Can Governments Help Households Smooth Consumption? Evidence from Japanese Public Pension Benefits*

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Abstract

Recent research finds that households do not "smooth" consumption between regular income receipts such as paychecks and government transfers. We examine whether the consumption response to such income payments is affected by the frequency at which these checks are delivered. We find that the consumption of Japanese households is sensitive to public pension benefit check receipt when these checks are distributed quarterly but that households smooth consumption once the payment frequency is shortened to a bi-monthly interval. Although contrary to the predictions of the Life-Cycle/Permanent Income Hypothesis, our results are consistent with a mental accounting model of self-control.

1 Introduction

The extent to which households smooth consumption as predicted by the Life-Cycle/Permanent Income Hypothesis (LCPIH) remains a point of contention. Recent papers find that consumption is responsive to one-time predictable transitory income changes due to income tax refunds (Souleles 1999), Social Security tax changes (Parker 1999), and the U.S. tax rebates of 2001 (Johnson, Parker, and Souleles 2006). Papers that examine one-time predictable permanent income changes such as those due to contracted union wage increases (Shea 1995) and the repayment of vehicle loans (Stephens 2008) also find a significant consumption response. In contrast, another set of papers finds that households smooth consumption when the predictable income change exhibits a repeated and seasonal pattern at annual frequencies. Paxson (1993) finds that seasonal consumption patterns in Thailand are similar across households with very different seasonal income patterns while Browning and Collado (2001) find comparable monthly consumption patterns across Spanish households although monthly paychecks are constant for one set of workers while another set of workers receives predictable bonus payments twice per year. In a similar vein, Hsieh (2003) finds that the consumption of Alaskan residents does not respond to the sizable annual dividend payments from state government's oil royalties.[1]

While this latter set of studies indicates that households smooth consumption in response to income changes with a regular *annual* seasonal component, a different set of findings emerges from studies of regular *intra-monthly* income fluctuations. Stephens (2003) finds that strict non-durable consumption increases by ten percent during the week following the receipt of U.S. Social Security checks. Using data from the UK, Stephens (2006) finds a seven percent increase in strict non-durable consumption during the week in which monthly paychecks arrive. 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. These results indicate that households tend to have difficulty smoothing consumption in response to high frequency income receipt.[2]

[1] Browning and Crossley (2001) suggest that differences in the welfare costs from failing to smooth consumption in response to some types of predictable changes (e.g., Parker 1999) relative to others (e.g., Browning and Collado 2001; Hsieh 2003) may explain the differences in the responsiveness to the income changes across these studies.

[2] In addition, monthly welfare payments are associated with increased hospital drug admissions (Riddell and Riddell, 2006; Dobkin and Puller, Forthcoming) and criminal activity (Foley, 2008). At the extreme, the periodic

Whereas it is difficult to reconcile this lack of smoothing between periodic income payments with the LCPIH, recent theoretical work which emphasizes the importance of self-control in consumption decisions can generate consumption behavior consistent with these findings. Time-inconsistent preferences due to hyperbolic discount functions make consumers willing to trade off current consumption for future consumption at a greater rate than they had previously desired to trade off consumption between the same two points in time (Laibson 1997). This "present bias" can cause consumption to track predictable income changes which may explain the observed consumption fluctuations between income receipts.[3] Alternatively, models where individuals have two internal systems (e.g., "dual selves"), one which is more deliberative while the other is present biased, are also consistent with increased spending when income is received since individuals must exert costly self-control mechanisms, such as willpower, to constrain immediate consumption (Thaler and Shefrin 1981; Shefrin and Thaler 1988; Benhabib and Bisin 2005; Fudenberg and Levine 2006; Loewenstein and O'Donoghue 2007).

In order to overcome the immediate urge to spend, households can exert self-control, use commitment devices (e.g., contributions to pension plans deducted directly from paychecks), or follow rules of thumb (e.g., always save $100 out of every paycheck). However, lacking the self-control or willpower to do so, households could be made better off by an intervention that would help them smooth consumption between checks. One suggested approach is to increase the frequency with which checks are disbursed (Ohls et al. 1992, Wilde and Ranney 2000; Shapiro 2005; Dobkin and Puller, Forthcoming). If individuals lack the ability to smooth consumption between checks, then smaller, higher frequency payments can reduce the costs of exerting willpower and better allow households to smooth consumption over the course of the month.[4] In fact, a payment frequency change was suggested as a mechanism for improved consumption smoothing by some members of a focus group comprised of U.S. food stamp program participants (Ohls et al. 1992). For example,

receipt of income has proven to be fatal. Phillips, Christenfeld, and Ryan (1999) find that daily mortality increases during the first week of the month in the U.S. and Dobkin and Puller (Forthcoming) find a monthly spike in hospital mortality among U.S. Supplemental Security Income recipients which they link to monthly benefit receipt.

[3]Using simulations, Laibson (1997) shows that there is a positive covariance between consumption and income for hyperbolic consumers with predictably alternating periods of high and low income when illiquid assets can be used for savings.

[4]Browning and Lusardi (1996) recount the story of Duke Ellington's band member who had to be paid daily rather than weekly since under the latter payment arrangement he would go hungry for six days each week.

one participant is quoted as saying

> "Give it to us in two installments. At the end of the month I'm dying [for money]. If you got it on the 1st and 15th, or whatever, it would be so much better. Checks or coupons, it doesn't matter, either way, but it does not last a month. The second part of the month is always a struggle." (Ohls et al. 1992, p.124)

If changing the interval between payments can improve the ability to smooth consumption, there is a potential role for governments to improve household welfare. While a government intervention into pay frequency may seem rather invasive, in fact government policies already influence the timing of multiple household income sources. Nearly every state government in the U.S. regulates the frequency of wage and salary payments made by public and private employers through labor legislation.[5] Moreover, a number of countries have laws which determine the maximum pay period length.[6] In addition, governments around the world determine the timing of income receipt from public transfer programs by setting the interval between such payments to households. Thus, understanding the impact of pay frequency policies on household consumption may have important implications for existing labor legislation and benefit program rules.

Adjusting the frequency of payments to improve the consumption smoothing behavior of households is consistent with the recently discussed role for "libertarian paternalism" which, according to Thaler and Sunstein (2003), "preserves freedom of choice but ... authorizes both private and public institutions to steer people in directions that will promote their welfare." (p.179)[7] Frequently cited examples in which such policies could be beneficial are the defaults when enrolling into 401(k) pension plans. Either setting the default so that workers are immediately enrolled in the pension plan but can choose not to participate or forcing the worker to decide whether or not to join the plan yields higher rates of plan participation than setting the default such that workers are only enrolled if they submit a request to participate (Madrian and Shea 2001, Carroll et al. 2005).

[5]The current listing of state pay frequency laws is available on the U.S. Department of Labor web page (http://www.dol.gov/esa/programs/whd/state/payday.htm).

[6]See Chapter VI of the report from the 2003 International Labor Conference (http://www.ilo.org/public/english/standards/relm/ilc/ilc91/pdf/rep-iii-1b-6.pdf)

[7]Related arguments have been made by Camerer et al. (2003) (for what they call "asymmetric paternalism") and by Loewenstein and Haisley (2007) ("light paternalism").

Policies that adjust the income payment frequency to help households with self-control problems smooth consumption fall under this framework since such policies do not impose any constraints on the choice of items that consumers can purchase.

Of course, a decline in consumption throughout the month can be generated in the standard life-cycle/permanent income model by households with a high degree of impatience. A shorter window between income receipts would reduce consumption fluctuations but possibly to the detriment of households with a strong desire to consume sooner. However, it is difficult to reconcile the observed monthly fluctuations with the standard life-cycle model. Shapiro (2005) finds that the daily discount rates required by a standard life-cycle model to justify the observed pattern of consumption between food stamp payments yields implausibly large annual discount rates. Even if these patterns could be generated by the life-cycle/permanent income model, available financial products such as credit cards would allow such households to continue consuming more earlier in the month without incurring finance charges. Thus, more frequent checks should not hamper the ability of "rational" households to consume more earlier in the period between checks.

We examine whether adjusting the frequency of income payments affects the consumption smoothing behavior of households by analyzing a change in the timing of Japanese public pension benefit disbursement. Since private pensions are uncommon in Japan, these benefits represent the primary source of income for retired Japanese households. Prior to 1990, Japanese public pension benefits were paid every *third* month. Since February 1990, households receive their public pension benefits every *other* month. This payment frequency change left the total annual public pension income received by households unchanged while increasing the number of benefit payments per year. Interestingly, the concerns of public pension recipients about their ability to smooth consumption between checks may have prompted this change. 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* (emphasis added), 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)

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 impact of initially quarterly and then bi-monthly public pension benefit receipt on monthly household non-durable consumption. We find that household consumption is responsive to public pension benefit receipt when payments are received quarterly but that monthly consumption is smooth between checks once benefits are distributed bi-monthly. Pooling the data before and after the pay frequency change allows us to identify separately the impact of check receipt from seasonal consumption patterns. We directly test whether the monthly consumption pattern changes due to the reform and find a statistically significant decrease in monthly consumption fluctuations following the increase in the frequency of public pension benefit disbursements. Our findings are robust to a number of sample specification adjustments.

We also examine whether variants of the LCPIH can provide plausible explanations for our findings. 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 primary source of income. 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. Finally, 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.

Our examination of household consumption behavior surrounding this pay frequency change contributes to the literature along a number of dimensions. First, we add to the recent literature which uses clearly identifiable income changes to test the LCPIH. Our finding that households do not smooth consumption when checks are delivered quarterly but do so when checks are sent bi-monthly highlights the context-specificity of such tests and suggests the need to perform these tests across a variety of domains. Second, we examine how the shortening of the interval between public pension payments impacts household consumption behavior. While prior researchers have

suggested that such a policy might improve household smoothing behavior (Ohls et al. 1992; Wilde and Ranney 2000; Shapiro 2005; Dobkin and Puller, Forthcoming), there is no prior evidence on the efficacy of such a change. Third, our results contribute to the growing set of field studies which is not easily explained by neoclassical theory but is consistent with predictions of behavioral economic models. More frequent and smaller checks may help households smooth consumption by reducing the cost of self-control and/or willpower exertion required to avoid the preference for immediate consumption. As we discuss below, the mental accounting framework of Shefrin and Thaler (1988) is consistent with such behavior even among households such as Japanese public pension recipients that hold positive levels of assets.

The remainder of the paper proceeds as follows. In the next section we describe the Japanese public pension system. We then describe the JFIES which is the source of the data we use in the paper. In section four we detail the identification strategy that we implement to determine the impact of public pension benefits on consumption while section five presents the results of our analysis. The final section summarizes our findings and discusses our results in the context of models that emphasize costly self-control in consumption decisions.

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.[8] 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.[9] Recent legislative changes have created corporate defined benefit and defined pension plans which will eventually replace the aforementioned firm-specific pensions. There are also personal pension plans that are specifically

[8] Unless otherwise noted, the discussion in this section is based on Casey (2004).

[9] 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.

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.[10] In addition, since 1985, dependent, non-working spouses are beneficiaries of the national pension.[11]

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 employees of local governments. 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.[12] Benefit levels in the employee pension depend upon the individual's earnings while they were working.

The age of eligibility currently differs for 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.[13] 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. The bridge pension is only available to those who have completely left the labor force. Workers who are ineligible for the employee pension cannot receive this bridge national pension.[14]

Prior to 1990, public pension benefits were paid once every three months in February, May,

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

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

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

[13] 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 will be limited to male benefit eligibility.

[14] 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.

August, and November.[15] 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.[16] 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 in 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. 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.[17]

3 Data

3.1 The Japanese Family Income and Expenditure Survey

The data we use are drawn 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 are interviewed each month for six consecutive months. The panel is rotating meaning that in any given month approximately one-sixth of households are being interviewed for the first time, one-sixth for the second time, etc. Roughly 8,000 households are interviewed in any given month. Households record daily expenditures and income receipt in a diary which is collected twice a month. However, the available micro data only identify the month

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

[16] An earnings test was not imposed on recipients ages 70 and above until April 2007.

[17] Between 1985 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 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).

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

We impose some sample restrictions due to the public pension eligibility rules and the sampling scheme of the JFIES. First, we limit the sample to male-headed households where the male head is at least 65 years old since national pension benefit receipt begins at this age, regardless of work status, for everyone who is eligible for these benefits. Second, we limit the 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.[18] Third, we limit the sample to households that appear in the JFIES for all six months of the survey. Sample attrition in the JFIES is limited so any bias from dropping these households is presumably very minimal.[19]

We limit the sample to "nuclear families" which we define as two person households with a husband and wife. By limiting the 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

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

[19]Over 90% of households complete all six JFIES interviews.

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.[20] Therefore, since the JFIES does not sample single person households and very few elderly couples have children under age 18, only a small share of elderly couples will be excluded by dropping those in intergenerational households.[21]

We construct household consumption measures from the data recorded in the JFIES diaries. The first consumption measure we examine is total household consumption. While this measure gives a general sense of monthly fluctuations in household spending, it contains spending on many durable items that are typically examined separately. As such, 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 (e.g., Parker (1999), Hsieh (2003), and Stephens (2008) use this measure.).[22]

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. As such, 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.[23] 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,

[20]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).

[21]Roughly fourteen percent of the sample is excluded due to this criterion.

[22]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.

[23]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.

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 typically examine the food consumption response.

The summary statistics for the monthly variables, after imposing the above sample restrictions, are shown in the first two columns of Table 1 under the heading of "Full Sample." All income and consumption measures reported in the Table as well as used throughout the paper are inflated using the Japanese Consumer Price Index. The table indicates that, on average, over 80 percent of income for these households is due to the public pension 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 find 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 see that households receive no income in nearly one-third the monthly observations. Table 1 also shows that all households have positive consumption in every month in the four consumption categories on which we focus.

3.2 Public Pension Income in the JFIES

We are interested both in whether monthly household consumption is responsive to the receipt of public pension income and in whether the change in the public pension payment frequency changed this response. 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 benefit receipt match the government's disbursement patterns before and after the change. We also examine the importance of public pension income as a source of income for the households in our sample.

Figure 1 examines public pension income by calendar month before the pay frequency change. Panel A of the Figure presents the share of sample households reporting the receipt of public pension income and the share reporting any income at all. The share of households reporting the

receipt of any income is 80 percent in months when public pension income is distributed while this share falls to roughly 60 percent during the remaining months. Of the households that meet the criteria we discussed above, the panel indicates that over 60 percent report receiving public pension income during the months it is distributed.

Panel A of Figure 1 also reveals that roughly 20 percent of households report such income in non-public pension months. 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.[24] Thus, the patterns shown in Panel A of Figure 1 are consistent with the government's public pension disbursement policy.

Average total income and average public pension income are presented in Panel B of Figure 1 by calendar month. This panel clearly indicates that nearly all of the income received by these households is due to public pension benefits. Over 95 percent of income received during the public pension disbursement months is due to public pension income. During the remaining months, roughly half of the average reported income is due to public pension benefits. However, total income received during these months is, on average, only one-quarter of what it is during the main public pension disbursement months. Moreover, the small set of households that receive public pension income outside of the quarterly disbursement pattern somewhat obscures the large spikes in income for the majority of households receiving public pension benefits prior to March 1990.

Figure 2 further confirms the importance of public pension income for these households prior to

[24]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.

the pay frequency change. First, we calculate the share of income over the entire six month sample period that is due to public pension benefits and its distribution in Panel A of the Figure. The majority of the sample receives more than 90 percent of its income from public pension benefits. In addition, over 10 percent of households do not receive any income from public pension benefits. Panel B shows that the modal household during this period reports receiving public pension 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. A similar share of the sample reports receiving public pension benefits for only a single month.

After the pay frequency change, the reported patterns of public pension receipt in the JFIES change accordingly. Panel A of Figure 3 shows that, following the change, 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. Over 80 percent of households report receiving any income during the check receipt months while roughly 60 percent receive some source of income during the remaining months. However, as the second panel of Figure 3 indicates, a substantial fraction of the average income received by these households comes from public pension income. The distributions of benefits across households after the pay frequency change are shown in Figure 4. Over two-thirds of households receive more than 90 percent of their income from public pensions as shown in the Panel A of Figure 4. Less than ten percent of households now report not receiving any public pension income. In addition, as shown in Panel B, over 60 percent of households report receiving exactly three public pension payments during their six month sample period.

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 February 1990 payment frequency change. In addition, the households in our sample are highly dependent upon public pension benefits for income indicating that changes in the payment frequency of public pension benefits dramatically shift the timing of the total income receipt by public pension recipients.

4 Empirical Methodology

Our focus in this paper is two-fold. First, we test whether Japanese household consumption is sensitive to the receipt of public pension benefits. Second, we examine if the change in the payment frequency of these benefits had an effect on the ability of households to smooth consumption. Testing of both of these issues requires further restrictions on our samples.

The restriction is that we only use households that report receiving public pension 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 households where the reported public pension benefit months do not match the primary government policy for check disbursement both before and after the payment frequency change. Thus, we only include households from February 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-January 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 employees 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. These two groups are excluded from our analysis. 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 households that report the receipt of 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.

The sample statistics for these households, after imposing these additional restrictions, are shown in the final two columns of Table 1 under the heading of "Regression Sample." Observable household characteristics in this sample 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.

Our two tests of interest, testing the consumption response to check receipt and testing whether the payment frequency change affects the smoothing behavior of households, can be implemented in a single specification. The equation relating the log of average daily consumption in month t to the timing of public pension benefits both before and after the payment frequency change is

$$\begin{aligned} log\ C_{i,t} &= \alpha_i + \beta_1 CHECK\ MONTH_t^{BEFORE} \\ &+ \beta_2 MONTH\ AFTER_t^{BEFORE} \\ &+ \gamma CHECK\ MONTH_t^{AFTER} \\ &+ \omega X_{i,t} + \theta M_t + \epsilon_{i,t} \end{aligned} \tag{1}$$

where $C_{i,t}$ is average daily consumption in month t for household i, α_i is a household fixed effect, $CHECK\ MONTH_t^{BEFORE}$ is a binary indicator for whether or not a check is received in month t before the pay frequency change, $MONTH\ AFTER_t^{BEFORE}$ is a binary indicator for whether or not month t is the month immediately following the month of check receipt before the pay frequency change, and $CHECK\ MONTH_t^{AFTER}$ is a binary indicator for whether or not a check is received

in month t after the pay frequency change, $X_{i,t}$ is a set of demographic household characteristics in month t, M_t is a set of calendar month specific characteristics, and $\epsilon_{i,t}$ is a household month-specific error term. Given that we focus on two-person households and no demographic characteristics vary at the monthly level in the JFIES survey data, $X_{i,t}$ only contains age of the household head and its square.

A number of calendar month specific characteristics that may affect average daily consumption are included in the the vector M_t. The vector includes a set of calendar month indicators to account for general seasonal fluctuations in consumption. We also include a set of 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 using diaries (Stephens 2003, 2006). Since daily consumption 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.[25] In addition, we allow average daily consumption to depend upon the timing of any holidays within a month by including seven variables containing the number of times a given day of the week contains a holiday within that month.[26] 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 do not explicitly control for calendar year in the above specification. However, since households are in the JFIES for a six month window, general economic trends are subsumed by the household fixed effect, α_i.[27]

The primary regressors of interest are the indicators for the relationship between the current month and the month in which a check is received. Prior to the change in the payment frequency, the consumption response to quarterly check receipt is captured by the regressors $CHECK$

[25] 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.

[26] In all months except for January, these variables are either zero or one. Appendix Table 1 contains a list of Japanese holidays. In Japan, holidays that fall on Sundays are observed on the ensuing Monday whereas holidays that fall on Saturdays are observed on the same day.

[27] The six month survey period falls into a single calendar for half of the JFIES households which means that, among these households, any calendar year effects will be subsumed the household fixed effect. While the survey period for the remaining households overlaps two calendar years, any general economic trends should be effectively captured by the household fixed effect given the six month survey duration.

$MONTH_t^{BEFORE}$ and $MONTH\ AFTER_t^{BEFORE}$. The coefficients, β_1 and β_2, on these payment timing regressors indicate the increase in monthly consumption relative to the excluded category which is the month prior to check receipt. Thus, testing whether or not *either* of these coefficients equal zero indicates whether households smooth consumption prior to the payment frequency change. After the change, a single regressor, $CHECK\ MONTH_t^{AFTER}$, captures whether or not a bi-monthly public pension payment is received in month t. A test of whether the coefficient, γ, on this regressor equals zero is a test of whether consumption is responsive to these payments after the change. In order to test whether the smoothing of consumption differs before and after the law change, we can test whether the impact on consumption in the month of check receipt is the same both before and after the payment frequency change. Based on the specification in equation (1), the null hypothesis of interest for testing the impact of the legislation on the smoothing behavior of households is $\beta_1 = \gamma$.

The fact that public pension benefits are disbursed in the same calendar months for all households causes a potential problem when trying to identify the impact of these benefits on monthly consumption. If we were to limit the sample only to the period prior to the payment frequency change, we would be unable to separately identify the impact of quarterly public pension receipt from seasonal consumption patterns. The same concern arises if we only examine the later period when public pension benefits are paid bi-monthly. However, pooling households across the periods before and after the change allows us to separately identify the impact of public pension benefit receipt from seasonal consumption fluctuations.

To account for the fixed effect in the specification, we difference equation (1) which yields

$$\begin{aligned} \Delta log\ C_{i,t} &= \beta_1(\Delta CHECK\ MONTH_t^{BEFORE}) \\ &+ \beta_2(\Delta MONTH\ AFTER_t^{BEFORE}) \\ &+ \gamma(\Delta CHECK\ MONTH_t^{AFTER}) \\ &+ \omega(\Delta X_{i,t}) + \theta(\Delta M_t) + (\Delta \epsilon_{i,t}) \end{aligned} \tag{2}$$

where Δ is the difference operator such that all of the variables preceded by Δ in equation (2)

are the changes in these values between months $t-1$ and t. Since all of the regressors included in (2) are differences of the regressors included in the level equation (1), we can easily interpret the estimated coefficients. In particular, we can still interpret the coefficients on the check timing regressors as the impact of public pension receipt on consumption relative to the month prior to check receipt. Moreover, estimating (2) follows the majority of the prior literature in using log consumption changes as the dependent variable.[28]

5 Results

5.1 The Impact of Public Pension Receipt on Monthly Household Income

The monthly fluctuations in both total income and public pension income for the regression sample are shown in Table 2.[29] The first three columns in the Table present the results of estimating specifications comparable to equation (2) except that the dependent variable is the monthly change in public pension income.[30] Column (1) of the Table shows the results which only use observations from the period prior to the payment frequency change. The estimated coefficient on $\Delta CHECK\ MONTH_t^{BEFORE}$ indicates that public pension income increases, on average, by over 690,000 yen in the month of check receipt relative to the month prior to check delivery. The estimated coefficient on $\Delta MONTH\ AFTER_t^{BEFORE}$ indicates that public pension income in the month after check receipt is essentially the same as in the month prior to check receipt. This result is expected since households in the sample do not receive checks during these two months. The estimated coefficient on $\Delta CHECK\ MONTH_t^{AFTER}$ in Column (2) of the Table indicates public pension income increases by roughly 500,000 yen in response to bi-monthly check receipt after the pay frequency change. The specifications used in Columns (1) and (2) cannot control for calendar month effects since, as discussed above, the impact of check receipt is not separately identified

[28] The log consumption measure is justified in the standard life-cycle model by assuming that consumers have constant relative risk aversion utility functions. Some prior papers use a level consumption measure as the dependent variable (e.g., Souleles 1999). In results available from the authors, we find qualitatively similar results when we use level consumption changes as the dependent variable.

[29] 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.

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

from seasonal effects when the either the pre- or post-change period is examined separately. The estimates in column (3) which pools across these two periods can account for calendar month effects. Not too surprisingly, pooling the results across these periods and including calendar month controls yields nearly identical results to those found in the first two columns.

The second set of results in Table 2, shown in columns (4)-(6), examine the impact of public pension receipt on total household income. If the receipt of public pension income is associated with the receipt of other household income, then the estimates in these columns would differ from those shown in the first three columns which only examine the impact on public pension income. The resulting estimates are nearly identical across these two sets of columns. We also find that the increase in total income in the month after check receipt prior to the change is significant, although still economically small, as shown in column (4). This significant increase is likely due to other sources of household income which increase during December since this month is one of the months after check receipt in this period. Notice that this effect disappears in column (6) where we can control for month effects after pooling across the two time periods. Overall, the monthly fluctuations in total income for these households are driven by public pension income both before and after the change in payment frequency.

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 (2) using observations across the entire sample period from 1985-1994.[31] The Table shows that consumption significantly increases in the month of check receipt prior to the payment frequency change. The estimated coefficient on $\Delta CHECK\ MONTH_t^{BEFORE}$ is statistically significant for total and non-durable consumption while it is marginally significant for strict non-durable and food consumption. Total consumption increases by nearly 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 over four percent in the month of check receipt while strict non-durable and food

[31] The full set of results corresponding to the estimates found in Table 3 are presented in Appendix Table 2.

consumption both increase by roughly 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 $\Delta MONTH\ AFTER_t^{BEFORE}$ are significant across all of the columns. Non-durable consumption is nearly three percent higher while both strict non-durable and food consumption are both 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. However, F-tests for each of the four consumption categories cannot reject the null hypothesis that the coefficients on the check receipt indicators before the change are equal.[32] Overall, these results show that consumption significantly responds to check receipt when checks are delivered quarterly.

We can also use the results shown in Table 3 to test whether consumption responds to bi-monthly check receipt after the payment frequency change. The estimated coefficient on $\Delta CHECK\ MONTH_t^{AFTER}$ is insignificant across all of the consumption categories. The point estimate on total consumption corresponds to a less than two percent increase while the estimates on the remaining categories are all well below a one percent change. Thus, following the payment frequency switch, consumption does not respond to public pension receipt.

A comparison of the point estimates for the consumption response to check receipt both before and after the change from the quarterly to the bi-monthly payment frequency finds that the change improved household consumption smoothing behavior. The estimated impact of check receipt on total consumption falls by nearly 70 percent after the change as seen by comparing the estimated coefficients on $\Delta CHECK\ MONTH_t^{BEFORE}$ and $\Delta CHECK\ MONTH_t^{AFTER}$. The estimated impact of check receipt decreases by at least amount across the remaining consumption categories.

While the above examination of the point estimates in Table 3 suggests that the payment frequency change greatly improved household consumption smoothing, we can directly test whether the consumption response to check receipt significantly differs across the two periods. The F-

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

statistics shown at the bottom of the Table test whether the coefficients on $\Delta CHECK\ MONTH_t^{BEFORE}$ and $\Delta CHECK\ MONTH_t^{AFTER}$ are equal. For total and non-durable consumption, the estimates are significantly different before and after the change. Overall, the results of these tests indicate household consumption smoothing behavior greatly improved following the change from a quarterly to a bi-monthly payment frequency.

The results for the full specification are presented in Appendix Table 2. There is a pronounced consumption increase in December across all four consumption categories.[33] In addition, consumption is significantly lower in January (relative to the excluded month which is May) for non-durable, strictly non-durable, and food consumption since the coefficients on all of the included month indicators are significant in Columns (2)-(4). There is some evidence of survey fatigue since the indicators for the fifth interview month is negative and significant across all of the columns.[34] Nearly all of the indicators for having a fifth day of the week are insignificant while some of the holiday variables are significant. Finally, the indicators for months surrounding the implementation of the consumption tax have the expected signs with a significant increase before the tax was implemented in March 1989 and a significant decrease following the implementation in April 1989.

Before proceeding, we should note that the results presented in Table 3 likely underestimate the consumption response to public pension receipt. The reason is that these 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). A consumption response in the last half of the month may be offset by lower spending during the first half of the month. Thus, our specification may be unable to find a significant response to check receipt after the policy change if one does exist. However, since the same mechanism is attenuating results prior to the reform, there is no reason to believe that the difference in the response to check receipt before and after the reform is exacerbated by this concern. Therefore, this receipt of checks in the middle of the

[33]Since December is a month of check receipt following the change, it is possible that the large spike in December spending might bias the results towards finding an effect following the change. However, as shown in Table 3, we do not find a significant response after the change. Moreover, we have estimated specifications similar to those shown in Table 3 and Appendix Table 2 which drop observations that include December and find results similar to those presented here.

[34]Since we are using changes in consumption as the dependent variable, each household can only contribute five monthly changes to the sample. Hence, we include four interview month indicators in the specification.

month should not affect our test of whether the consumption response to check receipt changed due to the change in pay frequency.

5.3 Robustness of the Results

A number of sample exclusion criteria are implemented to generate the regression sample that we use in Table 3. We impose these restrictions in order to limit the sample to 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 work behaviors. In doing so, we examine the consumption behavior of households where the amount and timing of monthly income receipt are very predictable.

Table 4 presents results where we expand the sample in a number of different dimensions to examine the robustness of the estimates to different sample selection criteria. Panel A of the Table adds households that report receiving at least one benefit check but do not report receiving benefit checks in all possible check distribution months during their six month panel period. However, we still require that all reported checks are received only in the months that match the check disbursement policy. 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. The findings in Panel A of Table 4 show that adding these households produces results that are nearly identical to those shown in Table 3. We now also find that the strict non-durable consumption response to check receipt benefit is significant in the month of check receipt before the reform.

Alternatively, we relax the restriction that household heads cannot work during the sample period. These households could impact the results due to income changes caused by entering or exiting the labor force during the sample period. In addition, the prevalence of bonus income among Japanese workers, primarily in December, could lead to spurious findings. On the other hand, since public pension benefits comprise a smaller share of total income among households with working heads, the inclusion of these households could yield a smaller response to check receipt. However, the estimates shown in Panel B of Table 4 indicate that the impact on the results of adding these

households is only minimal. The estimated responses of strict non-durable and food consumption prior to the reform are now insignificant in the month of check receipt but remain significant in the month following check receipt. The remaining estimates hardly change in terms of magnitude and are unchanged in terms of significance.

We also examine the impact of requiring that sample households consist only of nuclear families. Loosening this restriction increases the potential number of household members that may be employed which would provide an alternative source of income. While the additional income could lessen the reliance on public pension income and, thus, dampen the response to check receipt, the labor market activities of these family members might lead to spurious findings. Specifically, December bonuses arrive in the month after check receipt both before and after the change. As shown in Panel C of Table 4, eliminating this sample criterion produces results that are nearly identical in magnitude to those found in Table 3 and also increases the significance level of many coefficients. In particular, we now find that the response of food consumption to benefit check receipt is significantly different before and after the pay frequency change.

The final robustness check in Table 4 simultaneously relaxes the same sample restrictions as in Panels A, B, and C of Table 4. The results from using this sample, which is substantially larger than the Regression sample used in Table 3, are shown in Panel D of Table 4. Once again, the magnitude of the estimates is essentially unchanged. The difference in the consumption response in the check receipt month is significantly different before and after the pay frequency change for total, non-durable, and food consumption. We also find a response in strict non-durable consumption after the reform although this result is only marginally significant. However, the estimated response is 50 percent smaller than before the change. Overall, the set of results in Table 4 indicates that our findings are robust to a number of sample selection criteria.

As we discussed earlier, two subsets of households had different disbursement patterns prior to 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 5. 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. The change in the response to check receipt is still significantly different for both total and non-durable consumption. For the older households, the response is no longer significant prior to the change for either strict non-durable or food consumption although the estimated coefficients remain larger prior to the change. We still find that the magnitude of the response to check receipt is different before and after the change for non-durable consumption although the test statistic is marginally significant. While we still find a significant total consumption response before but not after the reform, the F-statistic testing the equality of these responses is no longer significant. The findings in Table 5 for households under age 70 indicate that the exclusion of households with different payment frequencies prior to the change does not affect our results.

5.4 Explanations Based on Variants of the LCPIH

While the basic LCPIH model predicts that consumption should not be excessively sensitive to predictable income fluctuations, variants of the LCPIH predict that consumption movements will be contemporaneous with income changes. Zeldes (1989) and Deaton (1991) show that liquidity (borrowing) constraints will 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 where either the households assets or the households asset to income ratio is used a as proxy for liquidity constraints (e.g., Zeldes 1989).

Models that allow for precautionary 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 with 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 does fluctuate 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.[35] 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.[36] However, outside of demand deposits,

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

[36]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.

the remaining asset categories are illiquid to some degree and, thus, are not easily available to smooth consumption fluctuations between benefit public pension payments.[37]

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).[38] 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 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.[39] As shown in Panel B of the Figure, however, the median 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.

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 wealth data in the FSS, 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 (lagged) 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.

[37]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.

[38]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.

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

We categorize households by whether their lagged annual income is below or above the median income for their survey year. Table 6 presents the results from estimating equation (2) 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 that consumption is sensitive to the receipt of income before the pay frequency change but it is smooth after the change. We can reject the null that the coefficients in the month of check receipt are the same both before and after this change for the low income group for total and non-durable consumption. 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, but we are unable to reject that the patterns change following the pay frequency change. The results in Table 6 generally show that the consumption increase appears to decline more gradually over the quarterly intervals before the change for the above median households while the decline appears to occur 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.

6 Discussion

In this paper, we examine whether changing the frequency of income payments affects the consumption smoothing behavior of households. Public pension benefits, which comprise the vast majority of income for retired Japanese households, were paid quarterly prior to 1990 and have been paid every other month since that time. We find that monthly household consumption significantly responds to benefit check receipt when these benefits are paid quarterly. After the payment frequency was shortened to bi-monthly intervals, there is no significant consumption response to the receipt of these checks. Moreover, we find that the consumption response in the month of benefit receipt is significantly different before and after the payment frequency change which indicates that this change improved household consumption smoothing behavior. These findings are robust to a number of sample specifications.

The standard life-cycle/permanent income hypothesis predicts that households smooth consumption regardless of the frequency between regular income payments. Variants of the LCPIH which have been used to explain the consumption response to predictable income changes in other contexts do not provide plausible explanations for our findings. Liquidity constraints and precautionary savings are not theoretically relevant for elderly households facing a constant income stream over the remainder of their lifetimes. In addition, the high levels of savings among sample households indicates that neither high discount rates nor liquidity constraints can explain our results. Furthermore, using past income as a proxy for liquidity constraints, we find no difference in the pattern of response to check receipt across the high and income groups.

Models where consumers either have hyperbolic discount rates or must exert willpower to control urges for immediate consumption can lead to consumption tracking predictable income receipt. Laibson's (1997) model of hyperbolic consumers predicts a consumption-income co-movement in response to predictably alternating periods of high and low income receipt. However, to generate this pattern, this model incorporates an illiquid asset and leads to an equilibrium in which households consume all liquid cash-on-hand. While the results in Figure 5 indicate that Japanese households do have a relatively high share of illiquid assets, the median household also carries roughly three months of income in accessible demand deposits. In addition, these households hold a combined eleven percent of their assets in stocks and bonds which, while not perfectly liquid, can be converted to current spending without incurring any substantial costs. Thus, this model is not well-suited to explain our findings.

Among the models of costly willpower exertion, Shefrin and Thaler's (1988) behavioral life-cycle hypothesis generates predictions that are broadly consistent with our findings. Since committing to a specific consumption plan can be difficult if enforced only by the use of costly (in terms of utility) self-control, households in their model may form a set of rules which generate disutility if they are not followed. One such set of rules is a mental accounting system which divides income and wealth into three categories: current income, current assets, and future income. Limiting consumption out of current income can be achieved by exerting costly self-control where the costs are increasing in the amount that is constrained. In addition, any consumption that requires a

withdrawal from the current asset account is subject to a fixed utility cost. Thus, households only make large withdrawals from the current asset account because the additional utility that results from consuming small withdrawals from this account will not be large enough to offset the fixed utility cost of spending out of current assets. A larger fixed utility cost arises from spending out of future income with similar implications for behavior.

A number of predictions from this model match our findings. First, in order to smooth consumption, Japanese public pension recipients must constrain themselves from consuming the entire payment in the month of check receipt in order to have income to spend in the subsequent month(s) before checks are again distributed. When the use of willpower is costly to refrain from spending, willpower exertion is the highest during month of check receipt and then falls until the next check is received as the household spends down the benefit payment. Thus, smoothing expenditures and smoothing marginal utility are no longer synonymous once the disutility of exerting willpower is introduced. Consumption may be falling between checks although utility is not. Second, since households incur a fixed utility cost if they withdrawal from the current asset account in order to smooth consumption between checks, consumption may decrease between checks even for households with positive assets if all spending is out of the current income account. Third, since self-control costs are increasing in the amount that is being constrained, smaller, more frequent checks (holding annual benefit payments constant) reduce the amount of willpower that must be expended to constrain current consumption when the check is received. As such, households are more likely to smooth consumption when the benefit payments are smaller since the willpower costs of smoothing consumption are lower. All of these predictions, while inconsistent with the LCPIH, are consistent with our findings.

As we noted earlier, our results contribute to the literature in a number of ways. We add to the recent literature which uses clearly identifiable income changes to test the LCPIH. Our findings reject this model when checks are delivered quarterly but do not reject the model when checks are sent bi-monthly. These results can be interpreted as important evidence of context-specificity for the LCPIH. In addition, this study provides empirical evidence for the suggestion by prior researchers that policies to shorten the interval between public pension payments can

lead households to smooth consumption between checks. Finally, our results contribute to the growing set of field studies which is not easily explained by neoclassical theory but is consistent with predictions of behavioral economic models.

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Table 1: Descriptive Statistics for Monthly Observations
Nuclear Households With Non-Working Heads Ages 65 and Over
(Income and Consumption in 1,000 Yen)

	Full Sample						Regression Sample					
	Before Change			After Change			Before Change			After Change		
Variable	Mean	Std. Dev.	Share Zero	Mean	Std. Dev.	Share Zero	Mean	Std. Dev.	Share Zero	Mean	Std. Dev.	Share Zero
Total Income	202	317	0.33	226	290	0.3	274	369	0.31	280	310	0.24
Public Pension Benefits	168	301	0.66	194	266	0.58	238	359	0.66	244	283	0.51
Total Household Consumption	212	169	0	227	190	0	226	172	0	234	192	0
Nondurables	129	81	0	138	88	0	138	89	0	142	83	0
Strictly Non-Durable	108	63	0	115	75	0	114	69	0	118	67	0
Food Consumption	57	25	0	59	25	0	59	27	0	60	26	0
Spouse Employed	0.08	0.28	–	0.08	0.27	–	0.09	0.29	–	0.08	0.27	–
Age of HH Head	71.9	5.2	0	72.0	5.4	0	70.9	4.7	0	71.7	5.3	0
Six Month Survey Period Totals												
Total Income	1192	839	0.04	1382	856	0.03	1614	671	0	1714	756	0
Public Pension	985	696	0.14	1193	706	0.09	1393	492	0	1499	558	0
Monthly Observations	16,231			21,120			4,522			9,316		
Number of Households	6,336						2,871					

Table 2: Monthly Income Changes Due to The Receipt of Public Pension Income[a]

	Public Pension Benefits			Total Income		
	Before Change (1)	After Change (2)	Entire Period (3)	Before Change (4)	After Change (5)	Entire Period (6)
$\Delta CHECK\ MONTH_t^{BEFORE}$	692***		694***	690***		697***
	(7.9)		(8.2)	(8.2)		(8.7)
$\Delta MONTH\ AFTER_t^{BEFORE}$	3.9**		0.4	12.1***		1.7
	(1.6)		(2.3)	(3.0)		(4.2)
$\Delta CHECK\ MONTH_t^{AFTER}$		499***	495***		502***	493***
		(4.3)	(4.7)		(4.6)	(5.3)
Month Effects?	No	No	Yes	No	No	Yes

[a]The dependent variable is the change between months $t-1$ and t 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 age, indicators for the introduction of the Consumption Tax in March and April, 1989, and indicators corresponding each month in the six month survey period. Calendar month indicators are included in columns (3) and (6). *, ** , 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]

	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
$\Delta CHECK\ MONTH_t^{BEFORE}$	0.059***	0.043***	0.021*	0.017*
	(0.016)	(0.012)	(0.012)	(0.010)
$\Delta MONTH\ AFTER_t^{BEFORE}$	0.035**	0.030***	0.024**	0.024**
	(0.016)	(0.012)	(0.012)	(0.009)
$\Delta CHECK\ MONTH_t^{AFTER}$	0.018	0.008	0.003	0.005
	(0.013)	(0.010)	(0.009)	(0.008)
F-test (p-value) for equality of coefficients on month of receipt effects before and after change	4.40**	6.21**	1.53	1.05
	(0.036)	(0.013)	(0.216)	(0.306)

[a]The dependent variable is the change between months $t-1$ and t 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 age, indicators for the calendar month, indicators for having a fifth day in the month for each day of the week, the number of monthly holidays falling on a given day for each day of the week, indicators for March 1989 and April 1989 corresponding to the consumption tax introduction, and indicators corresponding to each month in the six month survey period. *, ** , and *** represent significance at the 10 percent, 5 percent, and 1 percent levels, respectively.

Table 4: The Impact of Public Pension Receipt on Consumption Robustness Checks

	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
A. Include Households Reporting Fewer Payments (N=15,576)				
$\Delta CHECK\ MONTH_t^{BEFORE}$	0.053***	0.046***	0.026**	0.016*
	(0.014)	(0.011)	(0.011)	(0.009)
$\Delta MONTH\ AFTER_t^{BEFORE}$	0.032**	0.033***	0.027***	0.025***
	(0.014)	(0.011)	(0.010)	(0.008)
$\Delta CHECK\ MONTH_t^{AFTER}$	0.017	0.009	0.008	0.005
	(0.012)	(0.009)	(0.008)	(0.007)
F-test (p-value) for equality of coefficients on month of receipt effects before and after change	4.17** (0.041)	8.13*** (0.004)	2.22 (0.136)	1.10 (0.294)
B. Include Working Households (N=15,712)				
$\Delta CHECK\ MONTH_t^{BEFORE}$	0.055***	0.038***	0.015	0.013
	(0.015)	(0.011)	(0.011)	(0.009)
$\Delta MONTH\ AFTER_t^{BEFORE}$	0.027*	0.025**	0.023**	0.021**
	(0.015)	(0.011)	(0.011)	(0.009)
$\Delta CHECK\ MONTH_t^{AFTER}$	0.009	0.006	0.004	0.007
	(0.012)	(0.009)	(0.009)	(0.007)
F-test (p-value) for equality of coefficients on month of receipt effects before and after change	5.73** (0.017)	5.26** (0.022)	0.71 (0.400)	0.29 (0.593)

Continued on Next Page

Table 4: The Impact of Public Pension Receipt on Consumption Robustness Checks (Continued)[a]

	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
C. Include Non-Nuclear Households (N=17,788)				
$\Delta CHECK\ MONTH_t^{BEFORE}$	0.063***	0.046***	0.025**	0.024***
	(0.014)	(0.011)	(0.010)	(0.008)
$\Delta MONTH\ AFTER_t^{BEFORE}$	0.035**	0.029***	0.023**	0.025***
	(0.014)	(0.010)	(0.010)	(0.008)
$\Delta CHECK\ MONTH_t^{AFTER}$	0.018	0.010	0.009	0.003
	(0.011)	(0.008)	(0.008)	(0.006)
F-test (p-value) for equality of coefficients on month of receipt effects before and after change	6.77***	8.40***	1.50	4.34**
	(0.009)	(0.004)	(0.220)	(0.037)
D. Simultaneously Relax Same Restrictions As in Earlier Panels (N=23,332)				
$\Delta CHECK\ MONTH_t^{BEFORE}$	0.053***	0.040***	0.024***	0.022***
	(0.012)	(0.009)	(0.009)	(0.007)
$\Delta MONTH\ AFTER_t^{BEFORE}$	0.026**	0.027***	0.023***	0.022***
	(0.012)	(0.009)	(0.008)	(0.007)
$\Delta CHECK\ MONTH_t^{AFTER}$	0.010	0.009	0.012*	0.004
	(0.009)	(0.007)	(0.007)	(0.005)
F-test (p-value) for equality of coefficients on month of receipt effects before and after change	9.13***	8.28***	1.24	4.43**
	(0.003)	(0.004)	(0.265)	(0.035)

[a]See notes to Table 3.

Table 5: The Impact of Public Pension Receipt on Consumption
Sample Split By Age[a]

	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
Under Age 70				
$\Delta CHECK\ MONTH_t^{BEFORE}$	0.072***	0.054***	0.034**	0.018
	(0.021)	(0.016)	(0.015)	(0.013)
$\Delta MONTH\ AFTER_t^{BEFORE}$	0.036*	0.050***	0.044***	0.033***
	(0.020)	(0.016)	(0.016)	(0.013)
$\Delta CHECK\ MONTH_t^{AFTER}$	0.023	0.010	0.006	0.011
	(0.015)	(0.012)	(0.011)	(0.009)
Age 70 and Above				
$\Delta CHECK\ MONTH_t^{BEFORE}$	0.048**	0.033**	0.0091	0.015
	(0.019)	(0.015)	(0.014)	(0.011)
$\Delta MONTH\ AFTER_t^{BEFORE}$	0.033*	0.013	0.007	0.016
	(0.020)	(0.014)	(0.014)	(0.012)
$\Delta CHECK\ MONTH_t^{AFTER}$	0.015	0.006	0.001	–0.000
	(0.014)	(0.011)	(0.010)	(0.008)
Under Age 70				
F-test (p-value) for equality of				
coefficients on month of receipt	3.92**	5.54**	2.15	0.21
effects before and after change	(0.048)	(0.019)	(0.143)	(0.643)
Age 70 and Above				
F-test (p-value) for equality of				
coefficients on month of receipt	2.14	2.75*	0.27	1.23
effects before and after change	(0.144)	(0.097)	(0.604)	(0.267)

[a]See notes to Table 3.

Table 6: The Impact of Public Pension Receipt on Consumption
Sample Split By Income[a]

	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
Below Median Income				
$\Delta CHECK\ MONTH_t^{BEFORE}$	0.057***	0.040***	0.021	0.017
	(0.019)	(0.015)	(0.014)	(0.012)
$\Delta MONTH\ AFTER_t^{BEFORE}$	0.041**	0.041***	0.037***	0.025*
	(0.019)	(0.014)	(0.014)	(0.013)
$\Delta CHECK\ MONTH_t^{AFTER}$	0.020	0.014	0.007	0.004
	(0.014)	(0.011)	(0.010)	(0.009)
Above Median Income				
$\Delta CHECK\ MONTH_t^{BEFORE}$	0.062***	0.046***	0.019	0.016
	(0.020)	(0.016)	(0.016)	(0.012)
$\Delta MONTH\ AFTER_t^{BEFORE}$	0.029	0.020	0.012	0.024**
	(0.021)	(0.016)	(0.016)	(0.011)
$\Delta CHECK\ MONTH_t^{AFTER}$	0.016	0.001	–0.001	0.004
	(0.015)	(0.011)	(0.011)	(0.009)
Below Median Income				
F-test (p-value) for equality of				
coefficients on month of receipt	2.66	2.41	0.78	0.78
effects before and after change	(0.103)	(0.121)	(0.379)	(0.378)
Above Median Income				
F-test (p-value) for equality of				
coefficients on month of receipt	3.25*	5.88**	1.28	0.63
effects before and after change	(0.071)	(0.015)	(0.259)	(0.426)

[a]See notes to Table 3.

Appendix Table 1: List of Japanese Holidays

Regular Holidays

Name of Holiday	Month	Day
New Year's Day	Jan	1
Coming-of-Age Day	Jan	15
National Foundation Day	Feb	11
Vernal Equinox Day	March	20 or 21
Greenery Day[a]	April	29
Constitution Memorial Day	May	3
Children's Day	May	5
Marine Day	July	20
Respect-for-the-Aged Day	September	15
Autumnal Equinox Day	September	23 or 24
Health and Sports Day	October	10
Culture Day	November	3
Labour Thanksgiving Day	November	23
Emperor's Birthday[b]	December	23

Special Holiday

Name of Holiday	Year	Month	Day
The Funeral Ceremony of Emperor Showa.	1989	Feb	24
The Ceremony of the Enthronement of His Majesty the Emperor (at the Seiden)	1990	November	12
The Rite of Wedding of HIH Crown Prince Naruhito	1993	June	9

[a]During the reign of Hirohito (Showa period, 1926-1989), Greenery day was the Emperor's birthday.
[b]December 23 became the Emperor's birthday after becoming the reign of Naruhito (Heisei period, 1989-).

Appendix Table 2: The Impact of Public Pension Receipt on Consumption
Full Specification

	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
$\Delta CHECK\ MONTH_t^{BEFORE}$	0.059***	0.043***	0.021*	0.017*
	(0.0159)	(0.0122)	(0.0116)	(0.010)
$\Delta MONTH\ AFTER_t^{BEFORE}$	0.035**	0.030***	0.024**	0.024**
	(0.016)	(0.012)	(0.012)	(0.009)
$\Delta CHECK\ MONTH_t^{AFTER}$	0.018	0.008	0.003	0.004
	(0.013)	(0.010)	(0.009)	(0.007)
Age	0.000580	0.000277	–0.000174	0.00000423
	(0.000383)	(0.000292)	(0.000281)	(0.000243)
January Indicator	0.0830	–0.121**	–0.186***	–0.178***
	(0.076)	(0.056)	(0.052)	(0.05)
February Indicator	0.116***	0.028	0.007	0.042**
	(0.028)	(0.021)	(0.020)	(0.017)
March Indicator	0.069***	0.056***	0.048***	0.047***
	(0.020)	(0.015)	(0.015)	(0.012)
April Indicator	0.080**	0.066**	0.017	0.094***
	(0.039)	(0.030)	(0.028)	(0.023)
June Indicator	0.019	0.030*	0.013	0.091***
	(0.022)	(0.017)	(0.016)	(0.013)
July Indicator	0.100***	0.025	0.010	0.092***
	(0.036)	(0.027)	(0.026)	(0.022)
August Indicator	0.150***	0.043	0.077*	0.167***
	(0.057)	(0.043)	(0.041)	(0.036)
September Indicator	0.043	0.028	0.025	0.054**
	(0.040)	(0.030)	(0.029)	(0.025)
October Indicator	0.124**	0.107**	0.091**	0.084**
	(0.056)	(0.042)	(0.040)	(0.035)
November Indicator	0.123***	0.084***	0.052*	0.070***
	(0.039)	(0.029)	(0.027)	(0.024)
December Indicator	0.381***	0.273***	0.240***	0.439***
	(0.057)	(0.042)	(0.040)	(0.036)
Second Interview Month Indicator	–0.004	–0.011*	–0.011*	–0.015***
	(0.008)	(0.006)	(0.006)	(0.005)
Third Interview Month Indicator	0.012	0.002	0.003	–0.009*
	(0.008)	(0.006)	(0.006)	(0.005)
Fourth Interview Month Indicator	–0.017**	–0.014**	–0.010*	–0.012**
	(0.008)	(0.006)	(0.006)	(0.005)
Fifth Interview Month Indicator	–0.019**	–0.013**	–0.018***	–0.011**
	(0.009)	(0.006)	(0.006)	(0.005)

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Appendix Table 2 (Continued)[a]				
	Total Consumption (1)	Nondurable Consumption (2)	Strictly Nondurable (3)	Food Consumption (4)
Five Mondays Indicator	-0.026	-0.010	0.008	-0.024
	(0.033)	(0.025)	(0.023)	(0.020)
Five Tuesdays Indicator	-0.012	-0.019	-0.004	-0.023
	(0.039)	(0.029)	(0.027)	(0.024)
Five Wednesdays Indicator	-0.037	-0.007	0.014	-0.006
	(0.038)	(0.027)	(0.026)	(0.022)
Five Thursdays Indicator	-0.046	-0.025	-0.007	-0.013
	(0.036)	(0.026)	(0.025)	(0.022)
Five Fridays Indicator	-0.048	-0.021	-0.018	-0.042*
	(0.038)	(0.028)	(0.027)	(0.029)
Five Saturdays Indicator	-0.011	-0.005	0.008	-0.006
	(0.035)	(0.025)	(0.024)	(0.021)
Five Sundays Indicator	-0.060	-0.024	-0.006	-0.007
	(0.040)	(0.030)	(0.028)	(0.024)
Number of Monday Holidays	-0.035*	-0.002	0.016	-0.014
	(0.020)	(0.016)	(0.015)	(0.013)
Number of Tuesday Holidays	0.027	0.022	0.037**	-0.005
	(0.024)	(0.017)	(0.017)	(0.015)
Number of Wednesday Holidays	0.003	0.007	0.025*	0.006
	(0.017)	(0.014)	(0.013)	(0.011)
Number of Thursday Holidays	0.023	0.010	0.037**	0.005
	(0.023)	(0.018)	(0.017)	(0.015)
Number of Friday Holidays	0.007	0.015	0.035**	0.001
	(0.019)	(0.015)	(0.014)	(0.012)
Number of Saturday Holidays	0.002	0.007	0.031**	0.009
	(0.018)	(0.014)	(0.014)	(0.012)
Number of Sunday Holidays	0.047***	0.015	0.022*	0.009
	(0.018)	(0.013)	(0.013)	(0.012)
March 1989 Indicator	0.099*	0.107**	0.111***	0.129***
	(0.057)	(0.044)	(0.040)	(0.034)
April 1989 Indicator	-0.160***	-0.175***	-0.179***	-0.181***
	(0.056)	(0.046)	(0.048)	(0.036)
F-test (p-value) for equality of coefficients on month of receipt effects before and after change	4.39**	6.21**	1.53	1.05
	(0.036)	(0.013)	(0.216)	(0.306)

[a]See notes to Table 3.

Figure 1: Monthly Income Receipt Before Pay Frequency Change

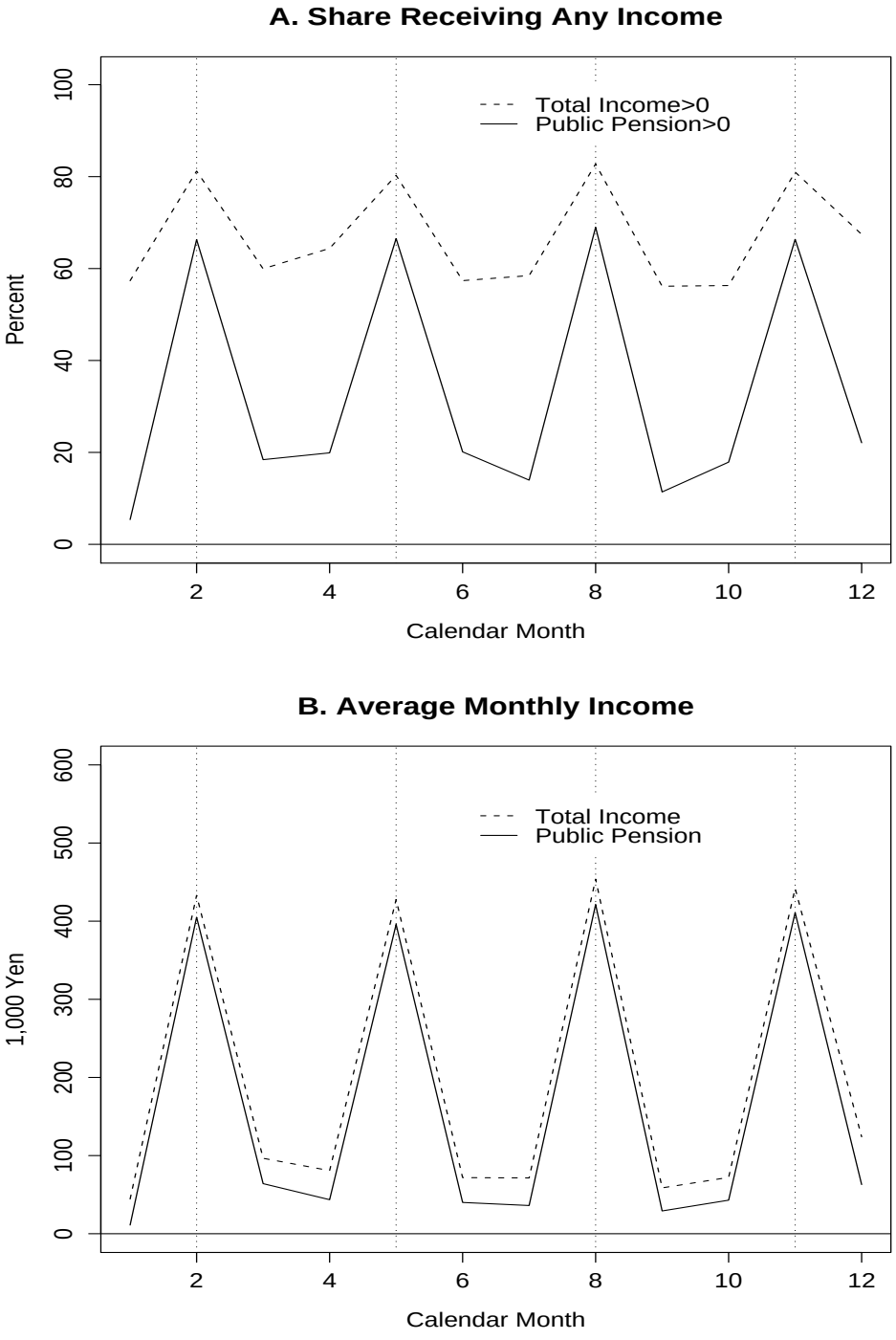

Figure 2: Public Pension Benefits Before Pay Frequency Change

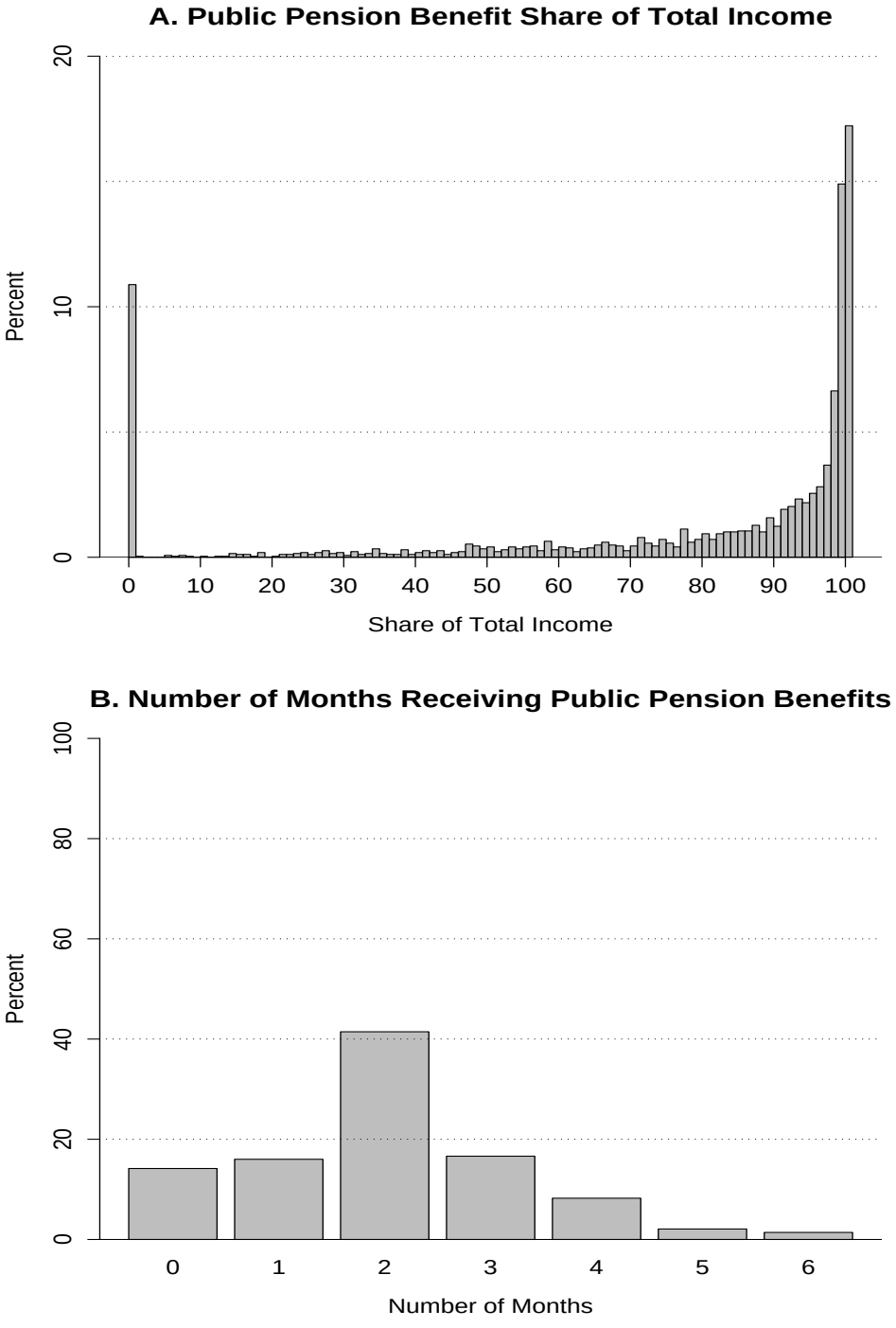

Figure 3: Monthly Income Receipt After Pay Frequency Change

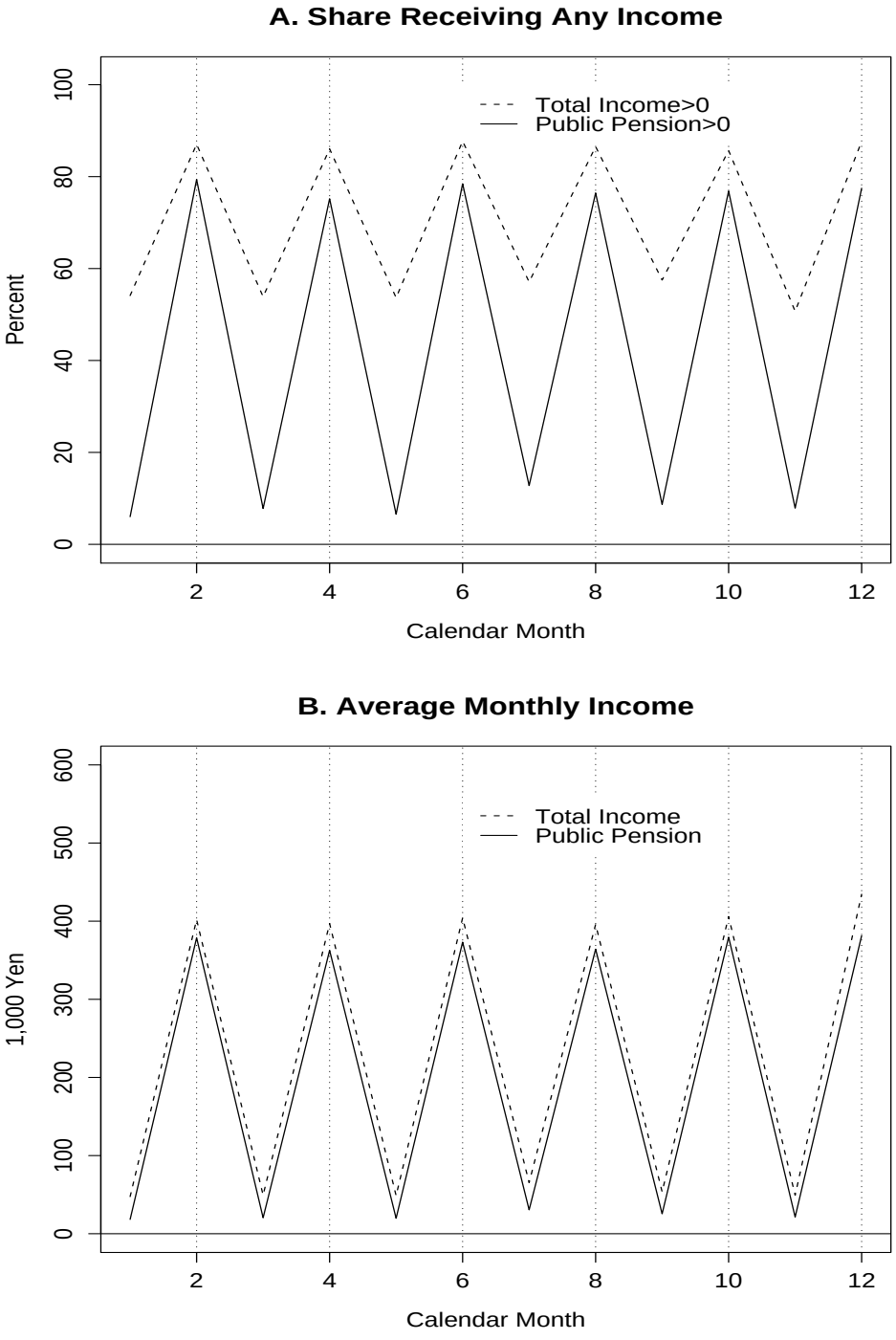

Figure 4: Public Pension Benefits After Pay Frequency Change

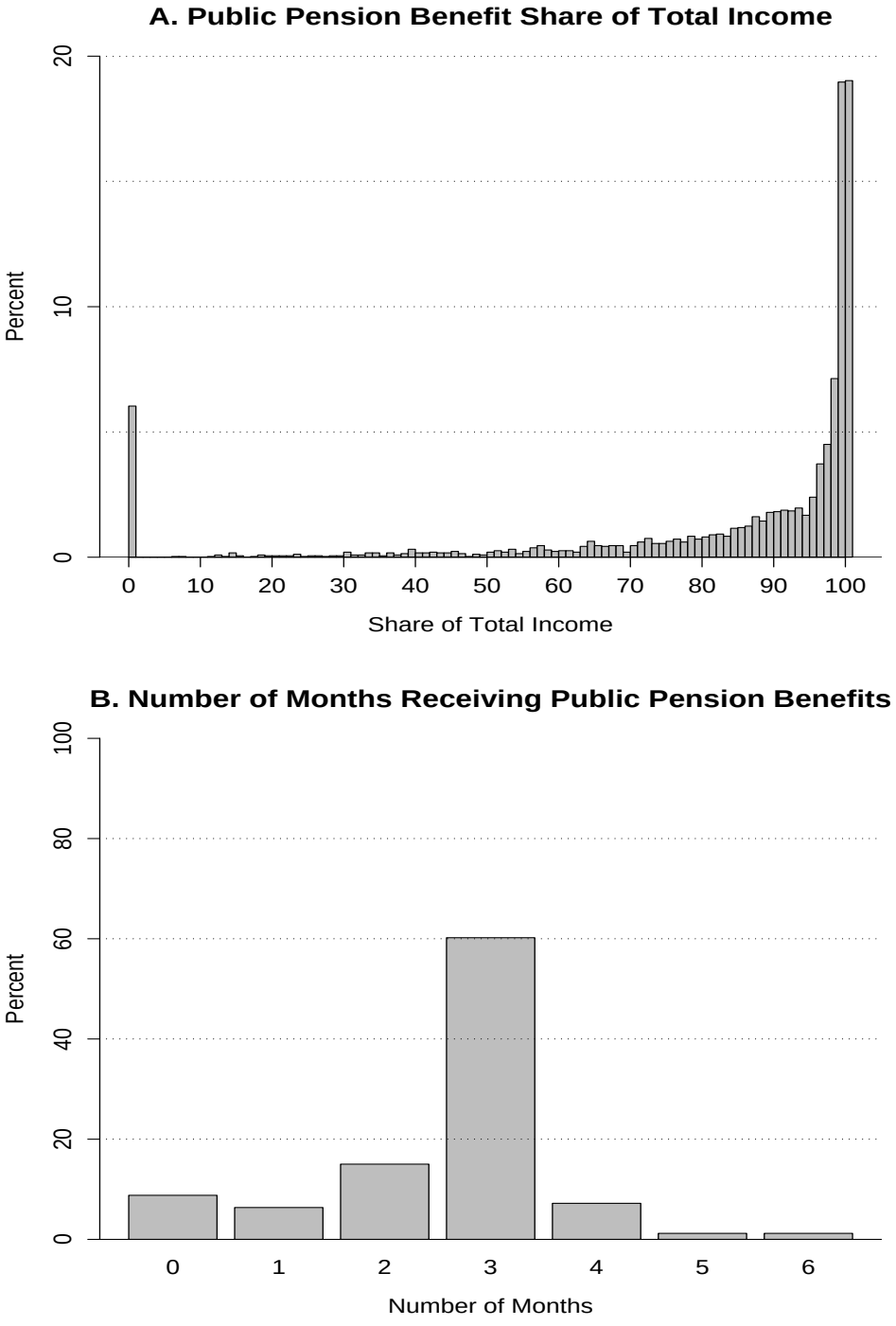

Figure 5: Net Assets to Yearly Income Ratio by Age