permanent income growth also have higher levels of consumption growth.

For elderly Japanese households receiving public pension income, these standard explanations for rejecting the basic LCPIH are less plausible. Among these households, real income growth is zero since benefits are only adjusted for changes in the price level. While income fluctuates between zero and the benefit amount from month to month, households are not constrained from borrowing from higher future income. Rather, households can save income from the month in which benefits are paid to spend during an intervening month. As such, liquidity constraints should not affect households in our sample.

Precautionary savings motives should have little impact on the consumption decisions of these households. Gourinchas and Parker (2002), when calibrating the parameters of a life-cycle model using data from the U.S., find that households transition from saving for precautionary reasons to life-cycle (i.e., retirement) reasons in their early 40s. In addition, as we have shown above, the vast majority of the households in our sample essentially face no income uncertainty since they receive nearly all of their income from public pension benefits. Moreover, universal health care coverage with income-tested ceilings on monthly co-payments greatly reduces the need of Japanese retirees to save for uncertain medical expenses. Therefore, we would not expect these precautionary savings motives to explain the consumption fluctuations due to public pension receipt.

These variants of the LCPIH also have implications for accumulated household assets. During the sample period, JFIES households that began their six month survey period during August, September, or October participated in the Family Saving Survey (FSS) which collects wealth information.[33] For these households, we can compute total net financial assets which include the value of the household's holdings in demand and time deposits, stocks and shares, bonds, insurance, and trust funds minus their credit card debt and housing debt.[34] However, outside of demand deposits, the remaining asset categories are illiquid to some degree and, thus, are not easily available to

[33]The JFIES began collecting wealth information for all sample households in 2001.

[34]The FSS does not include the value of real assets such as real estate and vehicles. Very few households in the sample hold housing debt so including this value has little effect on results shown here.

smooth consumption fluctuations between benefit public pension payments.[35]

Figure 5 presents the distribution of financial assets to annual income ratios by age for both total net financial assets (Panel A) and demand deposits (Panel B).[36] For recipient households, Panel A of the Figure indicates that the median household has four times its annual income in total net financial assets while households at the 25th percentile hold twice their annual income in net financial assets. Even recipient households at the 10th percentile have nearly a year's worth of income of total net financial assets. Demand deposits, the most liquid form of assets that can be used to smooth consumption, only comprise roughly 12 percent of total *gross* financial assets.[37] As shown in Panel B of the Figure, however, the median recipient household has a demand deposit to annual income ratio the ranges from 0.2 to 0.3 which amounts to roughly three months of income that is readily accessible. Combined with the fact that seven percent and four percent of gross financial assets are held in stocks and bonds, respectively, the results in Figure 5 show that households in this sample are not liquidity constrained. Moreover, an explanation of our findings based on a high rate of time preference is not plausible given the high levels of asset holdings among these households.

The wealth data also shed light on two additional issues. First, as shown in Panel A of Table 1, average total net financial assets and normal deposits are very close for recipient households both before and after the payment frequency change. These similarities reduce concerns that lower wealth among recipient households after the onset of Japan's "Lost Decade" are confounding our estimates. Second, as shown in both Table 1 and Figure 5, wealth levels are actually lower among employee households even though current income and consumption are higher among employee households.[38] If the larger responses for recipient households that we estimate when using our

[35]Time deposits are comparable to certificates of deposit in the U.S. which, prior to maturity, can only be accessed by incurring a penalty. Life insurance is a used as a savings vehicle by many Japanese households and trust funds include assets held at trust banks. The vast majority of household financial wealth in Japan is held in time deposits and insurance. See Iwaisako (2003) for a more in-depth discussion of the types and distribution of assets held by Japanese households.

[36]The annual income measure used to create this ratio is from a retrospective question about household income in the twelve months preceding the household's first JFIES monthly interview.

[37]Since some households hold zero or negative net financial assets, we calculate average shares out of gross financial assets.

[38]The large wealth differences between recipient and employee households are primarily due to the very substantial lump sum benefits distributed at retirement in Japan.

second identification strategy were driven by liquidity constraints, we would expect to find lower wealth among recipients which is the opposite of what we observe in the data.

We further examine the liquidity constraint explanation by, following the previous literature, splitting the sample based on the likelihood of being liquidity constrained. Since only one-quarter of the sample can be linked to the FSS wealth data, results using sample splits based on wealth yield imprecise estimates. However, we can split the sample based on the annual income measure used to generate Figure 5. Since this variable measures annual income during the year preceding the first monthly interview, it can be used to split the sample because it is pre-determined information in the context the household's consumption decisions during the survey period.

We categorize recipient households by whether their lagged annual income is below or above the sample median income for their survey year. Table 7 presents the results from estimating equation (4) where we include a different set of the three check receipt timing indicators for each of these two income groups. For both below and above median income households, we find the exact same patterns: consumption is sensitive to the receipt of public pension income when benefits are delivered quarterly but it is not after the change in payment frequency. Similar patterns appear for both strictly non-durable and food consumption for both sets of households, as well being similar to the pooled results shown in Table 3. The results in Table 7 generally show that the consumption increase declines more gradually over the quarterly intervals before the change for the above median households while the decline occurs in the last month before check receipt for lower income households. Although these patterns differ somewhat across the two income groups, both sets of responses to check receipt before the pay frequency change are inconsistent with the basic life-cycle/permanent income hypothesis.

7 Conclusion

In this paper, we examine the relationship between the timing of Japanese public pension benefits and the timing of the beneficiaries' consumption. Since public pension benefits comprise the vast majority of income for retired Japanese households, this benefit distribution pattern leads to very

large income spikes during months when checks are received as well as zero income during months between the receipt of these checks. As such, examining the timing of consumption in response to this anticipated seasonal income variation provides a strong test of the LCPIH. We find that when public pensions are paid quarterly prior to March 1990, household consumption responds to the receipt of these benefits. Both identification strategies we implement lead us to reject LCPIH as do our various robustness checks. Based on both household asset data and the similarity of the results between low and high income households, standard variants of the LCPIH such as liquidity constraints and precautionary savings cannot explain these results.

Our finding of a consumption response to quarterly public pension benefits contrasts with the prior literature which finds no effect of seasonal income variation on household consumption (Browning and Collado 2001; Hsieh 2003; Paxson 1993). One possible explanation for the difference between our findings and the earlier studies is that the magnitude of the income fluctuations is much greater in the current setting relative to the previous literature. For example, the Spanish bonus workers examined by Browning and Collado (2001) receive paychecks in June and December that are twice as large as their usual monthly amounts and equal one-seventh of annual earned income. The quarterly Japanese public pension payments account for one-fourth of total annual income for a vast majority of these households. In addition, while the Spanish bonus households still receive a monthly paycheck in the remaining calendar months, Japanese public pension recipients must go three months between benefit payments.

Our results point to interesting avenues for future research. Based on studies of low income households in which consumption increases upon benefit receipt and then significantly declines until the next payment is received, prior researchers have suggested that more frequent benefit payments may reduce these consumption fluctuations (Ohls et al. 1992; Wilde and Ranney 2000; Shapiro 2005; Dobkin and Puller, 2007; Mastrobuoni and Weinberg, 2009). Whether such a change can improve household welfare remains an open question. Although our results are consistent with this prediction, we are reluctant to ascribe a causal interpretation to this particular finding since the mid-month distribution of public pension benefits confounds a definitive test using our data. In addition, as the quote from the Japanese newspaper shown in footnote 2 stresses, a high degree of

planning is asked of households when income is received quarterly. Recent studies have attributed an important role for planning in explaining household differences in wealth accumulation for retirement (Ameriks, Caplin, and Leahy 2003; Lusardi and Mitchell 2007). Assessing the importance of household planning differences either as an explanation for short-run consumption fluctuations or as a link between short-run fluctuations and long-run retirement wealth accumulation, if a link even exists, can help us to better understand the role of planning in life-cycle savings decisions.

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Table 1: Descriptive Statistics for Monthly Observations

	Public Pension Recipients (Ages 65+)						Employees (Ages 50-59)		
	Before Change			After Change			Before Change		
Variable	Mean	Std. Dev.	Share Zero	Mean	Std. Dev.	Share Zero	Mean	Std. Dev.	Share Zero
A. Full Sample									
Total Income	202	317	0.33	231	291	0.29	576	486	0.02
Public Pension Benefits	168	301	0.66	199	268	0.57	–	–	–
Total Household Consumption	213	170	0.00	226	189	0.00	341	282	0.00
Nondurables	130	81	0.00	138	88	0.00	178	115	0.00
Strictly Non-Durable	108	63	0.00	115	75	0.00	140	78	0.00
Food Consumption	57	25	0.00	59	25	0.00	69	28	0.00
Working Household Members	0.08	0.28	0.92	0.08	0.27	0.92	1.41	0.49	0.00
Age of Household Head	71.9	5.2	0.00	71.9	5.4	0.00	54.9	2.7	0.00
Observations (Households)	16,003 (2,717)			21,629 (3,990)			9,422 (1,578)		
Total Net Financial Assets	18,112	27,869	0.03	19,220	18,171	0.03	10,628	15,626	0.15
Normal Deposits	1,260	2,253	0.09	1,220	1,744	0.07	807	893	0.07
Wealth Observations	523			658			361		
B. Regression Sample									
Total Income	273	369	0.31	287	310	0.23	578	489	0.02
Public Pension Benefits	236	359	0.66	245	283	0.51	–	–	–
Total Household Consumption	226	172	0.00	234	191	0.00	341	281	0.00
Nondurables	138	89	0.00	142	83	0.00	178	116	0.00
Strictly Non-Durable	114	69	0.00	118	66	0.00	140	78	0.00
Food Consumption	59	27	0.00	60	26	0.00	70	28	0.00
Working Household Members	0.09	0.29	0.91	0.08	0.27	0.92	1.40	0.49	0.00
Age of Household Head	70.9	4.7	0.00	71.7	5.2	0.00	54.9	2.7	0.00
Observations (Households)	5,463 (957)			11,322 (2,049)			9,275 (1,546)		
First-Difference Observations	4,506			9,583			7,844		

Table 2: Monthly Income Changes Due to The Receipt of Public Pension Income[a]			
	Public Pension Recipients: Before and After Change		PP Recipients vs. Employees: Before Change Only
	Public Pension Benefits (1)	Total Income (2)	Total Income (3)
$\Delta CHECK\ MONTH_{i,t+1}^{PRE}$	687***	688***	724***
	(8.3)	(8.7)	(10.2)
$\Delta MONTH\ AFTER_{i,t+1}^{PRE}$	13***	14***	-265***
	(3.7)	(5.3)	(11.9)
$\Delta CHECK\ MONTH_{i,t+1}^{POST}$	495***	491***	
	(4.7)	(5.3)	

[a]This Table reports estimates based on equation (4) (columns (1) and (2)) and equation (5) except that the dependent variable is the change between months t and $t+1$ in the level of the income measure shown at the top of each column. Standard errors robust to arbitrary forms of serial correlation within households are reported in parentheses. All columns report OLS regressions which include year indicators, age, and first differences of the following variables: indicators for the calendar month, indicators corresponding to each month in the six month survey period, indicators for having a fifth day in the month for each day of the week, the number of monthly holidays, and indicators for March 1989 and April 1989 corresponding to the consumption tax introduction. A dummy variable for Age 50-59 group is included in regression (3). *, ** , and *** represent significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table 3: The Impact of Public Pension Receipt on Consumption[a]
Public Pension Recipients Before and After Change

	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
$\Delta CHECK\ MONTH_{i,t+1}^{PRE}$	0.060***	0.041***	0.022**	0.022**
	(0.015)	(0.011)	(0.011)	(0.009)
$\Delta MONTH\ AFTER_{i,t+1}^{PRE}$	0.035**	0.029**	0.027**	0.029***
	(0.016)	(0.012)	(0.012)	(0.010)
$\Delta CHECK\ MONTH_{i,t+1}^{POST}$	0.016	0.003	-0.001	-0.001
	(0.012)	(0.009)	(0.009)	(0.008)
F-test (p-value) for equality of coefficients on month of receipt effects before and after change	5.29** (0.021)	7.9*** (0.005)	2.97* (0.085)	3.85** (0.05)

[a]This Table reports estimates based on equation (4). The dependent variable is the change between months t and $t+1$ in the log of the average daily consumption measure shown at the top of each column. Standard errors robust to arbitrary forms of serial correlation within households are reported in parentheses. All columns report OLS regressions which include, in addition to the variables shown in the Table, year indicators, age, and first differences of the following variables: indicators for the calendar month, indicators corresponding to each month in the six month survey period, indicators for having a fifth day in the month for each day of the week, the number of monthly holidays, and indicators for March 1989 and April 1989 corresponding to the consumption tax introduction. *, ** , and *** represent significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table 4: The Impact of Public Pension Receipt on Consumption[a]
Public Pension Recipients vs. Employees: Before Change Only

	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
$\Delta CHECK\ MONTH_{i,t+1}^{PRE}$	0.115***	0.075***	0.042***	0.036***
	(0.015)	(0.012)	(0.011)	(0.009)
$\Delta MONTH\ AFTER_{i,t+1}^{PRE}$	0.031**	0.023**	0.025**	0.029***
	(0.016)	(0.012)	(0.012)	(0.010)

[a]This Table reports estimates based on equation (5). The dependent variable is the change between months t and $t+1$ in the log of the average daily consumption measure shown at the top of each column. Standard errors robust to arbitrary forms of serial correlation within households are reported in parentheses. All columns report OLS regressions which include, in addition to the variables shown in the Table, year indicators, age, an age 50-59 group indicator, and first differences of the following variables: indicators for the calendar month, indicators corresponding to each month in the six month survey period, indicators for having a fifth day in the month for each day of the week, the number of monthly holidays, and indicators for March 1989 and April 1989 corresponding to the consumption tax introduction. *, ** , and *** represent significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table 5: The Impact of Public Pension Receipt on Consumption Robustness Check[a]

A. Public Pension Recipients Before and After Change

	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
$\Delta CHECK\ MONTH_{i,t+1}^{PRE}$	0.054***	0.041***	0.027***	0.028***
	(0.011)	(0.009)	(0.008)	(0.007)
$\Delta MONTH\ AFTER_{i,t+1}^{PRE}$	0.034***	0.030***	0.027***	0.026***
	(0.013)	(0.009)	(0.009)	(0.008)
$\Delta CHECK\ MONTH_{i,t+1}^{POST}$	0.018**	0.007	0.008	-0.002
	(0.009)	(0.007)	(0.007)	(0.006)
F-test (p-value) for equality of coefficients on month of receipt effects before and after change	6.3**	10.57***	3.24*	12.37***
	(0.012)	(0.001)	(0.072)	(¡0.001)

B. Public Pension Recipients vs. Employees: Before Change Only

	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
$\Delta CHECK\ MONTH_{i,t+1}^{PRE}$	0.114***	0.073***	0.047***	0.044***
	(0.010)	(0.008)	(0.007)	(0.006)
$\Delta MONTH\ AFTER_{i,t+1}^{PRE}$	0.031***	0.027***	0.031***	0.039***
	(0.010)	(0.008)	(0.007)	(0.006)

[a]The results in this table relax a number of sample selection criteria as discussed in the text. Panel A uses 20,873 first-difference observations and Panel B uses 42,742 first-difference observations. For more details on the additional regressors included in Panel A and Panel B, see the notes to Table 3 and Table 4, respectively.

Table 6: The Impact of Public Pension Receipt on Consumption
Public Pension Recipients Before and After Change
Sample Split By Age[a]

	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
Under Age 70				
$\Delta CHECK\ MONTH_{i,t+1}^{PRE}$	0.071***	0.050***	0.034**	0.023*
	(0.020)	(0.015)	(0.015)	(0.013)
$\Delta MONTH\ AFTER_{i,t+1}^{PRE}$	0.038*	0.051***	0.047***	0.038***
	(0.021)	(0.017)	(0.017)	(0.013)
$\Delta CHECK\ MONTH_{i,t+1}^{POST}$	0.022	0.006	0.002	0.006
	(0.015)	(0.011)	(0.011)	(0.009)
Age 70 and Above				
$\Delta CHECK\ MONTH_{i,t+1}^{PRE}$	0.049***	0.033**	0.012	0.021*
	(0.018)	(0.014)	(0.013)	(0.011)
$\Delta MONTH\ AFTER_{i,t+1}^{PRE}$	0.033	0.011	0.009	0.020*
	(0.020)	(0.015)	(0.014)	(0.012)
$\Delta CHECK\ MONTH_{i,t+1}^{POST}$	0.013	0.001	-0.003	-0.006
	(0.014)	(0.010)	(0.010)	(0.008)

[a]See notes to Table 3.

Table 7: The Impact of Public Pension Receipt on Consumption
Public Pension Recipients Before and After Change
Sample Split By Income[a]

	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
Below Median Income				
$\Delta CHECK\ MONTH_{i,t+1}^{PRE}$	0.058***	0.037***	0.023*	0.025**
	(0.019)	(0.014)	(0.013)	(0.012)
$\Delta MONTH\ AFTER_{i,t+1}^{PRE}$	0.041**	0.040***	0.039***	0.028**
	(0.020)	(0.015)	(0.014)	(0.013)
$\Delta CHECK\ MONTH_{i,t+1}^{POST}$	0.018	0.009	0.002	-0.003
	(0.014)	(0.010)	(0.010)	(0.009)
Above Median Income				
$\Delta CHECK\ MONTH_{i,t+1}^{PRE}$	0.061***	0.044***	0.021	0.019*
	(0.020)	(0.015)	(0.015)	(0.011)
$\Delta MONTH\ AFTER_{i,t+1}^{PRE}$	0.029	0.019	0.015	0.030**
	(0.021)	(0.016)	(0.016)	(0.012)
$\Delta CHECK\ MONTH_{i,t+1}^{POST}$	0.015	-0.003	-0.004	0.001
	(0.014)	(0.011)	(0.011)	(0.009)

[a]See notes to Table 3.

Appendix Table 1: The Impact of Public Pension Receipt on Consumption
Public Pension Recipients Before and After Change
Full Specification

	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
$\Delta CHECK\ MONTH_{i,t+1}^{PRE}$	0.060***	0.041***	0.022**	0.022**
	(0.015)	(0.011)	(0.011)	(0.009)
$\Delta MONTH\ AFTER_{i,t+1}^{PRE}$	0.035**	0.029**	0.027**	0.029***
	(0.016)	(0.012)	(0.012)	(0.010)
$\Delta CHECK\ MONTH_{i,t+1}^{POST}$	0.016	0.003	-0.001	-0.001
	(0.012)	(0.009)	(0.009)	(0.008)
Year 1987	-0.002	0.004	0.008	0.010
	(0.013)	(0.010)	(0.009)	(0.010)
Year 1988	0.006	0.002	0.009	-0.008
	(0.012)	(0.010)	(0.009)	(0.009)
Year 1989	0.007	0.014	0.023***	0.011
	(0.012)	(0.009)	(0.008)	(0.009)
Year 1990	-0.006	0.003	0.012	0.012
	(0.012)	(0.009)	(0.008)	(0.009)
Year 1991	0.015	0.006	0.011	0.014
	(0.011)	(0.009)	(0.008)	(0.009)
Year 1992	0.002	-0.002	0.005	0.007
	(0.011)	(0.009)	(0.007)	(0.009)
Year 1993	0.000	-0.001	0.007	0.012
	(0.011)	(0.009)	(0.007)	(0.009)
Age	0.001	0.000	-0.000	-0.000
	(0.000)	(0.000)	(0.000)	(0.000)
Second Interview Month Indicator	-0.005	-0.011*	-0.011*	-0.015***
	(0.008)	(0.006)	(0.006)	(0.005)
Third Interview Month Indicator	0.014*	0.004	0.005	-0.008
	(0.008)	(0.006)	(0.006)	(0.005)
Fourth Interview Month Indicator	-0.016**	-0.013**	-0.010*	-0.011**
	(0.008)	(0.006)	(0.006)	(0.005)
Fifth Interview Month Indicator	-0.020**	-0.014**	-0.019***	-0.011**
	(0.009)	(0.006)	(0.006)	(0.005)
March 1989 Indicator	0.094**	0.124***	0.114***	0.116***
	(0.048)	(0.039)	(0.035)	(0.029)
April 1989 Indicator	-0.070	-0.072*	-0.089**	-0.069***
	(0.046)	(0.040)	(0.039)	(0.026)

Continued on Next Page

Appendix Table 1 (Continued)[a]				
	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
January Indicator	-0.062***	-0.216***	-0.229***	-0.291***
	(0.021)	(0.016)	(0.015)	(0.013)
February Indicator	-0.069	-0.084	-0.030	-0.127**
	(0.087)	(0.064)	(0.062)	(0.049)
March Indicator	0.036	-0.032	-0.017	-0.037**
	(0.030)	(0.024)	(0.022)	(0.018)
April Indicator	-0.001	-0.010	0.021	-0.037
	(0.044)	(0.034)	(0.031)	(0.026)
June Indicator	-0.056	-0.030	0.008	-0.007
	(0.050)	(0.040)	(0.036)	(0.030)
July Indicator	0.004	-0.042	-0.025	0.003
	(0.045)	(0.037)	(0.033)	(0.028)
August Indicator	0.031	-0.040	0.008	0.071**
	(0.047)	(0.038)	(0.034)	(0.028)
September Indicator	-0.057	-0.071***	-0.057**	-0.059***
	(0.035)	(0.026)	(0.025)	(0.020)
October Indicator	0.006	0.021	0.028	-0.010
	(0.034)	(0.028)	(0.025)	(0.020)
November Indicator	0.021	-0.010	-0.008	-0.047**
	(0.035)	(0.026)	(0.025)	(0.020)
December Indicator	0.253***	0.190***	0.194***	0.337***
	(0.036)	(0.029)	(0.026)	(0.022)
Five Mondays Indicator	-0.004	-0.015	-0.007	-0.031*
	(0.029)	(0.021)	(0.021)	(0.017)
Five Tuesdays Indicator	0.019	-0.009	0.002	-0.015
	(0.032)	(0.023)	(0.023)	(0.018)
Five Wednesdays Indicator	-0.007	-0.014	0.002	-0.012
	(0.031)	(0.023)	(0.022)	(0.018)
Five Thursdays Indicator	-0.006	-0.018	-0.006	-0.024
	(0.032)	(0.023)	(0.023)	(0.018)
Five Fridays Indicator	-0.002	-0.015	-0.012	-0.030*
	(0.032)	(0.023)	(0.023)	(0.018)
Five Saturdays Indicator	0.005	-0.008	0.005	-0.005
	(0.029)	(0.021)	(0.021)	(0.016)
Five Sundays Indicator	-0.019	-0.018	-0.006	-0.021
	(0.034)	(0.025)	(0.024)	(0.019)
Number of Holidays	-0.000	0.009	0.018	0.002
	(0.015)	(0.013)	(0.012)	(0.010)
F-test (p-value) for equality of coefficients on month of receipt effects before and after change	5.3** (0.021)	7.9*** (0.005)	3.0* (0.085)	3.9** (0.05)

[a]See notes to Table 3.

Appendix Table 2: The Impact of Public Pension Receipt on Consumption Growth[a]

A. Public Pension Recipients Before and After Change

	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
$CHECK\ MONTH_{i,t+1}^{PRE}$	0.095***	0.070***	0.049**	0.051***
	(0.027)	(0.020)	(0.019)	(0.017)
$MONTH\ AFTER_{i,t+1}^{PRE}$	0.011	0.018	0.032	0.036**
	(0.029)	(0.023)	(0.022)	(0.018)
$CHECK\ MONTH_{i,t+1}^{POST}$	0.033	0.006	-0.002	-0.002
	(0.025)	(0.019)	(0.018)	(0.015)

B. Public Pension Recipients vs. Employees: Before Change Only

	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
$\Delta CHECK\ MONTH_{i,t+1}^{PRE}$	0.146***	0.098***	0.068***	0.065***
	(0.027)	(0.021)	(0.020)	(0.016)
$\Delta MONTH\ AFTER_{i,t+1}^{PRE}$	-0.054**	-0.029	0.009	0.023
	(0.027)	(0.022)	(0.021)	(0.017)

[a]This Table reports estimates based on equation (5). As discussed in the text, this specification is the same as in Table 3 except that the three check month indicators are included in the model in place of the first differences of the check month indicators. See notes to Table 3 for more details.

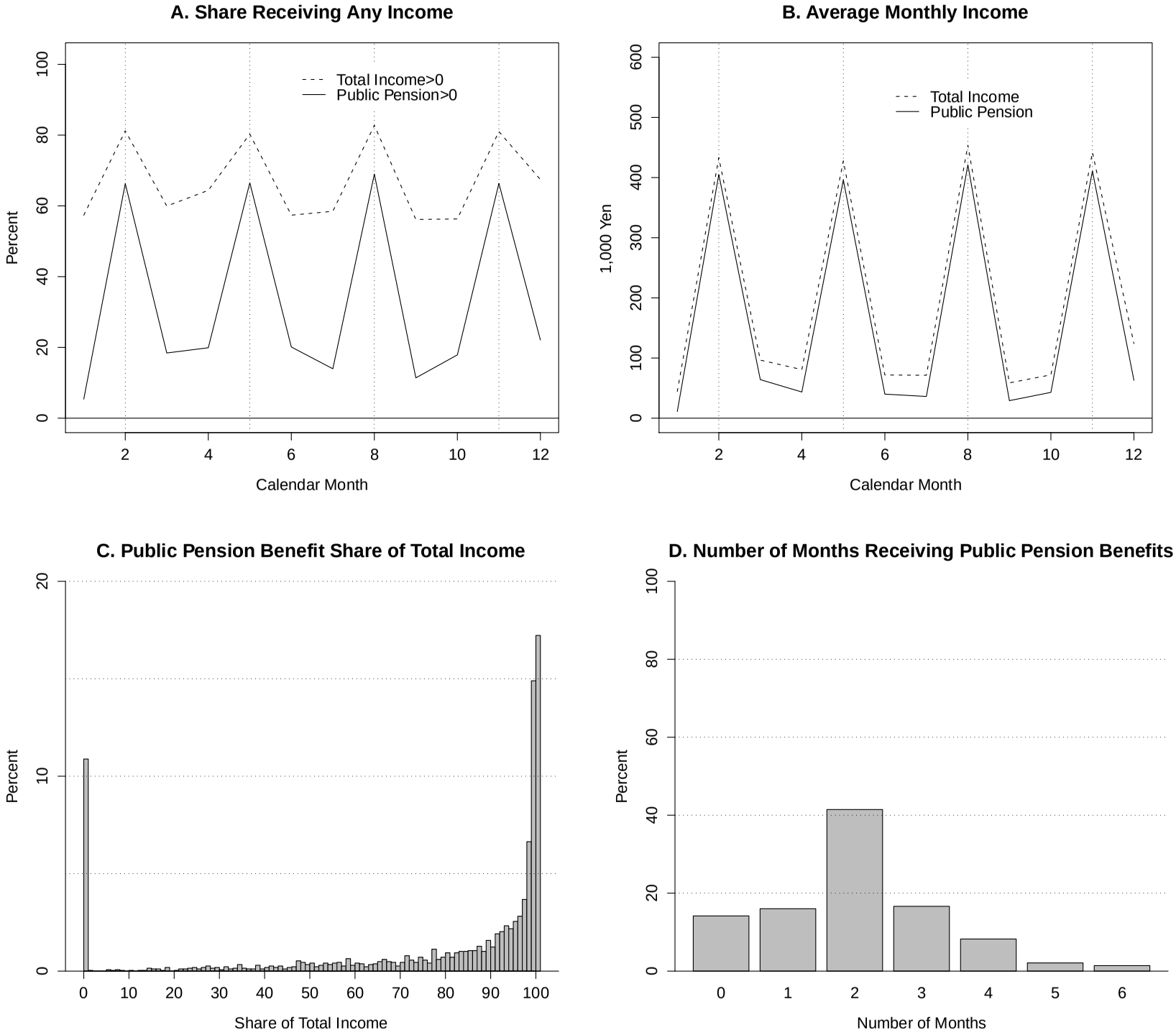


Figure 1: Public Pension Benefits Before the Pay Frequency Change

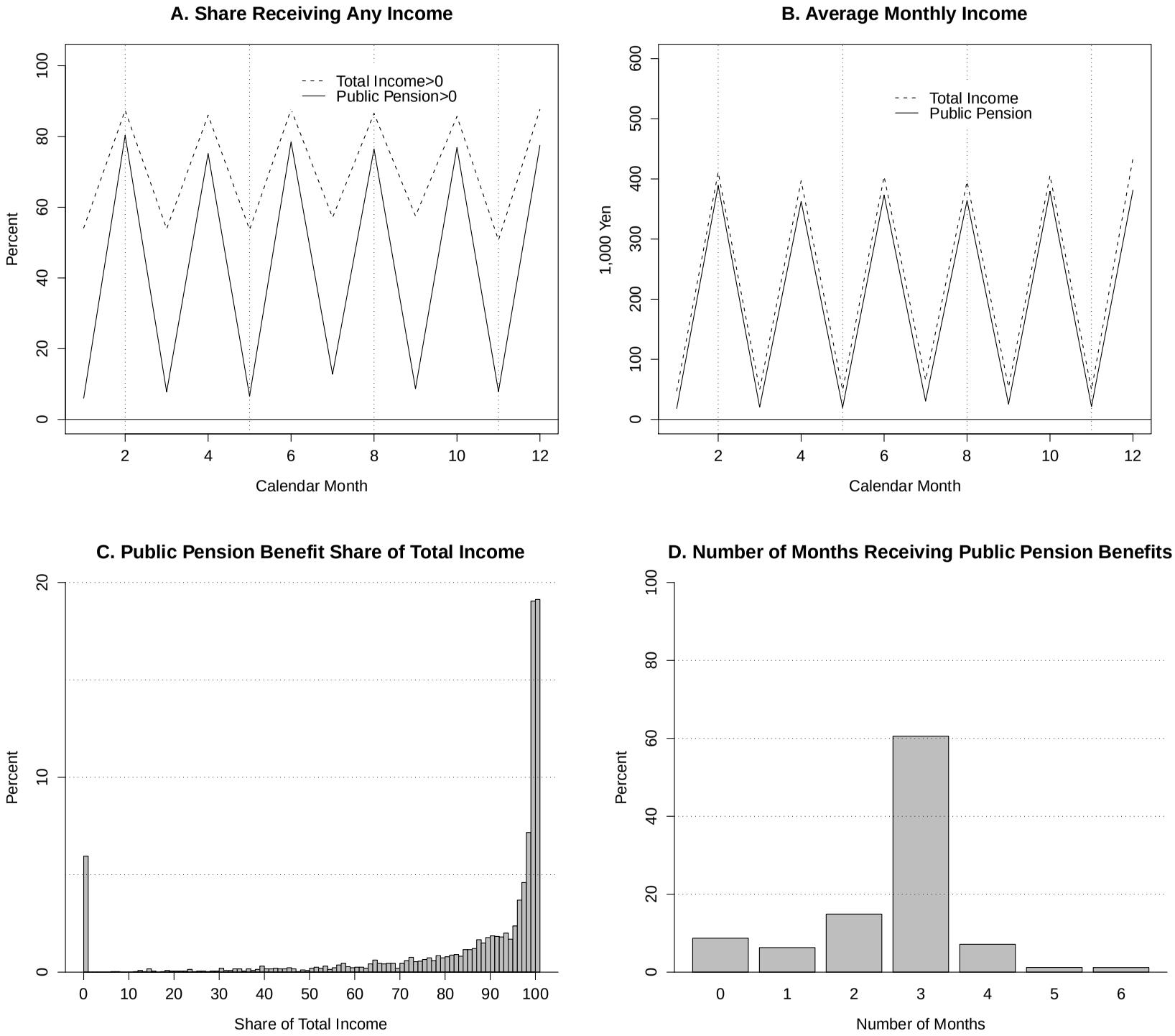


Figure 2: Public Pension Benefits After the Pay Frequency Change

Figure 3: Monthly Income of Recipients and Employees Before the Change

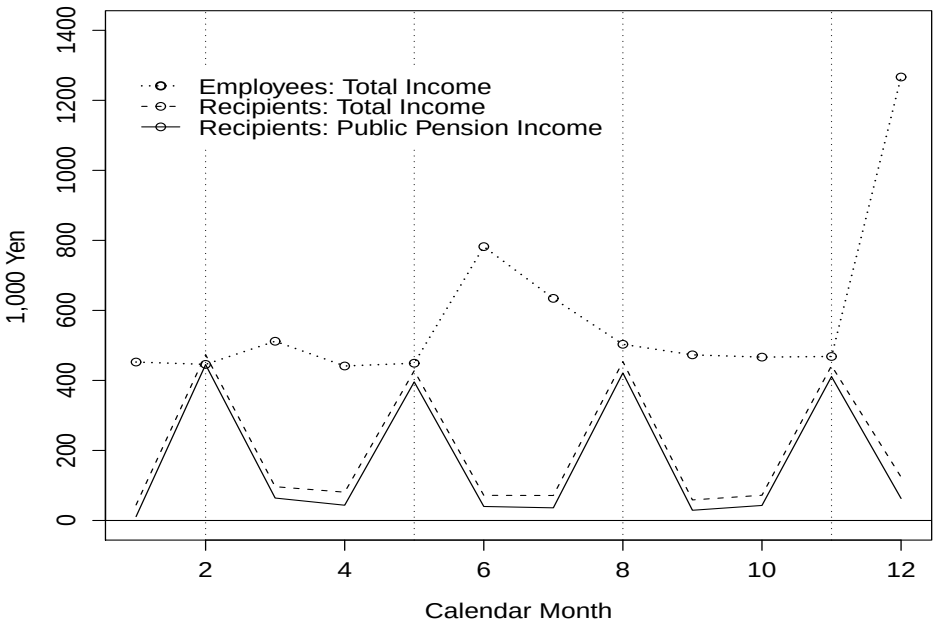
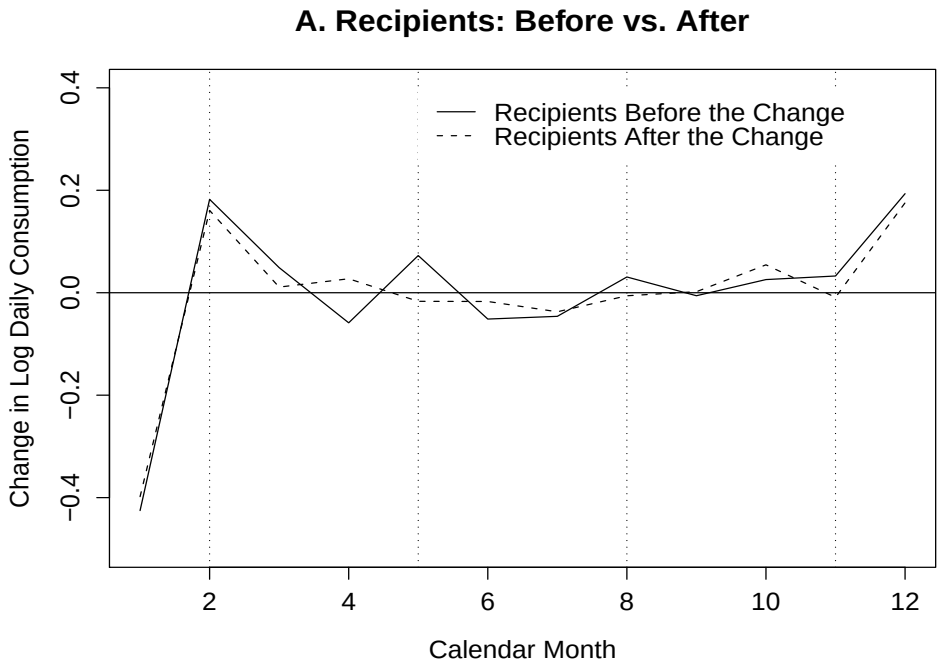


Figure 4: Monthly Changes in Log Daily Non-Durable Consumption



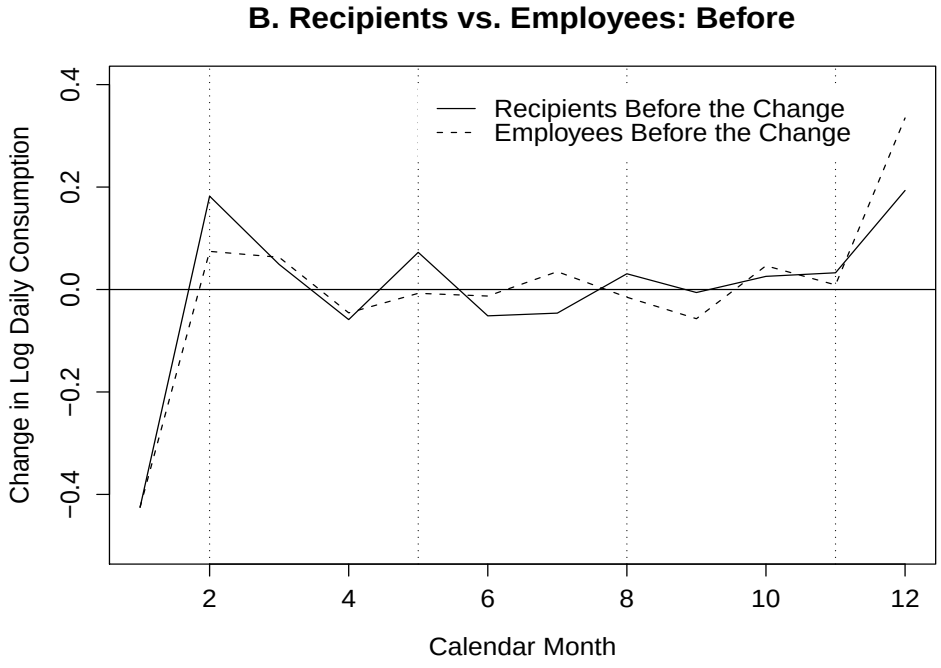


Figure 5: Net Assets to Yearly Income Ratio by Age