

New ESRI Working Paper No.44

**Responses of household expenditure to
changes in discretionary income:
Micro data study using two episodes of changes
in tuition payment in Japan**

Masahiro Hori

December 2017



Economic and Social Research Institute
Cabinet Office
Tokyo, Japan

The views expressed in “New ESRI Working Paper” are those of the authors and not those of the Economic and Social Research Institute, the Cabinet Office, or the Government of Japan. (Contact us: https://form.cao.go.jp/esri/en_opinion-0002.html)

**Responses of household expenditure to changes in discretionary income:
Micro data study focusing on tuition payments to examine consumption smoothing by
Japanese households[†]**

Masahiro Hori

Economic and Social Research Institute, Cabinet Office, Japan

December 2017

Abstract

This paper focuses on tuition fees in Japan to examine consumption smoothing by Japanese households. The analysis shows that a 100 yen decrease in discretionary income due to the payment of university tuition fees is associated with a decrease of about 15 yen in discretionary spending in the month that tuition payments are made. It is also found that the free high school tuition program introduced in 2010 significantly stimulated household spending, especially in the case of poorer households. Moreover, it is found that the free tuition program significantly altered the composition of household expenditure of wealthier households, with a surge in spending shares observed in non-tuition education expenses, clothing, and recreational goods. These findings indicate that Japanese households responded to predictable income changes and did not fully engage in consumption smoothing.

Keywords: consumption smoothing, life-cycle/permanent income hypothesis, college tuition payment, free high school tuition program, *Family Income and Expenditure Survey*

JEL Classification: D12, I21

1. Introduction

This paper focuses on tuition fees in Japan to examine consumption smoothing by Japanese households. In Japan, tuition fees make up a large proportion of household expenses of households with children attending school or university. Therefore, changes in discretionary income due to changes in tuition fee expenditures are likely to have a considerable impact on household welfare. Against this background, the aim of this paper is to examine consumption smoothing by households with children attending university or high school to grasp the welfare implications of the tuition burden for such households

Changes in tuition payments due to external factors often cause predictable large changes in discretionary income in predetermined months. The standard life cycle/permanent income hypothesis (LC/PIH) predicts that anticipated changes in individuals' income should have no impact on their expenditure patterns unless they are liquidity constrained. Therefore, examining the effect of anticipated changes in tuition payment flows on household spending patterns makes it possible to examine whether the LC/PIH holds in practice and households engage in consumption smoothing. Investigating the impact of college tuition fees on household expenditure patterns in the United States, Souleles (2000), for example, found that households appear to do a relatively good job in smoothing their consumption over the year, despite the large expense that tuition payments represent. Several other studies similarly found no or little link between large fluctuations in household income and household spending when the fluctuations were anticipated (Paxson, 1993; Browning and Collado, 2001; and Hsieh, 2003). On the other hand, a substantial number of empirical studies on (relatively small) policy-induced income changes have found that predictable income changes caused statistically significant changes in spending, known as "excess sensitivity," rejecting the LC/PIH.¹ Meanwhile, studies on Japan suggest that households display a high degree of "excess sensitivity" in the sense that significant consumption responses are reported not only when the anticipated income changes are small but also when they are large.²

This paper focuses on tuition fee payments to examine the issue of excess sensitivity in Japan. In Japan, it is mandatory for parents to send their children to elementary school to receive

primary education for 6 years and to junior high school from age 12 to receive lower secondary education for 3 years. On the other hand, attendance of senior high school (higher secondary education) is not mandatory, and both public and private high schools charge tuition fees. Similarly, two-year junior colleges as well as national and private universities offering four-year undergraduate degree and post-graduate degrees charge tuition fees. (In the remainder of this study, these will be summarily referred to as “universities.”) These high school and university tuition fees are widely regarded as major household expenses.

In order to examine excess sensitivity in Japan, this study conducts two different analyses focusing on tuition fee payments. The first analysis relies on the fact that university tuition payments are made in certain months of the year and hence represent large and clearly predictable changes in monthly discretionary income. One would therefore expect households that act according to the LC/PIH to smooth their consumption over the year to cover tuition payments.

The second analysis focuses on the reaction of household expenditures to a program to make high school tuition-free launched in FY2010. The program (1) makes public high school tuition free and (2) provides a subsidy of 118,800 yen (about 1,200 dollars) per year to students at private high schools. The subsidy is not paid directly to parents; instead, high schools receive the money on behalf of students or parents and use it to offset part of the tuition. According to the LC/PIH, rational households do not change their consumption path unless their permanent income is altered. Since the impact of the free tuition program on household budgets, though not negligible, is too small to result in a substantial increase in permanent income, one would expect that it would not have a notable effect on household spending patterns unless households are liquidity constrained.

Contrary to this expectation, the results of the analysis indicate that the change in income due to the free tuition program did have statistically significant effects on household consumption patterns. It is also found that the free tuition program stimulated poorer households' spending significantly more than richer households' spending; in addition, the program significantly altered the composition of wealthier households' expenditure, leading to a surge in the share of spending on education other than tuition fees as well as on clothing and recreational goods. The findings of this

paper therefore indicate that the consumption of Japanese households is excessively sensitive to anticipated (large as well as small) changes in household income, and that in this sense it is fair to broadly assume that Japanese households do not fully engage in consumption smoothing.

The remainder of this paper is organized as follows. The next section describes the data used for the analysis and identifies the university tuition payments and the 2010 high school tuition reduction in the dataset. Section 3 presents the results of regression analyses (i) measuring the size of the consumption response to changes in discretionary income due to university tuition payments, and (ii) investigating whether households with high school students altered the amount and composition of their spending after the introduction of the free tuition program. Section 4 summarizes the findings and concludes the paper.

2. Data description

The data used in this study are micro-level data from the *Family Income and Expenditure Survey* (FIES) conducted by the Statistics Bureau, Ministry of Internal Affairs and Communications. The survey covers approximately 9,000 non-single households which are randomly chosen from all regions of Japan. Survey units are randomly chosen from the selected municipalities and six two-or-more-person households are randomly chosen in each survey unit from 170 municipalities.

In the FIES, each household is surveyed for six months and one-sixth of the households are replaced by new households every month. The survey provides detailed information on income and expenditures as well as on household characteristics including the type of school which children in the household are attending. The monthly expenditure data are compiled from a diary.

For the first analysis, consisting of the influence of the payment of university tuition fees, monthly household panel data from 1984 to 2008 are used, while for the second analysis measuring the impact of the free high school tuition program, repeated semi-annual cross-section data from 2002 to 2012 covering the period before and after the introduction of the free tuition program are used. In order to improve the reliability of the estimates, certain criteria to limit the data used for each of the two analyses are set.³ Summary statistics of the main variables from the two data sets used for the

two analyses are shown in Tables 1(a) and (b).

Table 1(a) reports the summary statistics of the data used in the analysis of the link between university tuition fee payments and expenditure patterns. In this table, sample households are restricted to those with one university student. The average monthly total spending (excluding university tuition) is about 320,000 yen. The average monthly tuition payment (among households with positive tuition payments) is 317,000 yen; more specifically, 182,000 yen is paid for public universities/colleges and 361,000 yen for private universities/colleges. The average head of household age is 51.9 years, and the average family size is 4.1 members. Note that tuition fee payments are concentrated in certain specific months. The monthly pattern of tuition payments over the year is shown in Figure 1. The average monthly tuition amount for tuition-paying households is higher in March and April reaching around 500,000 yen.

Table 1(b) reports the summary statistics for the analysis focusing on the free high school tuition program. The table presents the summary statistics for all households in the sample, for households above and below the 25th percentile of households in terms to their spending level, and for households before and after the introduction of the program. The figures indicate that the annual income, disposable income, and household living expenditures of households above the 25th percentile, as expected, are larger than those below the 25th percentile. Moreover, households above the 25th percentile, again as expected, also spend more on each of the 15 disaggregated expenditure items than households below the 25th percentile. On the other hand, dividing households into those surveyed before and after April 2010 shows that the annual income, disposable income, and household living expenditure of the two groups are quite similar, and no clear pattern in terms of differences in individual expenditure items can be discerned.

The FIES also provides information on households' high school tuition fee payments, distinguishing between public and private high schools. Figure 2 presents the average high school tuition fee payments per high school student from FY2002 to FY2011. Given that these figures show a clear drop in FY2010, it can be said that the FIES data capture the change in the tuition policy effective since FY2010 well.

3. Regression analyses

This section reports the results of regression analyses examining households' response to discretionary income changes related to tuition payments. Specifically, the first analysis deals with consumption smoothing in response to large seasonal payments of university tuition fees, while the second examines households' response to the introduction of the free high school tuition program.

3.1 Consumption responses to university tuition fee payments

This subsection presents the results of regression analyses to measure the size of the consumption response to university tuition fee payments. For the regression, tuition payments are included in a Euler equation, where the coefficient on the tuition payment variable should be zero if the LC/PIH holds. The specification used for the estimation is as follows:

$$\begin{aligned} \Delta Y_{i,t} = & cons + \sum_{j=0}^1 \alpha_j \times \Delta X_{i,t-j} + \sum_{y=1984}^{2008} \beta_y \times Year(y) \\ & + \sum_{m=January}^{December} \gamma_{1m} \times Month(m) + \sum_{n=1}^6 \gamma_{2n} \times SurveyMonth(n) \\ & + \delta Z_{i,t} + \varepsilon_{i,t} \end{aligned} \quad (1)$$

where i indexes households and t indexes the month. The dependent variable is the change in the level of household h 's consumption in month t from the previous month. Consumption variables used are total household spending as well as various individual components, with tuition fees excluded from total household spending and service spending (under which they fall). The key independent variable is ΔX , which represents the month-on-month change in the amount paid for tuition. The estimated coefficients are interpreted as marginal propensities to consume out of a change in discretionary income due to the tuition payment. Other independent variables included are year dummies ($Year$), month dummies ($Month$), and dummies indicating the position (1st, 2nd,..., 6th) of the observation during the six month examination period for an individual household ($SurveyMonth$),⁴ as well as demographic variables ($Z_{i,t}$) that contain the age of the household head and changes in family size. All regressions are estimated using ordinary least squares (OLS) and the standard errors are clustered at the household and robust to heteroscedasticity.

Table 2 shows the results for households with only one university student. Panel (a) reports the regression results for households, referred to as “new student group,” which have only one child who was not a university student in the first month surveyed but who was in the sixth month. The coefficient on ΔX_t for total spending is negative and statistically significant. Specifically, households in this group reduce spending by 15 yen for every 100 yen in tuition fees paid and do not smooth consumption, which sharply contrasts with Souleles’s (2000) finding for the United States that households appear to be engaged in consumption smoothing. The result remains unchanged even if a one-month lag of ΔX_t is added to the regression. The remaining columns in panel (a) show that the consumption response to tuition payments varies across spending categories; however, the results generally indicate that households decrease their spending in the payment month and increase it in the next month. Next, panel (b) reports the results when combining households with a new student and households with a “continuing student,” defined as households with one university student in both the first and the sixth month of the survey. The results indicate that the pattern of the estimated coefficients does not change even after “continuing student households” are included.

Next, Table 3 reports the results for the same specification but using not only households with one university student but also households with more than one university student (panel (a) and (b)) as well as households with no university students (panel (c)). The basic pattern of the coefficients on tuition fee payments in panels (a) and (b) is similar to that reported in Table 2. Meanwhile, panel (c) reports the coefficients on tuition fee payments if all households in the sample regardless of whether they have a university student are included in order to separate month effects from tuition payment effects. The results show a similar pattern to the previous results.

In sum, households with university students respond to tuition fee payments by reducing spending by about 15 yen for every 100 yen in tuition fees paid in the same month, implying that the tuition burden lowers households’ welfare in terms of consumption. Moreover, households’ spending in the following month does not fully recover from the tuition fee payment, implying that Japanese households do not fully engage in consumption smoothing.

3.2 Reactions of household expenditures to the tuition-free high school program

This subsection presents the results of regression analyses to examine whether the 2010 tuition-free program in Japan altered the amount and composition of household spending using observations from the FIES.

3.2.1 Effects on the amount of household consumption

The introduction of the program can be regarded as an exogenous increase in income for households that benefited from the program, i.e., households with a high school student. However, households' financial gain through the free tuition program is too small to represent a substantial increase in their permanent income, so that the natural response for such households would be to leave their spending level unchanged unless they are liquidity constrained. On the other hand, *a priori* no particular change in spending patterns is expected. Any changes in the composition of spending as a result of the free tuition program therefore would be an empirical matter.

The basic specification for the estimation is as follows:

$$Y_{i,t} = \alpha + \beta_1 * DI_{i,t} + \beta_2 * FS_{i,t} + \beta_3 * Students_{i,t} + \beta_4 * FreeTuition_t + \beta_5 * [Students_{i,t} * FreeTuition_t] + \delta * Z_{i,t} + \varepsilon_{i,t} \quad (2)$$

where i refers to a household (unit of observation) and t refers to the timing of the survey (year and month). The dependent variable is defined in two ways. The first is (unadjusted) household living expenditure, which is the sum of monthly expenditures over the six month survey period for each household in the FIES. The second is household living expenditure adjusted for high school tuition by adding 59,400 yen (600 dollars), which corresponds to half of the annual tuition payment subsidy. The reason for using the second definition is that households sending their child or children to high school continue to consume a flow of services provided by the school even if they no longer pay for those services out of pocket. The explanatory variables include a constant, household disposable income over the six month survey period (DI), the number of household members (FS), the number of high school students in the household ($Students$), as well as an indicator ($FreeTuition$) which takes 1 for households that were surveyed after April 2010 when the free tuition program became effective, and

0 otherwise.

The main variable of interest is the interaction term between the number of high school students in the household (*Students*) and the dummy for the free tuition program (*FreeTuition*). The aim of including this term is to capture any changes in household spending by distinguishing households with high school students before and after implementation of the free tuition program. If households decreased their spending by an amount equivalent to the tuition fee exemption, the coefficient on the interaction term should be negative and significant and close to 59,400 yen (600 dollars) in size when the unadjusted dependent variable is used. On the other hand, when the dependent variable is adjusted by adding 59,400 yen (600 dollars), the coefficient should no longer be significant. The other control variables are expressed as vector *Z*, which includes the age of the household head, the shares of family members in each age group in a household, indicators for the month when the survey on each household was completed, and year dummies. The last term is a well-behaved error term.⁵ In the regression analysis below, households that benefited from the free tuition program – the treatment group – are compared with two alternative control groups: households with elementary school or junior high school students, and households without children aged 6 to 18.

Table 4 reports the estimated coefficients. Let us focus on the coefficients on the interaction term between the number of high school students in the household and the indicator for the period in which the free tuition program was in effect. Panel (a) shows that the coefficients are negative and significant but the size differs between households above and below the 25th percentile. The coefficient for households above the 25th percentile is minus 46,427 yen (464 dollars), while that for households below the 25th percentile is minus 22,462 yen (225 dollars), indicating that poorer households' spending fell by less than the high school tuition fee amount and less than the spending of wealthier households. The next column shows the coefficients on the same interaction term but replaces the unadjusted with the adjusted dependent variable where 59,400 yen (600 dollars) are added. The coefficients are now positive but not statistically significant in the estimation for all sample households as well as for households above the 25th percentile. In contrast, the coefficients are positive and significant for poorer households, indicating that those households did indeed increase their spending

after the introduction of the free tuition program. The implied marginal propensity to consume (MPC) is 62.2 (36,938 yen / 59,400 yen). The canonical LC/PIH predicts that less well-off households are more likely to be liquidity constrained and that for such households an increase in current economic resources through a windfall is likely to be associated with an increase in current spending. Next, panel (b) of Table 4 reports the coefficients using households without children aged 6 to 18 as the control group. The observed patterns for the coefficients are similar to those in the upper panel.

In sum, the free tuition program had a larger effect on poorer than wealthier households with children enrolled in high school. In fact, poorer households responded to the “windfall” provided by the scrapping of high school tuition fees by significantly increasing their spending. On the other hand, while some increase for richer households can be observed, the effect is not statistically significant.

3.2.2 Effects on the composition of household consumption

Next, how households’ composition of spending was affected is examined. The specification used for the estimation is as follows:

$$S_{i,j,t} = \alpha + \beta_1 * DI_{i,t} + \beta_2 * FS_{i,t} + \beta_3 * Student_{i,t} + \beta_4 * Tuitionfree_t + \beta_5 * [Student_{i,t} * Tuitionfree_t] + \delta * Z_{i,t} + \varepsilon_{i,t} \quad (3)$$

The notation here is the same as in the regressions above except for the dependent variable. The dependent variable is now the share of spending on item j over the six month survey period out of total household living expenditure over the six months. The consumption categories are: food, alcohol, dining out, clothing for men, clothing for women, clothing for children, compulsory school expenses, high school expenses, university expenses, cram school expenses, text and reference books, recreational goods, recreational services, spending money, remittances, and other living expenditures. Since the shares are dependent on each other, we perform Zellner’s seemingly unrelated regression (SUR) to obtain the coefficients.

Table 5 reports the estimated coefficients on the interaction term between the number of high school students in the household and the dummy taking a value of 1 for the period since April 2010, when the free tuition program became effective. Panel (a), which presents the results for unadjusted

household living expenditure, shows that the coefficient on high school expenses is negative and significant. This result simply reflects that households no longer incur high school expenses under the free tuition program. Positive and significant coefficients are also found for some other categories, namely, alcohol, clothing for children, cram/supplementary school expenses, text and reference books, and recreational goods. These coefficients show that households' spending shares on these consumption categories increased after introduction of the free tuition program. Meanwhile, panel (b) shows the results when adjusted expenditure is used as the denominator. The pattern of the coefficients is similar to that in panel (a). The only major difference is the coefficient on high school tuition expenses, which is positive and significant once the adjustment for the tuition subsidy is made.

The remaining columns report the estimated coefficients for wealthier and poorer households. First, the pattern of the estimated coefficients for households above the 25th percentile, i.e., wealthier households, is very similar to that for all households: in panel (a) for unadjusted household expenditure, positive and significant coefficients are found for alcohol, clothing, cram/supplementary school expenses, text and reference books, and recreational goods, while the coefficient for high school expenses is negative and significant. The coefficient on other living expenditures is positive but not significant. The pattern in panel (b) looks basically the same.

In contrast, the coefficients for households below the 25th percentile are mostly insignificant. In panel (a) using unadjusted household living expenditure, the exceptions are positive and significant coefficients on alcohol, recreational goods, and spending money for family members and a negative and significant coefficient on high school expenses. In panel (b), positive and significant coefficients are found for high school tuition fees and spending money for family members and negative and significant coefficients for dining out, college tuition fees, and other living expenditures.

In sum, the free tuition program had a more substantial impact on the spending composition of wealthier than of poorer households. Wealthier households responded to the increase in discretionary income by reallocating spending to some specific items, such as clothing and/or educational spending. In contrast, a shift in spending composition to those items is not found for poorer households.

4. Summary and conclusion

This paper focused on tuition fees to examine consumption smoothing by Japanese households. Specifically, two analyses were conducted. The first focused on expenditure patterns of households with a university student. The second focused on households' expenditure response to the introduction of the free high school tuition program in 2010. The findings can be summarized as follows:

- 1) The estimation results suggest that a 100 yen decrease in discretionary income due to the payment of university tuition fees is associated with a decrease of about 15 yen in discretionary spending in the month that tuition payments are made.
- 2) The results also suggest that the free high school tuition programs significantly stimulated household spending, especially in the case of poorer households.
- 3) The free tuition program significantly altered the composition of household expenditure of wealthier households, with a surge in spending shares observed in non-tuition education expenses, clothing, and recreational goods.

These findings indicate that Japanese households responded to predictable income changes and did not fully engage in consumption smoothing. While the fact that the consumption response looks larger for poorer households provides evidence of the presence of liquidity constraints, the finding regarding the composition effect for wealthier households probably means that changes in tuition fees have some welfare impact even for households that are not liquidity constrained.

[†] This paper forms part of the author's microdata-based research on household consumption in Japan at the Economic and Social Research Institute (ESRI). The author is grateful to Takashi Oshio for his discussion in a seminar at ESRI and would also like to thank ESRI colleagues for their comments and support. Special thanks go to Satoshi Shimizutani for his insightful discussion (as a coauthor in substance) and to the Statistics Bureau of Japan for providing the microdata from the *Family Income and Expenditure Survey* (FIES). The views expressed in this paper are personal and do not represent those of ESRI.

¹ Most recent work using micro-level data has found that household consumption reacts to predictable income changes when they materialize (Shea (1995), Shapiro and Slemrod (1995, 2003), Parker (1999), Souleles (1999, 2000), Stephens (2003), Johnson, Parker, and Souleles (2006)).

² Examples of such studies include Hori and Shimizutani (2009), Hsieh, Shimizutani, and Hori (2010), Hori and Shimizutani (2012), and Stephens and Unayama (2011).

³ For the university tuition analysis, households were removed if the reported age of the head of household decreases or increases by more than 1 year during the 6 months. Households were also excluded if the household's tenancy status changed from owner to renter or vice versa. For the free tuition program analysis, the sample is restricted to wage earner households, which account for roughly half of all survey households, and then further confined to those with children aged 6 to 18.

⁴ For example, For example, for a household surveyed from April to September, observations for May take the second position in the six month period.

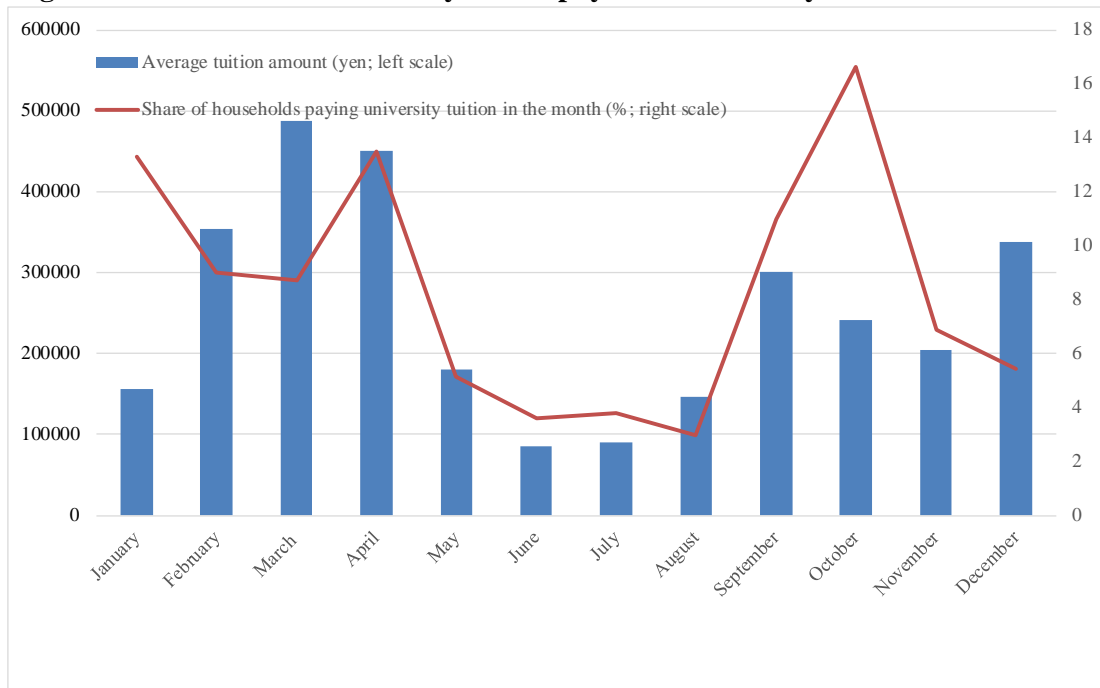
⁵ Another possible approach to examine the impact of the free tuition program on households would be to use the panel structure of the FIES and focus on households that were surveyed before and after the introduction of the program as the treatment group. However, the sample size of the treatment group is too small to obtain meaningful estimates.

REFERENCES

- Akabayashi, Hideo and Araki, Hiroko (2011) “Do Education Vouchers Prevent Dropout at Private High Schools? Evidence from Japanese Policy Changes,” *Journal of the Japanese and International Economies*, 25(3): 183–198.
- Attanasio, Orazio and Weber, Guglielmo (1995) “Is Consumption Growth Consistent with Intertemporal Optimization? Evidence from the Consumer Expenditure Survey,” *Journal of Political Economy*, 103(6): 1121–1157.
- Browning, Martin and Collado, Dolores M. (2001) “The Response of Expenditures to Anticipated Income Changes: Panel Data Estimates,” *American Economic Review*, 91(3): 681–692.
- Browning, Martin and Lusardi, Annamaria (1996). “Household Saving: Micro Theories and Micro Facts,” *Journal of Economic Literature*, 34(4): 1797–1855.
- Campbell, John Y. and Mankiw, Gregory N. (1989) “Consumption, Income, and Interest Rates: Reinterpreting the Time Series Evidence,” *NBER Macroeconomics Annual*, vol. 4: 185–216.
- Coulibaly, Brahim and Li, Geng (2006) “Do Homeowners Increase Consumption After the Last Mortgage Payment? An Alternative Test of the Permanent Income Hypothesis,” *Review of Economics and Statistics*, 88(1): 10–19.
- Hori, Masahiro and Shimizutani, Satoshi (2009) “The Response of Household Expenditure to Anticipated Income Changes: Bonus Payments and the Seasonality of Consumption in Japan,” *B.E. Journal of Macroeconomics*, 9(1) (Contributions), Article 34.
- Hori, Masahiro and Shimizutani, Satoshi (2012) “Do Households Smooth Expenditure over Anticipated Income Changes? Evidence from Bonus Payments to Public Employees in Japan,” *Journal of the Japanese and International Economies*, 26(3): 405 –433.
- Hsieh, Chang-Tai (2003) “Do Consumers React to Anticipated Income Changes? Evidence from the Alaska Permanent Fund,” *American Economic Review*, 93(1): 397–405.
- Hsieh, Chang-Tai, Shimizutani, Satoshi and Hori, Masahiro (2010) “Did Japan’s Shopping Coupon Program Increase Spending?” *Journal of Public Economics*, 94(7 –8): 523-529.
- Japan Student Services Organization (JASSO) (2010) *Survey on Student Life (Gakusei Seikatsu Chousa) FY2008*.
- Johnson, David S., Parker, Jonathan A. and Souleles, Nicholas S. (2006) “Household Expenditure and the Income Tax Rebates of 2001,” *American Economic Review*, 96(5): 1589–1610.
- Parker, Jonathan A. (1999) “The Reaction of Household Consumption to Predictable Changes in Social Security Taxes,” *American Economic Review*, 89(4): 959–973.
- Paxson, Christina H. (1993) “Consumption and Income Seasonality in Thailand,” *Journal of Political Economy*, 101(1): 39–72.

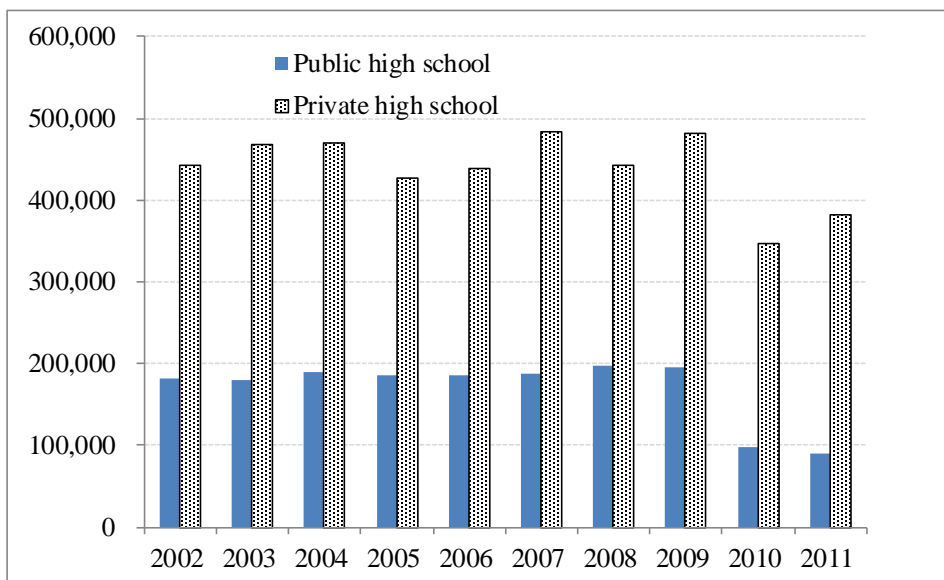
- Shapiro, Matthew D. (1984) "The Permanent Income Hypothesis and the Real Interest Rate," *Economic Letters*, 14(1): 93–100.
- Shapiro, Matthew D. and Slemrod, Joel (1995) "Consumer Response to the Timing of Income: Evidence from a Change in Tax Withholding," *American Economic Review*, 85(1): 274–283.
- Shapiro, Matthew D. and Slemrod, Joel (2003) "Consumer Response to Tax Rebates," *American Economic Review*, 93(1): 381–396.
- Shea, John (1995) "Union Contracts and the Life-Cycle/Permanent-Income Hypothesis," *American Economic Review*, 85(1): 186–200.
- Souleles, Nicholas S. (1999) "The Response of Household Consumption to Income Tax Refunds," *American Economic Review*, 89(4): 947–958.
- Souleles, Nicholas S. (2000) "College Tuition and Household Savings and Consumption," *Journal of Public Economics*, 77(2): 185–207.
- Souleles, Nicholas S. (2002) "Consumer Response to the Reagan Tax Cuts," *Journal of Public Economics*, 85(1): 99–120.
- Stephens, Melvin Jr. (2003). "'3rd of the Month': Do Social Security Recipients Smooth Consumption Between Checks?" *American Economic Review*, 93(1): 406–422.
- Stephens, Melvin Jr. (2006) "Paycheque Receipt and the Timing of Consumption," *Economic Journal*, 116(513): 489–522.
- Stephens, Melvin Jr. (2008) "The Consumption Response to Predictable Changes in Discretionary Income: Evidence from the Repayment of Vehicle Loans," *Review of Economics and Statistics*, 90(2): 241–252.
- Stephens, Melvin, Jr. and Unayama, Takashi (2011) "The Consumption Response to Seasonal Income: Evidence from Japanese Public Pension Benefits," *American Economic Journal: Applied Economics*, 3(4): 86–118.

Figure 1. Distribution of university tuition payments over the year



Source: Constructed from the FIES microdata from 1984 to 2008.

Figure 2. High school tuition payments per student (in yen)



Source: Author's calculation using FIES microdata.

Table 1(a). Summary statistics of the data used for the university tuition analysis

	Mean	Std. Dev.
Tuition payments	56,617.1	197,162.1
Tuition payments (excluding observations with zero expenditure)	317,162.4	367,605.3
Public university	9,297.8	56,584.4
Public university (excluding observations with zero expenditure)	182,125.1	176,770.8
Private university	47,319.3	190,393.2
Private university (excluding observations with zero expenditure)	361,486.4	404,187.5
Education expenditures	66,558.0	187,691.6
Education expenditures (excluding observations with zero expenditure)	145,172.4	255,784.6
Total spending (excluding university tuition payments)	319,013.4	239,395.9
Durable consumption	14,075.3	79,805.8
Semi-durable consumption	42,239.5	71,082.9
Non-durable consumption	137,732.1	51,614.5
Service consumption (excluding university tuition payments)	124,966.4	174,329.6
Food expenditures	105,154.7	45,585.3
Clothing expenditures	30,553.8	58,981.5
Age of household head	51.9	6.6
Square of the age of household head	2,741.1	733.1
Family size	4.1	1.0

Notes: The number of observations is 73,788 (12,298 households).

The sample is confined to households with only one university student.

Table 1(b). Summary statistics of the data used for the tuition-free high school program analysis

Variable	Sample households						By spending level						Before and after introduction of the program					
	Above 25th percentile			Below 25th percentile			Before			After								
	Mean	Std. Dev.		Mean	Std. Dev.		Mean	Std. Dev.		Mean	Std. Dev.		Mean	Std. Dev.				
Food	375,656	(145,343)		408,058	(144,208)		277,648	(96,636)		379,954	(146,020)		359,193	(141,527)				
Alcohol	28,951	(34,951)		32,994	(37,474)		16,723	(21,679)		29,415	(35,303)		27,173	(33,512)				
Dining out	94,198	(69,501)		106,214	(72,864)		57,854	(40,310)		94,186	(69,870)		94,241	(68,075)				
Clothing for men	23,180	(33,673)		27,909	(36,981)		8,877	(12,436)		23,809	(34,827)		20,769	(28,702)				
Clothing for women	41,105	(62,523)		49,093	(69,350)		16,943	(20,236)		41,830	(63,234)		38,328	(59,645)				
Clothing for children	18,779	(25,395)		21,069	(27,558)		11,854	(15,314)		19,191	(25,899)		17,204	(23,294)				
Compulsory school expenses	50,643	(87,563)		56,552	(96,314)		32,769	(48,733)		50,448	(87,068)		51,392	(89,433)				
High school expenses	48,809	(101,868)		59,471	(112,475)		16,562	(46,018)		52,523	(105,340)		34,585	(85,837)				
Program adjusted high school expenses	53,650	(106,348)		64,665	(117,030)		20,331	(51,148)		53,050	(105,920)		55,945	(107,948)				
University expenses	45,926	(191,962)		60,519	(219,137)		1,786	(21,590)		46,777	(193,905)		42,668	(184,305)				
Gram/Supplementary school expenses	57,164	(111,530)		70,879	(123,431)		15,680	(41,126)		56,549	(109,355)		59,519	(119,470)				
Text and reference books	5,334	(17,064)		6,486	(18,949)		1,848	(8,343)		5,503	(17,411)		4,683	(15,646)				
Recreational goods	101,226	(92,499)		118,386	(98,922)		49,324	(35,395)		102,944	(93,916)		94,647	(86,545)				
Recreational services	116,186	(130,176)		139,151	(140,254)		46,724	(47,777)		116,563	(132,038)		114,743	(122,778)				
Spending money for family members	113,081	(167,849)		140,552	(182,623)		29,989	(57,667)		118,359	(172,904)		92,866	(145,131)				
Remittances	57,967	(263,216)		76,542	(301,128)		1,785	(19,228)		60,838	(272,311)		46,970	(224,677)				
Other living expenditures	869,320	(528,603)		998,057	(544,818)		479,928	(158,181)		867,888	(528,832)		874,803	(527,718)				
Annual income of the previous year / 2	3,659,493	(1,973,031)		3,981,436	(2,003,604)		2,629,417	(1,453,062)		3,693,048	(1,977,231)		3,523,925	(1,950,216)				
Household disposable income	2,828,842	(1,315,205)		3,119,350	(1,292,461)		1,880,057	(864,714)		2,846,936	(1,327,269)		2,761,768	(1,267,319)				
Program adjusted household disposable income	2,833,653	(1,315,671)		3,124,524	(1,292,769)		1,883,682	(864,529)		2,847,445	(1,327,275)		2,782,526	(1,270,511)				
Household living expenditures	2,057,838	(1,012,361)		2,386,839	(957,726)		1,070,738	(220,654)		2,077,161	(1,022,734)		1,983,971	(968,198)				
Program adjusted household living expenditures	2,062,683	(1,013,500)		2,392,043	(958,806)		1,074,507	(221,077)		2,077,686	(1,022,886)		2,005,331	(974,722)				
Number of household members	4,255	(0,956)		4,301	(0,958)		4,108	(0,936)		4,273	(0,962)		4,184	(0,927)				
Number of high school students	0,373	(0,557)		0,412	(0,575)		0,248	(0,476)		0,376	(0,559)		0,360	(0,549)				
Age of the household head	45,474	(8,920)		45,727	(8,384)		44,661	(10,411)		45,372	(8,813)		45,884	(9,328)				
Share of household members aged 0-5	0,055	(0,108)		0,052	(0,106)		0,064	(0,114)		0,055	(0,108)		0,055	(0,109)				
Share of household members aged 6-14	0,275	(0,184)		0,266	(0,185)		0,303	(0,179)		0,274	(0,185)		0,279	(0,180)				
Share of household members aged 15-18	0,113	(0,151)		0,123	(0,153)		0,082	(0,140)		0,114	(0,151)		0,111	(0,152)				
Share of household members aged 19-24	0,033	(0,089)		0,035	(0,091)		0,027	(0,084)		0,034	(0,090)		0,029	(0,084)				
Share of household members aged 25-39	0,152	(0,201)		0,136	(0,193)		0,204	(0,216)		0,154	(0,202)		0,144	(0,197)				
Share of household members aged 40-59	0,324	(0,221)		0,342	(0,216)		0,266	(0,229)		0,321	(0,221)		0,334	(0,224)				
Share of household members aged 60-74	0,032	(0,094)		0,030	(0,090)		0,038	(0,107)		0,032	(0,094)		0,031	(0,097)				
Share of household members aged 75 or over	0,017	(0,063)		0,017	(0,063)		0,015	(0,063)		0,017	(0,063)		0,016	(0,065)				
Number of households	41,869			31,466			10,403			33,201			8,668					

Source: Author's calculation using FIES microdata.

Table 2. Regression results using households with one university student

	Total spending except tuition	Durables	Semi-durables	Non-durables	Services except tuition	Food	Clothing
(a) "New student group" only							
(1) No lag included							
$\Delta X (\alpha(1))$	-0.1529 *** (0.012)	-0.0066 * (0.004)	-0.0010 (0.003)	0.0008 (0.001)	-0.1460 *** (0.010)	0.0018 (0.001)	0.0012 (0.003)
R-squared	0.0600	0.0085	0.0377	0.2065	0.0556	0.2540	0.0433
Number of observations	6,395	6,395	6,395	6,395	6,395	6,395	6,395
(2) One month lag included							
$\Delta X (\alpha(1))$	-0.1547 *** (0.015)	-0.0080 (0.005)	0.0034 (0.005)	-0.0006 (0.002)	-0.1496 *** (0.014)	0.0018 (0.001)	0.0042 (0.004)
$\Delta X (1\text{month lag}) (\alpha(2))$	-0.0107 (0.012)	-0.0008 (0.004)	0.0112 *** (0.004)	-0.0019 (0.002)	-0.0192 * (0.010)	0.0015 (0.001)	0.0086 ** (0.003)
F test : $(\alpha(1))+(\alpha(2))=0$	F=47.42 Prob>F=0.00	F=1.19 Prob>F=0.28	F=3.95 Prob>F=0.05	F=0.60 Prob>F=0.44	F=66.93 Prob>F=0.00	F=1.97 Prob>F=0.16	F=3.58 Prob>F=0.06
R-squared	0.054	0.009	0.043	0.169	0.047	0.225	0.044
Number of observations	5,116	5,116	5,116	5,116	5,116	5,116	5,116
(b) "New student group" and "Consecutive student group"							
(1) No lag included							
$\Delta X (\alpha(1))$	-0.1281 *** (0.007)	0.0003 (0.002)	0.0004 (0.002)	0.0025 *** (0.001)	-0.1312 *** (0.006)	0.0011 ** (0.001)	0.0008 (0.002)
R-squared	0.0415	0.0015	0.0158	0.2401	0.0316	0.2742	0.0123
Number of observations	54,755	54,755	54,755	54,755	54,755	54,755	54,755
(2) One month lag included							
$\Delta X (\alpha(1))$	-0.1239 *** (0.010)	0.0031 (0.002)	0.0035 (0.003)	0.0019 ** (0.001)	-0.1325 *** (0.009)	0.0003 (0.0007)	0.0025 (0.002)
$\Delta X (1\text{month lag}) (\alpha(2))$	-0.0015 (0.007)	0.0021 (0.002)	0.0051 ** (0.002)	-0.0009 (0.001)	-0.0078 (0.006)	-0.0008 (0.001)	0.0032 (0.002)
F test : $(\alpha(1))+(\alpha(2))=0$	F=72.00 Prob>F=0.00	F=1.60 Prob>F=0.21	F=3.95 Prob>F=0.05	F=0.52 Prob>F=0.47	F=115.98 Prob>F=0.00	F=0.13 Prob>F=0.72	F=1.93 Prob>F=0.17
R-squared	0.042	0.002	0.016	0.248	0.031	0.285	0.012
Number of observations	43,804	43,804	43,804	43,804	43,804	43,804	43,804

Notes: The results are obtained using OLS. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively. Numbers in parentheses are robust standard errors.

Table 3. Regression results using households with more than one university student or no university student

	Total spending except tuition				Services except tuition			
	Durables	Semi-durables	Non-durables	Food	Clothing			
(a) "New student group" only								
(1) No lag included								
$\Delta X (\alpha(1))$	-0.1544 *** (0.010)	-0.0044 (0.003)	-0.0009 (0.003)	0.0015 (0.001)	-0.1506 *** (0.009)	0.0016 * (0.001)	0.0011 (0.002)	
R-squared	0.068	0.008	0.038	0.212	0.067	0.255	0.042	
Number of observations	7,350	7,350	7,350	7,350	7,350	7,350	7,350	
(2) One month lag included								
$\Delta X (\alpha(1))$	-0.1534 *** (0.013)	-0.0073 * (0.004)	0.0046 (0.004)	0.0006 (0.002)	-0.1512 *** (0.011)	0.0023 * (0.001)	0.0049 (0.004)	
$\Delta X (1\text{month lag}) (\alpha(2))$	-0.0112 (0.010)	-0.0022 (0.003)	0.0102 *** (0.003)	-0.0018 (0.002)	-0.0174 *** (0.008)	0.0014 (0.001)	0.0080 *** (0.003)	
F test : $(\alpha(1))+(\alpha(2))=0$	F=70.51 Prob>F=0.00	F=2.13 Prob>F=0.14	F=5.49 Prob>F=0.02	F=0.19 Prob>F=0.66	F=101.26 Prob>F=0.00	F=3.17 Prob>F=0.07	F=5.01 Prob>F=0.03	
R-squared	0.059	0.009	0.043	0.169	0.055	0.221	0.044	
Number of observations	5,880	5,880	5,880	5,880	5,880	5,880	5,880	
(b) "New student group" and "Consecutive student group"								
(1) No lag included								
$\Delta X (\alpha(1))$	-0.1329 *** (0.006)	-0.0007 (0.001)	-0.0007 (0.001)	0.0021 *** (0.001)	-0.1336 *** (0.005)	0.0008 * (0.0005)	0.0001 (0.001)	
R-squared	0.0442	0.0014	0.0162	0.2392	0.0358	0.2729	0.0125	
Number of observations	60,810	60,810	60,810	60,810	60,810	60,810	60,810	
(2) One month lag included								
$\Delta X (\alpha(1))$	-0.1291 *** (0.008)	0.0002 (0.002)	0.0022 (0.002)	0.0020 *** (0.001)	-0.1335 *** (0.007)	0.0006 (0.001)	0.0020 (0.002)	
$\Delta X (1\text{month lag}) (\alpha(2))$	-0.0032 (0.006)	0.0002 (0.002)	0.0041 ** (0.002)	-0.0003 (0.001)	-0.0072 (0.005)	-0.0003 (0.001)	0.0029 (0.002)	
F test : $(\alpha(1))+(\alpha(2))=0$	F=117.15 Prob>F=0.00	F=0.02 Prob>F=0.90	F=2.85 Prob>F=0.09	F=1.59 Prob>F=0.21	F=172.01 Prob>F=0.00	F=0.09 Prob>F=0.77	F=1.91 Prob>F=0.17	
R-squared	0.044	0.002	0.016	0.246	0.034	0.283	0.013	
Number of observations	48,648	48,648	48,648	48,648	48,648	48,648	48,648	
(c) All households								
(1) No lag included								
$\Delta X (\alpha(1))$	-0.1572 *** (0.009)	-0.0007 (0.001)	-0.0004 (0.001)	0.0029 *** (0.0005)	-0.1590 *** (0.008)	0.0011 *** (0.0004)	0.0004 (0.001)	
R-squared	0.0275	0.0010	0.0128	0.2311	0.0076	0.2452	0.0091	
Number of observations	1,683,497	1,683,497	1,683,497	1,683,497	1,683,497	1,683,497	1,693,497	
(2) One month lag included								
$\Delta X (\alpha(1))$	-0.1588 *** (0.011)	-0.0008 (0.001)	0.0021 (0.001)	0.0027 *** (0.001)	-0.1622 *** (0.011)	0.0006 (0.0005)	0.0016 (0.001)	
$\Delta X (1\text{month lag}) (\alpha(2))$	0.0013 (0.008)	-0.0008 (0.002)	0.0042 *** (0.001)	-0.0001 (0.001)	-0.0020 (0.007)	-0.0006 (0.0004)	0.0026 ** (0.001)	
F test : $(\alpha(1))+(\alpha(2))=0$	F=102.10 Prob>F=0.00	F=0.36 Prob>F=0.55	F=7.41 Prob>F=0.01	F=7.15 Prob>F=0.01	F=124.96 Prob>F=0.00	F=0.01 Prob>F=0.93	F=3.90 Prob>F=0.05	
R-squared	0.028	0.001	0.013	0.242	0.008	0.254	0.009	
Number of observations	1,346,859	1,346,859	1,346,859	1,346,859	1,346,859	1,346,859	1,346,859	

Notes: The results are obtained using OLS. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively. Numbers in parentheses are robust standard errors.

Table 4. Impact of free-tuition high school program on household living expenditures

	(a)	(b)	(c)	(d)	(c)	(e)	
	Household disposable income	Number of household members	Number of high school students in the household	Free-tuition high school program dummy	Interaction term	Interaction term (Dep. Adjusted expenditures)	Number of observations
	(a)	(b)	(c)	(d)	(c)	(e)	Adj R-squared
							Root MSE
(a) Households with high school student(s) (treatment group) vs. Households with child(ren) aged 6-18 not in high school (control group)							
All sample households	0.410 0.003	58,341 (6,433)	8,128 (15,210)	31,539 (35,719)	-43,729 (18,576)	15,671 (18,576)	34,511
	***	***			**		0.383
							770,000
By spending level							
Households above the 25th percentile	0.336 0.004	22,891 (8,033)	-52,749 (17,028)	49,340 (41,301)	-46,427 (20,819)	12,973 (20,819)	26,421
	***	***			**		0.296
							780,000
Households below the 25th percentile	0.063 (0.003)	19,267 (3,187)	34,659 (9,571)	-28,077 (19,404)	-22,462 (11,756)	36,938 (11,756)	8,090
	***	***			*	***	0.080
							210,000
(b) Households with high school student(s) (treatment group) vs. Households without child(ren) aged 6-18 (control group)							
All sample households	0.366 0.003	75,160 (6,046)	38,706 (29,170)	18,709 (34,446)	-43,314 (20,077)	16,086 (20,077)	46,637
	***	***			**		0.309
							880,000
By spending level							
Households above the 25th percentile	0.298 0.003	52,808 (6,863)	-26,088 (31,534)	48,611 (39,148)	-41,884 (22,032)	17,516 (22,032)	36,117
	***	***			*		0.241
							890,000
Households below the 25th percentile	0.046 (0.002)	11,022 (3,083)	19,324 (18,816)	-32,482 (16,706)	-12,391 (12,280)	47,009 (12,280)	10,520
	***	***		*		***	0.059
							200,000

Notes: Coefficients are obtained from OLS regressions. Standard errors of coefficients are shown in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively. Regressions also include the other control variables described in the text as well as a constant. The coefficients reported in column (e') are those on the interaction term when adjusted expenditure is used as the dependent variable.

Table 5. Impact of free-tuition high school program on shares of consumption categories in total household expenditures

	Households with high school student(s) (treatment group) vs. Households with child(ren) aged 6-18 not in high school (control group)					
	All sample households (Number of observations = 41,565)		By spending level			
	Households above the 25th percentile (Number of observations = 31,174)	Households below the 25th percentile (Number of observations = 10,391)	Households above the 25th percentile (Number of observations = 31,174)	Households below the 25th percentile (Number of observations = 10,391)		
	Interaction term	R-squared	Root MSE	Interaction term	R-squared	Root MSE
(a) Share in total household expenditures						
Food	0.005 (0.005)	0.483	0.060	0.005 (0.005)	0.372	0.051
Alcohol	0.005 *** (0.002)	0.017	0.017	0.004 ** (0.002)	0.018	0.016
Dining out	0.000 (0.003)	0.162	0.029	0.003 (0.003)	0.169	0.026
Clothing for men	0.002 * (0.001)	0.034	0.012	0.002 * (0.001)	0.023	0.012
Clothing for women	0.004 ** (0.002)	0.038	0.020	0.004 ** (0.002)	0.032	0.021
Clothing for children	0.003 *** (0.001)	0.196	0.011	0.003 *** (0.001)	0.217	0.011
Compulsory school expenses	0.000 (0.003)	0.259	0.034	-0.001 (0.003)	0.262	0.033
High school expenses	-0.070 *** (0.003)	0.494	0.031	-0.064 *** (0.003)	0.507	0.031
College expenses	0.002 (0.005)	0.226	0.051	0.004 (0.006)	0.259	0.057
Cram/Supplementary school expenses	0.013 *** (0.004)	0.101	0.042	0.015 *** (0.004)	0.095	0.044
Text and reference books	0.002 *** (0.001)	0.046	0.007	0.002 ** (0.001)	0.057	0.007
Recreational goods	0.014 *** (0.003)	0.047	0.034	0.014 *** (0.004)	0.050	0.035
Recreational services	0.005 (0.004)	0.106	0.044	0.005 (0.005)	0.090	0.046
Spending money for family members	0.004 (0.005)	0.068	0.061	-0.002 (0.007)	0.030	0.065
Remittances	-0.006 (0.006)	0.164	0.063	-0.001 (0.007)	0.188	0.070
Other living expenditures	0.017 * (0.010)	0.083	0.112	0.006 (0.011)	0.084	0.112
(b) Share in program-adjusted total household expenditures						
Food	-0.007 (0.005)	0.482	0.059	-0.004 (0.005)	0.371	0.051
Alcohol	0.004 ** (0.002)	0.017	0.017	0.003 * (0.002)	0.018	0.016
Dining out	-0.004 (0.003)	0.164	0.029	0.000 (0.003)	0.171	0.026
Clothing for men	0.000 (0.001)	0.034	0.012	0.001 (0.001)	0.023	0.012
Clothing for women	0.001 (0.002)	0.038	0.020	0.002 (0.002)	0.032	0.021
Clothing for children	0.002 ** (0.001)	0.197	0.011	0.003 *** (0.001)	0.218	0.011
Compulsory school expenses	-0.001 (0.003)	0.260	0.034	-0.002 (0.003)	0.263	0.033
High school expenses	0.046 *** (0.003)	0.546	0.031	0.032 *** (0.003)	0.549	0.031
College expenses	-0.004 (0.005)	0.227	0.051	-0.002 (0.006)	0.260	0.057
Cram/Supplementary school expenses	0.008 ** (0.004)	0.101	0.042	0.010 ** (0.004)	0.095	0.044
Text and reference books	0.001 * (0.001)	0.045	0.007	0.001 * (0.001)	0.056	0.007
Recreational goods	0.008 *** (0.003)	0.048	0.034	0.009 *** (0.004)	0.051	0.035
Recreational services	-0.002 (0.004)	0.108	0.044	-0.001 (0.005)	0.092	0.046
Spending money for family members	-0.002 (0.005)	0.068	0.061	-0.008 (0.007)	0.031	0.065
Remittances	-0.013 ** (0.006)	0.164	0.063	-0.009 (0.007)	0.188	0.070
Other living expenditures	-0.035 *** (0.010)	0.085	0.111	-0.036 *** (0.011)	0.086	0.112

Notes: Coefficients are obtained from Zellner's seemingly unrelated regressions. Standard errors of coefficients are shown in parentheses. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively. Regressions in this table include the same control variables as those included in the regressions in Table 4.

Appendix 1. Robustness check (1): University tuition analysis

This appendix reports the results using alternative empirical procedures as a robustness check for the university tuition analysis. Table A.1(a) reports the coefficients on the main variable [when ΔX_t is decomposed into public and private universities. – *Is this accurate? Is ΔX_t really decomposed? Or do you mean:* “on the main variable, ΔX_t , when distinguishing between students attending public and private universities.”] The patterns of the coefficients on ΔX_t are basically unchanged in both the specifications with and without lagged terms. Table A.1(b) reports the results using educational expenditure including both tuition and non-tuition payments as the main independent variable instead of tuition payments only. The pattern of the coefficients on total or service spending looks similar to that using tuition only, but the size of the coefficients looks much smaller. These findings suggest that studies using total educational spending including non-tuition payments such as Souleles (2002) are likely to be biased.

Table A.1. Regression results using alternative specifications

	Total spending except tuition		Durables	Semi-durables	Non-durables	Services except tuition		Food	Clothing			
(a) Students at public (national or prefectural) universities and private universities												
(1) No lag included												
Public [β 1]	-0.156 (0.015)	***	-0.0002 (0.006)	0.013 (0.004)	***	0.004 (0.002)	**	-0.173 (0.012)	***	0.002 (0.002)	0.015 (0.004)	***
Private [γ 1]	-0.126 (0.008)	***	0.0004 (0.002)	-0.001 (0.002)	0.002 (0.001)	***	-0.128 (0.007)	***	0.0010 (0.0006)	*	-0.0005 (0.002)	
R-squared	0.04		0.00	0.02	0.24		0.03		0.27		0.01	
Number of observations	54755		54755	54755	54755		54755		54755		54755	
(2) One month lag included												
Public [β 1]	-0.147 (0.020)	***	-0.002 (0.009)	0.018 (0.005)	***	0.007 (0.003)	**	-0.170 (0.016)	***	0.002 (0.002)	0.018 (0.004)	***
Public (1 month lag) [β 2]	-0.0002 (0.016)		-0.003 (0.006)	0.005 (0.006)	0.005 (0.003)	*	-0.008 (0.013)		0.0002 (0.002)		0.001 (0.004)	
F test : [β 1]+[β 2]=0	F=21.51 Prob>F=0.00		F=0.15 Prob>F=0.70	F=6.18 Prob>F=0.01	F=6.84 Prob>F=0.01		F=49.34 Prob>F=0.00		F=0.44 Prob>F=0.51		F=6.20 Prob>F=0.01	
Private [γ 1]	-0.122 (0.010)	***	0.004 (0.002)	0.002 (0.003)	0.002 (0.001)	*	-0.129 (0.009)	***	0.0002 (0.001)		0.001 (0.003)	
Private (1 month lag) [γ 2]	-0.002 (0.008)		0.003 (0.002)	0.005 (0.002)	**	-0.001 (0.001)		-0.008 (0.006)		-0.001 (0.001)	0.003 (0.002)	
F test : [γ 1]+[γ 2]=0	F=62.27 Prob>F=0.00		F=1.97 Prob>F=0.16	F=2.67 Prob>F=0.10	F=0.01 Prob>F=0.91		F=97.25 Prob>F=0.00		F=0.30 Prob>F=0.59		F=1.16 Prob>F=0.28	
R-squared	0.04		0.00	0.02	0.25		0.03		0.29		0.01	
Number of observations	43804		43804	43804	43804		43804		43804		43804	
(b) Educational expenditure instead of tuition payments												
(1) No lag included												
Education	-0.034 (0.010)	***	0.0004 (0.002)	0.002 (0.002)	0.004 (0.001)	***	-0.040 (0.010)	***	0.001 (0.0006)	**	0.002 (0.002)	
R-squared	0.03		0.00	0.02	0.24		0.01		0.27		0.01	
Number of observations	54755		54755	54755	54755		54755		54755		54755	
(2) One month lag included												
Education [A1]	-0.040 (0.012)	***	0.003 (0.003)	0.004 (0.003)	0.004 (0.001)	***	-0.050 (0.011)	***	0.0005 (0.0007)		0.003 (0.002)	
Education (1month lag) [A2]	-0.004 (0.009)		0.002 (0.003)	0.004 (0.002)	*	-0.0005 (0.001)		-0.010 (0.008)		-0.0005 (0.0007)	0.003 (0.002)	
F test : [A1]+[A2]=0	F=5.79 Prob>F=0.02		F=0.85 Prob>F=0.36	F=3.15 Prob>F=0.08	F=4.10 Prob>F=0.04		F=13.23 Prob>F=0.00		F=0.00 Prob>F=1.00		F=1.52 Prob>F=0.22	
R-squared	0.03		0.00	0.02	0.25		0.01		0.29		0.01	
Number of observations	43804		43804	43804	43804		43804		43804		43804	

Notes: The results are obtained using OLS. ***, ** and * indicate significance at the 1%, 5%, and 10% level, respectively. Numbers in parentheses are robust standard errors.

Appendix 2. Robustness check (2): Tuition-free high school program analysis

This appendix provides robustness checks of the free-tuition program analysis. Three alternative approaches are taken to confirm the robustness of the findings. First, observations for 2008 and 2009 are removed from the sample, since rational households will have anticipated the introduction of the free-tuition program in advance and altered their behavior prior to its implementation in April 2010. Table A.2.1 confirms that the basic results remain unchanged.

Second, the indicator of households' wealth is changed from households' spending level to their income level. Table A.2.2 indicates that the finding that the effect of the free-tuition program on the spending amount is larger for poorer than wealthier households is reconfirmed by this exercise, although for some reason no significant (or precise coefficient) estimates are obtained in the regressions with households below the 25th percentile.

Third, a "placebo" analysis is conducted to confirm whether the identifying assumption in the DID strategy used in this paper is fulfilled or not; the treatment and control groups would have the same outcomes in the absence of treatment (the common trend assumption). To conduct this analysis, the model in equation (1) is estimated assuming that the reform was implemented in years other than 2010. Concretely, the regression is run assuming that the program was implemented in 2005, 2007, or 2009, and the significance of the interaction term is examined. Table A.2.3 reports the results for the coefficients and confirms that the coefficients on the interaction term are statistically insignificant in the "placebo" regressions.

Table A.2.1. Robustness check I: Results after removing households surveyed in 2008 & 2009

	(a)	(b)	(c)	(d)	(e)	(e)	Number of observations	Adj R-squared	Root MSE
	Household disposable income	Number of household members	Number of high school students in the household	Free-tuition high school program dummy	Interaction term	Interaction term (Dep. Adjusted expenditures)			
(a) Households with high school student(s) (treatment group) vs. Households with child(ren) aged 6-18 not in high school (control group)									
All sample households	0.404 (0.004)	*** (59,544) (7,258)	*** (27,378) (17,350)	107.757 (98,149)	-43,606 (19,324)	** ()	26,842	0.380	770,000
By spending level									
Households above the 25th percentile	0.330 (0.004)	*** (24,880) (9,023)	*** (-25,521) (19,382)	125.336 (114,968)	-51,740 (21,586)	** ()	20,571	0.293	780,000
Households below the 25th percentile	0.060 (0.003)	*** (18,527) (3,624)	*** (35,955) (11,008)	-19.028 (51.335)	-25.393 (12,379)	** ()	6,271	0.073	210,000
(b) Households with high school student(s) (treatment group) vs. Households without child(ren) aged 6-18 (control group)									
All sample households	0.363 (0.003)	*** (71,993) (6,792)	*** (77,877) (32,793)	69.283 (98,369)	-37,438 (20,906)	* ()	36,303	0.311	880,000
By spending level									
Households above the 25th percentile	0.296 (0.004)	*** (51,197) (7,707)	*** (11,443) (35,526)	61.750 (113,587)	-39,474 (22,872)	* ()	28,118	0.243	890,000
Households below the 25th percentile	0.046 (0.003)	*** (11,579) (3,455)	*** (17,634) (20,971)	-13.809 (44,918)	-18,047 (13,017)	*** ()	8,185	0.059	200,000

Notes: See notes for Table 4.

Table A.2.2. Robustness check II: Impact of the free-tuition high school program on household living expenditures by income level

	Household disposable income (a)	Number of household members (b)	Number of high school students in the household (c)	Free-tuition high school program dummy (d)	Interaction term (e)	Interaction term (Dep. Adjusted expenditures) (e')	Number of observations	Adj R-squared	Root MSE
(a) Households with high school student(s) (treatment group) vs. Households with child(ren) aged 6-18 not in high school (control group)									
By income level									
Households above the 25th percentile	0.417 (0.005)	37,991 (10,388)	*** (-35,539)	*	37,121 (43,690)	-40,772 (22,485) *	25,880	0.325	820,000
Households below the 25th percentile	0.123 (0.014)	79,172 (7,936)	*** (66,520)	***	33,444 (55,737)	-33,996 (29,960)	8,631	0.074	610,000
(b) Households with high school student(s) (treatment group) vs. Households without child(ren) aged 6-18 (control group)									
By income level									
Households above the 25th percentile	0.370 (0.004)	59,304 (7,273)	*** (-1,657)		49,216 (41,812)	-50,782 (23,231) **	34,984	0.277	920,000
Households below the 25th percentile	-0.062 (0.015)	90,272 (10,589)	*** (123,323)	**	-38,866 (55,585)	6,466 (40,815)	11,653	0.026	730,000

Notes: See notes for Table 4.

New ESRI Working Paper No.44
Responses of household expenditure to changes in discretionary income:
Micro data study focusing on tuition payments
to examine consumption smoothing by Japanese households

Table A.2.3. Robustness check III: Placebo test results to examine the significance of the interaction term coefficient

	Placebo (2005)	Placebo (2007)	Placebo (2009)	Free-tuition program (2010)	
	(a)	(b)	(c)	(e)	
(a) Households with high school student(s) (treatment group) vs. Households with child(ren) aged 6-18 not in high school (control group)					
All sample households	-9,472	-12,271	4,039	-43,729	**
	(18,239)	(19,145)	(31,960)	(18,576)	
	[25,792]	[25,792]	[25,792]	[34,511]	
By spending level					
Households above the 25th percentile	-15,216	-29,283	-22,192	-46,427	**
	(20,215)	(21,241)	(35,481)	(20,819)	
	[19,776]	[19,776]	[19,776]	[26,421]	
Households below the 25th percentile	-144	5,210	8,768	-22,462	*
	(12,332)	(12,937)	(21,881)	(11,756)	
	[6,016]	[6,016]	[6,016]	[8,090]	
By income level					
Households above the 25th percentile	-13,245	-12,102	4,253	-40,772	*
	(21,938)	(23,094)	(39,287)	(22,485)	
	[19,338]	[19,338]	[19,338]	[25,880]	
Households below the 25th percentile	6,583	-9,829	16,998	-33,996	
	(30,252)	(31,451)	(49,579)	(29,960)	
	[6,454]	[6,454]	[6,454]	[8,631]	
(b) Households with high school student(s) (treatment group) vs. Households without child(ren) aged 6-18 (control group)					
All sample households	3,612	-1,769	16,432	-43,314	**
	(19,917)	(20,931)	(34,847)	(20,077)	
	[34,813]	[34,813]	[34,813]	[46,637]	
By spending level					
Households above the 25th percentile	-231	-8,908	-1,247	-41,884	*
	(21,638)	(22,731)	(37,719)	(22,032)	
	[27,012]	[27,012]	[27,012]	[36,117]	
Households below the 25th percentile	-2,493	11,041	-6,388	-12,391	
	(13,024)	(13,809)	(24,104)	(12,280)	
	[7,801]	[7,801]	[7,801]	[10,520]	
By income level					
Households above the 25th percentile	1,136	5,036	37,723	-50,782	**
	(22,951)	(24,245)	(41,025)	(23,231)	
	[26,115]	[26,115]	[26,115]	[34,984]	
Households below the 25th percentile	30,411	-4,244	-27,747	6,466	
	(41,084)	(42,334)	(65,886)	(40,815)	
	[8,698]	[8,698]	[8,698]	[11,653]	

Notes: Coefficients are those on the interaction term between the number of high school students in the household and the placebo dummy assuming that the program was implemented in 2005, 2007, or 2009 instead of 2010. Standard errors of coefficients are shown in parentheses, while the numbers of observations are shown in brackets. Observations after April 2010 are excluded from the regressions in columns (a), (b), and (c). The coefficients reported in column (e) are the corresponding coefficients taken from Table 4. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% level, respectively.

Appendix 3. Robustness check (3): Changes in the composition of spending by income level

To check the robustness of the findings on changes in the composition of spending reported in Table 5, this appendix reports the results when the income level instead of the spending level is used as a proxy to identify (or separate) wealthier and poorer households.

Table A.3. Impact on shares of consumption categories in the total household expenditures by income level

	Households with high school student(s) (treatment group) vs. Households with child(ren) aged 6-18 not in high school (control group)							
	By income level				By income level			
	Households above the 25th percentile (Number of observations = 25,880)		Households below the 25th percentile (Number of observations = 8,631)		Households above the 25th percentile (Number of observations = 25,880)		Households below the 25th percentile (Number of observations = 8,631)	
	Interaction term		R-squared Root MSE		Interaction term		R-squared Root MSE	
(a) Share in total household expenditures								
Food	0.008	(0.006)	0.416	0.050	0.002	(0.013)	0.444	0.070
Alcohol	0.007 ***	(0.002)	0.018	0.016	0.001	(0.003)	0.025	0.018
Dining out	0.001	(0.003)	0.169	0.026	-0.009	(0.006)	0.149	0.030
Clothing for men	0.004 ***	(0.001)	0.023	0.012	0.000	(0.002)	0.036	0.011
Clothing for women	0.003	(0.002)	0.032	0.021	0.006	(0.004)	0.042	0.019
Clothing for children	0.002 *	(0.001)	0.217	0.011	0.001	(0.002)	0.175	0.012
Compulsory school expenses	-0.004	(0.004)	0.262	0.033	0.007	(0.006)	0.242	0.033
High school expenses	-0.067 ***	(0.003)	0.507	0.031	-0.067 ***	(0.006)	0.445	0.032
College expenses	0.001	(0.006)	0.259	0.057	-0.006	(0.008)	0.148	0.045
Cram/Supplementary school expenses	0.014 ***	(0.005)	0.095	0.044	0.003	(0.007)	0.082	0.037
Text and reference books	0.002 **	(0.001)	0.057	0.007	0.002	(0.002)	0.030	0.008
Recreational goods	0.018 ***	(0.004)	0.050	0.035	0.005	(0.006)	0.046	0.032
Recreational services	0.006	(0.005)	0.090	0.046	0.005	(0.007)	0.090	0.040
Spending money for family members	0.005	(0.007)	0.030	0.065	0.007	(0.010)	0.054	0.052
Remittances	-0.010	(0.007)	0.188	0.070	-0.002	(0.007)	0.074	0.039
Other living expenditures	0.011	(0.012)	0.084	0.112	0.047 **	(0.021)	0.091	0.114
(b) Share in program adjusted total household expenditures								
Food	-0.002	(0.006)	0.415	0.050	-0.016	(0.013)	0.442	0.070
Alcohol	0.005 ***	(0.002)	0.013	0.016	-0.001	(0.003)	0.026	0.018
Dining out	-0.001	(0.003)	0.205	0.026	-0.013 **	(0.006)	0.151	0.030
Clothing for men	0.002	(0.001)	0.022	0.012	-0.002	(0.002)	0.036	0.010
Clothing for women	0.000	(0.002)	0.033	0.019	0.002	(0.004)	0.042	0.019
Clothing for children	0.002	(0.001)	0.211	0.011	0.000	(0.002)	0.176	0.012
Compulsory school expenses	-0.004	(0.004)	0.283	0.034	0.005	(0.006)	0.243	0.033
High school expenses	0.034 ***	(0.003)	0.573	0.028	0.080 ***	(0.006)	0.530	0.032
College expenses	-0.004	(0.006)	0.267	0.050	-0.012	(0.008)	0.149	0.045
Cram/Supplementary school expenses	0.009 *	(0.005)	0.100	0.043	-0.002	(0.007)	0.082	0.037
Text and reference books	0.001 *	(0.001)	0.055	0.006	0.001	(0.002)	0.029	0.008
Recreational goods	0.013 ***	(0.004)	0.050	0.034	-0.003	(0.006)	0.048	0.032
Recreational services	0.000	(0.005)	0.102	0.044	-0.004	(0.007)	0.092	0.040
Spending money for family members	-0.003	(0.007)	0.051	0.066	-0.001	(0.010)	0.055	0.051
Remittances	-0.018 **	(0.007)	0.190	0.065	-0.006	(0.007)	0.073	0.039
Other living expenditures	-0.034 ***	(0.012)	0.079	0.106	-0.029	(0.021)	0.093	0.114

Notes: See notes for Table 5.

Key findings:

- The findings regarding the composition of household spending after the introduction of the free-tuition program appear to be robust, regardless of the criterion used to distinguish wealthier and poorer households.
- The program altered the composition of household expenditure significantly for richer households, while the effects on the expenditure composition of poorer households are mostly insignificant.

Appendix 4: Effects of the free-tuition program on the high school enrollment rate

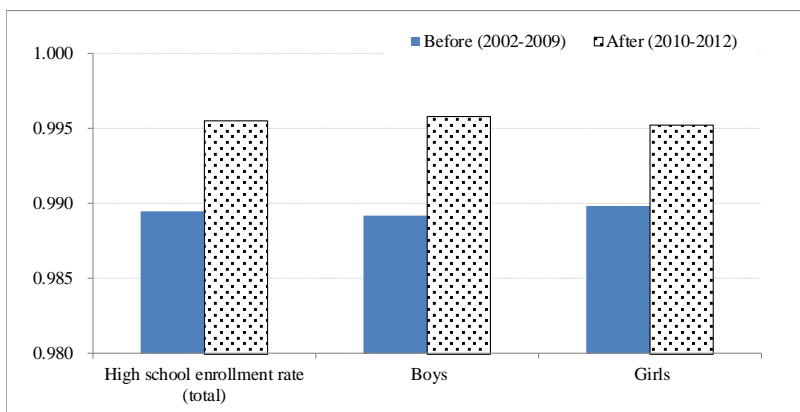
This appendix examines the effect of the free-tuition program on the high school enrollment rate. Since the aim is to explore changes following the introduction of the free-tuition program, the enrollment rate of households surveyed before April 2010 and households surveyed from April 2010 onward are compared.

Figure A.4.1 presents the enrollment rates for [all high schools, - *What does “all high schools” mean? All high schools in Japan? I suspect you mean “all types of high schools together” or “public and private high schools together...”*] comparing enrollment before and after the introduction of the free-tuition program by sex. The figure shows that enrollment rates increased after the introduction of the free-tuition program. Conducting Welch's *t*-test (one-sided; the test statistics are shown below the figure) to test whether the averages in the period before the program (FY2002 to FY2009) and the period following the introduction of the program (FY2010 and FY2011) are equal shows that the average student enrollment rate for [all high schools – *See my question above.*] is significantly higher in the latter period (the *p*-value is less than 5 percent).

Moreover, the effect of the free-tuition program may depend on households' wealth: one would expect the enrollment rate before the program to be higher among wealthier households, so that there should be more room for improvement in the enrollment rate among poorer households. Figure A.4.2, which uses households' spending level as indicator of households' wealth, confirms this prediction. For the figure, households are divided into those whose six-month spending total is above or below the 25th percentile and those above or below the 10th percentile. The figure shows an increase in enrollment rates in three groups: above the 25th percentile, below the 25th percentile, and below the 10th percentile. A closer look, however, shows a more pronounced increase in the enrollment rate among poorer households. While the enrollment rate remained almost unchanged among households above the 25th percentile (the [increase/change] was only 0.03 percentage points), among households below the 25th percentile the rate increased by 3.4 percentage points from 95.5 percent to 98.9 percent, and among households below the 10th percentile it increased by 2.7 percentage points from 93.3 percent to 96.0 percent. In fact, the Welch test (shown below the figure) confirms that the average enrollment rates in the two periods are not significantly different among households above the 25th percentile, but are significantly different (at the 5 percent level) among households below the 25th percentile.

In sum, the high school enrollment rate among lower income households increased significantly following the introduction of the free-tuition program. In other words, by making high school tuition-free, the program appears to have removed a financial barrier that may have prevented some households from sending their child(ren) to high school.

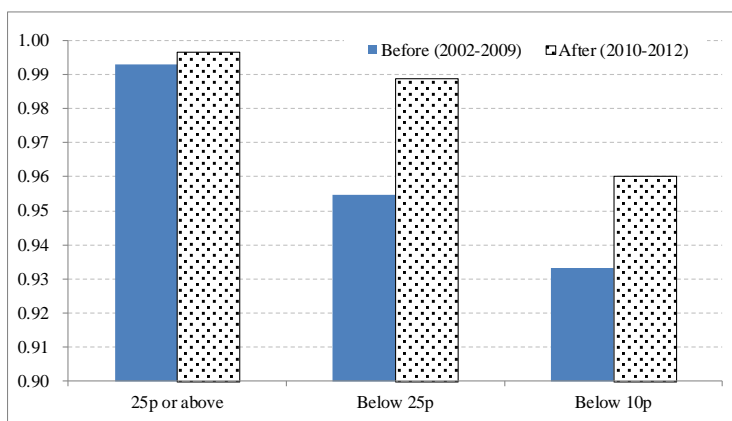
Figure A.4.1. High school enrollment rates before and after the tuition-fee high school program



High school enrollment rate			
	sample av.	[95% Conf. Interval]	
Before (2002-2009)	Total	0.989	0.986 0.993
	Boys	0.989	0.984 0.994
	Girls	0.990	0.985 0.995
After (2010-2012)	Total	0.996	0.991 1.000
	Boys	0.996	0.990 1.002
	Girls	0.995	0.989 1.002
p-value	Total	0.018	
H0: Before=After	Boys	0.045	
	Girls	0.100	

Source: Author's calculations using FIES data.

Figure A.4.2. High school enrollment rates by household spending level



	Average rate	[95% conf. interval]
Before (2002-2009)	25p or above	[0.990 0.996]
	Below 25p	[0.930 0.980]
	Below 10p	[0.876 0.991]
After (2010-2012)	25p or above	[0.992 1.000]
	Below 25p	[0.966 1.011]
	Below 10p	[0.877 1.043]
H0: Before<=After	p-value	
	25p or above	0.094
	Below 25p	0.024
	Below 10p	0.296

Source: Author's calculation using FIES data.