Bulletin of Applied Economics, 2022, 9(2), 147-158
https://doi.org/10.47260/bae/928

Do People Smooth their After-Tax Income? Evidence from Japanese Local Tax

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Abstract

This study provides evidence that under the Japanese local individual income tax system, individuals smooth their after-tax income by choosing the timing of their tax payments. We construct a monthly data set of Japanese local taxes with sample periods for over 26 years. The results show that though the tax amounts are pre-determined in one-year units by the system, individuals pay more taxes during months when their incomes are high, such as in "bonus" periods, than other months in a year. The t-statistics for means indicates that there exist significant upward deviations during these months.

JEL classification numbers: H31; H24; E62.
Keywords: Consumption smoothing; Local income tax; Inter-temporal decision making; Mean test; Levene test.

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Article Info: Received: June 9, 2022. Revised: July 30, 2022. Published online: August 16, 2022.

1 Introduction

Since Marshall (1890) proposed methods enabling inter-temporal resource allocation, inter-temporal smoothing behaviors have also been explored by a substantial number of economists. The smoothing hypothesis over horizons originates from the convexity of preferences and the optimization decision theory. This is widely recognized as one of the basic economic behaviors and has been applied to many economic theories. Empirical research on inter-temporal smoothing has been conducted in the context of the life-cycle or permanent- income hypothesis. A simple way to perform smoothing is through saving. However, it is difficult to measure the smoothing resources directly, because of the difficulty in estimating permanent income and eliminating financial or other related factors.[2] Instead, prior studies have used the excess sensitivity test of the Euler equation (Hall, 1978) and tested the smoothing hypothesis indirectly. Prior studies that have used excess sensitivity tests have estimated changes in expenditure and changes in income.[3]

This study examines the aspect of smoothing after-tax income when tax payments received in a year are exogenous; however, the timing of paying taxes are endogenously determined within a year by taxpayers. Our primary research question in this study explores whether taxpayers' discretion smooths their after-tax income when the pre-tax income changes exogenously. While studies on the changes in expenditures and income occupy the mainstream of prior studies of the smoothing hypothesis as explained above, studies on smoothing after-tax income endogenously through taxation systems remain unexplored.

Regarding how the changes in income lead to changes in *consumption*, we can consider two channels. First, when the before-tax income changes, the after-tax income also changes in taxation systems via people's behavior. Second, marginal consumption reacts to marginal changes in after-tax (disposable) income. Most of the prior studies on smoothing hypothesis have examined the second channel. In many cases, the first channel lies outside individuals' decisions and is usually exogenous. This study is significantly different from prior studies as it focuses on the first channel. It examines changes in after-tax income when individuals can choose the timing of the local individual income tax payments. Taxpayers endogenously control the after-tax income through the taxation systems.

The power of our test of the smoothing hypothesis relies on the existence of a particular feature of the Japanese local taxation system and the Japanese bonus payment system. Considering these two systems, we investigate taxpayers' after-tax smoothing behavior.

The Japanese local individual income taxes for the period of June to May of the following year are calculated together in June of the present year. Thus, the entire local individual income tax amount over the year (June to May of the following year) is predetermined. For self-employed workers, this entire amount over the year is split equally into four parts. Four sheets of tax notifications are mailed to each worker together in June. On each sheet, the dates of the pay limits are printed. The first pay limit is the end of June, the second is the end of August, the third is the end of October, and the pay limit of the final sheet is the end of January of the following year. Self-employed workers are obliged to pay taxes before the pay limit printed on each sheet. However, they can pay taxes with two, three, or four sheets together if they are before each deadline. Thus, within a year, they have some scope to control their after-tax income by using this taxation system (by paying their taxes in advance).

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[2] "Smoothing of consumption" is often the shorthand for keeping the expected marginal utility of expenditure constant.

[3] Prior studies on excess sensitivity test are split into two broad categories depending on the type of data used, that is, macro, micro, or panel data (see surveys of Browning and Lusardi (1996), Browning and Crossley (2001) and Jappelli and Pistaferri (2010, 2017)). Studies that investigate the response of households to the change in income and have employed aggregate, time-series data conclude that the life-cycle or permanent-income hypothesis (LCPIH) does not hold (Poterba, 1988; Wilcox, 1989). However, prior studies that have used micro or panel data are divided into opposite sides to determine the consistency of LCPIH. Browning and Collado (2001), Hsieh (2003), and Paxson (1993) show the consistency in this context, whereas Shapiro and Slemrod (1995), Souleles (1999), Parker (1999), Stephens (2003), and Stephens and Unayama (2011), Parker et al. (2013) present the inconsistency of LCPIH.

The second major advantage of using Japanese data is institutional features of the Japanese economy. This is because workers receive extra payments in summer (usually at the end of June) and winter (mid-December) of each year. The summer and winter bonuses are nearly twice as much as the monthly payments.[4] There are effectively 12 unequal payments per year, rather than 12 equal payments of the same annual value. Thus, for most workers, the path of income over the year varies in a significant but predictable way. The extra summer and winter payments are completely anticipated, and they are large in magnitude.

These local individual income taxation systems and bonus payment systems in Japan provide a powerful test of smoothing behavior. As we will see in the following sections, we find clear synchronization of changes in income and changes in tax payments. The descriptive statistics support the results. Specifically, when income is high due to bonus payments, individuals pay more taxes by choosing the timings to pay taxes at their discretion. More formally, we test how the average tax payments for each month deviate from the average per month using data from all months. Our hypothesis is that the average tax payments in bonus months, which are known to have high incomes, is higher than the overall average. As a result, the t-statistics of the mean tests shows that the monthly averages in question (July, August, and December) deviate significantly upwards, supporting the hypothesis.

The evidence we find suggests that people in Japan smooth their disposal incomes by paying taxes in months when incomes are high in a year. The reason for smoothing disposal incomes will be consumption smoothing. Thus, it helps to moderate economic fluctuations. The Japanese local tax payment system might be contributing to economic stabilization in Japan.

Our study is in line with Browning and Collado (2001), who have taken advantage of the bonus payment schemes in Spain. They have compared the expenditure patterns of workers who received or did not receive a bonus. They have examined their expenditure patterns graphically. They find that there are no clear differences between the two groups. Our paper also pays attention to bonus payments but by investigating the tax-payment behavior, concludes that consumers smooth their income.

The remainder of this paper is organized as follows. Section 2 provides a theoretical analysis that explains how consumers control their after-tax income through tax payments. Section 3 explains the data and presents the descriptive statistics. Section 4 presents statistical tests and econometric findings. Section 5 concludes the study and presents the implications of the findings for future research.

2 Theoretical Analysis

We examine a two-period ($t = 1,2$) optimal consumption model. The representative consumer utility maximization problem is set as follows:

$$\max_{\{C_t, T_t\}_{t=1,2}} U(C_1) + \beta U(C_2)$$

$$\text{s.t. } C_1 + T_1 = Y_1$$

$$C_2 + T_2 = Y_2$$

$$T_1 + T_2 = T.$$

Here, C_t is the consumption at period t; Y_t is the before-tax income in period t; T_t is the tax payment in period t; T is the sum of the tax payments (pre-determined); and β is the discount factor. We denote Y as the sum of Y_1 and Y_2, which is the sum of the before-tax income.

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[4] Winter bonus payments are usually greater than summer bonus payments.

We specify our utility function as a quadratic function:

$$U(C) = -\tfrac{1}{2}C^2 + bC,$$

where $b > 0$; suppose that the increasing part of this function is the relevant range. Note that the constraints are summarized as $T = Y - C_1 - C_2$. Thus, we can set the Lagrangian as follows:

$$L = U(C_1) + \beta U(C_2) + \lambda(Y - C_1 - C_2 - T),$$

where λ is the Lagrangian multiplier. The first order conditions for utility maximization are as follows:

$$\frac{\partial L}{\partial C_1} = U'(C_1) - \lambda = 0 \tag{1}$$

$$\frac{\partial L}{\partial C_2} = \beta U'(C_2) - \lambda = 0 \tag{2}$$

$$T = Y - C_1 - C_2. \tag{3}$$

The solutions to this problem are presented below:

$$C_1^* = \frac{\beta(Y - T) + b(1 - \beta)}{1 + \beta} \tag{4}$$

$$C_2^* = \frac{Y - T - b(1 - \beta)}{1 + \beta}. \tag{5}$$

Let the superscript * denote the equilibrium outcomes. Equations (4) and (5) generate the following equations:

$$T_1^* = Y_1 - C_1^* = \frac{(Y_1 - \beta Y_2) + \beta T}{1 + \beta} - \frac{1 - \beta}{1 + \beta} b \tag{6}$$

$$T_2^* = Y_2 - C_2^* = \frac{(\beta Y_2 - Y_1) + T}{1 + \beta} + \frac{1 - \beta}{1 + \beta} b, \tag{7}$$

where $T_1^*$and T_2^* represent the amount of tax payment collected in periods one and two, respectively, when the taxpayer can choose the timing to pay taxes at their discretion.

The first terms in equations (6) and (7) present the smoothing behavior. To ascertain this, consider the case $\beta = 1$. In this case, equation (6) becomes $[(Y_1 - Y_2) + T]/2$ and equation (7) becomes $[(Y_2 - Y_1) + T]/2$. Comparing these equations to the case of equal payment $T_1 = T_2 = T/2$, we find that equations (6) and (7) show the smoothing behavior. For example, when $Y_1 > Y_2$, taxpayers additionally pay the average difference of income $(Y_1 - Y_2)/2$ in advance in the first period and pay less than $Y/2$ by this amount $(Y_1 - Y_2)/2$ in the second period. Consequently, after-tax income will be smoothed in periods 1 and 2 ($Y_1 - T_1 = Y_2 - T_2 = Y/2$).

The second terms of equations (6) and (7) show the time preferences. Consider the case $\beta < 1$. In this case, time preference effects appear in the second terms of equations (6) and (7). When $\beta < 1$, since the consumer prefer the current consumption to the future one, they postpone tax payments and increase consumption in period 1. Therefore, for the optimal tax payment in period 1(T_1*), it works negatively, and for the optimal tax payment in period 2 (T_2*), it works positively.

A simple method of smoothing that comes to mind is to use savings. However, as we present here, even without the tool of savings, people can smooth by using the timing to pay taxes. In what follows, by using Japanese local tax data, we show that they are actually smoothing their after-tax incomes within a year. On top of that, theoretically, smoothing and time preference can work in opposite directions as discussed above, so we should investigate them empirically.

3 Data

3.1 Japanese Local Individual Income Tax

The data are drawn from *Local Public Finance*.[5] It is a monthly paperback magazine issued by an affiliation of the Ministry of Internal Affairs and Communications. They list breakdowns of prefecture taxes into local individual income tax, local consumption tax, etc. for each month in its appendix. This magazine is the only source of available monthly data on the breakdown of local taxes in Japan. These are monthly time-series data. Our sample period is from 1980 to 2006. [6]

Japanese local individual income tax calculation and collection methods are unique, and explanations are needed to understand the system. The amount of Japanese local individual income tax in the present year is decided entirely in June, that is, tax amounts for June to May (next year) are set in June.[7]

For workers under the self-assessed tax system, that is, workers who are primarily self-employed, four sheets of tax slips are mailed to them entirely in June.[8] These four sheets notify one-fourth of the total local individual income tax on each sheet. Although four sets of tax slips are mailed in June, each sheet has its own due date. The first due is at the end of June, and the other three due dates are set every following second or third month after that, that is, the end of August and October, and the final due date is set at the end of January. They can pay their taxes anytime as far as they do before each pay limit.

However, for people under the withholding tax system, that is, primarily employed workers, all the tax amounts for June to May (next year) calculated in June are split across twelve months equally and employed workers pay one-twelfth of their total current year tax amount via their companies every month from June this year to May the following year. Thus, the withholding part of the Japanese local individual income tax should be uniformly distributed in a year. If local individual income tax fluctuates within a year, we can infer that the fluctuations are caused by self-employed workers' tax-paying behaviors.

[5] The precise source is Institute of Local Finance (Chiho Zeimu Kyokai), *Local Public Finance (Chihozaisei)*, no.8 (1980) – no.7 (2007), monthly (in Japanese).

[6] In 2007 and 2008, the major institutional tax reforms both in local and national levels have enacted. Since discontinuity of the data is observed after these tax reforms, we trim the period after 2007 from our sample.

[7] This is technically because the tax base of Japanese local individual income tax is the previous year income (January to December of the previous year). A practical reason for this is that local governments prefer to determine the tax revenue of each year at the early stage of the year.

[8] Workers who retire within a year or workers who temporally leave companies to take maternal leave and nursing-care leave are also included.

3.2 Descriptive Statistics

We present the Japanese local individual tax data, which show that local individual income tax fluctuates. Table 1 shows the basic statistics of the monthly local individual income tax. We show the average local individual income tax in a year, standard deviation, maximum and minimum taxes, and the ratio of maximum to minimum.[9]

Table 1: Basic Statistics for Japanese Local Individual Taxes(10 million yen)

	Mean	Standard Deviation	Maximum (a)	Minimum (b)	Maximum (a) / Minimum (b)
1980	1181	272	1597	739	2.16
1981	1371	274	1786	846	2.11
1982	1478	320	2010	955	2.10
1983	1616	336	2154	1085	1.99
1984	1642	340	2293	1197	1.92
1985	1756	351	2443	1253	1.95
1986	1880	396	2613	1326	1.97
1987	2035	453	2915	1459	2.00
1988	2083	539	3052	1475	2.07
1989	1925	516	2848	1297	2.20
1990	2050	583	3438	1375	2.50
1991	2289	719	4003	1452	2.76
1992	2463	736	3922	1523	2.57
1993	2403	573	3509	1686	2.08
1994	2059	590	2901	843	3.44
1995	2211	438	3264	1728	1.89
1996	2176	360	2961	1755	1.69
1997	2332	618	3524	1719	2.05
1998	2013	387	2815	1635	1.72
1999	2053	539	3186	1548	2.06
2000	1987	518	3047	1389	2.19
2001	1975	524	3139	1410	2.23
2002	1935	533	3063	1409	2.17
2003	1862	509	2845	1384	2.06
2004	1904	526	2994	1363	2.20
2005	2020	609	3032	1082	2.80
2006	2266	649	3420	1381	2.48
1980－2006	1962	570	4003	739	2.20 (mean)

As shown in Table 1, the Japanese local individual income tax is not uniformly distributed in a year. Given the withholding system (see section 3.1), many researchers in Japan have assumed a uniform distribution of the local individual income tax for a long time. However, the data show clear fluctuations, as shown below.

[9] The data is missing in October 1983. We substitute the missing value with the average of the other eleven months in 1983.

Let us select some years of the turning points of business cycles. As shown in Table 1, the average local individual income tax fluctuates between JPY12,527 million and JPY24,430 million in 1985, JPY14,516 million and JPY40,026 million in 1991, and JPY17,188 million and JPY35,236 million in 1997. In average, taxes in the maximum month in a year are 2.20 times as large as those in the minimum month for 1980–2006.

Table 2: Means of Local Individual Income Tax over a Business Cycle

	1980-1984	**1985-1990**	**1991-1996**	**1997-2006**
Jun.	965	1423	1671	1481
Jly.	1968	2606	3080	2949
Aug.	1891	2883	2754	2903
Sep.	1465	1955	2029	1960
Oct.	1570	2093	2651	2204
Nov.	1441	1841	2115	1811
Dec.	1646	2206	2673	2212
Jan.	1278	1673	2054	1969
Feb.	1355	1768	2096	1740
Mar.	1627	2165	2571	2135
Apr.	1105	1400	1763	1524
May	1182	1445	1747	1530
Mean(Jun.-May.)	1458	1955	2267	2035
Standard Diviation	303	466	461	489
Maximum/Minimum	2.04 (Jly./Jun.)	2.06 (Aug./Apr.)	1.84 (Jly./Jun.)	1.99 (Jly. /Jun.)

Table 2 shows the average local individual income tax over a business cycle. It fluctuates between JPY9,648 million and JPY19,678 million (1980–1984)[10]. For 1985–1990, the average local individual income tax fluctuates between JPY13,997 million and JPY28,831 million. For 1991–1996, it varies between JPY16,706 million and JPY30,802 million, and for 1997–2006, the fluctuation varies between JPY14,809 million and JPY29,494 million. The highest month is July (for 1980–1984, 1991–1996, 1997–2006) and August (for 1985–1990).[11] The lowest month is June in most cycles, except for the cycle for 1985–1990 (the lowest month is April). They hit the highest in July across the three business cycles and in August across one business cycle. The difference between the highest and lowest months is approximately twice or more than twice in magnitude in most business cycles.

4 Empirical Results

First, we investigate statistically that the local individual income tax revenue fluctuates in a year. To check this, we create hypothetical data in which the amount of tax revenue is equal in all the months in a year. As explained in Section 3.1, from the institutional information, we know that the withholding part of the local individual income tax is collected evenly every month in a year (from June to May of the following year). Thus, this hypothetical uniform distribution data can be recognized as the local individual income

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[10] Precisely, period 1980–1984 indicates the period from June of 1980 to May of 1985. So as the other periods do.

[11] Tax officials may or may not count taxes which are collected at the very end of the month as the payments reflected on the next month. However, as we do not have enough information as to tax officials' counting lags, we ignore these counting lags in this study.

tax, all of which are assumed under the withholding part.[12] Any deviation of the actual local individual income taxes from this hypothetical data is caused by self-employed workers. Table 3 shows the Levene test results wherein the actual local individual income taxes are distributed significantly differently from the hypothetical uniform distribution data. As seen in the third column, the actual and the hypothetical series are distributed differently, mostly with a p-value of 0.000.

Table 3: Levene Test Statistics

	Statistics	**p-value**
1980	23.0761	0.0001
1981	15.3082	0.0007
1982	24.0083	0.0001
1983	26.855	0.0000
1984	22.0896	0.0001
1985	19.1937	0.0002
1986	25.8694	0.0000
1987	23.5680	0.0001
1988	23.0355	0.0001
1989	20.9586	0.0001
1990	16.0957	0.0006
1991	20.9964	0.0001
1992	34.3285	0.0000
1993	25.9968	0.0000
1994	18.6336	0.0003
1995	18.1982	0.0003
1996	17.7868	0.0004
1997	20.6210	0.0002
1998	33.8815	0.0000
1999	19.2463	0.0002
2000	15.6617	0.0007
2001	15.7275	0.0007
2002	18.6099	0.0003
2003	23.2644	0.0001
2004	20.6600	0.0002
2005	21.4293	0.0001
2006	23.0574	0.0001

Finally, we conduct a mean test to indicate that the mean of a particular month over a business cycle may significantly differ from the mean over the business cycle. More precisely, taxes in each month over the cycles differ from the means in Table 2. Table 4 shows the t-statistics of the mean tests. The means of local individual income tax in June, July, August, January, April, and May from 1980 to 1984 significantly differ from the mean over the business cycle. For the period 1985–1990, the t-statistics shows that they are significantly different from the mean over the business cycle in June, July, August, October, November, December, January, February, March, April, and May. From 1991 to 1996, all the local individual income tax, except August and September, are significantly different from the overall mean. From 1997 to 2006,

[12] There are no breakdowns that itemize the withholding part and self-assessed part of the local individual income tax on a monthly basis.

the means of local individual income tax in June, July, August, October, November, January, December, February, April, and May are significantly different from the overall mean.

Table 4: T-statistics for means of Local Individual Income Tax

	1980-1984	1985-1990	1991-1996	1997-2006
Jun.	-6.033**	-10.123**	-9.729**	-9.324**
Jly.	4.076**	5.051*	8.888**	6.521**
Aug.	4.548**	6.552**	1.000	5.757**
Sep.	0.070	0.006	-0.972	-0.702
Oct.	1.350	2.049*	7.037**	2.944**
Nov.	-0.229	-3.367**	-6.225**	-4.268**
Dec.	1.742	4.554**	4.732**	3.053**
Jan.	-2.484*	-7.737**	-4.835**	-0.437
Feb.	-1.318	-6.902**	-5.644**	-5.538**
Mar.	1.801	2.810**	4.217**	1.601
Apr.	-5.018**	-17.096**	-14.460**	-11.932**
May	-3.226**	-16.286**	-13.492**	-15.045**
n	5	6	6	10

Note: ** indicates 5 percent significance (two-tailed).
* indicates 10 percent significance (two-tailed).

Dividing them into months that deviate upward and months that deviate downward leads us to powerful insights. Taxes in June, November, January, February, April, and May go lower than the overall mean. On the other hand, taxes in July, August, October, December go significantly beyond the mean. In particular, taxes in July, August, and December go far upward. As explained in the Introduction, workers receive extra income in summer and winter in the Japanese bonus payment system. The phenomenon that taxes hit high in July is induced by the fact that Japanese summer bonus is paid at the end of June, and hence people pay taxes when their incomes are high despite that the next pay limit is the end of August. In the same way, taxes in December are also large, thought the final pay limit is January. This suggests that the Japanese winter bonus income is paid in the middle of December, and taxpayers pay when their incomes are high.

5 Conclusion

This study takes advantage of the local income taxation system and bonus payment system in Japan to examine whether tax payments react to predictable and large changes in income within a year. It finds that there is a clear synchronization between income and tax-paying behaviors. Individuals pay more taxes by choosing the timing to pay their taxes during months when their income increases due to bonus payments. The main findings are as follows. (i) Theoretically, the smoothing effect and time preference work in contrast to each other in the case that taxpayers have higher income in the earlier stage and can choose the timing regarding when to pay their taxes. (ii) Descriptive statistics show that the local individual income tax presents a spike in July, August, and December, which correspond to the months when a bonus is paid to the individuals. (iii) The t-statistics for means indicate that the upward deviations in these months are significant.

Considering the Japanese local income tax system, these facts lead to the conclusion that individuals smooth their after-tax income by choosing the timing of tax payment. They pay more taxes substantially in advance of the pay limits when their income is high, such as during bonus periods.

Paying taxes when their incomes are high contributes to moderate after-tax income; thus, it leads to smooth consumption. This after-tax income smoothing behavior reflects several possibilities, such as rationality, no liquidity constraint, or no myopia.[13] In this paper, we cannot establish the reason for this because one cannot comment on heterogeneity when using macro data.[14]

The evidence that we find is intriguing from an economic stabilization perspective. Economic stabilization, especially the built-in stabilizer of taxes, works under a progressive taxation system. It has the following mechanism. During an economic expansion, taxes increase more than income and moderate the upward shift of after-tax income, and thus they eventually moderate that of consumption. Conversely, during an economic contraction, taxes decrease more than income and prevent after-tax income and consumption from decreasing sharply. This mechanism works without any government interventions or individuals' intentional behaviors. Our findings suggest that taxpaying behavior itself can contribute to stabilizing economic fluctuations. This is a novel point of view, which can lead to new avenues for future research.[15]

ACKNOWLEDGEMENTS. I thank the editor and an anonymous referee for useful comments. I thank Masayoshi Hayashi, Mochizuki Masamitu, as well as the participants at annal meetings of Japanese Economics Association and Japan Institute of Public Finance for their helpful comments. I acknowledge financial support from JSPS KAKENHI (Grant Number 1 9 K 1 3 7 1 6).

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[13] Kaplan and Violante (2014) develop a structural economic model to elaborate two assets (liquidity and illiquidity), and they show that larger responses to fiscal shocks than the standard one-asset model.
[14] Among the possibilities, the way to deal with liquidity constrains should differ among previous studies. Studies based on macro data just list possibilities of myopia, liquidity constraints for reasons of their results that the life-cycle or permanent-income hypothesis does not hold (Poterba, 1988; Wilcox, 1989).
[15] A related issue is stabilization by labor supply behavior; under progressive taxation labor supply will be curtailed when income reaches a critical high point (Auerbach and Feenberg, 2000).

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