Real and Phantom Constraints: How Japan's Tax System Shapes Female Labor Supply *

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January 31, 2026

PRELIMINARY AND INCOMPLETE.

Abstract

This paper shows that tax and social insurance complexity distorts female labor supply in Japan by creating a salient but misleading income threshold. Using administrative data on married women, we document sharp bunching at multiple earnings cutoffs. Strikingly, women respond more strongly to a threshold with little true income effect than to a nearby threshold involving a large discrete loss. We show that this pattern is inconsistent with full-information labor supply and reflects systematic misperceptions of marginal incentives. Rising minimum wages exacerbate these distortions by pushing workers toward salient cutoffs. Correcting misperceptions yields nontrivial gains in aggregate labor income and GDP.

JEL Codes: J20, J22, J24
Keywords: labor supply, human capital

*We thank seminar participants from the Harris School of Public Policy (University of Chicago), The Wharton School of the University of Pennsylvania, Doshisha University, Yokohama City University, Bank of Japan and Kansai Labor Workshop for excellent comments. This work was supported by JSPS KAKENHI Grant Numbers JP22H05009, JP22H05011 and JP22H05007. Municipality administrative data used in this paper were provided by the Center for Research and Education in Program Evaluation (CREPE), the University of Tokyo. The approval of use of the Labour Force Survey was granted by the Statistics Bureau to Kondo and Fukai based on JSPS KAKENHI Grant JP22H05009. The data of Japan Panel Survey of Consumers were provided by Panel Data Research Center at Keio University. Declarations of interest: none.

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1 Introduction

Many advanced economies facing below-replacement fertility and population aging increasingly view higher female labor supply as essential for sustaining economic growth and fiscal capacity. While policy discussions often emphasize childcare provision, parental leave, and workplace flexibility, less attention has been paid to how the design and complexity of tax and social insurance systems themselves shape labor supply behavior. Beyond the standard disincentive effects of taxation, complex systems with multiple thresholds, exemptions, and interactions can distort work incentives in ways that are difficult for individuals to fully understand, potentially discouraging additional work effort even when statutory marginal tax rates are modest.

Japan provides a particularly salient setting in which to study these issues. As one of the world's largest economies, Japan faces a rapidly aging population and a shrinking workforce, making the efficient use of all potential labor, especially female labor, increasingly important. Although female labor force participation has risen substantially over recent decades, many women remain concentrated in part-time and low-earning jobs with limited opportunities for advancement. This pattern suggests that institutional features may constrain women's labor supply decisions not only at the participation margin, but also in terms of hours, earnings, and job choice, with implications for human capital accumulation and aggregate productivity.

A central institutional feature affecting female labor supply in Japan is the income tax and social insurance system, which treats secondary earners (typically married women) very differently from primary earners. The system includes multiple income thresholds tied to spousal tax exemptions and social insurance eligibility, generating kinks and notches in net income that depend not only on earnings but also on firm size, spousal income, and whether the spouse is salaried or self-employed. As a result, secondary earners face a highly nonlinear and opaque incentive structure, making it difficult to map additional work effort into changes in net income.

Figure 1 illustrates the empirical motivation. The distribution of annual labor earnings

among married female employees exhibits pronounced clustering at two income levels: 1.03 million and 1.3 million JPY.[1] These thresholds correspond to salient points in the tax and social insurance schedule. Earnings above 1.03 million JPY are subject to income tax, while crossing 1.3 million JPY triggers a discrete loss of spousal benefits. The observed bunching suggests that many women adjust their labor supply to remain within specific income ranges, potentially discouraging higher earnings, increased hours, or transitions into more stable employment.

Importantly, this bunching reflects real labor supply adjustments rather than reporting behavior. Unlike many contexts studied in the bunching literature, where responses may reflect income shifting or evasion (Saez, 2010; Kleven et al., 2011; Kleven and Waseem, 2013; Le Maire and Schjerning, 2013), earnings in our setting are largely third-party reported by employers. We observe substantial clustering even among workers with fully reported wage income, indicating that these patterns arise from genuine changes in labor supply.

A striking feature of the data is that bunching at the 1.03 million JPY threshold (a kink where the marginal tax rate increases modestly) is substantially larger than bunching at the nearby 1.3 million JPY notch, which involves a much larger mechanical reduction in net income (the threshold where social insurance obligations become mandatory). Under standard models of labor supply with full information, this pattern is difficult to reconcile. We argue that it is instead consistent with widespread misperceptions or incomplete understanding of the tax and social insurance system, induced by its complexity and overlapping provisions. In particular, women appear to behave as though the 1.03 million JPY threshold represents a much larger penalty than it actually does.

These patterns highlight why examining the effects of income tax policies on female labor supply in Japan is of broader interest. Institutional features of Japan's tax and social insurance systems continue to generate strong disincentives for secondary earners, despite sustained policy efforts to promote female labor force participation. In particular, the

[1]The average exchange rate from 2015–2021 was approximately \$1 USD = 110 JPY, implying that 1.03 million JPY equals about \$9,300 and 1.3 million JPY about \$11,700.

dependent spouse exemption and associated contribution thresholds create pronounced nonlinearities in budget constraints that discourage women from working beyond specific income levels. Such nonlinear budget sets are well known to generate sharp behavioral responses at policy-induced kink points (Saez, 2010). Comparable mechanisms have been documented elsewhere. In the United States, joint taxation has historically imposed high marginal tax rates on married secondary earners, substantially reducing married women's labor supply (Eissa, 1995; Eissa and Hoynes, 2004). In several European countries, family-based taxation and benefit withdrawal rules generate high effective marginal tax rates for secondary earners, implying substantial disincentives to female labor supply, particularly along the intensive margin (Figari et al., 2011; Selin, 2014). In contrast, reforms toward individual taxation in Sweden have been associated with sustained increases in female labor force participation (Selin, 2014). Japan's provisions, introduced in 1986 and originally intended to protect household welfare, now distort labor supply choices in ways that reduce aggregate labor input at a time of severe worker scarcity.

Recent work in behavioral public finance emphasizes that these distortions may be amplified when tax systems are complex and imperfectly understood. When tax schedules are nonlinear and nontransparent, marginal incentives may not be fully salient, leading behavior to diverge from full-information benchmarks. In particular, Ferey et al. (2024) show that optimal tax design and welfare analysis differ substantially when agents face nonlinear tax schedules that are not fully salient, providing a theoretical foundation for empirical labor supply responses that cluster around salient thresholds rather than adjust smoothly. In practice, modern tax systems often combine multiple provisions such as joint filing rules, spousal exemptions, and social insurance thresholds into incentive structures that are difficult for taxpayers to internalize. When net-of-tax incentives are hard to perceive, responses to statutory marginal rates may be muted or distorted, and behavior may instead reflect simplified heuristics or salient cutoffs. In this context, examining female labor supply responses to Japan's tax system provides insight into how tax complexity and limited salience interact to shape labor supply decisions.

This paper makes four main contributions. First, using administrative panel data, we document large and persistent bunching of married women's earnings at secondary-earner thresholds, even in the presence of third-party reporting. Second, by comparing responses at a kink and a nearby notch, we quantify the degree of misperception implied by observed behavior and show that it cannot be explained by standard labor supply elasticities alone. Third, we show that increases in the minimum wage amplify bunching at these tax thresholds, revealing an interaction between labor market regulation and tax complexity: when wages are pushed upward mechanically, more women cluster at salient income cutoffs rather than adjusting smoothly. Finally, we quantify the macroeconomic implications of these misperceptions. Eliminating the *perceived* penalty at the 1.03 million JPY threshold reallocates earnings toward higher income ranges and generates nontrivial gains in aggregate labor income and GDP in an economy facing persistent labor scarcity.

Our analysis relates to several strands of the literature. Early work emphasizes that credible estimation of labor supply in the presence of nonlinear, piecewise-linear budget constraints requires careful treatment of tax-induced endogeneity and sample composition, particularly for married women (Blundell et al., 1998; Eissa, 1995). More recent research documents sharp behavioral responses at policy-induced kinks and notches (Saez, 2010; Bastani and Selin, 2014; Kleven, 2016). We extend this literature by showing that the relative magnitude of responses across thresholds can reveal distortions in beliefs rather than preferences alone.

Finally, this paper also builds on a literature studying female labor supply in Japan. Previous work has examined the spousal allowance using structural models and policy simulations, focusing on how changes to the allowance affect household labor allocation (Akabayashi, 2006; Abe, 2009; Bessho and Hayashi, 2014). We complement this work by providing micro-based administrative evidence on how women adjust earnings in response to existing thresholds and by documenting how tax complexity shapes these responses. This paper also relates to recent studies focusing on the salience of 1.03 million threshold (Yokoyama, 2018; Mori and Okudaira, 2025; Takahashi et al., 2025). Together, our re-

sults highlight the substantial efficiency costs of complex tax design and underscore the importance of considering informational frictions when evaluating labor supply incentives.

We find that married women significantly misperceive marginal tax rates at the 1.03 million JPY threshold–in fact, overestimating them four fold based upon our structural elasticity estimate. That is, rather than respond to a kink of 15% (the actual marginal rate at the threshold), they respond as if the marginal tax rate were closer to 65%. A highly salient national tax reform in 2018 affecting the spousal deduction modestly reduced these misperceptions by increasing awareness of the correct tax scheme. We further find that the salience of the 1.03 million JPY threshold is sufficiently strong that, as minimum wages rise, an increasing number of women reduce their labor supply to avoid crossing the threshold. The growth rate in labor earnings approaches zero (despite increases in the minimum wage) as total earnings approaches 1.03 million JPY. We estimate that eliminating misperceptions at the 1.03 million JPY threshold would generate a one-time increase in GDP of about 0.05 percentage points, nearly a 4 percent gain relative to average growth in 2015–2017, achievable largely through information provision rather than substantial government spending.

2 Background

2.1 Trends in female labor supply and earnings

During the 1990s and 2000s, rising educational attainment along with Japan's economic stagnation that prompted more households to rely on dual incomes encouraged an increase in female labor force participation (LFP). Japan had traditionally experienced the "M-curve" pattern of female LFP, characterized by a high participation rate among young women, a sharp decline during child-rearing years, and a return to the workforce in later years with many women re-entering the labor force in non-regular roles, such as part-time, temporary, or contract work, often with lower wages and fewer benefits. In the 2010s, female LFP accelerated under Prime Minister Shinzo Abe's "Abenomics" policies, which

prioritized expanding childcare facilities and encouraging family-friendly workplace practices. Additionally, Japan's aging population and shrinking labor force created economic pressure to include more women in the workforce.

By the 2020s, participation rates reached record highs, surpassing 80% and exceeding those of some Western nations like the U.S., with a gradual shift toward full-time and higher-skilled jobs, even as many women continued to occupy non-regular positions.[2] Figure 2a plots age profiles of LFP by 5-year age cohorts from the Labour Force Survey (LFS).[3] As the figure shows, for a given age cohort, LFP has been consistently increasing over time. LFP falls for all cohorts during main childbearing years but then grows again as women return to the labor force. This fall of LFP during the childrearing years is smaller for younger cohorts, implying that increasingly more mothers stay in the labor force and in regular employment. Figure 2b generally shows a decrease in the fraction of employees that are non-regular over time for a given age cohort. However, within a cohort, the pattern remains that the fraction grows over time. Thus, as employed women progress through the life-cycle, they are more likely to take on non-regular employment. The trajectories show that each cohort reaches (or shows indications that will reach) at least 50% of married women at some point over the prime earning ages of 35 to 54.

The majority of non-regular employees are married women who earn in a range around one million JPY per year as secondary earners. Table A.1 reports the distribution of employment status for women aged 25–60 over 2015-2021 (the same period covered by our administrative tax data that we will describe in Section 3). Among all married women, 39% are non-regular employees. Restricting the sample to those with annual incomes between 0.5 and 1.5 million JPY, the share of non-regular employees rises sharply to 83%.[4]

[2]"Non-regular" (hiseiki) does not have a precise definition but is generally defined by what it is not. "Regular" workers (seishain) are usually on indefinite contracts and work full time. Everyone else is considered non-regular. This may mean fixed term contracts, part-time or some combination of these. It is also possible to be non-regular while on an indefinite contract and full time but these employees would be treated differently from regular employees, usually by being paid hourly rather than a monthly salary.

[3]See Appendix Section A for details on the LFS.

[4]Ideally, we would focus on incomes below 1.3 million JPY; however, the survey reports income only in brackets, with the closest category being 1.0–1.49 million JPY.

Table A.2 further disaggregates employment status by income category, focusing on annual incomes below 1.49 million JPY. Among married, female, non-regular employees, 45% earn less than 1 million JPY, and an additional 30% earn between 1.0 and 1.49 million JPY. Given that Figure 1 shows very few individuals earning between 1.30 and 1.49 million JPY, this distribution suggests that roughly three-quarters of married female non-regular workers earn below the 1.3 million JPY threshold. Moreover, Figure A.5 indicates that most married women earning between 0.5 and 1.5 million JPY work part-time, with a pronounced concentration at 20 hours per week.

A substantial fraction of non-regular workers are paid at or near the minimum wage. Minimum wages are subject to a 3% annual increase in Japan (with the recent exception of 2021, when minimum wages remained flat due to a Covid-19 era policy). In large part due to this, the hourly wages of part-time married women have followed an upward trend, making the income thresholds increasingly binding, as documented by Mori and Okudaira (2025). An annual income of one million JPY combined with 20 hours of work per week corresponds to an hourly wage of approximately 960 JPY. Until October 2018, this level exceeded the minimum wage in all 47 prefectures; however, minimum wages in Tokyo and Kanagawa surpassed 960 JPY in October 2018, followed by Osaka in October 2019. Mori and Okudaira (2025) show that although hourly wages of female part-time workers increased in response to higher minimum wages, their annual earnings rose by much less, suggesting a reduction in hours worked. We return to this issue in Section 6.

2.2 The Japanese income tax system and its impact on secondary earners

The Japanese income tax system is individual-based and progressive with national income tax rates ranging from 5% to 45%. In addition to the national income tax, individuals are also subject to local resident taxes with a marginal tax rate of 10%. Furthermore, social insurance contributions are also roughly proportional to earned income for salaried workers covered by employer provided health and pension insurance (which we refer to

as "employee insurance") while a different scheme is applied to those not covered by this program (which is typically the government provided national health and pension insurance).

A key feature of the Japanese tax and social insurance system is its treatment of secondary earners, who are predominantly women. The system includes several provisions that can create disincentives for secondary earners to fully participate in the labor market. Our empirical analysis focuses on women married to salaried workers (not self-employed) with annual total income less than 9 million JPY because social insurance burdens are impacted by the type of employment for both spouses and primary earners with annual total income above 9 million JPY face different deduction schemes. [5]

During the years covered by our data, 2015-2021, there were two major changes: the expansion of employee insurance in October 2016, and the reform of spousal deduction in the tax scheme in 2018. Table 7 summarizes tax and social insurance thresholds over time. Since income is measured on annual basis, we divide the period into 2015-2016, 2017, and 2018-2021.

2.2.1 Take-home income in 2015-2016

Figure 3a shows the relationship between gross salary income and take-home income in the range of gross salary income between 0.5 million JPY and 1.5 million JPY. There are two important thresholds that we highlight–1.03 and 1.3 million JPY. We focus on these thresholds because, as we will show, these are the thresholds that married women actually target. At the same time, the impact on after-tax household income is quite different between the two.

The first threshold is relevant for two reasons. First, the national income tax kicks in at 1.03 million JPY at a marginal rate of 5%, though this has an overall small impact on after-tax incomes. In addition, local residential tax kicks in at one million JPY at a marginal rate of 10%.

[5] Appendix figures A.1-A.4 show simulated after tax household income by type of households including self-employed and high income earners

Second, a provision called the "spousal tax deduction" (haigūsha kōjo) is also impacted by this same threshold. It allows a primary earner (the husband) to reduce their taxable income if their spouse (the wife) earns below 1.03 million JPY. If the spouse's income remains below this threshold, the primary earner can claim a deduction of up to 380,000 JPY, thereby reducing their overall tax liability. In addition, primary earners with total incomes below 10 million JPY receive an additional deduction called the "special" spousal deduction (haigūsha tokubetsu kōjo). [6] This latter deduction, despite receiving a new name, simply extends the eligibility of the spousal deduction. Prior to 2018, the deduction began phasing out once the wife's gross salary income passed 1.05 million JPY. The 1.05 million JPY threshold was moved to 1.5 million by the 2018 reform, as will be explained later.[7]

Next, there is a second threshold for social insurance payments at 1.3 million JPY. Social insurance is a mandatory system that provides health insurance, pension benefits, and other welfare services. Japan's social insurance system consists of two systems, employee's social insurance for eligible salaried workers and the national system for those not covered by insurance provided by the employers. All eligible employees, namely employees working more than 30 hours, have to enroll in the employee's insurance, where both employers and employees contribute to the social insurance system through payroll deductions. The amount of employee's contribution is 14.2% of the gross salary.

Most primary earners are covered by insurance provided by the employer. For secondary earners, the national social insurance threshold is set at an annual income of 1.3 million JPY. If a secondary earner's annual income is below 1.3 million JPY, and the household head is a salaried worker covered by the employer's social insurance scheme, the secondary worker is generally exempt from making contributions to the national so-

[6]Prior to 2018, primary earners with total incomes above 10 million JPY were eligible for spousal deduction but not for special spousal deduction. Thus, upon passing the 1.03 million JPY threshold, the spousal tax deduction was reduced to zero, increasing the income tax burden of the husband. This tax notch is illustrated by the solid red line in Figure A.1, panel (c).

[7]During the phase-out, each additional 50,000 JPY of secondary-earner income reduces the primary earner's deduction by 50,000 JPY, effectively adding the primary earner's marginal tax rate to the secondary earner's effective marginal tax rate. The small zigzag in Figure 3a reflects the resulting increase in tax liability for households in which the primary earner faces a 10% national income tax rate, the median bracket in our sample.

cial insurance system.[8] This means that wives still receive health insurance and pension benefits without having to contribute directly. This exemption can result in substantial cost savings for the household, as it avoids the additional financial burden of social insurance contributions, which can be significant at around 300,000 JPY, about 23% of total income for a secondary earner earning 1.3 million JPY. [9]

Put together, these deductions and exemptions create a notable "income trap" for secondary earners. Married women may choose to limit their work hours or take on lower-paying jobs to remain under the thresholds. This has the effect of discouraging women from seeking full-time employment and career advancement opportunities, perpetuating traditional gender roles and contributing to the persistent gender wage gap in Japan.

2.2.2 2017-: Expansion of Social Insurance Coverage to Part-time Workers in Large Firms

In October 2016, social insurance coverage was expanded to employees in firms with more than 500 employees whose monthly salary is above 88,000 JPY (corresponding to an annual income of 1.06 million JPY) and working more than 20 hours a week, primarily impacting secondary workers. [10] This reform affects annual income earned in 2017 and beyond. As such, secondary earners employed by large firms are exposed to different incentives than those employed by smaller firms.

This is shown as the dashed line in Figure 3b. A discontinuous decline in after-tax household income at 1.06 million JPY, slightly to the right of the 1.03 million JPY threshold, corresponds to the monthly salary threshold. Note that even if employed by large firms, secondary workers working less than 20 hours still follow the schedule shown as

[8] An exception is the case where the secondary earner's salary and work hours exceed the threshold for the mandatory coverage of Employee's social insurance. Prior to October 2016, the threshold was working more than 30 hours per week, and very few workers with annual income within 1.3 million JPY exceeded this threshold.

[9] Payment for National Pension Insurance is about 200,000 JPY per year regardless of income level. Payment for National Health Insurance varies across municipality of residence, income and household composition, and on average about 100,000JPY for annual gross salary income of 1.3 million JPY and increases with income at the rate of 10%.

[10] The coverage was further expanded to smaller firms in 2022 and 2024, a time period beyond the scope of our data.

the solid line. In other words, this notch at 1.06 million JPY is relevant only if hourly wage is lower than 1020 JPY. Those whose hourly wage is higher than 1020 JPY switch to the dashed line when their weekly hours exceeds 20 hours per week; the correponding annual income increases with hourly wages. If hourly wage exceeds 1250 JPY, annual income reaches the 1.3 million threshold for national social insurances before weekly hours reach 20.

Those employed by large firms with hourly wages less than 1250 JPY passes the 20 hours threshold before their income reaches 1.3 million JPY. Thus, for them, the notch at 1.3 million JPY, that exists for secondary earners at small firms, no longer exists. Instead, as expressed as the switch from the left to right panels in Figure **??**, take-home income discontinuously decreases when weekly hours exceed 20. [11]

Note that, as described in Section 3, our data do not include information on firm size or social insurance status. Thus, as explained in Section 4, we assume 25% of our sample is working at large firms with hourly wages less than 1250 JPY and facing the budget line shown as the dashed line when their income exceeds 1.3 million JPY, and the remaining 75% are facing the budget line shown as the solid line.

2.3 Survey evidence for the reasons to adjust income below the thresholds

Japan Panel Survey of Consumers (JPSC) asked whether respondents limit their annual income below a certain threshold, and if yes, the reasons to do so. Among all married women with positive income last year, about 13% adjusted their income below a certain threshold, and this percentage is stable across years. The respondents can choose multiple reasons from 9 options, but most respondents answer some of the following top four reasons: spousal deduction from husband's taxable income (67.4%), to be covered by husband's social insurance (57.3%), to avoid being taxed on own income (44.3%), and

[11] Strictly speaking, the coverage by the Employee's insurance increases future pension benefits, so it is not a pure cost like the payments for the national system imposed after crossing the 1.3m threshold. In practice, however, the thresholds for newly covered employees are perceived as a new income trap.

spousal allowances from husband's employer (23.2%). [12] Although the questionnaire does not mention specific thresholds such as 1.03 million and 1.3 million, their salary incomes last year are concentrated near 1 million except for those who choose social insurance as their only reason to adjust (they typically bunch just below 1.3 million).

General Survey on Part-time Workers conducted by Ministry of Health, Labour and Welfare in 2011 also asks a similar question to married female part-time employees. The four major reasons are the same, while percentage of each is somewhat different: (1) to avoid being taxed on one's own income (63.0%), (2) to keep dependent status in social insurance system (49.3%), (3) not to lose spousal deduction from husband's taxable income (37.7%) and (4) to keep spousal allowances from husband's employer (20.6%)

Spousal allowances, the fourth popular reason, is paid as a part of husband's salary. According to the Survey on Actual Conditions of Private Sector Wages by Occupation conducted by National Personnel Authority, as of 2015, 40.3% of private companies paid spousal allowances to employees with dependent spouses whose income is within the threshold for tax dependent, i.e. below 1.03 million JPY. However, the percentage of companies who pay spousal allowances decreased to 21.7% by 2021, as many switch to allowances for dependent children.

Among employers that pay the spousal allowances, the average monthly amount is 12,000-14,000 JPY, slightly varying depending on survey data sources. Thus, on average, the annual amount is about 156,000 JPY.

Because our data cannot distinguish spousal allowances from salary income, spousal allowances are not considered in the budget constraint for the elasticity estimates and included in the estimated perceived cost at 1.03 million threshold. Given an annual amount about 156,000 JPY and that 23.2% answered spousal allowances as one of the reasons to adjust income, 36,192 JPY can be attributed to the lost spousal allowances, which is not really a"misperceived" cost, though it is relatively speaking more minor.

[12]This question was asked in survey years 2016-2021, regarding the income earned previous year. The percentages are from pooled sample of 2016-18 surveys (income earned in 2015-2017).

3 Data

Our primary source of data is administrative records on resident registration and local residential tax provided by municipalities participating in the "Project for Utilizing Municipal Tax Data to Promote Evidence-Based Policy Making (EBPM)," led by the Center for Research and Education in Program Evaluation (CREPE) at the University of Tokyo.[13] We use data from 8 municipalities in 6 prefectures that participated in the project in 2022, with complete household composition data from 2016 to 2022.[14]

The resident registration records contain information on all individuals registered in the municipality as of January 1st of each year, including gender, birth date (or birth quarter), and relationship to the head of household. Each person is assigned a unique ID, allowing us to follow the same individual as long as they live in the same municipality. In addition, the unique household ID enables us to identify marital status (all women whose spouse is identified to be living in the same household [15] are defined as married), spousal income, and the age of children living in the same household.

The demographic and household composition variables described above are reported for the beginning of year t and combined with income earned in year $t-1$ from the tax record. Thus, our sample includes income earned between 2015 and 2021. We focus on gross salary income as the main outcome variable that represents annual salary before any deductions or social insurance premiums. We also use spouse's total income and taxable income to determine the tax scheme that the household face. [16] Note that the salary

[13]Fukuda (2025) describes the details of this project.

[14]Because participation in the CREPE project is voluntary, municipalities in the sample are not a random sample of all municipalities in Japan. The municipality-level tabulations from the Population Census 2020 (Table A.3) show that the sampled municipalities are similar to the national average in terms of the share of college graduates, employment status and industry compositions. Population sizes significantly vary across the participating municipalities, with the largest municipality accounting for about half of the total sample, and the second one accounting for 13%.

[15]Specifically, there are four patterns: a household head living with a spouse of the head, a spouse of the head living with the head, the only child of the head living with a spouse of the head's child, and a spouse of the head's child living with the head's child

[16]"Total income (*gokeishotoku*)" is the sum of income from various sources such as salary, business, and public pension. Some deductions corresponding to the necessary cost for the earning, including salary income deduction, are applied; thus total income is smaller than gross salary income for salaried workers with no other income. Taxable income is total income minus other deductions such as basic deduction, spousal deduction, and social insurance payment deductions. Total income determines the eligibility for spousal deductions, and taxable income determines the tax bracket.

income is reported by the employer to the Tax Agency for the majority of salaried workers including part-time employees. [17] Thus, there is little room for individuals to manipulate reported salary income without actually changing the labor supply.

We limit the sample to married women aged 25-60 to exclude college students and to minimize the presence of pension-recipient spouses, who are subject to a different tax scheme. Furthermore, we limit our sample to women whose spouses have positive gross salary income and total income below 9 million JPY[18]. As shown in Table 1, our final sample covers roughly 83% of all married women aged 25-60 living in the sampled municipality.

Table 2 presents the descriptive statistics. The sample comprises 255,811 unique individuals. The average annual salary income is 1.63 million yen. Notably, the 10th percentile of salary income is zero, indicating that a certain share of the sample does not work at all. The median annual wage income is 1.00 million yen, which is below the thresholds for dependent spouses.

These administrative data contain many advantages over the survey data. First, gross salary income is observable even for those who earn below the minimum threshold for being subject to local residential tax. Second, these data provide accurate gross salary income and household composition for individuals and their families living together. The preciseness of income is crucial given the multiple income thresholds we study. We know of no survey data that is able to break down income to such precise thresholds. A weakness of the municipality administrative data is that it lacks all other information not needed for local government operations. In particular, hours worked, employment status, industry and other employer characteristics, as well as educational background. To cover this weakness, we use LFS and JPSC as supplemental data. Details of these data are

[17] Salaried workers employed by only one employer do not have to file a tax return unless their earnings exceeds 20 million JPY or other income exceeds 200,000 JPY. Instead of filing tax return, they submit documents to verify various deductions including dependent spouse's status to their employers, and the employers adjust the amount of tax withheld from salary at the end of the year based on these documents.

[18] We exclude women married to men with no gross *salary* income because these husbands are not covered by the Employee's Insurance scheme and thus the social insurance notch at 1.3m is not relevant to them. This corresponds to 10.5% of the original sample. Further, we excluded women married to men earning more than 9 million JPY in total income because they are not eligible for full-amount of spousal deductions. This further reduces the sample size by about 7%.

described in Appendix Section A.

4 Estimation of labor income elasticity and perceived cost using bunching method

4.1 Model setup

We estimate the elasticity of labor supply for married women by exploiting distributional bunching induced by nonlinearities in the tax schedule,that is, nonlinear budget constraints. The basic idea is to focus on individuals' behavioral responses around income thresholds such as kinks, where marginal tax rates increase, and notches, where after-tax income drops discontinuously. If individuals are highly responsive to taxation, they tend to bunch around such thresholds to avoid losses; if not, such bunching will be limited. In other words, the degree of bunching provides information about the income elasticity of labor supply, which we use to estimate the elasticity parameter.

Following Saez (2010) and Kleven (2016), we assume a quasi-linear utility function of the following form:

$$u = z - T(z) - \frac{n}{1+1/e} \cdot \left(\frac{z}{n}\right)^{1+1/e}, \tag{1}$$

where z denotes income, n captures individual heterogeneity such as ability, $T(z)$ is the tax function, and e is the elasticity of labor income with respect to the net-of-tax rate to be estimated. We further assume that individual heterogeneity n follows a smooth distribution $f(z)$.

We consider a setting in the Japanese tax system, under the utility function in equation (1), where both a kink, characterized by a change in the marginal tax rate, and a notch, defined as a discontinuous drop in net income exist. Specifically, the tax function $T(z)$ takes the following form:

$$T(z) = t \cdot z + \Big[\Delta T + \Delta t \cdot (z - z^*)\Big] \cdot \mathbf{1}[z > z^*], \tag{2}$$

where t is the marginal tax rate below the threshold, ΔT is the lump-sum increase in social insurance tax at the threshold, Δt is the increase in the marginal income tax rate above the threshold, and z^* is the income threshold.

In this context, we apply the methodology developed by Kleven and Waseem (2013) and Kleven (2016) to estimate the compensated elasticity of labor supply. The estimation is based on the amount of the drop in net income at the notch, the location of the threshold z^*, and the behavior of marginal bunchers. Marginal bunchers are those who are indifferent between bunching and not bunching, and the income they would have earned in the absence of the kink or notch is denoted by $z^* + \Delta z^*$.

The elasticity e is implicitly defined by the following equation:

$$\frac{1}{1+\Delta z^*/z^*}\Big[1+\frac{\Delta T/z^*}{1-t}\Big] - \frac{1}{1+1/e}\Big[\frac{1}{1+\Delta z^*/z^*}\Big]^{1+1/e} - \frac{1}{1+e}\Big[1-\frac{\Delta t}{1-t}\Big]^{1+e} = 0, \tag{3}$$

where e is the compensated elasticity. Solving this equation with respect to e yields the elasticity estimate.

A crucial quantity in this estimation is Δz^*, which reflects the income range over which individuals bunch at the threshold. Specifically, individuals with incomes in the interval $(z^*, z^* + \Delta z^*)$ are assumed to shift their income to exactly z^* in response to the kink or notch. The value of Δz^* is inferred from the degree of bunching observed in the data. We use the excess density mass of the income distribution at the threshold, denoted B, to compute Δz^* as follows:

$$B = \int_{z^*}^{z^*+\Delta z^*} b_0(z)dz \simeq b_0(z^*) \cdot \Delta z^*, \tag{4}$$

where $b_0(z)$ represents the counterfactual income density that would have been observed in the absence of the notch or kink. In other words, by comparing the observed excess mass B to the counterfactual density $b_0(z^*)$, we can infer how far up the income distribution individuals must be bunching to generate the observed excess. Both B and $b_0(z^*)$ are

estimated from the data, allowing us to recover Δz^* consistent with the equation above.

We now extend the analysis to account for situations in which labor supply is subject to frictions and cannot be freely optimized. Although individuals attempt to stay below a threshold, some may fail to do so due to adjustment difficulties, resulting in earnings above the threshold. In such cases, the excess density at the threshold observed in the data may be attenuated, leading to downward-biased estimates of the elasticity.

When there is a notch in the budget constraint, it is often easier to obtain information about such optimization frictions. This is because, under rational behavior, no individual should optimally choose to earn above the threshold where net income drops discontinuously. Thus, if individuals are observed in that dominated region—i.e., earning just above the notch—it indicates the presence of frictions. The proportion of such individuals can be interpreted as the degree of friction.

Formally, let a denote the fraction of individuals who are unable to optimize due to adjustment costs or other frictions. Since these individuals would have otherwise bunched at the threshold, the observed bunching mass Δz^* should be scaled up by a factor of $1/(1-a)$ in order to recover the true bunching that would have occurred in the absence of frictions. Accordingly, the elasticity e is estimated using this adjusted bunching range[19].

The share a is calculated based on the proportion of individuals observed in the dominated region just above the threshold. Specifically, it is computed as the ratio of the number of individuals in this region to the counterfactual density that would have existed in the absence of the notch. The elasticity estimate that incorporates this optimization friction is referred to in this study as the *structural elasticity*, while the elasticity estimated directly from the observed bunching—without any correction—is referred to as the *observed elasticity*.

[19]For a more rigorous discussion, see Kleven (2016).

4.2 Estimation procedure

We apply the method described above to estimate the elasticity of labor income for married women in Japan by exploiting behavioral responses to nonlinearities and discontinuities in the tax schedule, using administrative tax data. Our goal is to understand how the complex tax system impacts behavior and quantify the distortion on labor supply. For this purpose, we assume that married women understand the total change in tax and social insurance burden they face when they increase their income from 0.96m (below the bunch) to 1.3m, although they do not understand the details inside the range due to institutional complexity. Then, we treat the excess mass of density between 0.96m and 1.3m as a single large bunch.

The estimation relies on the identification of marginal bunchers, represented by Δz^*, and the estimation of the counterfactual density. We estimate the counterfactual income distribution using the observed distribution of individuals with annual incomes between 0.36 and 4.8 million JPY. From this range, the "bunching region" is excluded and a smooth polynomial is fitted to the area below and above the bunching region. Specifically, the beginning of the bunching region, denoted by Z_L, is set to 0.84m. [20] The end of the bunching region, Z_U, is set to $z^* + \Delta z^*$. The number of individuals is counted in bins of 10,000 JPY, and a polynomial is fitted to these counts in the range [0.36m, Z_L] and [Z_U, 4.8m] to estimate the counterfactual density.

Following standard practice, we run the following regression:

$$c_j = \sum_{k=0}^{p} \beta_k \cdot (z_j)^k + \sum_{r \in R} \rho_r \cdot \mathbf{1}\left[\frac{z_j}{r} \in \mathbb{N}\right] + \sum_{k=z_L}^{z_U} \gamma_k \cdot \mathbf{1}[z_j = k] + v_j, \tag{5}$$

where j indexes income bins, c_j is the count of individuals in bin j, z_j is the income level of bin j, p is the order of the polynomial, $\mathbb{N}$ is the set of natural numbers and

[20] Following Kleven (2016), we deduded Z_L by eyeballing the density graph. Also, annual gross salary income of 0.96m corresponds to monthly salary of 80k JPY, the largest round number not to exceed the 1.0m and 1.03m thresholds. We confirmed that many individuals have exact 0.96m annual income, as supportive evidence that the spike at 0.96m in the density graph is due to this rounding at monthly salary of 80k JPY. In contrast, few have exact 1.03m of annual income, suggesting that the bunching below the 1.03m threshold is a consequence of adjustment through hours of work by those paid hourly.

$R = \{0.12m, 0.60m\}$. Since rounding behaviors are observed in the income distribution—particularly at multiples of 12 months—we account for this by including fixed effects for multiples of 0.12 million JPY for incomes below 1 million JPY, and for multiples of 0.6 million JPY for incomes above 1 million JPY (i.e., 50,000-JPY per month intervals).

The value of Δz^* is not known a priori, and is determined by identifying the range in which the excess mass (bunching) below the threshold is offset by the missing mass above the threshold when compared to the counterfactual. That is, Δz^* is determined so that $\sum_{i=z_L}^{z_U} \gamma_i = 0$.

4.2.1 Heterogeneity in tax schedules across individuals

The analysis period spans from 2015 to 2021. During this period, the tax and social insurance systems faced by married women are not uniform across individuals. In particular, since 2017, eligibility for enrollment in employees' social insurance has depended on working hours and firm size, resulting in heterogeneity in the tax schedule individuals face. To account for this institutional feature, we explicitly incorporate heterogeneity in tax schedules into the elasticity estimation.

Table 3 summarizes the tax and social insurance systems faced by individuals in each year. From 2017 onward, workers can be classified into two groups: those who are not enrolled in employees' social insurance (hereafter, type a) and those who are enrolled (type b). While the administrative data do not allow us to directly observe which group an individual (i) belongs to, government statistics indicate that the proportion of type a workers is 0.75, implying $\Pr(i \in a) = 0.75$ and $\Pr(i \in b) = 0.25$.

As a result, the marginal bunching range Δz^* observed in the data is a weighted average of the type-specific marginal bunching ranges:

$$\Delta z^* = 0.75 \cdot \Delta z_a^* + 0.25 \cdot \Delta z_b^*, \tag{6}$$

where Δz^* is identified from the observed excess mass, while Δz_a^* and Δz_b^* are not directly observable.

Given the tax schedule faced by each type of worker, the marginal buncher conditions can be written as the equation (3) which yields two type-specific equations, denoted by

$$g(\Delta z_a^*; e_a) = 0 \quad \text{and} \quad h(\Delta z_b^*; e_b) = 0,$$

where e_a and e_b denote the compensated labor supply elasticities of type a and type b workers, respectively. Both elasticities are a priori unknown.

If we impose the assumption that the elasticity of labor supply is identical across the two groups, i.e., $e_a = e_b \equiv e$, then the elasticity can be identified by jointly solving the following system of nonlinear equations:

$$\begin{aligned} \Delta z^* &= 0.75 \cdot \Delta z_a^* + 0.25 \cdot \Delta z_b^*, \\ g(\Delta z_a^*; e) &= 0, \\ h(\Delta z_b^*; e) &= 0. \end{aligned}$$

This system contains three equations and three unknown parameters—e, Δz_a^*, and Δz_b^*—and can be solved numerically. In the empirical analysis, we report the elasticity estimate obtained from this procedure, which explicitly accounts for heterogeneity in the tax and social insurance systems faced by individuals.

4.2.2 Calculation of standard errors

The counterfactual density $b_0(z)$ is estimated by fitting a smooth polynomial to the binned income distribution outside the excluded (bunching) region. Because the estimated counterfactual—and hence the implied excess mass and elasticity estimate—can be sensitive to the choice of the polynomial order, we estimate the elasticity under multiple specifications indexed by the polynomial order p. Specifically, we consider polynomial orders ranging from $p = 5$ to $p = 8$. This multi-specification approach is intended to mitigate concerns that the estimated excess mass is driven by a particular functional-form assumption for the counterfactual density.

Let $\hat{e}_{yp}$ denote the elasticity estimate obtained for year y using polynomial order p. In addition to reporting year-by-year estimates for each specification, we summarize the overall magnitude of the elasticity by reporting the average across years and polynomial orders:

$$\overline{e} \equiv \frac{1}{|\mathcal{Y}| \cdot |\mathcal{P}|} \sum_{y \in \mathcal{Y}} \sum_{p \in \mathcal{P}} \hat{e}_{yp}, \tag{7}$$

where $\mathcal{Y}$ denotes the set of years in the sample and $\mathcal{P} = \{5, 6, 7, 8\}$ denotes the set of polynomial orders considered.

Standard errors are computed using a clustered bootstrap procedure at the individual level. Specifically, for each bootstrap replication, we resample individuals with replacement, thereby preserving within-individual dependence in earnings across observations. For each resampled dataset, we reconstruct the binned income distribution, re-estimate the counterfactual density under each polynomial specification, and re-compute the implied bunching statistics and elasticity estimates. This procedure is repeated 1,000 times, and the standard error of $\hat{e}_{yp}$ is calculated as the standard deviation of its bootstrap distribution. When reporting $\overline{e}$, we compute the average elasticity within each bootstrap replication and use the resulting bootstrap distribution of $\overline{e}$ to obtain its standard error.

4.3 Backing out misperceived tax burdens

In the baseline estimation, we jointly analyzed the income range between 0.96 million JPY and 1.3 million JPY, treating the observed excess mass in this interval as a single large bunch. This approach was motivated by the institutional complexity of the Japanese tax and social insurance system and the possibility that individuals may not fully understand the detailed structure of tax incentives within this range. While this assumption allows us to recover a reduced-form elasticity of labor supply, the observed density patterns around specific thresholds suggest that individuals may misperceive the tax schedule in systematic ways.

In particular, the threshold at 1.03 million JPY corresponds to a kink at which the marginal tax rate increases by 15 percentage points. Despite the relatively modest statu-

tory change, the excess mass observed at this kink is larger than that observed at the 1.3 million JPY notch, where the drop in net income due to social insurance contributions is substantially larger. Moreover, the density around 1.03 million JPY exhibits pronounced left-bunching, whereas a standard tax kink would be expected to generate more symmetric bunching around the threshold (Gelber et al., 2025). These patterns suggest that individuals perceive a fixed cost of exceeding the threshold rather than a change in the marginal tax rate.

To quantify the extent of such tax misperception, we exploit the fact that the elasticity of labor income has already been estimated in the baseline analysis. Using the estimated elasticity together with the observed bunching behavior at the 1.03 million JPY threshold, we back out the perceived tax incentives that would rationalize the observed responses. We consider two alternative representations of tax misperception: (i) misperception expressed as an overestimation of the marginal tax rate, and (ii) misperception expressed as a perceived fixed cost (notch) associated with exceeding the threshold.

4.3.1 Misperceived marginal tax rates

We first consider a benchmark model in which individuals correctly understand the structure of the tax schedule but overestimate the increase in the marginal tax rate at the 1.03 million JPY threshold. Specifically, suppose that individuals perceive the marginal tax rate above the threshold to increase by $\Delta t + \rho^k$, where Δt is the true statutory increase in the marginal tax rate (15 percentage points) and ρ^k captures misperception of the marginal tax rate.

Under this perception, the after-tax income schedule can be written as

$$z - T(z) = (1 - t)z - \Big[(\Delta t + \rho^k)(z - z^*)\Big] \cdot \mathbf{1}[z > z^*], \tag{8}$$

where $z^* = 1.03$ million JPY denotes the threshold income level. In this kink-only environment, the relationship between the elasticity of labor income e and the marginal

bunching range Δz^* admits a closed-form expression:

$$\hat{e} = -\frac{\log(1 + \Delta z^*/z^*)}{\log\left(1 - \frac{\Delta t + \rho^k}{1-t}\right)}. \tag{9}$$

where $\hat{e} \in \{\hat{e}_{obs}, \hat{e}_{str}\}$ denotes the elasticity estimated in the baseline analysis.

We use this expression to back out the perceived marginal tax rate distortion ρ^k. In doing so, we treat the elasticity e as given by the baseline estimates (either the observed or structural elasticity) and estimate Δz^* using the bunching behavior observed locally around the 1.03 million JPY threshold. Solving the equation above for ρ^k yields an estimate of the extent to which individuals overestimate the marginal tax rate increase at the kink.

While this representation provides a transparent benchmark, it does not naturally account for the pronounced left-bunching observed in the data, nor does it capture the intuition that individuals may perceive exceeding the threshold as triggering a discrete loss rather than a marginal change in incentives. We therefore turn to an alternative representation in which misperception takes the form of a perceived fixed cost.

4.3.2 Misperceived fixed costs (Notches)

We next consider a model in which individuals correctly perceive the marginal tax rate increase Δt at the threshold but mistakenly believe that exceeding the threshold entails an additional fixed cost ρ^n. In this case, the perceived after-tax income schedule is given by

$$z - T(z) = (1-t)z - \left[\rho^n + \Delta t(z - z^*)\right] \cdot \mathbf{1}[z > z^*], \tag{10}$$

where ρ^n represents the perceived notch associated with crossing the threshold.

Under this perceived tax schedule, the marginal buncher condition implies the following relationship between the elasticity e, the marginal bunching range Δz^*, and the

perceived fixed cost ρ^n:

$$\frac{1}{1+\Delta z^*/z^*}\left[1+\frac{(\rho^n-\Delta t\cdot z^*)/z^*}{1-t}\right]=\frac{1}{1+1/\hat{e}}\left[\frac{1}{1+\Delta z^*/z^*}\right]^{1+1/\hat{e}} - \frac{1}{1+\hat{e}}\left[1-\frac{\Delta t}{1-t}\right]^{1+\hat{e}}, \tag{11}$$

where $\hat{e}\in\{\hat{e}_{obs},\hat{e}_{str}\}$ denotes the elasticity estimated in the baseline analysis. Given $\hat{e}$ and the observed marginal bunching range Δz^* at the 1.03 million JPY threshold, this equation can be solved for ρ^n.

The estimation of Δz^*, the counterfactual density, and the averaging across polynomial specifications follows exactly the same procedure as in the baseline estimation. Standard errors are computed using the same clustered bootstrap procedure described above.

This representation allows the misperception of the tax schedule to be interpreted as a perceived discrete loss associated with exceeding the threshold, which is consistent with the observed left-bunching and the disproportionate behavioral response to the 1.03 million JPY kink. Together, the two approaches provide complementary perspectives on how tax misperception shapes labor supply responses in a complex tax system.

4.4 Decomposing bunching into statutory and misperceived incentives

To assess the aggregate implications of tax misperception, it is necessary to quantify how much of the observed bunching behavior can be explained by the true statutory tax incentives, as opposed to misperceived tax incentives. In particular, we aim to decompose the observed bunching at the 1.03 million JPY threshold into a component that is consistent with rational responses to the true marginal tax rate increase of 15 percentage points, and a residual component attributable to tax misperception.

Our approach builds on the theoretical framework in Kleven (2016). Under standard

assumptions, the excess mass of bunching at a threshold can be approximated by

$$B \simeq b_0(z^*) \cdot \Delta z^*, \tag{12}$$

where B denotes the excess density mass at the threshold, $b_0(z^*)$ is the counterfactual density evaluated at the threshold, and Δz^* is the marginal bunching range.

Using this relationship, we compute two versions of the marginal bunching range at the 1.03 million JPY threshold. The first, denoted Δz^*_{obs}, is inferred directly from the observed income distribution using the bunching estimation procedure described above. This value captures the total observed bunching response at the threshold. The second, denoted $\Delta z^*_{0.15}$, is obtained by plugging the true statutory marginal tax rate increase $\Delta t = 0.15$ together with the estimated elasticity of labor income into the theoretical bunching formula. This value represents the marginal bunching that would arise if individuals responded optimally and fully understood the true tax schedule.

These two marginal bunching ranges imply corresponding excess mass measures,

$$B^{\text{obs}}_{1.03} \simeq b_0(z^*) \cdot \Delta z^*_{\text{obs}}, \tag{13}$$

$$B^{0.15}_{1.03} \simeq b_0(z^*) \cdot \Delta z^*_{0.15}, \tag{14}$$

where $B^{\text{obs}}_{1.03}$ denotes the observed excess mass at the threshold and $B^{0.15}_{1.03}$ denotes the excess mass predicted under rational responses to the true marginal tax rate.

Taking the ratio

$$\frac{B^{0.15}_{1.03}}{B^{\text{obs}}_{1.03}} = \frac{\Delta z^*_{0.15}}{\Delta z^*_{\text{obs}}}, \tag{15}$$

yields an estimate of the share of observed bunching that can be explained by the true statutory marginal tax rate increase. The remaining share, $1 - B^{0.15}_{1.03}/B^{\text{obs}}_{1.03}$, can be interpreted as the fraction of bunching attributable to tax misperception. This decomposition provides a quantitative measure of the prevalence of misperceived, or behaviorally non-rational, responses at the threshold, which we subsequently use to assess the aggregate labor supply implications of correcting tax misperception.

4.5 Results

4.5.1 Estimated elasticity parameters

Figure 4 illustrates the estimation result for year 2016. The black solid line is the observed density, and the dashed lines in different colors are counter factual density estimated by equation (5) corresponding to different order of polynomial (p). Z^L is set to 0.84, and Z^U is estimated so that the excess mass between the observed and counter factual densities in the left to $Z^* = 1.3m$ equals the missing mass in the right to Z^*. Then we take average of estimates from different p; for 2016, observed elasticity is 0.314 and structural elasticity is 0.774.

Then, we further take the average across years. Table 4 shows the observed and structural elasticities for years 2015-2017 and 2018-2021. [21] Since 2018-2021 is the period after spousal deduction reform and explained in the next section, this section focus on the results for 2015-2017.

As expected, the observed elasticity is smaller than the structural elasticity. This is because the observed elasticity is under the assumption of no adjustment frictions in labor supply. The larger degree of friction is, the more difficult to bunch, thus the elasticity corresponding to the same size of excess mass becomes larger.

4.5.2 Estimated misperceived tax rates

Table 5 presents the perceived cost at the 1.03 million threshold in addition to the actual kink of 15% marginal tax rate. Following Table 4, both calculations based on observed and structural elasticities for periods 2015-2017 and 2018-2021 are presented. Furthermore, to interpret the cost, the table shows both in terms of marginal tax rate (kink) and in terms of fixed cost (notch).

For example, if we interpret the cost as an additional marginal tax rate increase, the estimated misperceived marginal tax rate based on the structural elasticity is 49.3%. The

[21] Although the budget line for 2017 is different from that for 2015-2016, the estimated elasticities are very similar for both periods.

total cost perceived by individuals is 15%+49.3% = 63.3% increase of marginal tax rate. If we interpret the same cost as a fixed cost, it is equivalent to 0.256 million JPY in addition to the 15% kink that actually exists.

The estimated costs based on the observed elasticity are larger because the observed elasticity is an underestimate (or lower bound) of the true elasticity. Therefore, the estimated misperceived costs based on the observed elasticity should be interpreted as the upper bound. The estimates imply that the cost could be as large as MTR of 76.6% or, equivalently, 0.555 million JPY.

Note that the perceived cost at the 1.03 million threshold may include the spousal allowances as a part of husband's salary. As explained in Section 2.3, 36,192 JPY can be attributed to the spousal allowances. This is 14% of the misperceived fixed costs for 2015-2017.

5 Change caused by spousal deduction reform in 2018

5.1 2018-: Reform of Spousal Deduction

In 2018, two major changes were implemented to the spousal deduction and special spousal deduction. First, the secondary earner's income threshold that the special spousal deduction starts to decrease moved from 1.05 million JPY to 1.5 million JPY. This change can be perceived that the change in the effective marginal tax rate for the secondary earner near the 1.03 million threshold became smaller. This reform impacts women married to men with higher tax rate more. As we limit the sample to women married to men with annual total income below 9 million JPY, the husband's tax rate (interpret as change in the effective marginal tax rate of the wife's additional earnings) takes 10%, 15%, 20%, 30% or 33%.

Second, for the primary earners with total incomes more than 9 million JPY, both spousal deduction and special spousal deduction were reduced to two thrids of the amount for those with total incomes less than 9 million JPY. They were further reduced to one

third for those with total incomes more than 9.5 million JPY, and to zero for those with total incomes more than 10 million JPY. To avoid complication from this second change, women married to men with total incomes more than 9 million JPY were excluded from our sample.

Note that the name of the deduction changes when dependent spouse's gross salary income exceeds 1.03 million, although the amount deducted from the primary earner's taxable income is unchanged. Probably partly due to this, there exist persistent belief that spousal deduction would be lost if wife earned more than 1.03 million even after this reform. For example, according to the question about reasons to adjust income in the JPSC, mentioned in Section 2.3, 63.6% answer spousal deduction as reasons to adjust annual income even after 2019, and their earnings are still concentrated around 1 million, not the new threshold of phase out at 1.5 million.

5.2 Change in the bunching behavior after spousal deduction reform

The reform of spousal deduction moved some women who used to adjust to 1.03 million threshold to the social insurance notch at 1.3 million. To see this from the year-to-year change in the income distribution, Figure 5 shows the kernel density estimates of annual salary income for each year from 2015 to 2021, calculated using a bandwidth of 5,000 JPY (plus/minus total = 10,000 JPY). Figure 6 draws the first difference of the kernel density, i.e. the year-to-year change in the distribution, and Figure 7 shows the cumulative change from 2015. In all figures, the first vertical line indicates 1.03 million JPY, while the second vertical line indicates 1.3 million JPY.

Figure 5 shows that the bunching at 1.03 and 1.3 million thresholds is quite stable. At the same time, the density between 1.03 and 1.3 million slightly increased since 2018. This change is also shown in the panel "2018-2017" of Figure 6, and more clearly in panels after 2018 in Figure 7. This change is probably due to the change in the spousal deduction in 2018.

Table 5 also indicates that misperceived costs decreased in the period 2018-2021 than in the period before the reform. If interpret as MTR, the misperceived cost reduced by 9% of the pre-reform level. Although there still remains more women bunching at the 1.03 million threshold than expected from the rational response to the 15% kink, the misperception became smaller after the spousal deduction reform.

Since the threshold that the amount of deduction starts to decrease was 1.05 million JPY, very close to the 1.03 million JPY threshold, before the reform, the reform to move this threshold to 1.5 million JPY may be taken as flattening of the kink at 1.03 JPY million, and the change in the perceived marginal tax rate should be roughly equal to the marginal tax rate on husband's income. If so, the reform should have affected women married to men with higher tax rate more. To examine this, we repeated the same estimation as Table 5 using subsamples of womne whose husband's tax rate are 15%, 20%, 30% and 33%.

Table A.4 presents the results by subsamples, with the percent change in the perceived cost before and after the reform. Contrary to expectations, the change was rather greater for those with lower spousal tax rate. Therefore, the response to the reform is not likely to be attributable to the response to true change in tax incentives.

An alternative explanation is information effect, that is, the reform made individuals aware of the correct tax scheme, therefore they learned that it is not rational to adjust income below the 1.03 million JPY threshold. A supportive evidence is a discontinuous jump in the number of Google searches of "spousal deduction" from 2018. Also, Yokoyama (2018) showed that the 2004 reform induced women whose budget line did not change to bunch at 1.03 million JPY by making the threshold more salient. Therefore we speculate that the 2018 reform had some information effect that induced individuals to learn true tax scheme and move the 1.3 million threshold.

6 Implication of rising minimum wages

Japan's steadily rising minimum wage at a 3% annual increase interacts sharply with the tax and social insurance system faced by married secondary earners.[22] Because a large share of married women work part time at hourly wages close to the minimum wage, increases in the minimum wage mechanically push annual earnings toward salient income thresholds, even if hours worked are held fixed. In a frictionless setting with full information, higher minimum wages would be expected to translate into higher annual earnings until workers reach thresholds where statutory marginal incentives change.

In practice, adjustment patterns differ sharply across the two main thresholds. As minimum wages rise, an increasing mass of married women reaches the 1.03 million JPY threshold, where perceived tax penalties are large despite modest true marginal tax rates. Many women respond by reducing hours in order to keep earnings just below this cutoff, causing growth in annual income to slow and eventually stall as earnings approach the threshold.

By contrast, the response at the 1.3 million JPY threshold potentially reflects a different mechanism. Crossing this threshold triggers mandatory social insurance contributions and a large discrete reduction in household net income. As a result, some degree of bunching at 1.3 million JPY is consistent with rational responses to true incentives. However, even at this threshold, rising minimum wages do not lead to smooth upward earnings adjustments. Instead, women near 1.3 million JPY also reduce hours to avoid crossing the notch, reinforcing earnings compression in the upper part of the secondary-earner income distribution.

Taking advantage of the panel nature of our data, Figures 8 and 9 illustrate the dynamics of income growth as minimum wages increase. In Figure 8 we plot annual changes in labor income over 2015-2021. The blue and red symbols represent the mean and median annual changes with year t as the base year. The light blue bar represent the 25th to 75th perceniles and the grey bars the 10th to 90th percentiles. As the subfigures

[22] In 2021, minimum wages remained unchanged due to a policy intervention in light of the Covid-19 pandemic.

show, far below the thresholds, the mean change in income (and often the median as well) is large and positive reflecting increases in the minimum wage and increases in hours from a low base. The mean and median change in annual income approach zero as women near the first threshold and remain there through the second threshold at 1.3 million JPY. Moreover, the distribution of income changes are substantially smaller in the regions near the two thresholds–illustrating that the practice of minimizing income growth upon approaching the thresholds is widespread among married women. Given annual increases in the minimum wage and that many women who earn under 1.3 million JPY earn either the minimum wage or a wage highly correlated with changes in the minimum wage, it is conceivable that reducing hours is the primary method to keeping annual income stable under the thresholds. Upon passing the upper threshold, there is no reason to restrict income (other than standard responses to marginal tax rates) and the minimum wage becomes less important. The distribution of income changes is substantially wider and more variable, reflecting market and other forces that drive wages.

Figure 9 further illustrates the relevance of the income trap. In this figure, we fix the base year at 2015 income and then plot the mean and median income in the labeled year in bins of size 0.01 million JPY. For example, the top left panel plots income in 2015 versus 2016. The next panel plots income in 2015 versus 2017 and so forth. The final panel plots income in 2015 versus 2021. In each case, the diagonal black line represents the 45 degree line and the horizontal and vertical black dashed lines represent the two thresholds of 1.03 and 1.3 million JPY. When incomes do not change, the data lie upon the 45-degree line. When incomes increase, they lie above. Looking first at the top left panel. Here we see that individuals with relatively low income in 2015 earn more in 2016 with the means and medians lying above the 45-degree line. As 2015 incomes approach the first threshold, we see that the median returns to the 45-degree line, staying there until incomes pass the second threshold at 1.3 million JPY. The mean just below the 1.03 million JPY threshold tends to hug the same value in 2016 and similarly for incomes within the center box. Here the mean does not go over 1.30 million JPY. Over time,

the pattern becomes more stark–particularly for the median married female employee. Consider now 2019 and the median income. For incomes that were below 1.03 million JPY in 2015, the median income in 2019 remains below 1.03 four years later. A similar pattern is observed within the center box. The median woman earning just over the first threshold in 2015 increases hear earnings a bit but its clear that the median woman earning below 1.3 million in 2015 aims to remain under the 1.3 million JPY threshold even in 2019. By 2021, the 1.03 is still a binding threshold for half of employed women, though some begin to break beyond the 1.3 million threshold by 2021. Once past the second threshold, incomes show positive salary growth, all above the 45-degree line.

7 Interpreting and implications of tax misperception

Our analysis thus far establishes that married women in Japan respond strongly to salient income thresholds, even when these thresholds correspond to modest true marginal incentives. Using administrative data, we show that the implied perceived marginal tax rates substantially exceed statutory rates, and that these misperceptions lead women to constrain earnings within a narrow range over extended periods of time. This persistence suggests that tax misperception does not merely affect short-run timing of labor supply, but results in a sustained reduction in aggregate labor input.

In this section, we quantify the potential macroeconomic importance of this behavioral distortion. We conduct a simple thought experiment in which misperceptions of the tax and social insurance schedule are eliminated, so that women supply labor according to the true marginal tax rate they face. Using our estimated labor supply elasticities and the observed distribution of earnings, we translate the implied increase in female labor input into an approximate change in aggregate output using standard production-accounting logic. This exercise is intentionally partial equilibrium and abstracts from general-equilibrium wage adjustments or long-run human capital responses. Its purpose is to provide an order-of-magnitude benchmark for the efficiency costs of tax complexity and the potential gains from improved transparency or simplification.

To be even more specific, we calculate the impact on GDP growth if "excess bunchers" were to move from the 1.03 million JPY threshold to the 1.3 million JPY threshold. Hence, this is not a calculation of the impact of removing bunching due to kinks or notches but the more modest calculation of eliminating misperceptions. In other words, we estimate the number of women who would bunch at the 1.03 million JPY threshold due to the kink based upon our elasticity calculations (call them "legitimate bunchers") and then calculate the number we observe in the data minus these legitimate bunchers as the number of "excess bunchers". We then assume that eliminating the misperception of the marginal tax rate at the 1.03 million JPY threshold would, at a minimum, move them to the notch at 1.3 million JPY. Table 6 presents a back-of-the-envelope calculation that shows that eliminating the excess bunching due to misperceptions represents about a additional 0.05 percentage point increase in GDP growth, where the average growth over 2015-17 was 1.36%. After this one time shock, GDP would be permanently higher. Over ten years, this would add about 313 billion JPY to GDP. The effect is small due to the modest nature of the experiment, but not trivial, especially because this is akin to a free lunch.

As an additional thought experiment, we can compare the impact of eliminating misperceptions with another policy meant to increase female labor supply–the expansion of publicly subsidized childcare. Fukai and Kondo (2024) find that access to public childcare for a mother with a child under the age of one increases annual labor income by about 1 million JPY, on average. To increase labor income by the same 0.264 trillion JPY (the population total of increased labor income due to eliminating the misperception as shown in Table 6), 264,000 additional childcare slots would be needed. Given that there are about 700,000 births per year in Japan, this is equivalent to offering public childcare to roughly 37 percent of a birth cohort. Of course such a massive expansion would likely have other general equilibrium effects not captured by the marginal increase estimated by Fukai and Kondo (2024), but this suggests that the size of the impact of eliminating misperceptions is very large compared to other existing policies.

8 Conclusion

We show in this paper that Japan's tax and social insurance system distorts married women's labor supply not only through statutory incentives, but also through misperceived incentives created by complexity and salience. Using administrative tax data, we document pronounced bunching of female earnings at salient thresholds. Women respond far more strongly to the 1.03 million JPY threshold, where the true marginal tax increase is small, than to the nearby 1.3 million JPY threshold that involves a large discrete income loss. This pattern is inconsistent with full-information labor supply models and instead reflects systematic misperceptions of marginal incentives.

By comparing responses at kinks and notches, we quantify these misperceptions and show that women behave as though crossing the 1.03 million JPY threshold entails a much larger penalty than it actually does. On average, married women act as if they were facing a marginal tax rate of about 65%, rather than the true rate of 15%. As a result, these beliefs generate persistent earnings compression. As minimum wages rise, women reduce hours to remain below salient cutoffs rather than allowing earnings to grow, leading to sustained income stagnation within the income trap.

The aggregate implications are meaningful. A back-of-the-envelope counterfactual that eliminates misperceptions at the 1.03 million JPY threshold, without altering the true tax schedule, yields a nontrivial one-time increase in GDP of 0.05 pp. While modest in size, this gain arises without fiscal cost, highlighting the efficiency losses created by opaque policy design.

More broadly, our findings show that tax complexity can act as a behavioral barrier to labor supply even when statutory disincentives are small. Policies aimed at increasing female labor supply should therefore focus not only on changing incentives, but also on simplifying and clarifying them. Reducing salient but misleading thresholds may offer substantial efficiency gains at low cost.

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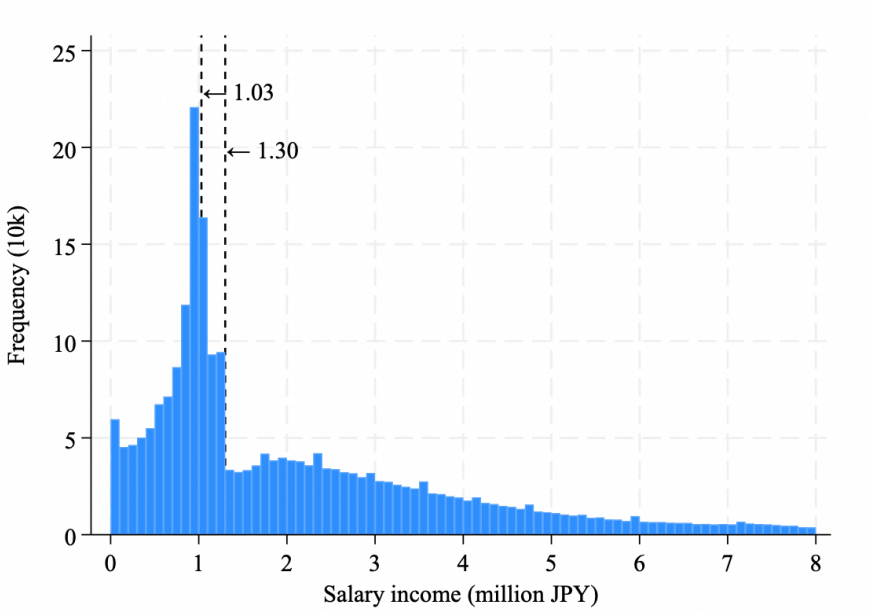
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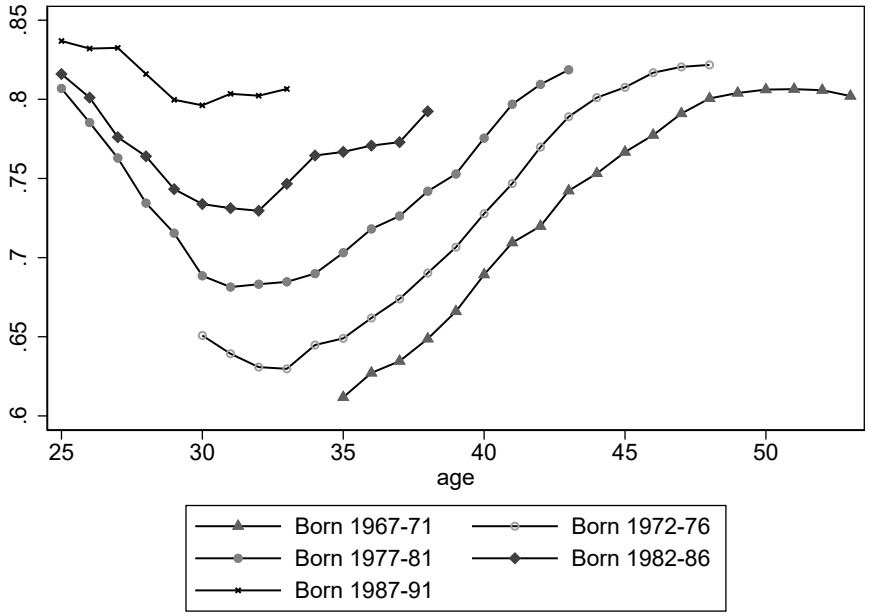
Figure 1: Distribution of annual salary income



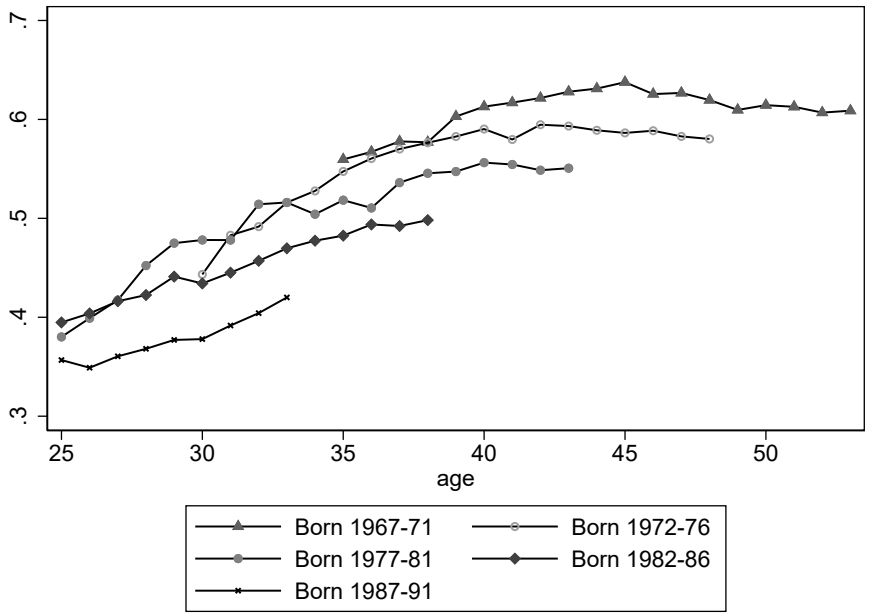
Notes: This figure shows the distribution of salary income of married women age 25-60. The vertical black dashed lines represent the thresholds 1.03 and 1.3 million JPY. Source: CREPE project municipality tax data

Figure 2: Female employment by birth year cohort

(a) Labor Force Participation



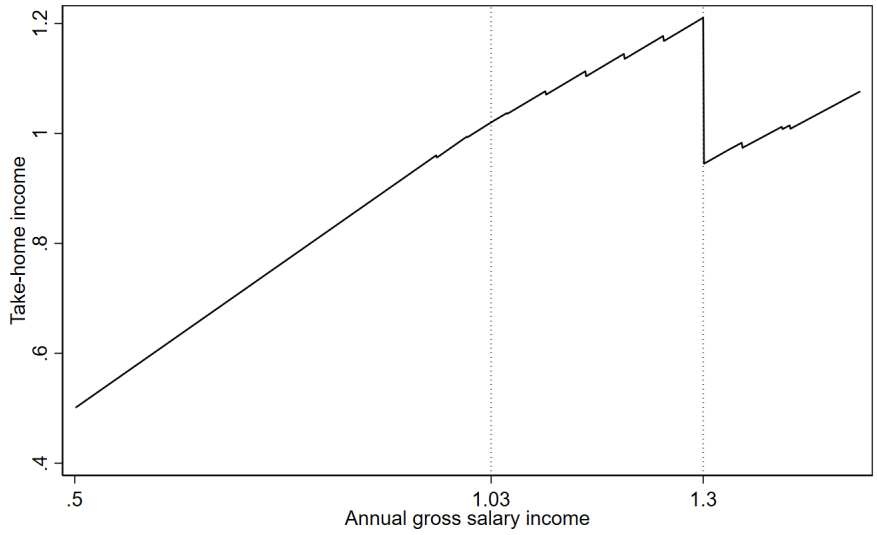
(b) Nonregular employment (% in all employed)



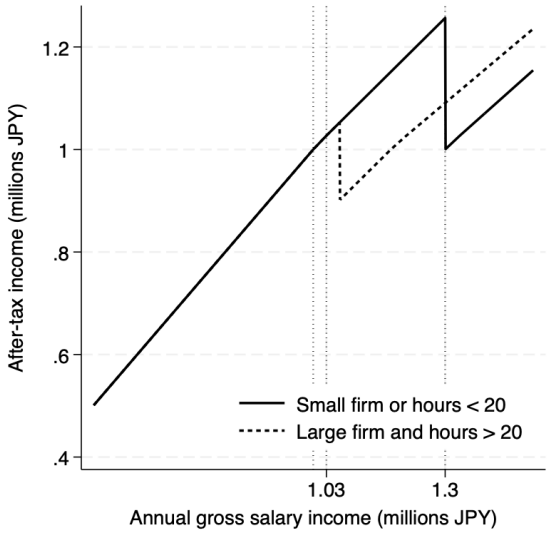
Notes: Labor Force Survey 2002-2024, authors' calculations. Cohorts born before 1976 are missing earlier data points due to data availability (they were older than 25 in 2002).

Figure 3: Take-home income of married female part-time workers

(a) 2015-2016

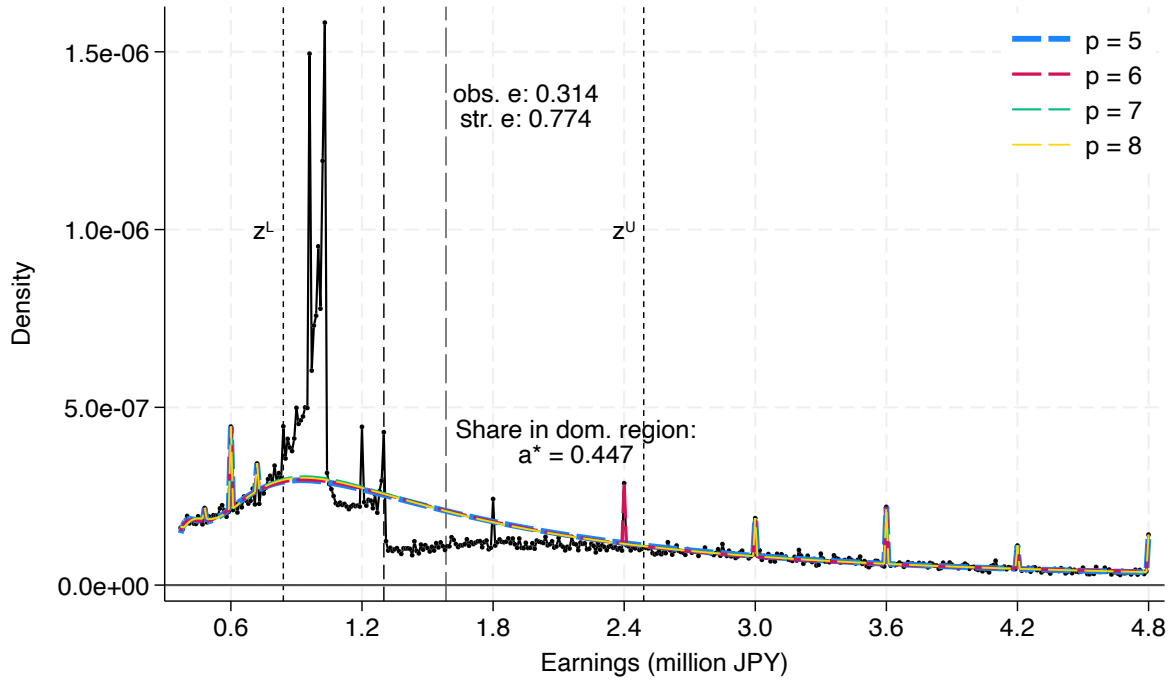


(b) 2017



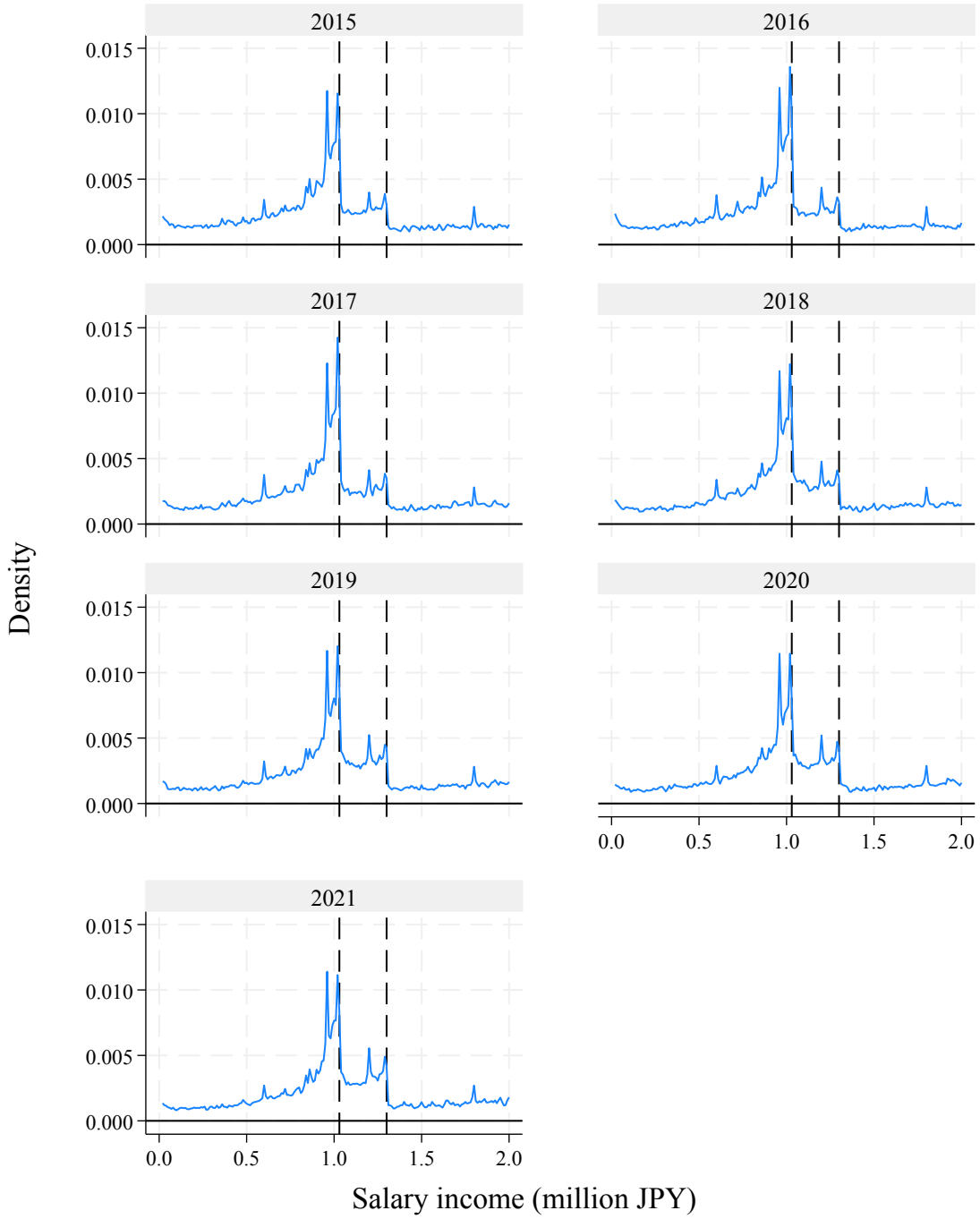
Notes: Women married to salaried worker with total income less than 9 million. Take-home pay is gross salary income minus tax, social insurance payments, and increased tax imposed on husbands due to the phase-out of the spousal deduction. We use a marginal tax rate of 20% (10% national income tax + 10% local tax) for the husband, without loss of generality.

Figure 4: Empirical and Counterfactual Earnings Distribution around Notches in 2016



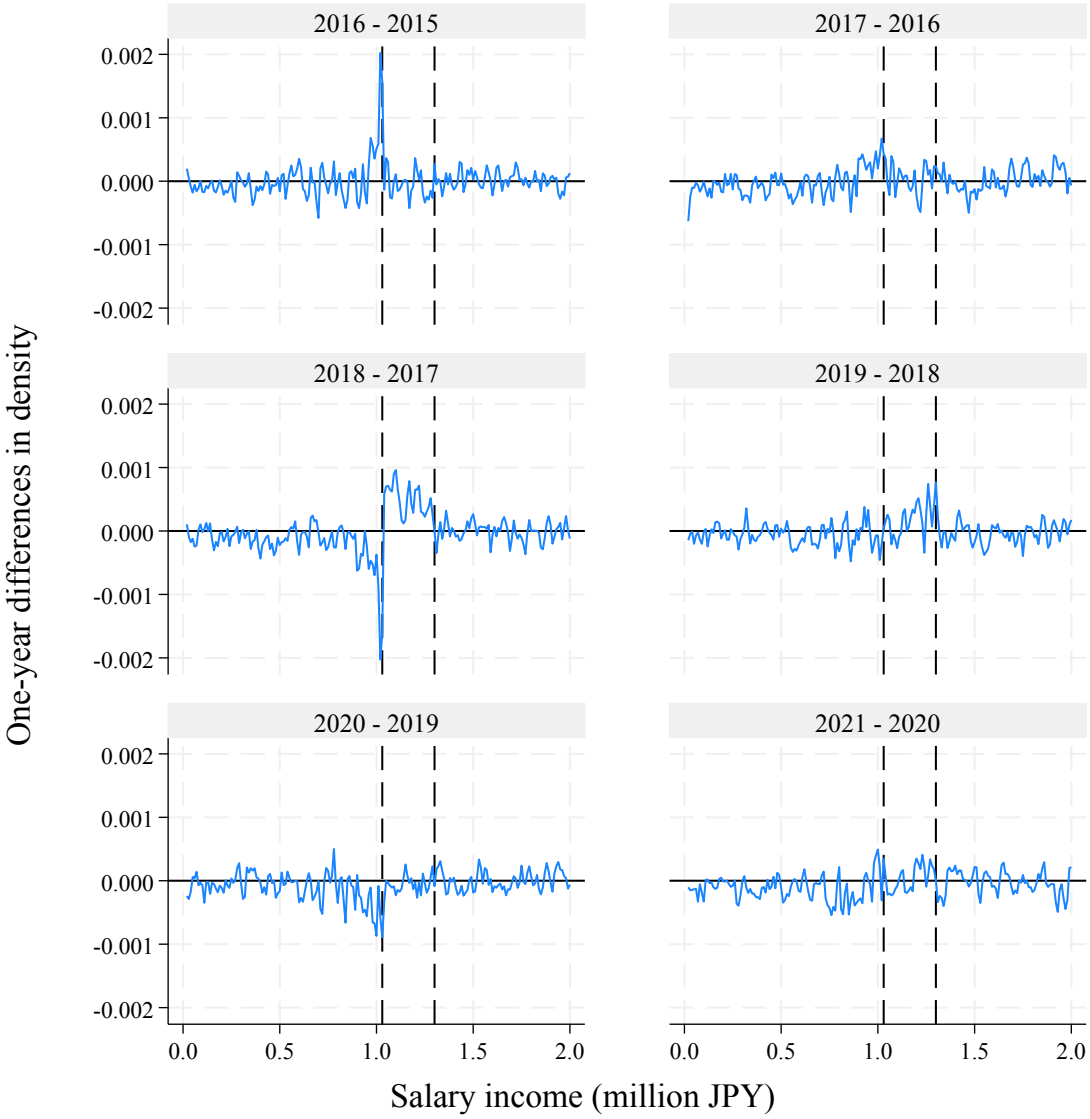
Notes: The figure shows the empirical distribution of income (solid black line) and the counterfactual distribution (blue lines) for married women aged 25 to 60 in 2016. The counterfactual is obtained by fitting a polynomial of order 5–8 to the empirical distribution, excluding observations in a neighborhood of the notch. Excluded ranges $[z_L, z_U]$ are marked by vertical short-dashed line, Dominated regions are marked by vertical long-dashed lines, and earnings threshold (z^*) is marked by dashed line.

Figure 5: Distribution of annual salary income by year



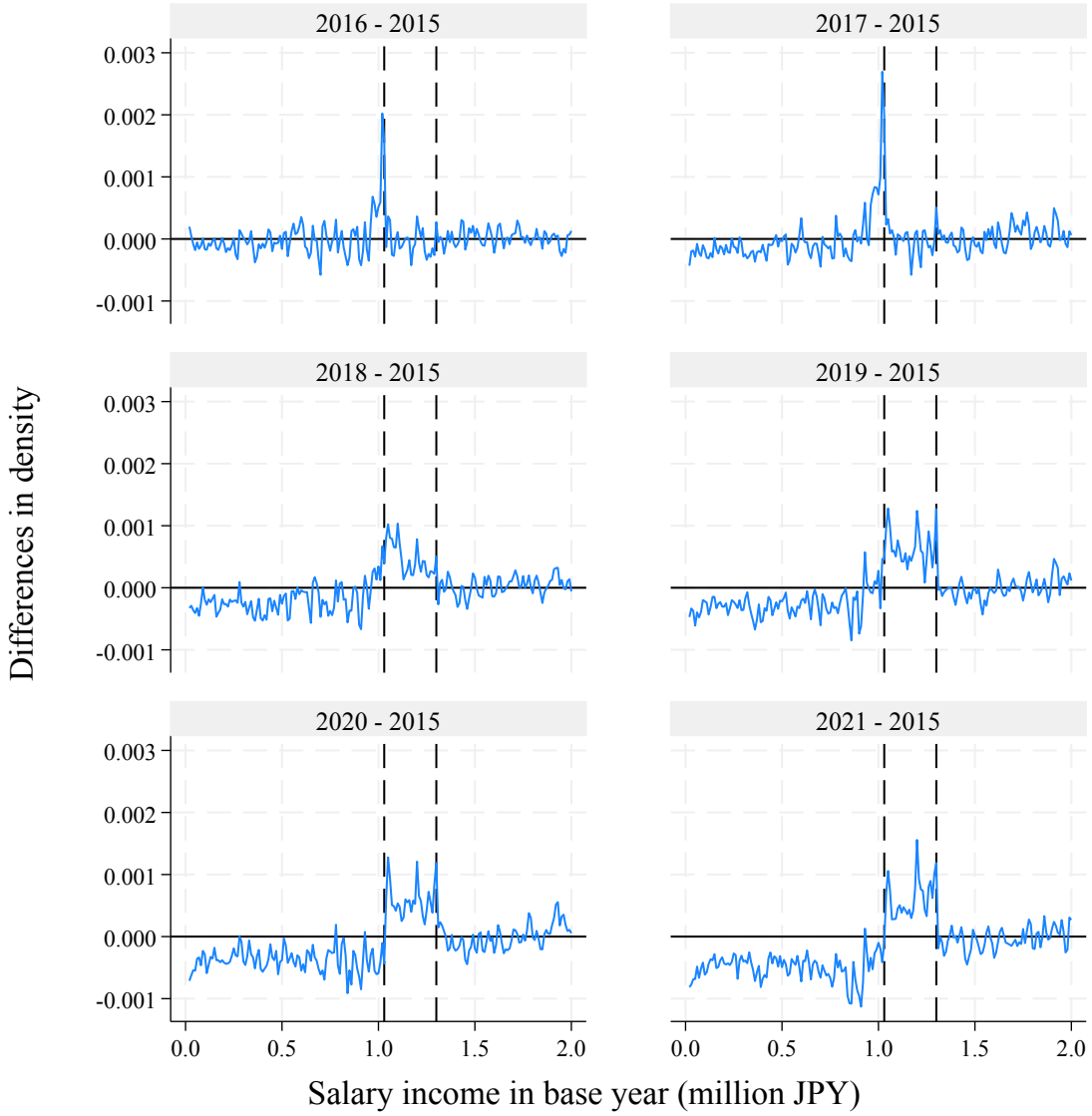
Notes: Source: CREPE project municipality tax data

Figure 6: Change in the distribution of annual salary income by year



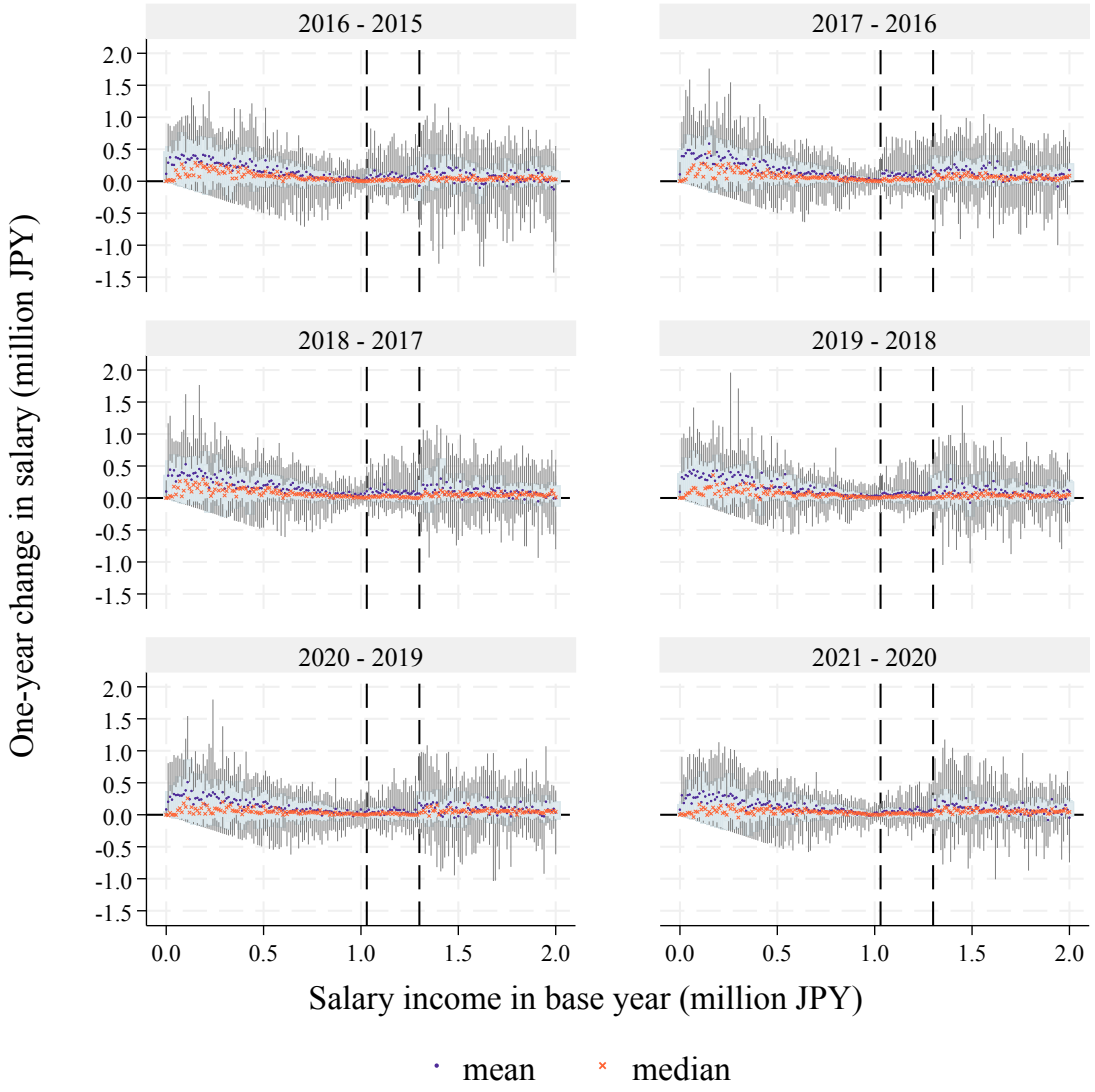
Notes: Source: CREPE project municipality tax data

Figure 7: Change in the distribution of annual salary income by year, base year = 2015



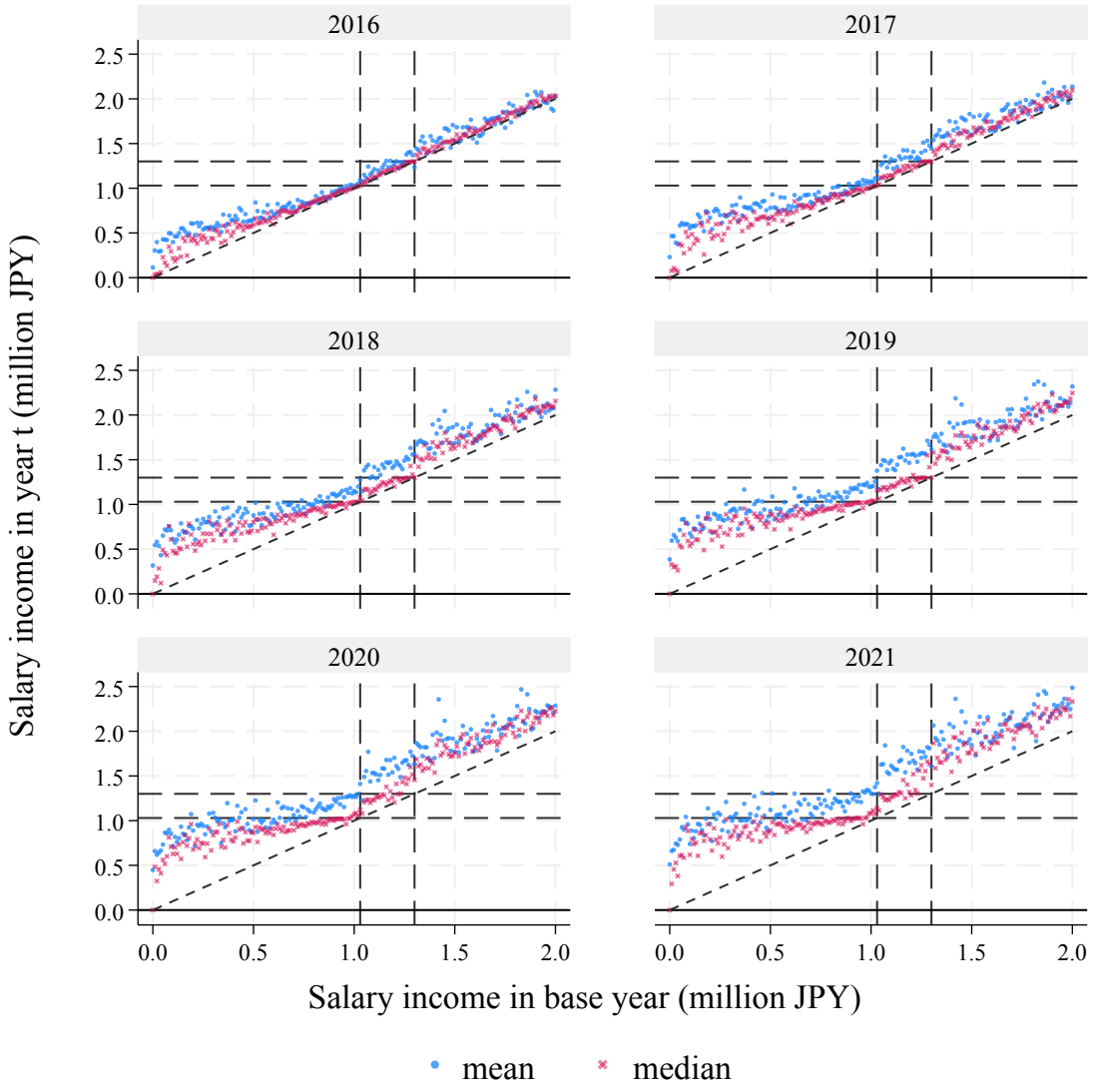
Notes: Source: CREPE project municipality tax data

Figure 8: Annual change in the salary income



Notes: The base year (x-axis) is income in year t. The y-axis is the change in income between year $t+1$ and t. The vertical and horizontal dashed lines represent the thresholds 1.03 and 1.3 million JPY. The light blue bars represent the 25th to 75th percentiles. The gray bars represent the 10th to 90th percentiles. Source: CREPE project municipality tax data

Figure 9: Salary growth over 2016 to 2021, base year = 2015



Notes: The base year (x-axis) is income in 2015. The y-axis is income in year t where each figure is a different year. The short-dash black line is the 45 degree line. The vertical and horizontal dashed lines represent the thresholds 1.03 and 1.3 million JPY. Source: CREPE project municipality tax data

Table 1: Sample construction

	Obs	**% deleted**
All women living with spouse and aged 25–60 as of January 1st	1,516,291	
Spouses with positive salary income (excludes self-employed	1,362,271	10.2
Spouses' annual total income is < 9 million yen	1,261,103	7.4

Note: "% deleted" shows the share removed by each restriction relative to the prior row.

Table 2: Summary statistics of administrative record data

	mean	sd	min	10%tile	25 %tile	50 %tile	75%tile	90%tile	max
Salary income (million JPY)	1.63	1.92	0	0	0.03	1.00	2.44	4.29	36.01
Age	44.13	9.24	25	31	37	44	52	57	60
Husband's total income (million JPY)	4.01	1.92	0	1.78	2.46	3.79	5.29	6.71	9.00
Age of husband	46.11	10.12	18	32	38	46	54	60	90
N. of children under 18	0.75	1.03	0	0	0	0	2	2	10
N. of observations	1,257,757								
N. of unique individuals	255,811								

Source: CREPE project municipality tax data in year 2015-2021. Sample is limited to married women aged 25-60 whose spouses have positive salary income and total income less than 9 million JPY.

Table 3: After-tax income schedules by year and social insurance enrollment

Year	Group	After-tax income $z - T(z)$
2015–2016	All individuals	$0.7650\,z - 71,000$
2017	Type a (75%)	$0.7650\,z - 71,000$
	Type b (25%)	$0.7293\,z + 73,500$
2018–2021	Type a (75%)	$0.7650\,z$
	Type b (25%)	$0.7293\,z + 144,500$

Notes: Before crossing the income threshold, after-tax income is given by $z - T(z) = z$ for all individuals and years. From 2017 onward, individuals are divided into two groups depending on enrollment in employees' social insurance. Type a workers are not enrolled, while type b workers are enrolled. Group shares are based on government statistics.

Table 4: Estimated elasticity parameters

Parameters	Period	Estimates (1)	(SE) (2)	l95 (3)	u95 (4)
Observed elasticity	2015 - 2017	0.324	(0.020)	0.284	0.364
	2018 - 2021	0.469	(0.022)	0.425	0.513
Structural elasticity	2015 - 2017	0.786	(0.036)	0.715	0.857
	2018 - 2021	0.969	(0.037)	0.897	1.041

Note: We estimate elasticity for each p and year, and then take the average over the group p and year. Standard errors are obtained by 1,000 individual-level cluster bootstrap replications.

Table 5: Estimated misperceived tax rates

Parameters	Period	Estimates (1)	(SE) (2)	l95 (3)	u95 (4)
Misperceived MTR using obs. elasticity ρ^k_{obs}					
	2015 - 2017	0.766	(0.010)	0.746	0.786
	2018 - 2021	0.697	(0.010)	0.678	0.717
Misperceived MTR using str. elasticity ρ^k_{str}					
	2015 - 2017	0.493	(0.013)	0.468	0.519
	2018 - 2021	0.448	(0.009)	0.430	0.466
Misperceived FC using obs. elasticity (in mil. JPY) ρ^n_{obs}					
	2015 - 2017	0.555	(0.015)	0.525	0.585
	2018 - 2021	0.507	(0.013)	0.483	0.532
Misperceived FC using str. elasticity (in mil. JPY) ρ^n_{str}					
	2015 - 2017	0.256	(0.009)	0.238	0.275
	2018 - 2021	0.246	(0.007)	0.231	0.260

Note: We estimate elasticity for each p and year, and then take the average over the group p and year. Standard errors are obtained by 1,000 individual-level cluster bootstrap replications. MTR denotes marginal tax rates, and FC denotes fixed costs.

Table 6: Estimated impact of eliminating misperceptions at 1.03 Million JPY

Variable	**Value**
Number of total bunchers at 1.03 million JPY	14,086
Number of legitimate bunchers (mtr = 0.15*)	1,549
Excess bunchers due to misperception	12,537
Total number of individuals aged 15 or older**	1,410,453
Population of Japan (above age 15) in 2015	109,970,000
Population-weighted number of excess bunchers	977,447
Increased labor income (trillions JPY)†	0.264
Average GDP (trillions JPY), 2015–2017‡	554.23
Average GDP growth, 2015–2017‡ (%)	1.36
Contribution to GDP growth (pp)	0.05

Note:
* Based upon structural elasticity.
** Excluding individuals with missing marital status and/or age.
† Calculated as $(1.3 - 1.03)$ million JPY per person.
‡Source: World Bank GDP indicators.

Table 7: Tax and Insurance Thresholds Over Time

Threshold (m = million JPY)	**Details**
	2018–2022
0.96–1.00m	Lump-sum part of local residential tax (5,000 JPY)
1.00m	Income-proportional part: (Income – 0.98) × 10%
1.03m	National income tax; marginal tax rate increases by 5 percentage points
1.06m†	Employer provided health insurance and pension. Approx. 150,000 JPY (plus about 150,000 JPY employer contribution)
1.30m	National Pension & National Health Insurance (if not covered by employee's insurance). Approx. 300,000 JPY
1.50m	Spousal deduction starts to decrease: 20k × husband's tax rate (typically 20% or 30%)
	October 2016–2017
0.96–1.00m	Lump-sum part of local residential tax (5,000 JPY)
1.00m	Income-proportional part: (Income – 0.98 million) × 10%
1.03m	National income tax; marginal tax rate increases by 5 percentage points
1.05m	Spousal deduction starts to decrease: 20k × husband's tax rate (typically 20% or 30%)
1.06m†	Employer provided health insurance and pension. Approx. 150,000 JPY (plus about 150,000 JPY employer contribution)
1.30m	National Pension & National Health Insurance (if not covered by employee's insurance). Approx. 300,000 JPY
	2007–September 2016
0.96–1.00m	Lump-sum part of local residential tax (5,000 JPY)
1.00m	Income-proportional part: (Income – 0.98 million) × 10%
1.03m	National income tax; marginal tax rate increases by 5 percentage points
1.05m	Spousal deduction starts to decrease: 20k × husband's tax rate (typically 20% or 30%)
1.30m	National Pension & National Health Insurance (if not working more than 30 hours/week). Approx. 250–300,000 JPY (gradually increasing as population ages)
Working > 30 hours/week	Employee's health insurance & pension: 10–15% of pre-tax salary (rate gradually increasing)

† Additional requirements: 88,000 JPY/month, 20 hours/week and firm size > 500 employees

A Supplemental data sources

A.1 Labour Force Survey (LFS)

The LFS, conducted monthly by the Statistics Bureau of Japan since 1947, is a comprehensive national survey that measures employment and unemployment in the country. It targets around 40,000 randomly selected households, representing approximately 100,000 individuals aged 15 and older, ensuring a nationally representative sample.

The survey covers all regions and prefectures of Japan, with data benchmarked to the 2015 national census. It provides key labor market indicators such as employment status, unemployment rate, hours worked, and industry classifications. In addition, the special questionnaire introduced in 2002 asks regular/non-regular status and labor income in brackets. We use the microdata from this special questionnaire for 2002-2024 to obtain descriptive tabulations mainly presented in Section 2.

A.2 Japan Panel Survey of Consumers (JPSC)

The JPSC is a comprehensive, longitudinal study that exclusively interviews women and aims to capture detailed information about the economic and social behaviors of Japanese households. Initiated in 1993 by the Institute for Research on Household Economics, the survey focuses on various aspects of consumer behavior, including income, expenditures, savings, and investments. It gathers data annually from a representative sample of women aged 24 to 34 at the start of the survey, expanding the sample over time to include newer cohorts. The data are panel, which allows us to follow the respondents over time.

The survey asks individual and household income, sources of income, employment status, hours, hourly wages if paid hourmy, and many variables related to education. There are also detailed questions related to family structure, marital status, and children. Importantly for our study, it also asks a direct question about whether the respondents adjust their income below a certain threshold to avoid tax and social security burden. The weakness of the JPSC relative to the other two datasets are smaller sample size and measurement errors in income due to self-reporting.

In the current version of this study, we use the JPSC to examine the reason to adjust income below the 1.03m and 1.3m thresholds (Section 2) and to check how many married women are affected by minimum wage changes (Appendix section C). Descriptive statistics of the sample used for the latter analysis is presented in Appendix Table A.5.

B Budget constraints used in the elasticity estimation

This section describes the relationship between gross salary income and take-home income after tax and social insurance payments near the 1.3m threshold in each year. To estimate the labor income elasticity, we simplify the budget constraint so that all changes that actually kick in different thresholds locating between 0.93-1.3m gross salary income kick in at 1.3m.

Let X and SI denote gross salary income and social insurance payment. In all years in 2015-2021, the national income tax is $max[(X - 1.03m - SI) * 0.05, 0]$. The local residential tax is $max[(X - 0.98m - SI) * 0.1, 0] + 5000$ if $X > 1.0m$. Each municipality sets a minimum income threshold $0.93m \leq L \leq 1.0m$ for lump-sum tax of 5000, and if $L < X \leq 1.0m$, the local tax amount is 5000, and if $X \leq L$, the local tax amount is zero.

SI, the amount of social insurance payment, is determined by monthly salary, employer's firm size and hours of work per week, and the scheme changed in October 2016. Also, until 2017, the spousal deduction applied to primary earners' taxable income started to phase out. Thus, we divide the analysis period into 2015-2016, 2017, and 2018-2021. Let SD be the loss on household income by loosing the spousal deductions. For each period, the take-home income is calculated by $X - SI - national_tax - local_tax - SD$.

B.1 Justification for ignoring SI coverage due to working more than 30 hours

Employee's social insurance was applied to employees who work more than 30 hours per week regardless of the firm size. If hourly wage is higher than 833 yen, annual income exceeds 1.3m by working 30 hours per week. Although 833 yen was above the minimum wage except for Tokyo, Kanagawa and Osaka in 2015, according to a rough calculation based on the record of social insurance deductions, we decided to ignore this possibility for the following reason.

6 municipalities (81% of the main sample) provided the record of social insurance deductions. To exclude the case that the worker pay Employment Insurance only,[23] we assume that those whose social insurance deductions exceeds 10,000 JPY are covered by own Employee's Insurance or National Insurance scheme. Among those who earned 0.96m-1.3m in 2015, 15.98% had social insurance deductions exceeding 10,000 JPY. However, the majority of them seem to be either those who left a fulltime job during the year or those started a fulltime job during the year. As an estimate for the % of those who were not in transition from or to fulltime work, we calculated % of those whose income were less than 1.3m for 2015-2017 among those who earned 0.96m-1.3m in 2016,[24] which was 37.5%. 37.5% of 15.98% is 5.99%. [25]

The calculation above implies only about 6% of married female part-time workers within the bunching region (0.96m-1.3m) were covered by Employee's Insurance. Since we cannot observe hours of work and thus the room for further adjustment is limited, we ignore the possibility that workers earning less than 1.3m enrolled to Employee's Insurance through their employer for simplicity. Note that women married to self-employed men are excluded from our sample, thus most of them would have been be eligible to be covered by husband's insurance if they had not enrolled to Employee's Insurance by themselves. Hence, in the theoretical framework, they are considered as those who cannot adjust their earnings due to frictions because there is no reason to choose to pay the social insurance while earnings less than 1.3m.

B.2 Budget constraint for 2015-2016

Social insurance: If $X < 1.3m$, $SI = 0$. If $X \geq 1.3m$, $SI = 0.3m + (X - 1.3m) * 0.1$.

Spousal deductions: Spousal deduction started to phase out at 1.05m. Spousal deduction was 380000 for national tax and 33000 for local tax if $X \leq 1.05m$. At $X = 1.3m$,

[23] Employment Insurance is mandatory for all employees working more than 20 hours per week, and the amount is about 0.5% of salary (exact rate changes every year).

[24] We use 2016 instead of 2015 because income earned in 2014 is not available.

[25] A similar number was obtained using the self-reported social insurance coverage and income from JPSC: among 473 married women whose annual income was below 1.3m in 2015, 29 were categry 2 insured (i.e. covered by own Employee's Insurance) and earned less than 1.3m in 2014 and 2016. 29/473=6.1%.

the amount of deduction is 110000 for both local and national taxes. The deduction becomes zero at 1.41m, this is within the dominated region due to the social insurance notch. So, we simplify the phase out of spousal deduction as a lump-sum change in deduction from husbands income that kicks in at 1.3m.

Since the median national income tax rate for husbands of women whose income is between 0.96m-1.3m is 10.0%, the loss from losing the spousal deduction (SD)is 380,000* 10% of national income tax on huband's income + 33,000* 10% of local tax on husband's income = 71,000 JPY.

Budget constraint just above 1.3m

The take-home income just above 1.3m can be written as follows

$$X - SI - national_tax - local_tax - SD \tag{A.1}$$

$$= X - SI - (X - 1.03m - SI) * 0.05 - (X - 0.98m - SI) * 0.1 + 5000 - 71000 \tag{A.2}$$

$$= 0.85X - 0.85SI + 1.03m * 0.05 + 0.98m * 0.1 - 5000 - 71000 \tag{A.3}$$

$$= 0.85X - 0.85(0.3m + (X - 1.3m) * 0.1) + 73500 \tag{A.4}$$

$$= 0.765X - 71000 \tag{A.5}$$

B.3 Budget constraint for 2017

From October 2016, those working at firms with more than 500 employees have to enroll to Employee's Health and Pension Insurance if their monthly salary exceeds 88,000 yen and weekly work hours exceeds 20 hours. Hence, for those working more than 20 hours/week at firms with more than 500 employees and earns more than 88,000 yen/month, $SI = 0.142X$ and

$$X - SI - national_tax - local_tax - SD \tag{A.6}$$

$$= X - SI - (X - 1.03m - SI) * 0.05 - (X - 0.98m - SI) * 0.1 + 5000 - 71000 \tag{A.7}$$

$$= 0.85X - 0.85 * 0.142X + 1.03m * 0.05 + 0.98m * 0.1 - 5000 - 71000 \tag{A.8}$$

$$= 0.7293X + 73500 \tag{A.9}$$

According to the Labour Force Survey, among married non-regular female workers aged 25-60, 33% were working at firms with more than 500 employees. Among them, however, if the hourly wage exceeded 1250, the annual income reached 1.3m threshold before the weekly hours reached 20. According to the Basic Survey of Wage Structure, 1250 is around the 75 percentile of hourly wage distribution among female part-time workers, thus we assume that 33%*75% = 25% of married women in our sample started to face this insurance scheme from 2017.

The remaining 75% are facing the same budget constraint as 2015-2016:

$$X - SI - national_tax - local_tax - SD = 0.765X - 71000 \tag{A.10}$$

B.4 Budget constraint for 2018-2021

From income earned in 2018, the kink point of spousal deduction/special spousal deduction moved from 1.05m to 1.5m. Thus the loss of spousal deduction was no longer relevant for the 1.3m threshold. Thus, the budget constraint became as follows:

For those working at a firm smaller than 500 employees or working at hourly wages > 1250 (75% of the sample),

$$X - SI - national_tax - local_tax = 0.765X \tag{A.11}$$

For those working at a firm larger than 500 employees at hourly wages < 1250 (25%

of the sample),

$$X - SI - national_tax - local_tax = 0.7293X + 144500 \tag{A.12}$$

B.5 Dominated regions

For those working at firms with more than 500 employees with hourly wages lower than 1250 yen in 2018-2021:

$$0.7293X + 144,500 = 1.3m \tag{A.13}$$

$$X = 1584396 \tag{A.14}$$

Thus no one would have an incentive to choose gross salary income below 1,584,396 yen.

Note that for those working at firms with less than 500 employees in 2018-2021, the dominated region is wider:

$$0.765X = 1.3m \tag{A.15}$$

$$X = 1699346 \tag{A.16}$$

And for years prior to 2018 reform, the dominated region is even wider due to the loss of spousal deduction.

We use 1,584,396, the narrower range, because we cannot observe firm size or hourly wages. Note that the dominated region is used only for calculation of the degree of frictions, and does not affect the observed elasticity. Since we chose a conservative range for the dominated region, we may underestimate the degree of frictions.

C Relevance of minimum wages for female part-time workers in Japan

This appendix section provides evidence supporting our assumption that the majority of married women whose annual salary income is near 1.03 million JPY are paid hourly wages close to the minimum wage. Specifically, we check whether married women who are paid hourly are affected by the minimum wage using the JPSC.

The summary statistics of the JPSC analysis sample are summarized in Table A.5. The total number of married women in each wave is 1000–1600. The percentage of workers paid by hour is increasing, ranging from around 24% in the early 2000s to around 33% in the late 2010's.

Each observation is matched with the minimum wage of the prefecture of residence. Since the survey is conducted in October and the minimum wage is revised on around October 1st, we regress the hourly wage as of October of the year on the minimum wage that is effective in October of the same year.

The 5th-7th columns of Table A.5 the percentage of those whose hourly wage is within 5%, 10%, and 20% from the minimum wage, respectively. Specifically, we take the difference between the hourly wage and the minimum wage and see whether the difference is smaller than 5%, 10% or 20% of the hourly wage. The last two columns show average hourly wage and minimum wage of each year. As the minimum wage increases, the percentage of those near the minimum wage increases, and in the late 2010's, about 80% of married women who are paid by hourly wages are within 20% from the minimum wage.

Using this sample of married women paid by hour, we estimate the following equation:

$$\log(w_{pit}) = \beta \log(MW_{pt}) + \tau_t + \eta_i + \epsilon_{pit} \tag{A.17}$$

where subscripts i, t, p represent individual, year, and prefecture of residence, respectively, w_{pit} is hourly wage of individual i who lives in prefecture p in year t, and MW_{pt} is the minimum wage of the prefecture of residence in the year. τ_t and η_i represent year- and

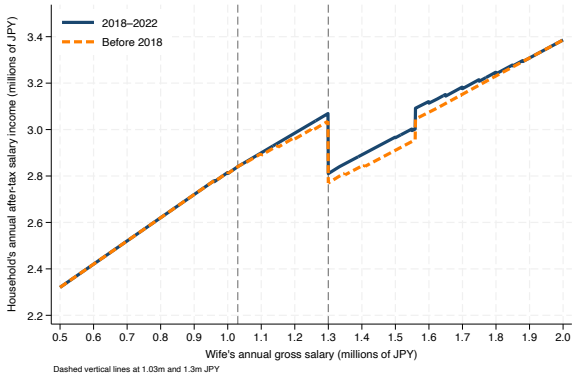
individual- fixed effects.[26] The estimated β is interpreted as the change in the hourly wages caused by the change in the minimum wage.

Table A.6 present the estimated β, with and without year fixed effects. Focusing on the specification with year fixed effects, for all married women paid by hour, a 1% increase in the minimum wage increases the hourly wage by 0.4%. Columns (2)-(4) and (6)-(8) limit the sample to those whose $w_p i, t-1$ was within X percent from the minimum wage. Not surprisingly, whose whose previous year's wage was closer to the minimum wage are more affected by the minimum wage change. Combining the fact that about 80% of married women who are paid by hourly wages are within 20% from the minimum wage, shown in Table A.5, and that a 1% increase in the minimum wage increases the hourly wage by 0.8% for those whose last year's wage was within 20% from the minimum wage, shown in Column (6), changes in the minimum wage substantially affect the hourly wages of married women working part-time.

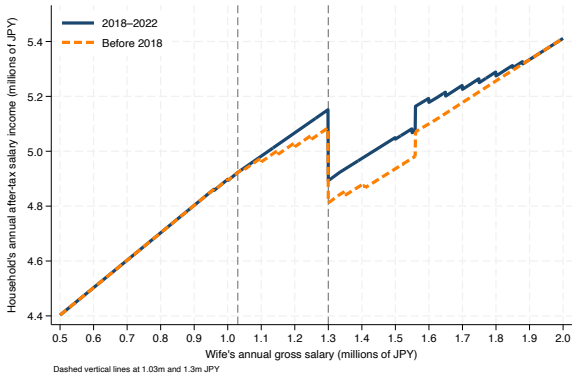
[26]Prefecture fixed effects are ignored because they are absorbed by the individual fixed effects.

Figure A.1: After-tax household income, wife employed at small firm

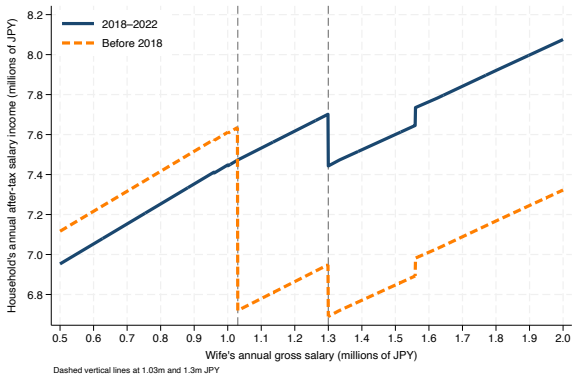
(a) Husband's income = 2 million JPY



(b) Husband's income = 5 million JPY



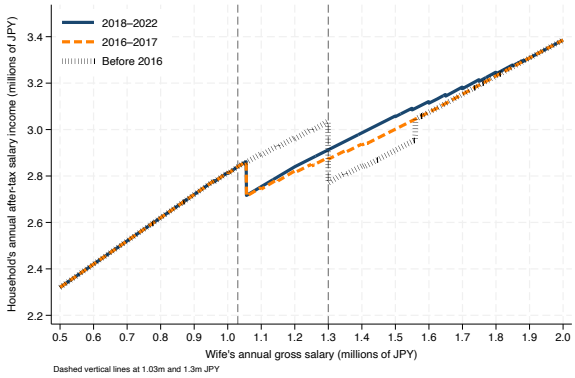
(c) Husband's income = 10 million JPY



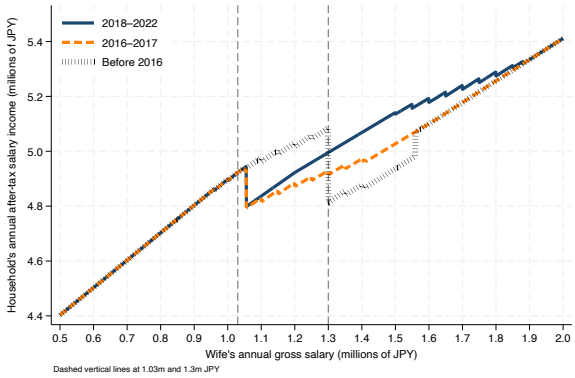
Notes: Simulated calculations.

Figure A.2: After-tax household income, wife employed at large firm

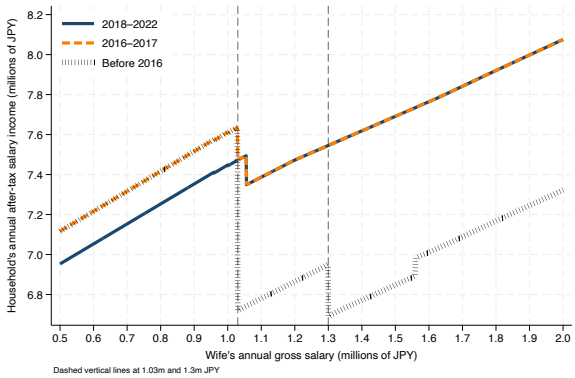
(a) Husband's income = 2 million JPY



(b) Husband's income = 5 million JPY



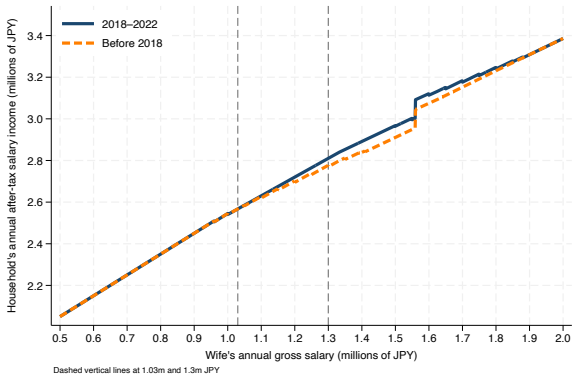
(c) Husband's income = 10 million JPY



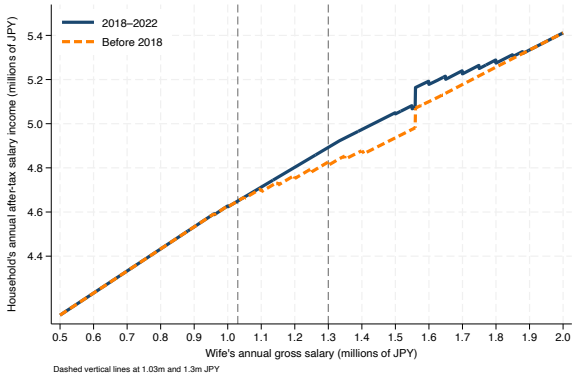
Notes: Simulated calculations.

Figure A.3: After-tax household income, wife employed at small firm, husband non-salaried

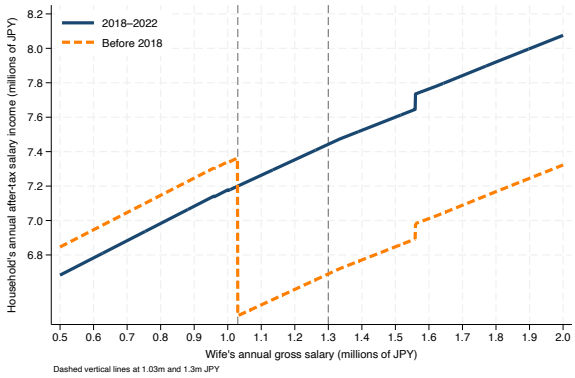
(a) Husband's income = 2 million JPY



(b) Husband's income = 5 million JPY



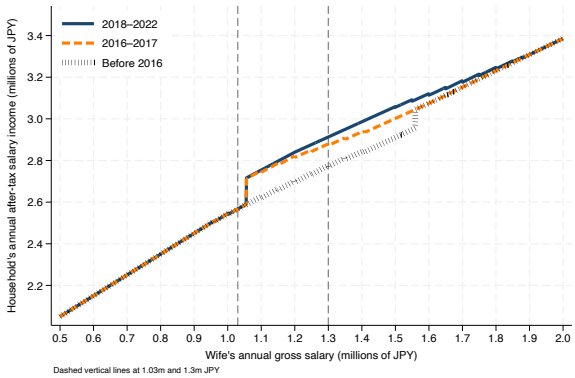
(c) Husband's income = 10 million JPY



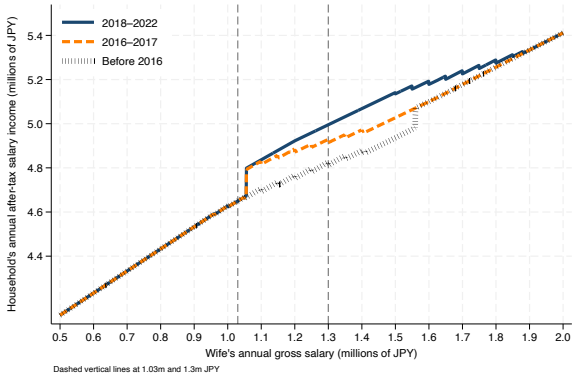
Notes: Simulated calculations.

Figure A.4: After-tax household income, wife employed at large firm, husband non-salaried

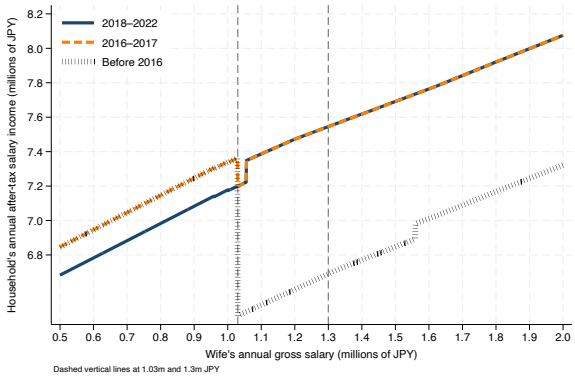
(a) Husband's income = 2 million JPY



(b) Husband's income = 5 million JPY



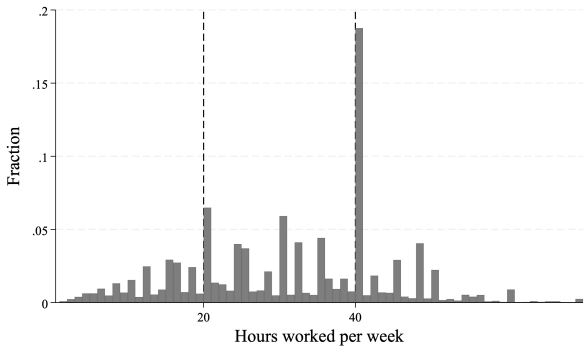
(c) Husband's income = 10 million JPY



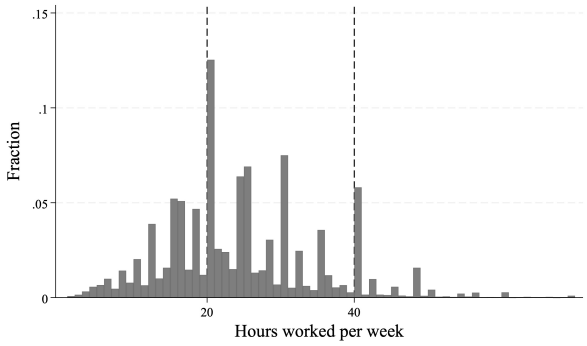
Notes: Simulated calculations.

Figure A.5: Hours worked by income, married women (2015-2021)

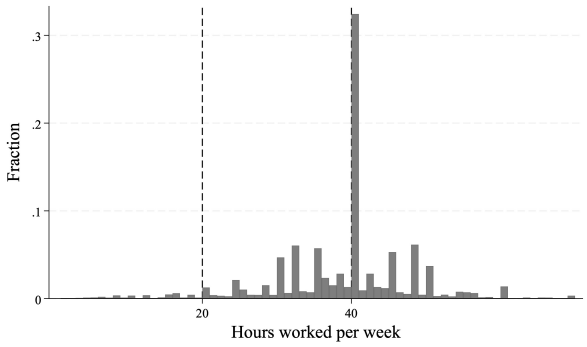
(a) All



(b) Earnings 0.5 - 1.5 ¥(million)



(c) Earnings 1.5+ ¥(million)



Notes: Sample is limited to married women aged 25-60 with positive working hours. Those who reported more than 70 hours (0.4%) or on leave (4.2%) are excluded.
Source: Labour Force Survey Special Questionnaire, 2015-2021.

Table A.1: Employment status of women aged 25-60, LFS 2015-2021

	0.5-1.5 (¥, mil) Married	All Married	All Single	All Total
Employed (%)				
Regular employee	6.74	25.44	49.07	32.77
Non-regular employee	82.7	39.07	30.35	36.37
Other employed	7.26	6.41	4.57	5.84
Unemployed (%)	0.95	1.23	3.70	1.99
Out of labor force (%)	2.36	27.85	12.31	23.03
Total	100	100	100	100

Source: Labour Force Survey Special Questionnaire, all months in year 2015-2021.

Table A.2: Income distribution of employed women aged 25-60 (2015-2021)

(a) Married women				
	Regular employees	**Non-regular employees**	**Other employed**	**All**
Percent of total employed	35.87	55.09	9.03	100
Income (¥, million) earned in the last 12 months				
No income	0.00	0.00	7.00	0.63
<0.5	1.37	10.07	13.70	7.28
0.5 – 0.99	3.07	36.15	20.18	22.84
1 – 1.49	5.19	29.88	15.17	19.70
1.5 – 1.99	6.99	9.78	6.63	8.49
2 – 2.99	21.94	10.21	11.70	14.55
3 – 3.99	22.78	2.59	9.13	10.42
4 – 4.99	16.19	0.74	5.49	6.71
5 – 6.99	15.60	0.39	4.78	6.24
7 – 9.99	5.84	0.13	3.04	2.44
10 – 14.99	0.84	0.05	2.13	0.52
>15	0.19	0.01	1.06	0.17

(b) Single women				
	Regular employees	**Non-regular employees**	**Other employed**	**All**
Percent of total employed	58.42	36.13	5.44	100
Income (¥, million) earned in the last 12 months				
No income	0.00	0.00	1.74	0.09
<0.5	0.52	5.52	19.89	3.38
0.5-0.99	0.84	12.69	10.91	5.67
1-1.49	3.54	26.21	11.61	12.17
1.5-1.99	7.49	21.34	9.31	12.59
2-2.99	28.90	25.17	16.44	26.87
3-3.99	27.27	6.69	10.54	18.92
4-4.99	15.36	1.53	7.21	9.92
5-6.99	11.58	0.64	5.76	7.31
7-9.99	3.73	0.13	3.42	2.41
10-14.99	0.65	0.07	1.99	0.51
>15	0.12	0.02	1.17	0.14

Notes: Those whose income is "no income" in the column of "Other employed" are unpaid family workers in self-employed households. The "All" column is the weighted average of all employees where the weights are individual percent of total employed.

Source: Labour Force Survey Special Questionnaire, 2015-2021.

Table A.3: Comparison between sampled municipalities and national average based on Population Census 2020, percent

	Female		**Male**	
	Our sample	National avg.	Our sample	National avg.
College graduates	23.5	25.6	39.2	40.8
Married	65.8	66.3	61.9	60.9
Employed	76.1	77.2	91.7	92.1
Self employed	3.4	3.4	7.6	7.5
Part-time employee	39.9	39.5	5.3	5.7
Share of employed (percent)				
Manufacturing	9.4	11.5	22.8	22.2
Wholesale and retail	18.0	17.7	13.3	13.0
Medical, health care and welfare	27.6	23.7	6.8	6.0
Other	45.0	47.1	57.1	58.8

Note: add note
add another note

Table A.4: Estimated misperceived tax rates by husband's tax brackets

Parameters	Period	15% (1)	20% (2)	30% (3)	33% (4)
Misperceived MTR using obs. elasticity ρ^k_{obs}					
	2015 - 2017	0.751	0.789	0.779	0.607
	2018 - 2021	0.633	0.704	0.740	0.644
	% change	-15.7%	-10.7%	-5.0%	6.2%
Misperceived MTR using str. elasticity ρ^k_{str}					
	2015 - 2017	0.438	0.506	0.604	0.477
	2018 - 2021	0.347	0.460	0.564	0.484
	% change	-20.8%	-9.0%	-6.6%	1.5%
Misperceived FC using obs. elasticity (in mil. JPY) ρ^n_{obs}					
	2015 - 2017	0.577	0.572	0.577	0.371
	2018 - 2021	0.455	0.488	0.506	0.393
	% change	-21.2%	-14.7%	-12.3%	6.0%
Misperceived FC using str. elasticity (in mil. JPY) ρ^n_{str}					
	2015 - 2017	0.231	0.254	0.351	0.246
	2018 - 2021	0.177	0.240	0.312	0.247
	% change	-23.4%	-5.3%	-11.3%	0.1%

Note: We estimate elasticity for each subgroup defined by husband's tax rate, p and year, and then take the average over the group p and year. MTR denotes marginal tax rates, and FC denotes fixed costs.

Table A.5: Summary statistics of JPSC

Year	Number of married women	Number of married women paid by hour	% paid by hour	Among married women paid by hour				
				within 5% from MW (%)	within 10% from MW (%)	within 20% from MW (%)	avg. hourly wage	avg. minimum wage
2002	1064	252	23.7	7.9	25.8	65.5	850.4	661.1
2003	1366	337	24.7	8.0	23.7	60.5	907.7	661.9
2004	1310	330	25.2	7.9	19.7	58.8	874.1	663.6
2005	1275	331	26.0	8.2	18.7	56.8	881.9	667.1
2006	1243	358	28.8	7.3	16.8	53.4	932.0	670.8
2007	1216	349	28.7	10.3	21.5	58.5	908.6	685.2
2008	1415	392	27.7	12.2	22.7	59.4	911.3	701.2
2009	1403	421	30.0	13.5	26.8	58.4	927.6	710.2
2010	1400	431	30.8	17.9	34.3	68.9	918.6	727.4
2011	1394	432	31.0	18.5	33.8	67.6	944.8	734.1
2012	1377	423	30.7	18.0	36.4	68.8	942.7	744.0
2013	1552	476	30.7	23.7	37.6	71.2	956.1	758.9
2014	1512	481	31.8	25.6	42.0	72.6	963.3	775.1
2015	1471	472	32.1	32.4	49.4	73.1	995.0	793.9
2016	1429	477	33.4	35.2	53.0	76.7	991.7	818.4
2017	1420	476	33.5	43.3	58.8	79.6	1000.3	842.6
2018	1383	453	32.8	42.4	57.2	81.7	1023.6	868.6
2019	1349	446	33.1	47.1	65.7	82.3	1037.2	896.4
2020	1320	430	32.6	37.2	60.5	79.5	1056.6	896.6
2021	1278	436	34.1	45.6	60.3	79.1	1106.5	925.2
N. of obserevations.	27177	8203						
N. of unique individuals	2471	1354						

Notes: TBA.

Source: Japan Panel Survey of Consumers (JPSC).

Table A.6: Association between minimum wage and hourly wage

Sample	All	within 20%	within 10%	within 5%	All	within 20%	within 10%	within 5%
log(mw)	0.626***	0.722***	0.841***	0.964***	0.408***	0.778***	0.833***	1.034***
	[0.014]	[0.012]	[0.014]	[0.018]	[0.071]	[0.069]	[0.113]	[0.175]
year FE	No	No	No	No	Yes	Yes	Yes	Yes
Observations	8,203	4,359	2,451	1,503	8,203	4,359	2,451	1,503
R-squared	0.229	0.516	0.673	0.716	0.24	0.529	0.685	0.726
Number of id	1,354	821	579	416	1,354	821	579	416

Notes: Standard errors in brackets. $***p < 0.01, **p < 0.05, *p < 0.1$.

Source: Japan Panel Survey of Consumers (JPSC).