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Abstract

This study estimates the elasticity of income with regard to the net-of-tax rate using panel data from Japanese tax returns from 2014 to 2020. The following conclusions were drawn. First, the elasticities of gross income and non-financial gross income with respect to the net-of-tax rate ranges from 0.16 to 0.17 and from 0.07 to 0.09, respectively, whereas the elasticities of overall taxable income and non-financial taxable income are from 0.195 to 0.21 and from 0.11 to 0.118, respectively. These findings provide evidence supporting the well-known statement that the elasticity of labor income is smaller than that of financial income and that the elasticity of broad income is smaller the ETI. Second, the elasticity estimates are free from large scale deduction changes. We focus on the income tax reforms on salary income deduction in the late 2010s, and find that these reforms have no impacts on the elasticity estimates.

Keywords: Elasticity of taxable income; elasticity of gross income; personal income tax

1. Introduction

Since the pioneering work of Lindsey (1987), a vast body of research has attempted to estimate the elasticity of taxable income (ETI) and/or the elasticity of broad income (EBI). The elasticity of taxable income (ETI) is an important concept in public economics. While it may reflect labor supply elasticity and tax avoidance, Feldstein (1998) points out that ETI is the key to estimating the deadweight loss of taxes, even when ETI reflects tax avoidance. Saez (2001) shows that ETI is a key parameter in characterizing optimal income tax progressivity.

A high-quality estimation of ETI requires administrative tax data. The recently expanding availability of tax administrative data has enabled academic researchers to estimate ETI using panel data regression. A pioneering study by Feldstein (1995) estimated the ETI using NBER tax panel data and argues that the ETI is at least one and could be substantially higher. However, researchers have raised important concerns regarding this identification problem. First, since the marginal tax rate depends on taxable income under the progressive income tax system, an endogeneity problem is expected in a simple regression with net-of-tax rates (1-tax rates) as an independent variable. Second, because the income process includes transitory income, the mean reversion may have caused bias. Third, since income inequality widens as marginal tax rates generally decrease in most countries, ETI can be overestimated, ignoring income trend differences across different income level groups.

First, most researchers use the predicted change in the log net of tax rates (meaning "ln(1-tax rate)"), assuming that income remains the same as that in the base year. For the second concern, Auten and Caroll (1999) include log income in the base year as a control variable in the regression. For the third concern, Gruber and Saez (2002) include a log income 10-piece spline for each income class decile. In response to these concerns, Gruber and Saez (2002) find that the overall elasticities for broad income and taxable income are approximately

0.12 and 0.4. Following Gruber and Saez (2012), ETI has been actively studied. Saez et al. (2012) conducted a comprehensive survey of developments before 2012. They concluded that the best available estimates of ETI range from 0.12 to 0.40.

Various further improvements in panel data regression methods have been proposed. For example, Weber (2014) points out that when transitory income is serially correlated, the commonly used predicted net of tax rate instrumental variable, with only one lag, cannot avoid endogeneity. She suggests that predicted net tax rate instruments with two or longer lags can accommodate the endogeneity problem. Her preferred estimates of ETI and broad income are 0.858 and 0.475, respectively, which are much larger than previous estimates. Burns and Ziliak (2015) estimated ETI by grouping instrumental variables based on the different effects of federal and local taxes across states and over time. In addition to the difference-in-differences (DID) and instrumental variable (IV) approaches, new estimation methods using bunching (e.g., Saez, 2010; Chetty et al., 2011), time series analysis (Martens and Montiel Olea, 2018) and cross-country evidence (Rubolino and Waldenström, 2020) been developed[1].

In addition, ETI estimations using improved methods and data in non-U.S. countries have increased. For example, Kleven and Schultz (2014) estimate ETI using population-wide administrative data on Danish tax reforms. Duerrenberg, Peichl, and Siegloch (2017) used German panel data to consider ETI in the presence of deduction possibilities. Based on the

[1] Some recent studies point out possible bias of the standard ETI estimation method such as Gruber and Saez (2002) and Weber (2014) due to elasticity heterogeneity (Kumar and Liang (2020)), changes in trend differentials (Jakobsen and Søgaard (2022)) or income effects (Dufour, Michaud and Smart (2025), and propose new estimation methods. Since the sample period of this study is short (7 years) and did not include major tax reform year, it seems that we cannot apply their proposed estimation methods in this study. Thus, the main focus of this paper is the very first ETI estimation using Japanese micro tax data and its comparisons with the ETI estimations in other countries based on the standard ETI estimation method.

accumulated literature on the panel data regression of ETI, Neisser (2021) conducts a meta-regression analysis based on sixty-one studies and concludes that the average ETI before deduction ranges from 0.053 to 0.120, while the average ETI after deduction varies from 0.074 to 0.827.

On the other hand, in Japan, the academic use of tax administrative data including personal tax records was not allowed until very recently. Some Japanese researchers (Cabinet Office of Japan (2001); Kitamura and Miyazaki (2013); Uemura et al., Kitamura and Kaneda (2016); Kurita (2019) have tried to estimate ETI using taxable income calculated based on income and other data from existing non-tax surveys. For example, Kitamura and Miyazaki (2013) conducted a DID estimation of ETI using microdata from the National Survey of Family Income and Expenditure and found the Japanese ETI as 0.29 to 0.64. However, because the taxable income is calculated according to income tax law, the tax avoidance response to the change in marginal tax rates cannot be estimated by construction.

Another approach is an estimation using tabulated tax data published by the NTA. Yashio (2005) estimates the ETI of the self-employed using the National Tax Agency Annual Statistics Report and finds that it is 0.053. In their cross-country study, Rubolino and Waldenström (2020) estimate the Japanese ETI of the top percentile income share by time series regression and find that the long-run elasticity is 0.36 over the period from 1900 to 2014. Their analysis was based on the estimation of the World Wealth and Income Database (Alvaredo et al. (2016)) using the annual static report of NTA. The qualities of these estimation are limited since they are based on aggregate data.

One important exception is the ETI estimation by Miyazaki and Ishida (2022), who use the public disclosure of “List of Top Taxpayers” by NTA. Since 1950, the NTA has publicly notified the List of Top Earners originally, and the List of Top Taxpayers later in order to

encourage information provision about tax evasion by others. These unique data include the names, addresses, and tax liabilities of taxpayers whose incomes were more than 10 million JPY (in the case of the List of Top Taxpayers). Based on the individual data of the top taxpayers in Tokyo, Miyazaki, and Ishida (2022) estimate the elasticity of taxable income over the period from 1986 to 1989, which includes the 1987-1989 comprehensive income tax reform in Japan, and find that the ETI with regard to the net tax rate is approximately 0.158 – 0.226. Still, there are significant limits of the data. First, the income data included only the total sum of capital income and labor income. Second, the coverage of taxpayers on the list is limited to top taxpayers. The third and most important problem was that, after the introduction of the Act on the Protection of Personal Information, this public disclosure system was abolished in 2005. Since then, no data on top Japanese taxpayers have been available for academic research.

However, in 2022, the NTA launched a pilot program for joint research with selected academic researchers, and our research group was fortunate to be chosen for this study on income tax data. Thus, this study is the first to estimate the ETI using detailed income tax administration data in Japan. In comparison with the existing research using the similar estimation method in other countries, we find that the elasticities of gross income and non-financial gross income with respect to the net-of-tax rate ranges from 0.16 to 0.17 and from 0.07 to 0.09, respectively, whereas the elasticities of overall taxable income and non-financial taxable income are from 0.195 to 0.21 and from 0.11 to 0.118, respectively. These findings provide evidence supporting the well-known statement that the elasticity of labor income is smaller than that of financial income and that the elasticity of broad income is smaller the ETI. Second, the elasticity estimates are free from large scale deduction changes. We focus on the income tax reforms on salary income deduction in the late 2010s, and find that these reforms have no impacts on the elasticity estimates.

The remainder of this paper is organized as follows. Section 2 provides the background information on the Japanese income tax system. The estimation strategy used is presented in Section 3, and Section 4 describes the data. Section 5 presents our estimation results. Finally, Section 6 provides the concluding remarks.

2. Japan's Income Tax System and Tax Reforms

This section provides an overview of Japan's income tax system and recent tax reforms (2014-2020). Income taxes were collected in three forms: comprehensive taxation, separate return filing taxation, and separate withholding taxation. Tax returns deal with comprehensive and separate return-filing taxation. The income tax amount is determined through the following steps: First, income is determined by subtracting necessary expenses from various types of income. The income tax system provides deductions to calculate income. Employment income deduction is subtracted from employment earnings, and public pension deduction is subtracted from miscellaneous income, including public pensions. Second, various income deductions are subtracted from the total combined income, subject to comprehensive taxation, to calculate taxable income. Income deductions include deductions for social insurance premiums, small-scale enterprise mutual aid premiums, life insurance premiums, earthquake insurance premiums, widows and single parents, working students, disabled persons, (special) spouses, dependents, basic deductions, miscellaneous losses, medical expenses, and donations. Third, if no income is subject to separate return filing taxation, the tax amount is calculated by applying the tax rate to taxable income. If income is subject to separate returns filing taxation, then the tax amount for separate returns filing taxation is added to the tax amount for comprehensive taxation. Fourth, various tax credits are subtracted from the tax amount. Tax credits include dividend credit, special credit for housing loans, special credit for donations to political parties,

and special credit for earthquake-resistant home improvements. Finally, the amount of disaster relief is subtracted from this tax amount to obtain the standard income tax amount. Special income tax for reconstruction (the standard income tax amount multiplied by 2.1%) is added, and the foreign tax credit is subtracted to obtain the final income tax amount.

With regard to the main tax reforms, the maximum tax rate increased in 2015. The previous six-tier system (5, 10, 20, 23, 33, and 40%) was revised into a seven-tier system with a maximum tax rate of 45%. Maximum deductions in employment income decreased in 2016. Previously, the minimum guaranteed deduction amount for employment income was 650,000 JPY, and the maximum amount of applicable deduction was 2.45 million JPY (for employment earning of 15 million JPY), although the amount of applicable deduction increases as employment income increases. After the revision, however, the maximum amount of the applicable deduction was now 2.3 million JPY (for 12 million JPY of employment earning). In addition, the maximum amount of applicable deduction was lowered to 2.2 million JPY (for employment earning of 10 million JPY) in 2017.

Beginning in 2018, special exemptions for spouses were expanded. Previously, if the total income of the spouse eligible for the exemption was 380,000 JPY or less, the applicable exemption amount was 380,000 JPY in general and 480,000 JPY if the spouse was 70 years of age or older. In addition, if the total income is less than 10 million JPY, a special exemption for the spouse can be applied, even if the spouse's total income exceeds 380,000 JPY. The maximum amount of applicable exemption is 380,000 JPY, and the amount of applicable exemption decreases with the income of the spouse. However, after the revision, if a spouse's total income was less than 850,000 JPY, the special exemption for the spouse was 380,000 JPY. However, the applicable exemption amount continued to decrease according to the spouse's

income. In addition, a new measure is introduced to reduce the applicable exemption amount if the total income exceeds 9 million JPY.

Starting in 2020, the basic exemption was expanded, and in its place, the deductions for employment income and public pensions were reduced. In addition, the exemption and special exemption for spouses were expanded further. Previously, the applicable amount for basic exemption was 380,000 JPY. After the revision, the applicable amount is 480,000 JPY. However, a new measure was introduced to reduce the applicable amount of basic exemption if the total income exceeded 24 million JPY. The minimum amount of the employment income deduction is now guaranteed to be 550,000 JPY, and the maximum amount of the applicable deduction is 1.95 million JPY (for 8.5 million JPY of employment earning). The minimum guaranteed amount of the public pension deduction was 700,000 JPY for those under 65 years old and 1.2 million JPY for those 65 years and over. In both cases, the applicable deduction amount increased as earning from public pensions increased. After the revision, the minimum guaranteed amount was 600,000 JPY for those under 65 years old and 1.1 million JPY for those aged 65 years and over. The applicable deduction amount continues to increase as income from public pensions increases. Still, the maximum applicable deduction is now 1.955 million JPY (for 10 million JPY of public pensions). In addition, a new measure was introduced to reduce the applicable deduction amount when total income (other than miscellaneous income related to public pensions) exceeded 10 million JPY.

3. Empirical strategy

To estimate the elasticity of income with respect to the net tax rate, we apply the conventional instrumental variable (IV) approach of Gruber and Saez (2002):

$$\log\left(\frac{z_{it}}{z_{it-1}}\right) = \alpha + \epsilon \log\left[\frac{1-\tau_{it}}{1-\tau_{it-1}}\right] + \mathrm{f}(z_{it-1}, z_{it-2}) + year_t + u_{it},$$

$$i = 1, .., N, t = 2016, \ldots, 2020, \qquad (1)$$

where z_{it} denotes the income of individual i in year t. τ_{it} is income tax rate, so that $1-\tau_{it}$ is the net-of-tax rate and thus ϵ represents the elasticity of income with respect to the net-of-tax rate. We use a variety of incomes as dependent variables to examine the elasticity of not only gross and non-financial incomes but corresponding taxable incomes. $\mathrm{f}(z_{it-1}, z_{it-2})$ is 5 knot linear splines of one and two years lagged incomes, which is incorporated to control for heterogeneous trends in income growth across different income levels.[2] To deal with the potential bias arising from the progressivity of income tax, as pointed out by Gruber and Saez (2002), we employ the IV approach, in which the prediction of tax rates created by applying the current-year tax code to prior incomes is expected to be free from an endogeneity problem due to behavioral changes caused by a tax rate change. The main instrument employed in this study is the one-year lagged income. One year lagged income is employed based on the following reasons. First, usage of one year lagged income is standard in the literature given that the pioneering work by Gruber and Saez (2002) employed that as an instrument, and thus most previous research applied it to calculate the prediction of net-of-tax rate. Because of this, estimates from the regressions using one year lagged income to create an IV are comparable to those reported by a vast amount of the previous studies. Second, we performed serial correlation tests of incomes and taxable incomes and found that no serial correlations in income and taxable income appear even in the time length of one year lag.[3] $year_t$ stands for year

[2] We follow Burns and Ziliak (2017)s' approach regarding the specification of spline function.

[3] As Weber (2014) pointed out, serial correlation in income may bias the estimation of elasticity when one-year lagged income is used to calculate the prediction. However, this concern does not hold for our data because, as stated, there are no serial correlation in income and taxable income.

dummies, and u_{it} is a conventional error. In the estimation, regressions weighted with the log of income are performed and cluster-robust standard errors are reported.

A full sample of income tax return data provided by the National Tax Agency was employed for the current analysis. However, the sample is restricted to correctly estimate the elasticity of income: In Japan, tax filings are requested only for those who meet certain conditions, such as earning a salary of more than JPY 20 million. We limit our sample to those who earn a non-financial income of more than JPY 20 million to avoid potential bias caused by differential treatment in tax filing. We exclude those who earned non-financial taxable income less than JPY 10 million, because the presence of such taxpayers seems quite strange when their non-financial income exceeds JPY 20 million. This restriction is eased in a robustness check. Older adults, specifically 65 years old or older in 2020, and are excluded from the sample because many of them receive annuities and have different tax incentives; moreover, we cannot simulate their tax liabilities precisely because of a lack of personal information. Those who aged at 18 or under in 2020 are also excluded from the sample. In addition, to deal with problems with mean reversion in income, we create complete panel data, in which those who dropped out of the original database in some years are not sampled.

4. Data

4.1 Tax return data in Japan

This section describes the data used and the sample analyzed. This study will use administrative record information held by the National Tax Agency, specifically individual data (2014-2020) on items listed in Tables 1 (A and B) and 3 of the "Income Tax and Special Reconstruction

Income Tax Returns" (hereinafter referred to as "tax data"). However, taxpayer names and other information were kept confidential to protect privacy.

In Japan, household microdata, including statistical surveys conducted by the government, have been available for some time, and each statistic has its own unique and abundant information. Although these data have been used in many studies, it has been pointed out that the income data, in particular, do not include very high-income earners in the sample. In contrast, the tax data used in this study are not a sample survey but cover a large number of taxpayers (more than 20 million each year), including very high-income earners. Against this backdrop, tax returns are first required for taxpayers whose salary exceeds JPY 20 million. Second, large shares that account for more than 3% of the total number, or the number of shares issued are required to file income tax returns. Third, sole proprietors are required to file income tax returns. However, some information and samples are not covered by the tax data. First, the sample was based on individuals, not households, and did not include information on family structure. Second, tax returns deal with income subject to comprehensive taxation and separate return filing taxation and thus do not include income subject to separate withholding taxation, which is widely applied to interest income, dividend income, transfer income (i.e., capital gain), and retirement income. In addition, for salaried workers with no income other than a salary, tax payment procedures are completed only by withholding, and they may not file an income tax return.

One of the characteristics of tax data is that they contain detailed income information. The Japanese income tax system classifies income based on its nature. Income taxes were collected in three forms: comprehensive taxation, separate return filing taxation, and separate withholding taxation. Of these, income tax returns cover the subject matter of both comprehensive taxation and separate-return filing taxation. The first table of tax returns covers

the subjects of comprehensive taxation, which includes business income (business income and agricultural income), real estate income, interest income, dividend income, employment income, miscellaneous income (miscellaneous income from public pensions, miscellaneous income from business, and other miscellaneous income), and comprehensive transfer and temporary income, for which the amounts of earnings and income are available. Table 3 deals with the subject of separate returns filing taxation, including short-term transfer income (general and reduced), long-term transfer income (general, specific, and reduced), income from the transfer of general stocks, income from the transfer of listed stocks, income from dividends from listed stocks, and income from futures transactions. In addition, forest income and retirement income are included in Table 3 because they are treated differently from comprehensive taxation and are taxed separately. The earnings and income amounts for these items are available. The total amount of each income in the comprehensive taxation and the separate return filing taxation is called the "total income amount. The amount obtained by deducting the loss carried forward from it is called the "total income amount" in the case of the comprehensive taxation only, or the "total income amount, etc." in the case of both the comprehensive taxation and the separate return filing taxation.

Tax data provide detailed information for calculating the amount of income tax in tax returns. Not only the amount of earnings and income but also the applicable amounts for tax deductions and tax credits are available. Income tax deductions include deductions for social insurance premiums, small-scale enterprise mutual aid premiums, life insurance premiums, earthquake insurance premiums, widows and single parents, working students and disabled persons, (special) spouses, dependents, basic miscellaneous losses, medical expenses, and donations. However, suppose a taxpayer has a salary subject to year-end adjustments. Then, only the total amount of items from the deduction of social insurance premiums to the basic

deduction (the total amount of year-end adjustment deductions) can be included in the tax return. Hence, for some samples, only the total number of year-end adjustment deductions is available, the breakdown of which is unknown. Tax credits include dividend credits, special credits for housing loans, special credits for donations to political parties, special credits for earthquake-proofing houses, disaster credits, and foreign tax credits.

The following data cleaning procedures were performed to use the tax data: First, when there are amended or revised tax returns, the data include information on the tax returns filed before the amendment or revision for the same taxpayer. Therefore, only the most recent return filing date per taxpayer was retained, and all other returns were deleted. Second, individuals who sometimes had negative values for income and deductions not assumed under the tax law were deleted.

4.2 Descriptive Statistics

Table1 presents descriptive statistics of the data. The table reports summary statistics for the sample used in the baseline estimation in column (1) in Table 2. Income and tax liability are normalized by gross income in 2020. The marginal tax rates of national and local income taxes are computed for the normalized taxable income and their brackets. The averages of marginal tax rate for broad and non-financial incomes are the ones weighted by broad and non-financial incomes, respectively. The sex dummy shows that 69% of the sampled taxpayers are male and 24% of the sampled taxpayers are blank. The mean of gross income is 39.9 million JPY (about 267330 USD) and its minimum is 10.5 million JPY (about 70350 USD), then indicating that the sample is restricted to high income earners. Occupation dummies show that 40% of the sampled taxpayers are company employees and public servants.

Table 1 inserted around here

5. Estimation results

Table 2 provides estimates of income elasticity with respect to the net of tax rate. To begin with, the test results of serial correlation tests, in the lower side of each column, suggest no correlation for the incomes until two years lags. As shown in Column (1), the elasticity of gross income is 0.17, which is close to the ETIs of most OECD countries. However, the elasticity is also close to those for Japan (e.g., 0.15 – 0.23 in Miyazaki and Ishida, 2022). Column (2) reports an estimate of gross non-financial income elasticity, which is 0.08, much smaller than the estimate of gross income elasticity. The estimate is smaller than those reported by prior studies but is consistent with the view that the ETI of labor income is likely to be smaller than that of incomes including financial incomes. Columns (3) and (4) present elasticity estimates of overall taxable income and non-financial taxable income, which are 0.21 and 0.12 and statistically significant at the 1% significance level, respectively. This result is in line with the conventional argument that the ETI should be smaller than the elasticity of broad income (EBI) because the EBI is measured by applying broad income as a denominator (Kopczuk, 2005). The comparison between the elasticities of gross income and non-financial income indicates that the elasticity estimate of gross income is more than twice as large as that of non-financial income, and similar relationship is observed for the comparison between the elasticities of overall and non-financial incomes. It follows from the point estimates that the EGI and elasticity of non-financial income are, respectively, 0.17 and 0.08, and the elasticities of overall

taxable income and non-financial income are slightly larger than each of the corresponding estimates.

Table 2 inserted around here

As robustness checks, we eased some of the restrictions imposed on the sample employed in the estimation. As in column (1) in Table 3, first, the sample in 2020 is excluded because the 2020 income tax reform rectified tax deductions for spouse, which might make it difficult to simulate tax liabilities by applying earnings of different years for those who raised a spouse. The elasticity estimates of each income category are significant, with almost the same point estimates as those in Table 2. As in columns (2) and (3), when sex dummies and occupation dummies are added, most of the estimates still remain statistically significant and seem to be equal in size to those in the base regressions. Without the restriction of own non-financial taxable income larger than 10 million JPY, columns (3) demonstrates significant point estimates, which are slightly, specifically 0.01 point, smaller than those in the baseline. Finally, non-income-weighted regressions are run, yielding significant but 0.01 smaller estimates than the baseline estimates. It is concluded from Tables 1 and 2 that, irrespective of the restrictions of the sample and the method of regression analysis, the income elasticity estimates range from 0.16 to 0.17 for gross income and from 0.07 to 0.09 for gross non-financial income. When it comes to the ETI, the elasticity estimates fall into the range from 0.195 to 0.21 for overall taxable income and from 0.11 to 0.118 for taxable non-financial income.

Table 3 inserted around here

Since the late 2010s, salary income deduction, which is the deduction applied only for salary earnings, has been narrowed given the argument that high salary income earners enjoy a large amount of deduction, which are not applied to other types of earnings. With a focus on high salary earnings, the amount of salary income deduction changed from 2,450,000 JPY for salary earning of over 15 million JPY to 2,300,000 JPY for salary earning of over 12 million JPY in 2016, to 2,200,000 JPY for salary earning of over 10 million JPY in 2017, and to 1,950,000 JPY for salary earning of over 8.5 million JPY in 2020. Our sample comprises high income earners with more than 20 million JPY of earnings, suggesting that changes in the thresholds do not matter in terms of behavioral response to a change in the income tax schedule but the amounts of the deduction may influence reported income, in specific, of salary income earners whose income lies in the top tax rate bracket. Then, the treatment group is defined as salary income earners with taxable income 150,000 JPY less than 40 million JPY in 2016, 100,000 JPY less than 40 million JPY in 2017, and 25,000 JPY less than 40 million JPY in 2020, whereas the control group consists of others. The reason is that taxpayers whose income lies within those ranges had an incentive to reduce their taxable income because, if they earned the same salary in the next year, a tax rate applied to their income would rise from 40% to 45%. To explore the effects of changes in salary income deduction, we incorporate the treatment dummy and an interaction term of the treatment dummy and the net-of-tax rate.

As in Table 4, the elasticity estimates still remain significant with the almost same estimates as those in Table 2, and the coefficients of the interaction term all are insignificant,

thereby inferring that the impacts of salary income deduction changes on the elasticity estimates are negligible. The coefficients of treatment dummy are significantly positive, which is reasonable as the tax reforms on salary income deduction expanded the amount of taxable income. It concludes that, whether or not salary income deduction reforms occurred, the elasticity estimates are significant and positive as those in Table 2.

Table 4 inserted around here

6. Conclusions

A vast number of previous studies have addressed the elasticity of taxable income (ETI) with respect to the net-of-tax rate. This study attempted to estimate the income and taxable income elasticities using Japanese tax return data. It contributes by estimating income elasticity with respect to the net tax rate using a full sample of income tax return data provided by the National Tax Agency. We created individual panel data for income tax filers for 2014 – 2020 from the tax return data and then applied the conventional instrumental variable approach developed by Gruber and Saez (2002).

The following conclusions were drawn. First, in Japan, the elasticities of gross income and gross non-financial income with respect to the net-of-tax rate ranges from 0.16 to 0.17 and from 0.07 to 0.09, respectively, whereas the elasticities of overall taxable income and non-financial taxable income lie into the range, respectively, from 0.195 to 0.21 and from 0.11 to 0.118. These estimates are smaller than or close to the ETIs for most OECD countries and are close to those provided by previous research for Japan (e.g., 0.15 – 0.23 in Miyazaki and Ishida, 2022). It is worth noting that the elasticity of gross income (overall taxable income) is over

twofold greater as that of gross non-financial income (non-financial taxable income), and the elasticity of gross income (gross non-financial income) is slightly, roughly 0.04, smaller than those of overall taxable income (non-financial taxable income). These results support evidence that the elasticity of labor income is smaller than that of financial income and that the elasticity of broad income is smaller the ETI. Second, the elasticity estimates are free from large scale deduction changes. In specific, the income tax reforms on salary income deduction in the late 2010s have no impacts on the elasticity estimates. It however should be noted that, given that the deduction reforms expanded the amount of taxable income through shrinkage of the deduction, as expected, that reform raised the amount of taxable income.

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Table1. Descriptive Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum	Observations
Gross income	39900000	127000000	10500000	-	731616
Non-financial income	35500000	45600000	10500000	-	731616
Overall taxable income	36600000	127000000	10000000	-	731616
Non-financial taxable income	32200000	44800000	10000000	-	731616
Gross revenue	58600000	100000000	20000000	-	731616
Non-financial revenue	55800000	97000000	20000000	-	731616
Marginal tax rate, gross income	0.4255512	0.0393405	0.33	0.45945	731616
Marginal tax rate, non-financial income	0.4200745	0.0403243	0.33	0.45945	731616
Age	52.32552	6.829626	18	64	731616
Male dummy	0.6874727	0.4635238	0	1	731616
Female dummy	0.0698604	0.2549118	0	1	731616
Occupation dummies					
Schalars and education	0.000831	0.0288158	0	1	731616
Religion and culture	0.0001162	0.0107781	0	1	731616
Politicians	0.0010825	0.0328841	0	1	731616
Exectives	0.1560108	0.3628658	0	1	731616
Real-estate agencies	0.119411	0.3242717	0	1	731616
Company employees and public servants	0.4010136	0.4901041	0	1	731616
Others	0.0054769	0.0738033	0	1	731616
Pensioners	0.0004224	0.0205469	0	1	731616
Agriculture	0.0112682	0.1055521	0	1	731616
Livestock raisers and fisheries	0.0010443	0.0322982	0	1	731616
Healthcare professionals and insurance	0.172119	0.3774841	0	1	731616
Legal practitioners, tax accountants, architects, and so on	0.0670707	0.2501446	0	1	731616
Writers, composers, and artists	0.0024466	0.049403	0	1	731616
Entertaners	0.0027788	0.0526409	0	1	731616
Professional players and fashion models	0.0056314	0.0748309	0	1	731616
Salespersons	0.0062068	0.0785385	0	1	731616
Professors	0.0016156	0.0401621	0	1	731616
Other businesses	0.0052979	0.0725934	0	1	731616
Retailers	0.0102308	0.1006286	0	1	731616
Wholesale agents	0.0017072	0.0412828	0	1	731616
Manufacturing and repair retailers	0.0057489	0.0756034	0	1	731616
Service business	0.0053949	0.0732517	0	1	731616
Construction business	0.0135727	0.1157087	0	1	731616
Other sales	0.0035018	0.0590727	0	1	731616

Notes: Units of gross incomes, taxable incomes and revenues are JPY (about 0.0067 USD as of March 2025). Revenues and incomes are normalized by gross income in 2020. The marginal tax rates of national and regional income taxes are computed for the normalized taxable income and their brackets. The averages of marginal tax rate for gross and non-financial incomes are the ones weighted by gross and non-financial incomes, respectively.

Table 2. Estimation of the elasticity of income with respect to the net-of-tax rate, baseline

Dependent variable	Gross income	Non-financial gross income	Overall taxable income	Non-financial taxable income
	(1)	(2)	(3)	(4)
Elasticity wrt the net-of-tax rate	0.171***	0.082**	0.207***	0.118***
	(0.036)	(0.038)	(0.038)	(0.039)
Serial correlation test				
Chi-sq (2)	4.341	0.149	0.954	0.117
P-value	0.1141	0.9283	0.3288	0.9430
Centered R^2	0.256	0.305	0.328	0.408
Observations	731615	731909	731616	731910

Notes: Standard errors adjusted for clusters are in parentheses; *, **, and *** denote significance at 10%, 5%, and 1%, respectively. Every estimation is weighted by the log of each type of incomes. An instrumental variable employed is one-year lagged prediction. Income controls are logs of 5 piece splines 1 and 2 years lagged.

Table 3. Robustness checks

	Sample years of 2019 or earlier	Include sex dummies	Include sex and occupation dummies	No < 10 million taxable income restriction
	(1)	(2)	(3)	(4)
Panel A. Broad income used as income				
Elasticity wrt the net-of-tax rate	0.172***	0.170***	0.159***	0.170***
	(0.041)	(0.036)	(0.035)	(0.036)
Centered R^2	0.263	0.257	0.263	0.249
Observations	586125	731615	731615	733778
Panel B. Non-financial gross income used as income				
Elasticity wrt the net-of-tax rate	0.091**	0.082**	0.074**	0.082**
	(0.042)	(0.038)	(0.036)	(0.038)
Centered R^2	0.304	0.306	0.313	0.305
Observations	586397	731909	731909	734725
Panel C. Overall taxable income used as income				
Elasticity wrt the net-of-tax rate	0.200***	0.206***	0.195***	0.206***
	(0.042)	(0.038)	(0.036)	(0.038)
Centered R^2	0.340	0.329	0.335	0.315
Observations	586125	731616	731616	733778
Panel D. Non-financial taxable income used as income				
Elasticity wrt the net-of-tax rate	0.115***	0.117***	0.113***	0.118***
	(0.044)	(0.039)	(0.038)	(0.039)
Centered R^2	0.416	0.408	0.414	0.407
Observations	586398	731910	731910	734726

Notes: Standard errors adjusted for clusters are in parentheses; *, **, and *** denote significance at 10%
respectively. Every estimation is weighted by the log of each type of incomes. An instrumental variable e
year lagged prediction. Income controls are logs of 5 piece splines 1 and 2 years lagged.

Table 4. Effects of a change in the salary income deduction on elasticity estimates

Dependent variable	Gross income	Non-financial gross income	Overall taxable income	Non-financial taxable income
	(1)	(2)	(3)	(4)
Elasticity wrt the net-of-tax rate	0.172***	0.084**	0.209***	0.119***
	(0.037)	(0.038)	(0.038)	(0.039)
Elasticity × Treatment dummy	-0.074	-0.104	-0.093	-0.119
	(0.139)	(0.236)	(0.151)	(0.256)
Treatment dummy	0.016***	0.041***	0.024***	0.049***
	(0.005)	(0.004)	(0.005)	(0.004)
Centered R^2	0.256	0.305	0.328	0.408
Observations	731615	731909	731616	731910

Notes: Standard errors adjusted for clusters are in parentheses; *, **, and *** denote significance at 10%, 5%, and 1%, respectively. Every estimation is weighted by the log of each type of incomes. An instrumental variable employed is one-year lagged prediction. Income controls are logs of 5 piece splines 1 and 2 years lagged. Treat group is salary income earners with taxable income 150,000 less than 40 million in 2016, 100,000 less than 40 million in 2017, and 25,000 less than 40 million in 2020.