Is Minimum Wage an Effective Anti-Poverty Policy in Japan?

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Abstract

This paper considers whether minimum wage is a well-targeted anti-poverty policy by examining the backgrounds of minimum-wage workers, and whether raising the minimum wage reduces employment for unskilled workers. An examination of micro data from a large-scale government household survey, the Employment Structure Survey (*Shugyo Kozo Kihon Chosa*), reveals that about half of minimum-wage workers belong to households with annual incomes of more than 5 million yen as a non-head of household. A regression analysis indicates that an increase in the minimum wage moderately reduces the employment of male teenagers and middle-aged, married females, while it encourages the employment of high school age youth.

Key Words: Minimum Wage, Poverty, Targeting, Employment, Japan
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1. Introduction

The media recently have been attracting public attention to poverty issues in Japan. Indeed, in 1999 about 8 percent of households were below the poverty threshold, which is the government criterion for eligibility for livelihood assistance, as reported by Komamura (2003).[2] Whether or not to raise the minimum wage is vigorously debated as a possible way to alleviate the situation of the poor. With heightened public interest on minimum wage as a background, the new minimum-wage legislation enacted in November 2007 requires the government to consider the level of livelihood assistance when determining the minimum wage. The passage of this new legislation paved the way for increasing the minimum wage.

Economists have long discussed whether raising the minimum wage is an effective policy option to alleviate poverty and have tended to take a negative attitude toward it as a variation of price intervention. This discussion dates back to the early 20th century,[3] and a classical work by Stigler (1946) viewed the minimum wage as an ineffective antipoverty policy because minimum-wage workers do not necessarily belong to poor households, and it could reduce the employment of unskilled workers. Whether minimum-wage workers belong to poor households continued to be evaluated by Card

[2] Komamura (2003) estimates that among households presumably eligible for livelihood assistance, only 18.5 percent actually received the assistance.

[3] See Neumark and Wascher (2008) for the history of economic thought on the minimum wage.

and Krueger (1995), Burkhauser et al. (1996), and Neumark and Wascher (2008), who concluded that in the U.S. a non-negligible fraction of minimum-wage workers belong to non-poor households. The minimum wage's negative impact on employment has been widely studied in the U.S., and the evidence is reviewed in Brown et al. (1983), Card and Krueger (1995), Kennan (1995), Brown (1999), and Neumark and Wascher (2008). Although the influential book by Card and Krueger (1995) changed the way economists think about the minimum wage's role in a labor market that is not perfectly competitive, as evidenced by Manning (2003), economists' general attitude toward the minimum wage continues to be skeptical because of its negative impact on employment and its potential to reduce opportunities for skill formation, as represented by Neumark and Wascher (2008).

In spite of intense interest in the role of the minimum wage in Japan, not much is known about minimum-wage workers and whether raising the minimum wage would decrease employment. Abe and Tanaka (2007), Abe and Tamada (2008), and Kambayashi, Kawaguchi, and Yamada (2009) consistently pointed out that the minimum wage has a significant impact on the wage distribution, particularly on part-time workers in rural areas. These findings may give the impression that raising the minimum wage is an effective anti-poverty policy; however, Tachibanaki and Urakawa (2007) reported that

a large portion of minimum-wage workers are not household heads and such workers tend to belong to wealthier households than non-minimum-wage workers, based on Japan's General Social Survey, 2000-2002, with annual sample size around one thousand.

Evidence regarding the effect of minimum wage on employment is still mixed. Kawaguchi (2009) did not find systematic evidence of employment loss caused by an increase in the real value of minimum wage based on time-series data that covered 1983-2006. Exploiting regional variation in the real value of minimum wage, Tachibanaki and Urakawa (2007) did not find evidence of employment loss caused by a high minimum wage based on prefecture-level, cross-sectional household data from 2002; while Yugami (2005) found a positive correlation between the unemployment rate and the minimum wage based on prefecture-level census data from 2000. Ariga (2007) found that a higher prefectural minimum wage increased the wages of high-school graduates and suppressed new job openings for them based on prefecture-level, cross-sectional data from the Employment Service Bureau of the Ministry of Labor and Health. None of the above studies exploited prefecture-level panel data to estimate the effect of minimum wage on employment, allowing for prefecture unobserved heterogeneity. However, an unobserved macro shock could be correlated with the time series change of the minimum wage, or a regional, unobserved heterogeneity could be

correlated with the level of the regional minimum wage. Thus, controlling for both an unobserved macro shock and unobserved, prefecture heterogeneity using prefecture-level panel data is indispensable. Kambayashi, Kawaguchi, and Yamada (2009) explored 1997-2002 prefecture-level panel data and using a fixed-effects estimation[4] found that a higher real value of the minimum wage reduces employment for young men below age 22 and women between the ages of 31 and 59.

The purpose of this paper is to examine the backgrounds of minimum-wage workers and minimum wage's effect on employment, as well as schooling decisions, based on micro data from the Employment Status Survey (ESS) between 1982 and 2002. The analysis reveals that about 4 percent to 10 percent of male workers and 22 percent to 41 percent of female workers were employed at the minimum wage in 2002, while the corresponding numbers were about 3 percent to 6 percent for males and 22 percent to 36 percent for females in 1982. An examination of minimum-wage workers' backgrounds reveals that about half of them belong to households with an annual income of more than 5 million yen as a non-head of household.

The variation in the fraction of workers affected by a minimum-wage hike

[4] Using another approach, Kawaguchi and Yamada (2008) analyzed a panel of individuals and found that those low-wage workers who are directly affected by minimum-wage hikes are more likely to lose their jobs after minimum-wage hikes, allowing for individual fixed effects.

resulting from the heterogeneity of wage distributions across prefectures is exploited to evaluate the effect of a federal minimum-wage increase on employment across states. The estimation results indicate that a minimum-wage hike decreases employment among teenage males and middle-aged, married females. Its magnitude is small for teenage males, but moderate for middle-aged, married females. An analysis of schooling and employment choices among high school age teenagers indicates that an increase in the real minimum-wage level encourages youths to work and induces them to drop out of high school. The findings show that higher minimum wages reduce the employment rate of teenage youth while encouraging employment of high school age youth. The combination of these two factors implies that the minimum-wage hike negatively affects high school graduates' labor market prospects.

This paper is organized as follows. Section 2 introduces the institutional background of the minimum-wage system. Section 3 explains the data and the time-series trend of the minimum wage. Section 4 examines the background of minimum-wage workers and considers whether a minimum-wage hike helps poor households. Section 5 evaluates the minimum wage's effect on employment. Section 6 reports the minimum wage's effect on the choices of 16- and 17-year olds. The last section derives conclusions.

2. Institutional Background

The minimum wage in Japan became statutory in 1959. There are two distinct minimum wage systems: a regional minimum wage set by prefectures that applies to all workers, and an industry minimum wage that is applied on top of the regional minimum wage to workers in specific industries in specific prefectures. This paper focuses only on the regional minimum wage because the industrial minimum wage does not have extensive coverage and is gradually being abolished,[5] and the specific industries that the industrial minimum wages are defined for cannot be exactly matched to the industry codes in the data.

The regional minimum wages are determined by the following process. First, a national council on minimum wage, which consists of members representing the public interest (retired bureaucrats and academics), employers, and employees (union leaders), provides "criteria (*meyasu*)" for minimum-wage increases for four distinct regional blocks that include all 47 prefectures divided roughly by wage level. Second, local minimum wage councils deliberate and decide their own minimum-wage levels, but the criteria suggested by the national council have a significant influence on the local

[5] The report by *Saitei Chingin no Arikata Kenkyukai* (minimum wage study group) of the Ministry of Health, Labor and Welfare (2005) issued a recommendation for the revision of industrial minimum wage, including a possibility of its abolishment. In the fiscal year 2000, 4.5 million workers were covered by industry minimum wage while 52 million workers were covered by regional minimum wage according to the press release of the ministry of labor and welfare on January 25 in 2001.

councils' final decisions. In the national council's negotiations, the opinions of representatives of the public interest are conclusively important because there are always conflicts between the representatives of employees and employers that make it very difficult to reach a unanimous agreement on the amount of a minimum-wage increase. In this situation, the opinions of council members representing the public interest are respected as a means of reaching an agreement, even though these opinions seem to be strongly affected by a rate of average wage increase that is based on a government establishment survey implemented for the purpose of minimum-wage determination.[6]

3. Minimum Wage Variables and Data

This study utilizes the Employment Status Survey (ESS, *Shugyo Kozo Kihon Chosa*) from the years 1982, 1987, 1992, 1997, and 2002. The ESS is conducted every five years on household members age 15 or older from a sample of approximately 440,000 households that is representative of the complete population. The survey collects information on household members and each member's labor force status on October 1 of each survey year. The file contains about 1 million individuals, with equal numbers of males and females, for each year the survey is conducted.

[6] *Chingin Kettei Joukyo Chosa* [Survey of Current Wage Determination] by the Ministry of Health and Labor. This survey takes place every June and samples about 10,000 establishments in manufacturing, wholesale and retail, restaurants, and service industries that hire no more than 30 employees.

Two variables are defined to express the value of minimum wages in relation to wage distributions in regional labor markets: the fraction of minimum-wage workers (FMW) and the Kaiz index. FMW is defined as the percentage of workers earning the minimum wage or less out of all employed workers.

Information regarding the minimum wage by prefecture is obtained from the Pandect of Minimum Wage Determination (*Saitei Chingin Kettei Yoran*). While the minimum wage is basically provided as an hourly rate,[7] the survey only records individuals' annual earnings in ranges. To compare annual earnings with the minimum wage, we calculate *minimum wage annual income*, which is defined as the annual earnings of an individual if he works at the minimum wage all year, as the product of minimum wage by weekly work hours and the annual number of workdays divided by 5.[8] Because annual work-days and weekly work hours are also reported in ranges, we construct two different ranges of minimum-wage earnings by assigning a maximum and minimum value to one range bracket for work-days and one range bracket for weekly work hours.[9] The actual minimum-wage earnings should lie between the two different

[7] Until 2002, minimum wage was also defined by daily wage as well as hourly wage, but this was abolished after 2002.
[8] 5 is the number of week-days.
[9] The ranges of annual workdays are: less than 50, 50-99, 100-149, 150-199, 200-249, and 250 and above for all survey years. The ranges of work hours are: less than 15, 15-21, 22-34, 35-42, 43-48, 49-59, and 60 and above for 1987; less than 15, 15-21, 22-34, 35-42, 43-45, 46-48, 49-59, and 60 and above for 1992; less than 15, 15-21, 22-34, 35-42, 43-48, 49-59, and 60 and above for 1997; less than 15, 15-19, 20-21, 22-34, 35-42, 43-48, 49-59, and 60 and above for 2002. For the lowest and highest bracket ranges of annual workdays, 0 and 260 days are assigned, respectively. For the lowest and highest bracket ranges of weekly

minimum-wage earnings levels used here. The annual earnings, also reported in ranges, are defined as the minimum value of a range bracket.[10] A minimum-wage worker is defined as a worker earning less than the minimum-wage earnings. FMW is defined as the number of minimum-wage workers divided by the number of employed workers. The FMW using the maximum and minimum values of workdays and work hours are called the fraction-of-minimum-wage-workers minimum (FMW, min) and the fraction-of-minimum-wage-workers maximum (FMW, max), respectively. In the above process, workers working less than 200 days in a year on irregular work schedules, which consist of around 12% of the sample, are dropped because the survey does not record their work hours and workdays. This data limitation may underestimate FMW if those workers working limited days without a regular work schedule are more likely to receive minimum wages than the workers working on regular schedules. Self-employed workers and family workers are also excluded from the sample because they are not covered by the minimum wage law.

The Kaiz index is defined as the minimum wage divided by the average wage at

work hours, 0 and 80 are assigned, respectively.

[10] The annual income ranges denominated by thousand yen are: less than 500, 500-990, 1,000-1,490, 1,500-1,990, 2,000-2,490, 2,500-2,990, 3,000-3,990, 4,000-4,990, 5,000-5,990, 6,000-6,990, 7,000-7,990, 8,000-8,990, 9,000-9,900, 10,000-14,900, and 15,000 or above for year 2002. The ranges for 1992 and 1997 are: less than 500, 500-990, 1,000-1,490, 1,500-1,990, 2,000-2,490, 2,500-2,990, 3,000-3,990, 4,000-4,990, 5,000-6,990, 7,000-9,900, 10,000-14,900, and 15,000 or above. The ranges for 1987 and 1982 are: less than 500, 500-990, 1,000-1,490, 1,500-1,990, 2,000-2,490, 2,500-2,990, 3,000-3,990, 4,000-4,990, 5,000-6,990, 7,000-9,900, and 10,000 or above. To compare annual income with each year, this study integrates income ranges of 5 years with that of 1982.

an hourly rate. The average hourly wage is determined from prefecture-level data from the Basic Survey on Wage Structure (BSWS) because hourly wage can be precisely calculated from monthly hours of work and earnings based on payroll records.[11] We calculate the average wage at an hourly rate as the scheduled monthly wage divided by the scheduled monthly hours of work. While both FMW and Kaiz variables measure the value of the minimum wage as it relates to wage distributions, the two measures exploit different information: FMW exploits information from the lower part of the wage distribution relative to the minimum wage, while the Kaiz index captures the mean of the wage distribution relative to the minimum wage. Thus, it is possible for the Kaiz index to be low even if FMW is high when the wage distribution has a fat right tail.

4. Characteristics of Minimum-Wage Workers

Table 1 reports the breakdown of minimum-wage workers by education, sex, and age categories. The FMW among junior-high and high-school graduates is higher than that among college graduates. Both younger and older workers are more likely to be minimum-wage workers. It is also notable that the FMWs increased in all categories,

[11] The Japanese government conducts the Basic Survey on Wage Structure (BSWS) annually. This survey includes observations randomly chosen from almost all regions and industries, except agriculture, in Japan. The establishments in the sample, which are randomly chosen in proportion to the size of prefectures, have 10 or more employees in both private and public sectors, or belong to private firms with 5 to 9 employees. Employees are also randomly selected from among the establishments included in this survey. This study uses prefecture-level data disclosed by the Japanese government.

from 1982 to 2002. Table 2 indicates the FMWs and the Kaiz index by prefectures. Both the FMW and the Kaiz tend to be high in rural areas. Figures 1A and 1B show the histograms of annual earnings normalized by the minimum value, defined as: (Annual earnings - the minimum value of minimum wage earnings) / the minimum value of minimum wage earnings. We clearly confirm that the minimum wage is much more relevant to the wage distribution in a low-wage prefecture (Okinawa) than in a high-wage prefecture (Tokyo).

Table 3 reports FMW by industry and indicates that FMWs in the wholesale-and-retail-trade and accommodation-eating-drinking industries increased from 1982 to 2002. Table 3 also indicates that part-time workers are more likely to be minimum-wage workers than regular workers. Workers in smaller firms are more likely to be minimum-wage workers than workers in larger firms.

Table 4 examines whether minimum-wage workers belong to low-income families. We classify minimum-wage workers by the status of their head-of-household and six annual household income categories (in thousands of yen): less than 1,000, 1,000-1,990, 2,000-2,990, 3,000-3,990, 4,000-4,990, and 5,000 and above. Table 4 tabulates the distribution of household income among minimum-wage workers and non-minimum-wage workers. As far as heads-of-households are concerned,

minimum-wage workers are more likely to belong to low-income households than non-minimum-wage workers. However, around 70 percent of minimum-wage workers are not household heads. As shown in Column (4), the household heads of low-income families whose annual income is less than 3 million yen comprised only around 15% of minimum-wage workers in 2002. The major segment of minimum-wage workers (around 50% in 2002) belongs to middle- and high-income families (over 5 million yen) as a non-head-of-household.

Table 5 reports the composition of minimum-wage workers with respect to sex, age and level of education. We can see that junior-high and high-school graduates and middle-aged women (30-59 years old) are more likely to be minimum-wage workers. In particular, more than a half of minimum-wage workers are middle-aged women, many of whom may be part-time workers.

The nationwide data in Figure 2 show that the Kaiz index and FMW variables move together in 1982-2002. Figure 3 includes the results of three typical prefectures: Aomori and Okinawa (low-wage prefectures) and Tokyo (high-wage prefecture). Both the FMW and Kaiz index are high in Aomori and Okinawa but low in Tokyo, as mentioned before. The time trends in the three prefectures are similar to the nationwide trend, but the magnitude of the variation differs across prefectures.

Figure 4 illustrates the FMW among junior-high and high-school graduates by four different age categories and sex. Figure 4A indicates that younger male workers, especially teenagers, tend to be minimum-wage workers, but few male workers in the 25-59 age group are. The FMW is high among females regardless of age, as reported in Figure 4B. Both Figures 4A and 4B report that the FMW among young workers increased from 1992 to 2002.

5. Minimum Wage's Effect on Employment

We empirically investigate the effect of minimum wage on the employment of workers who are more likely to be affected by a minimum-wage hike. The analysis in the previous section reveals that a large percentage of youth, elderly, and married females receives wages near the minimum wage. To restrict our analysis to the demographic groups that are presumably heavily affected by the minimum wage, we focus on the following seven categories of workers: male teenagers (15-19 years old), male young adults (20-24 years old), male elderly (over 60 years old), female teenagers, female young adults, female elderly, and middle-aged (25-59 years old) married females.

To establish the causal effect of a minimum-wage hike on employment, we examine the relation between the fraction of workers who are affected by the

minimum-wage hike and the change in employment using prefecture-level variation. More specifically, we calculate the fraction of workers who are affected by a minimum-wage hike (*Fraction Affected, FA*), in other words, workers whose wage is above the current minimum wage but below the revised minimum wage. This FA takes different values across prefectures, even if the amounts of the minimum-wage hike are homogeneous across prefectures, because the minimum-wage hike is more prevalent in the low wage prefectures, such as Okinawa, than in high wage prefectures like Tokyo. Card (1992) originally proposed using the FA variable to examine the effect of the federal minimum-wage increase on employment, because the uniform increase of the minimum wage across states has different impacts across states depending on each state's wage distribution.

The following model is estimated to examine the effect of FA on the change in the employment rate of worker group k in prefecture i between years t and t-5:

$$(2)\quad \Delta E_{i,t}^{k} = \beta_0^k + \beta_1^k FA_{i,t-5} + \beta_2^k \Delta AW_{i,t} + \beta^k \Delta X_{i,t}^{k} + Y_t \gamma^k + e_{i,t}^{k},$$

where $\Delta E_{i,t}^{k}$ is the change in the employment rate of category *k* in prefecture *i* between years *t* and *t-5*; $FA_{i,t-5}$ is the fraction of workers who are affected by the minimum-wage hike between *t* and *t-5*; $\Delta AW_{i,t}$ is the change in the average wage of middle-aged (25-59 years old) male workers; $X_{i,t}^{k}$ is a set of explanatory variables (the proportion of the

population in the relevant categories and the unemployment rate of middle-aged males); and Y_t is a set of dummy variables for year t. We adopt two definitions of FA: FA_min and FA_max. FA_min is the fraction of workers who satisfy the condition, $MWIncome_{it-5}^{\min} \leq Income_{it-5} < MWincome_{it}^{\min}$. The minimum of the minimum-wage annual income, $MWIncome_{it}^{\min}$, is calculated using the hourly minimum wage and the minimum value of annual work hours. FA_max is similarly defined based on the maximum of minimum-wage annual income. Card and Krueger (1995) claimed that an increase in the average wage relative to output price causes firms to cut employment through a reduction in output production. We control this scale effect by including the change in the average adult male's wage ($AW_{i,t}$) and the year dummy variables as explanatory variables. The estimation method is weighted least squares (WLS), with the weight being the inverse of the standard error of the dependent variable.

Table 6 reports the descriptive statistics for the regression analysis sample. The FA has a mean around 4%-6% with sufficient variation across years and prefectures. Table 7 displays the fraction of workers affected by a minimum-wage hike for a five-year period, and we can confirm that FA tends to be higher in rural, low-wage areas, such as Aomori and Okinawa, than in high-wage areas such as Tokyo. It also displays a variation over time within a prefecture.

To illustrate the regression results for subsamples, Figure 5A and 5B visually reports the regression results for male and female teenagers between 1997 and 2002. The fraction of workers affected by the minimum-wage hike (FA) on the horizontal axis is the residual from the regression of FA on other explanatory variables. Both figures confirm a weakly negative relation between regression-adjusted FA and the change in the employment rate over the five-year period.

Table 8 reports the comprehensive results of regressions by demographic groups. Table 8A Columns (1) and (2) indicate that the higher FA results in the reduction of the employment rate among male teenagers. A one-percent increase in FA reduces the employment rate by about 0.2 percentage point. Considering that the average employment rate of teenage males is around 16 percent (Table 6) and the average FA is around five percent, the magnitude is small. Columns (3) and (4) indicate the negative impact of higher FA on the employment rate of young adults, but the coefficients are not statistically significant. Higher FA does not affect the employment rate of elderly people.

Table 8B reports the results for females. The estimated coefficients are consistently negative and some of the coefficients are statistically significant. However, all results depend on the choice of FA variable, and it is rather difficult to see a clear relation between FA and the employment rate from this table. Table 8C reports the results

for married females in the 25-59 age group who are likely to be employed as part-time workers. The estimated coefficients clearly indicate that the minimum-wage hike reduces employment among members of this group. A one-percent increase in FA decreases the employment rate by 0.4-0.8 percentage point. Considering the average of FA is around five percent and the employment rate of this group is roughly 66 percent, the magnitude is rather moderate.

6. Minimum Wage's Effect on the Choices of Youth, Ages 16-17

The effects of minimum wage on the outcomes of youths are not limited to employment but also include schooling decisions. Cunningham (1981) and Ehrenberg and Marcus (1980) examined this subject by arguing that the minimum wage's effect on schooling decisions is complex because it affects both the opportunity cost of schooling and the return to schooling. The opportunity cost of attending high school is the wage that high-school-age youth expect to receive in the labor market. If the employment-reduction effect is limited, then a minimum-wage hike may increase the expected wage; in contrast, with a significant employment-reduction effect the expected wage may decrease. Minimum wage also affects the return to schooling through a modification of the wage structure. If the minimum wage reduces the labor demand for low-skilled workers, it may

increase the demand for skilled workers through a substitution effect, which may lead to a higher return to education. In our context, an increased minimum wage may reduce the demand for part-time jobs among high-school students or high-school dropouts, and increase the demand for high-school graduates. If a minimum-wage increase does not reduce employment, however, even high-school dropouts can earn a higher wage and are therefore less likely to return to education because of the minimum-wage increase. Overall, minimum wage has a complex effect on high-school age youths' schooling decisions through the opportunity cost of attending high school and the relative value of returning to high school to receive a diploma.

In addition, Ehrenberg and Marcus (1982) emphasized the importance of household liquidity constraints. If a youth belongs to a household that is liquidity-constrained, she may finance her studies by working part-time. In this scenario, increasing the minimum wage may reduce employment as well as school attendance. These theoretical complexities suggest the importance of treating youths' decisions about schooling and employment jointly.

This section investigates the minimum wage's effect on young people's choice between employment and school enrollment. We focus on high-school age individuals, 16 and 17 years old, and classify them into the following exclusive categories to capture

the possible joint decision of schooling and employment: (a) not in school and not employed, (b) in school and not employed, (c) in school and employed, and (d) not in school and employed. The empirical model used in this section is the aggregate data version of Neumark and Wascher (1995), which is the same model that was used in the previous section except for the dependent variables. As in the employment analysis, we exploit the prefectural variation of the fraction of workers affected by the minimum-wage hike. The estimation model is described as follows:

$$(2)\quad \Delta p^{k}_{i,t} = \beta^{k}_{0} + \beta^{k}_{1} FA_{it-1} + \beta^{k}_{2} \Delta AW_{j,t} + \Delta X^{k}_{j,t} \beta^{k} + Y_{t} \gamma^{k} + \varepsilon^{k}_{j,t},$$

where $p^{k}_{i,t}$ is the population of each category *k* divided by the relevant-aged population in prefecture *i* and year *t*; FA is the fraction of workers affected by the minimum-wage hike in the five-year period; and AW, X, and the other variables are the same as in the previous section. The estimation method is weighted least squares (WLS), in which the inverses of the standard errors of the dependent variables are used as weights. The above model is estimated based on a sample that includes only young people 16 and 17 years old. Some 15 and18 year olds are also high-school age depending on the quarter of their birth, but the birth quarter is not recorded before the 1997 survey; therefore, we cannot restrict the sample to include 15 and 18 year olds.

Table 9 reports the summary statistics of the analysis sample for the choice of

youths. Around 93 percent of 16-17 year-old youths are in school without employment, while 2.5 percent are in school and work part-time jobs. Of the remaining five percent, more than three percent are out of school and employed while 2 percent are idle.

Table 10 presents the estimation results. For all estimations, the changes in proportions of youth who are in school but not employed are treated as the base category. Panel A reports the regression results using the fraction of workers who are affected by the minimum-wage changes as an independent variable. The change in the fraction of workers who are affected by a minimum-wage hike is defined by a range as in the previous analysis, because the definition of minimum-wage workers depends on whether we use the minimum hours of work or the maximum hours of work to define minimum-wage annual income. Columns (1) and (2) report the effect of the fraction affected on the change in the fraction of workers who are out of school and not employed. Regardless of the measurement of the fraction of workers affected by the minimum-wage hike, the minimum-wage hike did not significantly change the fraction of youths in this category. Columns (3) and (4) show that the fraction of youths who were employed while attending school increased when the minimum-wage hike affected more workers. To quantify its impact, let us think about the counterfactual situation that Okinawa did not increase its minimum wage between 1997 and 2002, and the fraction affected was zero

instead of the actual 4.54 percent reported in Table 7. The coefficient estimate is 0.30 (Column (4)); thus the estimated effect on the increase in the probability of the choice to stay in school and be employed decreases by 1.359 percentage points. This is a large effect, given that only 2.5 percent of youths work while attending school (Table 9). Columns (5) and (6) report that the increase in the fraction of workers affected by a minimum-wage hike increases the probability of youths to be out of school and employed. The estimated magnitude is about one third of the effect on the choice of being in school and employed.

Overall, the higher the fraction of workers who are affected by the minimum-wage hike, the higher the fraction of youths in employment, either while attending high school or dropping out of high school. In particular, estimates indicate that a higher minimum wage relative to the regional wage distribution encourages high-school students to work as part-time workers. An examination of the long-term consequence of the minimum wage on skill formation and labor-market outcomes, as conducted by Neumark and Nizalova (2007) for the US, remains unwarranted..

7. Conclusion

This paper aimed to answer the following three questions based on Japanese data.

First, do minimum-wage workers belong to low-income households? Second, what are the minimum wage's effects on employment among populations that are marginally attached to the labor market? Third, what are the minimum wage's effects on the employment and schooling choices of 16- and 17-year-olds?

Five waves of the Employment Status Survey (ESS), from 1982, 1987, 1992, 1997, and 2002, were used to calculate the percentage of workers earning the minimum wage. The annual earnings and work-hours reported in range brackets enabled us to calculate the minimum and maximum number of minimum-wage workers. The minimum fraction of minimum-wage workers was around 3%-4% between 1982 and 2002, while the maximum fraction was 6%-10% during the same period for males. The corresponding figures for females were around 22% and 36%-40%, respectively.

Female workers, workers with low educational backgrounds, workers in rural areas, and workers in retail or food industries were more likely than others to be employed at the minimum–wage level. While workers with weaker labor-market characteristics were more likely to work at the minimum wage, those minimum-wage workers did not necessarily belong to disadvantaged households. In 2002, only around 20 percent of minimum-wage workers were heads-of-households and about half of them belonged to households with annual incomes of 5 million yen or more as a non-household

head. This result confirms the finding of Tachibanaki and Urakawa (2007) that was based on a much smaller dataset.

The analysis results exploiting the cross-prefecture heterogeneity of the fraction of workers affected by a minimum-wage hike indicates that a minimum-wage hike reduces the employment of teenage males and middle-aged, married females. Its magnitude for teenage males is estimated to be small, but that for middle-aged married females is rather large.

The analysis of the minimum wage's effect on the choices of high-school age youths shows us that an increase in the minimum wage encourages employment for young people whether or not they are attending high school. While higher minimum wage relative to regional wage decreases teenage male employment, it positively affects the employment of high-school age youths. The combination of these two pieces of evidence implies that a minimum-wage increase relative to the regional wage distribution will have a strong negative impact on male high-school graduates. The minimum wage's long-term effect on the skill formation and long-term labor-market outcomes of young people has yet to be examined. Overall, a rising minimum wage does not seem to be a powerful policy for alleviating poverty in Japan because it is not well targeted toward poor households and it reduces the employment of less-skilled workers. Adopting a more

direct anti-poverty policy, such as an earned-income tax credit (EITC), would be one viable policy alternative.[12]

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[12] Recent studies by Leigh (2009) and Rothstein (2008), however, report that the expansion of EITC suppresses the wages of low-skilled workers because it encourages their labor supply.

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Table 1: Fraction of Minimum Wage Workers by Education, Sex, and Age Categories.

Year	1982		2002	
Fraction of Minimum Wage Workers (FMW)	FMW Min	FMW Max	FMW Min	FMW Max
Education (%)				
Junior High School	14.92	24.37	18.47	33.47
High School	9.17	16.79	13.48	26.20
Junior College	7.09	13.57	11.56	23.93
College	1.78	3.94	3.06	7.39
Sex (%)				
Male	2.80	6.48	4.42	10.48
15-19	26.47	44.31	38.95	61.78
20-24	7.86	20.36	14.93	33.98
25-29	2.40	6.91	4.69	14.58
30-39	0.91	2.56	2.07	6.23
40-49	0.70	2.06	1.39	3.93
50-59	1.46	3.66	1.84	4.61
60-	9.18	16.59	9.52	19.64
Female	22.22	36.16	22.11	40.74
15-19	27.74	43.84	48.86	71.02
20-24	13.59	26.10	20.78	41.56
25-29	14.79	25.22	13.38	29.23
30-39	24.51	39.09	19.80	36.33
40-49	24.70	40.34	22.52	42.02
50-59	24.22	37.93	22.52	41.72
60-	37.45	51.85	33.94	54.21

Note: The fraction of minimum-wage workers is defined as the number of minimum-wage workers among all employed workers. Minimum-wage worker is defined if imputed minimum-wage annual earnings are below reported annual earnings. Imputed minimum-wage annual earnings are calculated in two ways: one based on the minimum values of workdays and work hours, and the other based on the maximum values of workdays and work hours. The minimum-wage worker defined by the former method is the minimum number of minimum-wage workers and the latter method is the maximum number of minimum-wage workers. Thus, the resulting fraction of minimum-wage workers has its bound ranging from FMW min to FMW max.

Table 2: Percent of Workers Earning less than the Minimum Wage and the Kaiz index.

Year	1982			2002			Year	1982			2002		
M. W. Variable	FMW min	FMW max	Kaiz	FMW min	FMW max	Kaiz	M. W. Varriable	FMW min	FMW max	Kaiz	FMW min	FMW max	Kaiz
Hokkaido	9.6	15.4	0.38	15.0	26.0	0.40	Shiga	8.4	14.7	0.35	9.8	20.5	0.36
Aomori	12.7	21.8	0.43	14.6	26.9	0.44	Kyoto	8.4	14.4	0.35	12.8	24.9	0.37
Iwate	13.2	22.9	0.42	13.7	25.4	0.44	Osaka	7.7	16.3	0.33	12.2	24.9	0.35
Miyagi	9.1	16.1	0.37	11.4	21.6	0.37	Hyogo	7.5	13.8	0.33	11.6	22.9	0.36
Akita	14.3	23.3	0.45	14.0	26.2	0.43	Nara	7.6	12.4	0.35	9.8	20.0	0.36
Yamagata	12.0	21.3	0.44	11.4	22.0	0.42	Wakayama	9.6	16.0	0.35	13.0	24.8	0.39
Fukushima	10.7	19.3	0.40	11.2	21.9	0.39	Tottori	10.4	18.4	0.44	10.3	20.0	0.41
Ibaraki	7.4	13.9	0.37	9.3	20.5	0.36	Shimane	12.7	20.3	0.42	10.2	20.4	0.42
Tochigi	9.1	16.4	0.37	11.7	23.4	0.37	Okayama	10.7	16.3	0.37	12.0	21.0	0.38
Gunma	9.9	17.1	0.38	12.0	23.9	0.38	Hiroshima	8.0	14.7	0.35	11.8	22.6	0.36
Saitama	7.1	13.0	0.35	10.8	22.5	0.37	Yamaguchi	9.8	16.3	0.36	12.5	23.2	0.40
Chiba	7.1	12.8	0.34	9.3	20.3	0.35	Tokushima	12.4	20.2	0.40	11.0	20.8	0.38
Tokyo	8.3	16.0	0.32	8.8	19.5	0.31	Kagawa	9.4	15.9	0.37	10.2	20.1	0.39
Kanagawa	6.7	13.6	0.32	9.2	19.9	0.35	Ehime	12.2	20.6	0.38	12.5	22.9	0.38
Niigata	10.2	19.2	0.42	11.2	21.2	0.42	Kochi	11.3	19.6	0.40	11.9	22.2	0.40
Toyama	9.8	15.9	0.38	9.8	19.4	0.40	Fukuoka	9.6	17.4	0.35	13.6	26.4	0.38
Ishikawa	10.4	17.4	0.39	11.0	23.4	0.40	Saga	11.5	20.0	0.42	13.0	24.8	0.42
Fukui	9.0	15.9	0.40	10.0	20.7	0.39	Nagasaki	11.1	18.9	0.38	14.1	25.8	0.41
Yamanashi	8.2	15.0	0.40	9.9	21.0	0.37	Kumamoto	12.5	22.3	0.41	15.0	28.0	0.41
Nagano	9.5	16.2	0.39	10.1	21.5	0.39	Oita	10.5	18.2	0.39	13.7	25.5	0.40
Gifu	9.5	17.7	0.40	13.5	25.4	0.41	Miyazaki	14.2	24.1	0.43	15.2	28.1	0.43
Shizuoka	9.2	15.4	0.37	10.9	23.6	0.39	Kagoshima	12.6	22.2	0.42	13.7	25.9	0.41
Aichi	8.9	15.3	0.35	11.4	22.6	0.36	Okinawa	14.0	23.5	0.36	19.2	33.6	0.44
Mie	10.7	17.5	0.37	12.9	24.6	0.37							

Note: The same note applies as in Table 1. Kaiz index is defined as a minimum wage divided by the average wage of 25-59 years old male workers.

Table 3: Percent of Workers Earning less than Minimum Wage.

Year	1982		Year	2002	
Fraction of Minimum Wage Workers (FMW)	FMW min	FMW max	Fraction of Minimum Wage Workers (FMW)	FMW min	FMW max
Industry (%)					
Agriculture	22.30	34.63	Agriculture	28.92	44.77
Forestry	3.55	7.59	Forestry	5.61	12.89
Fishery	6.45	11.57	Fishery	12.50	24.88
Mining	2.79	6.09	Mining	4.71	7.17
Construction	5.11	11.85	Construction	5.92	13.13
Manufacturing	11.54	18.89	Manufacturing	10.87	21.41
Electricity, Gas, Heat Supply and Water	2.28	3.31	Electricity, Gas, Heat Supply and Water	1.43	3.43
Communications and Transport	2.17	5.04	Information, Communication and Transport	5.75	15.13
Wholesale and Retail Trade	14.98	26.67	Wholesale and Retail Trade	19.28	35.26
Finance, Insurance, and Real Estate	5.10	10.27	Finance, Insurance, and Real Estate	6.71	16.42
Service	10.26	17.50	Accommodation, Eating and Drinking	29.61	52.37
			Compound Service	5.28	12.83
			Misc. Service	11.18	22.00
Government	3.22	5.31	Government	1.90	5.57
Employment Category (%)					
Regular	6.03	11.67	Regular	4.73	10.99
Part-timer & Arubaito	45.43	71.25	Part-timer	36.99	68.37
			Arubaito	36.78	62.00
			Temporary Staff	10.58	29.04
Contract Worker	12.43	21.48	Contract Worker	9.85	24.84
Misc.	21.48	33.54	Misc.	22.31	37.23
Employer Size (%)					
1-4	24.84	36.93	1-4	25.19	38.55
5-9	16.11	26.99	5-9	17.53	31.24

10-19	13.43	23.66	10-19	15.67	29.41
20-29	12.68	22.57	20-29	14.26	28.31
30-49	12.06	21.63	30-49	13.64	27.57
50-99	10.98	19.94	50-99	12.05	25.55
100-299	8.28	16.26	100-299	9.81	21.71
300-499	6.03	12.56	300-499	8.32	18.67
500-999	4.69	10.26	500-999	7.80	17.17
1000-	3.16	6.45	1000-	7.55	16.24
Government	3.29	5.52	Government	3.41	8.48

Note: The same note applies as in Table 1.

Table 4: Household Background of Minimum Wage and Non Minimum Wage Workers

	(1)	(2)	(3)	(4)
Year	1982		2002	
Minimum Wage Worker?	No	Yes	No	Yes
Household Head				
-99 (10000 yen)	0.08	5.28	0.14	2.27
-199	5.28	9.32	1.23	7.26
-299	12.15	3.53	4.35	5.38
-399	12.98	1.87	6.55	3.03
-499	10.69	1.01	7.34	1.92
500-	20.5	1.09	37.64	3.88
Non-Household Head				
-99	0.01	0.77	0.02	0.43
-199	0.59	5.73	0.19	1.98
-299	2.67	14.69	0.83	5.09
-399	5.09	17.77	1.96	8.5
-499	7.00	15.35	3.1	9.72
500-	22.97	23.56	36.66	50.54

Note: Minimum-wage workers are the workers whose annual earnings (= minimum value of labor earnings bracket) is below minimum-wage annual earnings (= maximum annual hours of work * hourly minimum wage).

Table 5: Who are Minimum Wage Workers?

Composition of Minimum Wage Workers by Education Level, Sex, and Age.

Year	1982	2002
Education (%)		
Junior High School	41.95	20.39
High School	48.54	57.13
Junior College	6.18	15.9
College	3.18	6.52
Sex by age groups (%)		
Male	24.54	26.54
15-19	3.87	2.38
20-24	6.75	5.99
25-29	3.31	4.14
30-39	2.94	3.51
40-49	1.84	2.26
50-59	2.35	2.87
60-	3.49	5.4
Female	75.46	73.46
15-19	4.02	2.57
20-24	9.29	7.62
25-29	6.16	6.43
30-39	19.69	13.28
40-49	20.27	18.44
50-59	11.28	17.35
60-	4.75	7.77

Note: The same note applies as in Table 4.

Table 6: Summary Statistics for the Employment Analysis Sample

	Observations	Mean	SD	Min	Max
Fraction Affected Minimum (FA_min)	188	0.039	0.027	0.003	0.113
Fraction Affected Maximum (FA_max)	188	0.055	0.036	0.003	0.138
Employment Rate					
Male, 15-19	235	0.162	0.028	0.097	0.240
Male, 20-24	235	0.751	0.072	0.552	0.895
Male, 60-	235	0.490	0.052	0.341	0.635
Female, 15-19	235	0.155	0.030	0.092	0.239
Female, 20-24	235	0.721	0.054	0.561	0.863
Female, 60-	235	0.239	0.043	0.144	0.351
Female, 25-29, Married	235	0.659	0.104	0.415	0.858
Change in Employment Rate					
Male, 15-19	188	-0.005	0.028	-0.083	0.063
Male, 20-24	188	-0.021	0.044	-0.134	0.095
Male, 60-	188	-0.019	0.036	-0.113	0.077
Female, 15-19	188	-0.005	0.028	-0.079	0.065
Female, 20-24	188	-0.007	0.039	-0.108	0.131
Female, 60-	188	-0.007	0.021	-0.054	0.040
Female, 25-29, Married	188	0.051	0.071	-0.032	0.298
Share of Population					
Male, 15-19	235	0.040	0.006	0.028	0.061
Male, 20-24	235	0.034	0.008	0.020	0.059
Male, 60-	235	0.112	0.026	0.053	0.165
Female, 15-19	235	0.039	0.006	0.026	0.057
Female, 20-24	235	0.037	0.007	0.023	0.053
Female, 60-	235	0.150	0.035	0.071	0.231
Female, 25-29, Married	235	0.216	0.079	0.047	0.308
Change in Share of Population					
Male, 15-19	188	-0.002	0.005	-0.017	0.012
Male, 20-24	188	-0.001	0.006	-0.018	0.011
Male, 60-	188	0.016	0.006	0.003	0.032
Female, 15-19	188	-0.002	0.005	-0.017	0.012
Female, 20-24	188	-0.002	0.005	-0.017	0.010

Female, 60-	188	0.019	0.007	0.004	0.037
Female, 25-29, Married	188	-0.054	0.061	-0.180	-0.006
Change in Average Wage	188	0.318	0.443	-0.575	1.137
Unemployment Rate					
Change in Unemployment Rate	188	0.006	0.011	-0.016	0.030

Table 7: Fraction of Workers Affected by Minimum-Wage Hike (%).

Year	1982-1987	1997-2002	Year	1982-1987	1997-2002
Hokkaido	3.18	0.81	Shiga	2.48	0.27
Aomori	6.22	4.15	Kyoto	6.19	1.34
Iwate	6.55	4.47	Osaka	5.32	0.98
Miyagi	4.63	0.52	Hyogo	5.76	1.11
Akita	6.27	3.46	Nara	2.20	0.26
Yamagata	6.72	3.07	Wakayama	2.93	0.53
Fukushima	5.54	1.37	Tottori	5.25	1.50
Ibaraki	2.27	0.36	Shimane	5.21	1.95
Tochigi	3.11	0.37	Okayama	2.60	0.53
Gunma	3.00	0.38	Hiroshima	2.72	0.52
Saitama	4.59	0.77	Yamaguchi	3.28	0.62
Chiba	4.74	0.75	Tokushima	5.19	0.65
Tokyo	2.98	0.71	Kagawa	4.36	0.80
Kanagawa	3.65	0.70	Ehime	5.15	0.60
Niigata	4.50	0.50	Kochi	5.56	0.51
Toyama	3.18	0.38	Fukuoka	2.95	0.68
Ishikawa	3.76	0.63	Saga	5.80	3.66
Fukui	3.98	0.50	Nagasaki	5.27	4.04
Yamanashi	2.92	0.60	Kumamoto	6.92	3.55
Nagano	2.74	0.51	Oita	5.02	3.72
Gifu	3.90	1.40	Miyazaki	6.87	4.34
Shizuoka	2.66	1.12	Kagoshima	5.88	4.03
Aichi	6.27	0.94	Okinawa	6.09	4.54
Mie	3.17	1.18			

Note: The fraction of workers affected by the minimum-wage hike (FA) is defined as the number of workers affected by the minimum-wage hike (i.e. $MWIncome_{it}^{\min} \leq Income_{it} < MWincome_{it+5}^{\min}$) divided by the number of employed workers.

Table 8A: Fraction of workers affected by the minimum-wage hike and the change of employment rate, Male

Dependent Variable: Change in Employment Rate

	(1)	(2)	(3)	(4)	(5)	(6)
Age Group	15-19		20-25		60-	
FA	FA_min	FA_max	FA_min	FA_max	FA_min	FA_max
Fraction Affected	-0.23	-0.20	-0.26	-0.26	-0.02	-0.00
	(0.11)	(0.12)	(0.15)	(0.14)	(0.11)	(0.11)
Change in Population	0.43	0.08	-1.31	-1.34	0.14	0.15
Share	(0.60)	(0.58)	(0.84)	(0.82)	(0.36)	(0.36)
Change in Average	0.02	0.02	0.02	0.02	0.02	0.02
Wage	(0.02)	(0.02)	(0.03)	(0.02)	(0.01)	(0.01)
Change in	-0.72	-0.70	-0.33	-0.27	-0.89	-0.88
Unemployment Rate	(0.45)	(0.47)	(0.71)	(0.70)	(0.39)	(0.38)
Constant	0.02	0.02	0.01	0.02	-0.04	-0.04
	(0.02)	(0.02)	(0.03)	(0.03)	(0.01)	(0.01)
Dummy for Year	Y	Y	Y	Y	Y	Y
Observations	188	188	188	188	188	188
R-squared	0.35	0.35	0.34	0.35	0.69	0.69

Note: Standard errors are reported in parentheses. The inverse of the estimated variance of the dependent variable is used as a weight for the weighted least squares estimation.

Table 8B: Female

Dependent Variable: Change in Employment Rate

	(1)	(2)	(3)	(4)	(5)	(6)
Age Group	15-19		20-25		60-	
FA	FA_min	FA_max	FA_min	FA_max	FA_min	FA_max
Fraction Affected	-0.37	-0.13	-0.09	-0.23	-0.10	-0.11
	(0.10)	(0.11)	(0.12)	(0.12)	(0.10)	(0.08)
Change in Population	0.49	0.16	-1.43	-1.62	0.01	-0.01
Share	(0.64)	(0.64)	(0.79)	(0.80)	(0.22)	(0.22)
Change in Average	-0.02	-0.01	-0.00	-0.01	-0.01	-0.01
Wage	(0.01)	(0.02)	(0.02)	(0.02)	(0.01)	(0.01)
Change in	-0.25	-0.18	0.04	0.05	-0.10	-0.07
Unemployment Rate	(0.59)	(0.61)	(0.54)	(0.54)	(0.29)	(0.29)
Constant	0.01	0.01	0.03	0.05	-0.03	-0.03
	(0.01)	(0.01)	(0.02)	(0.02)	(0.01)	(0.01)
Dummy for Year	Y	Y	Y	Y	Y	Y
Observations	188	188	188	188	188	188
R-squared	0.22	0.18	0.50	0.51	0.44	0.45

Table 8C: Female, 25-59, married

Dependent Variable: Change in Employment Rate

	(1)	(2)
FA	FA_min	FA_max
Fraction Affected	-0.43	-0.82
	(0.13)	(0.13)
Change in Population	0.49	0.81
Share	(0.60)	(0.58)
Change in Average	-0.03	-0.07
Wage	(0.02)	(0.02)
Change in	-1.32	-1.38
Unemployment Rate	(0.78)	(0.75)
Constant	0.11	0.18
	(0.02)	(0.03)
Dummy for Year	Y	Y
Observations	188	188
R-squared	0.76	0.78

Table 9: Summary Statistics of Analysis Sample for High School Age Choice

	Observations	Mean	SD	Min	Max
In School, Not Employed	235	0.933	0.022	0.851	0.983
△In School, Not Employed	188	-0.919	0.024	-0.970	-0.847
Out School, Not Employed	235	0.017	0.008	0.002	0.058
△Out School, Not Employed	188	0.001	0.008	-0.024	0.028
In School, Employed	235	0.025	0.018	0.002	0.100
△In School, Employed	188	-0.004	0.014	-0.054	0.045
Out School, Employed	235	0.025	0.011	0.006	0.071
△Out School, Employed	188	-0.011	0.013	-0.062	0.023
Unemployment Rate	235	0.023	0.012	0.006	0.070
△Unemployment Rate	188	0.006	0.011	-0.016	0.030
Population Share Of Age 16-17	235	0.047	0.010	0.028	0.075
△Population Share Of Age 16-17	188	-0.002	0.005	-0.011	0.011
Average Wage	235	2.950	0.718	1.637	4.613
Change in Average Wage	188	0.318	0.443	-0.575	1.137

Table 10: Effect of Minimum Wage on Choices among High-School-Age Teenagers

	(1)	(2)	(3)	(4)	(5)	(6)
5 Year Change in State	Out of School Not Employed		In School Employed		Out of School Employed	
FA variable	FA min	FA max	FA min	FA max	FA min	FA max
Fraction Affected	-0.00	0.04	0.27	0.30	0.11	0.13
	(0.03)	(0.03)	(0.07)	(0.06)	(0.05)	(0.04)
Change in Population Share	-0.17	-0.15	-0.08	0.38	0.04	0.24
	(0.26)	(0.25)	(0.35)	(0.32)	(0.34)	(0.33)
Change in Average Wage	0.00	0.01	0.01	0.01	-0.02	-0.01
	(0.00)	(0.00)	(0.01)	(0.01)	(0.01)	(0.01)
Change in Unemployment Rate	0.07	0.07	0.20	0.17	0.01	0.00
	(0.14)	(0.14)	(0.21)	(0.22)	(0.20)	(0.20)
Constant	0.00	-0.00	-0.01	-0.03	-0.01	-0.02
	(0.00)	(0.00)	(0.01)	(0.01)	(0.00)	(0.01)
Year dummy	Y	Y	Y	Y	Y	Y
Observations	188	188	188	188	188	188
R-squared	0.11	0.11	0.18	0.22	0.17	0.18

Note: Standard errors are in parentheses.

Figure 1A:

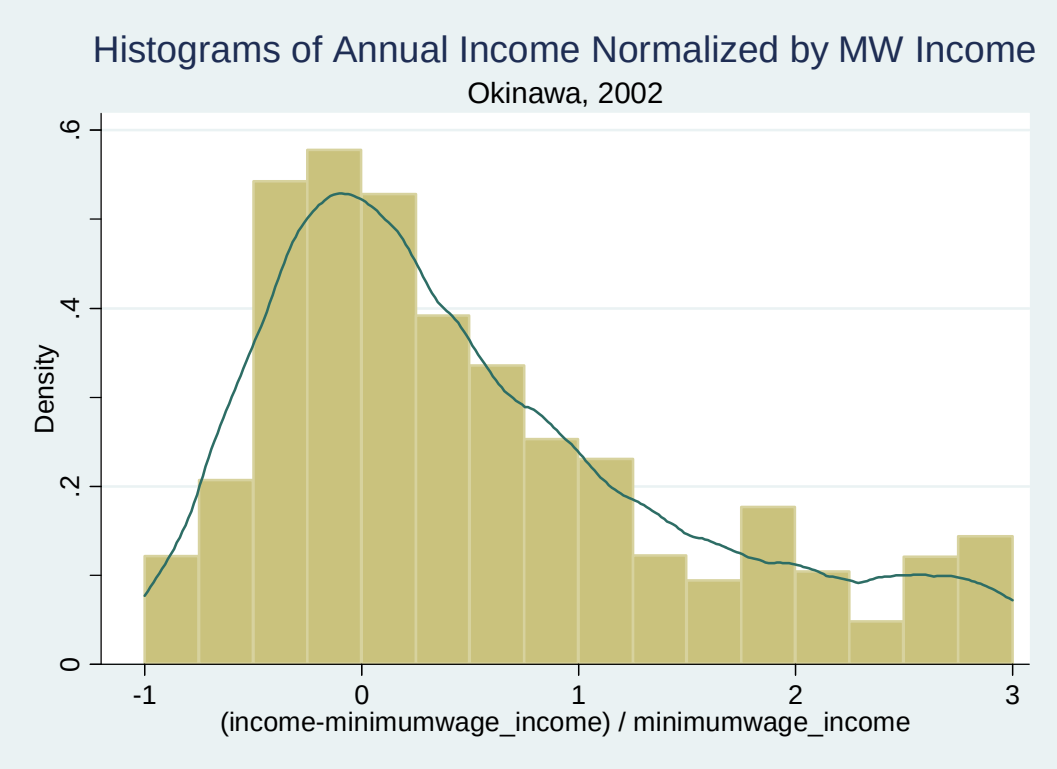
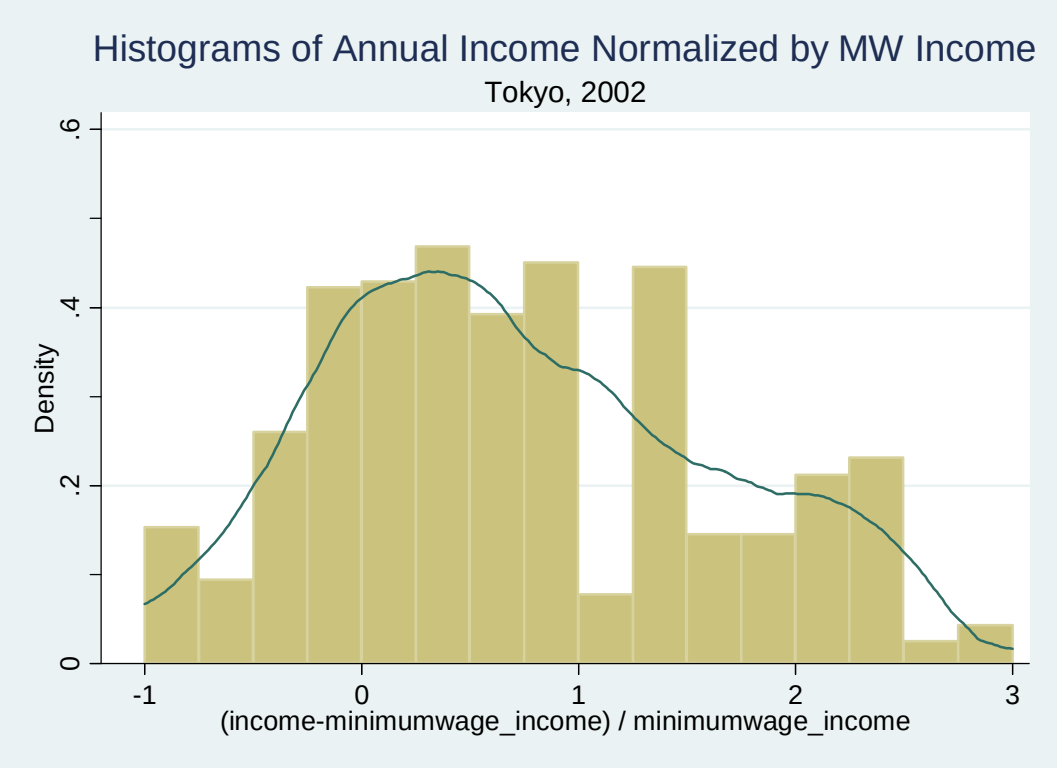


Figure 1B:



Notes:

1. Minimum-wage income is defined as annual income that is earned if an individual works at the minimum wage all year, by multiplying the minimum wage by minimum value of weekly hours and annual work-days.
2. Workers earning more than 3 times as much as minimum wage annual earnings are not included in the sample.

Figure 2

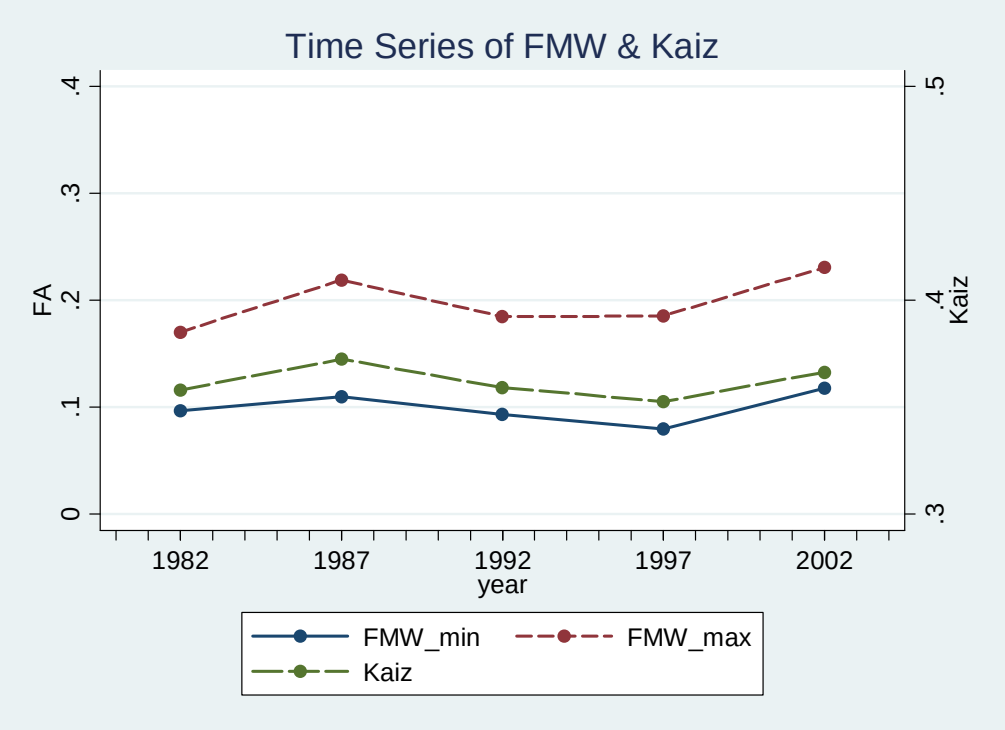

Time Series of FMW & Kaiz
FA
0
.1
.2
.3
.4
Kaiz
.3
.4
.5
1982
1987
1992
1997
2002
year
FMW_min
FMW_max
Kaiz

Figure 3A: Okinawa

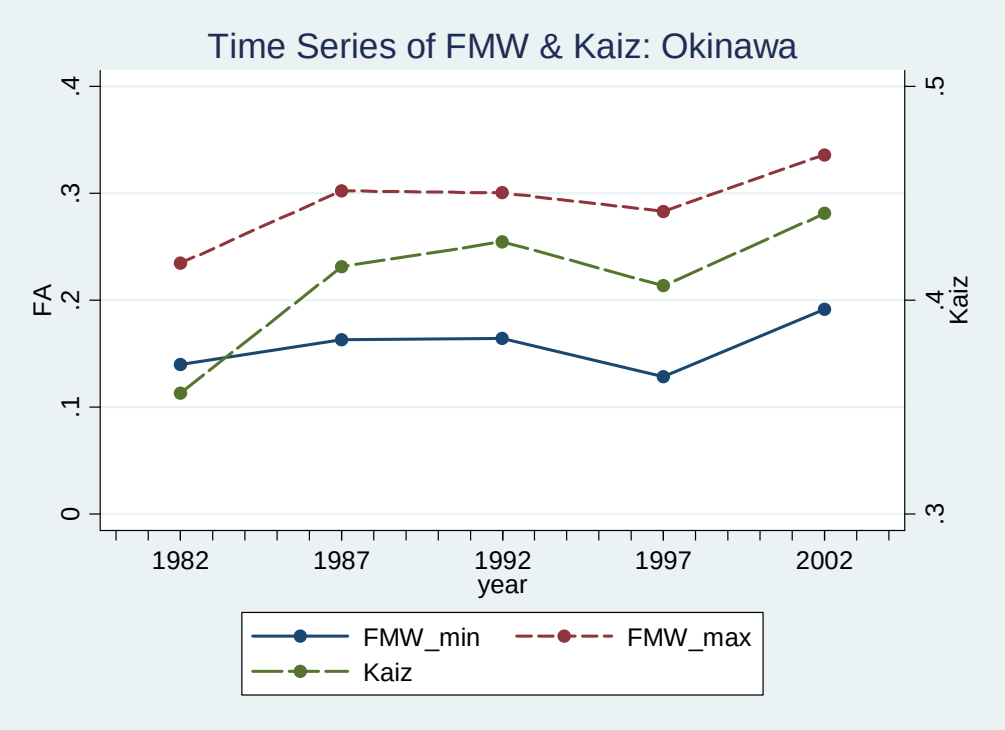


Figure 3B: Tokyo

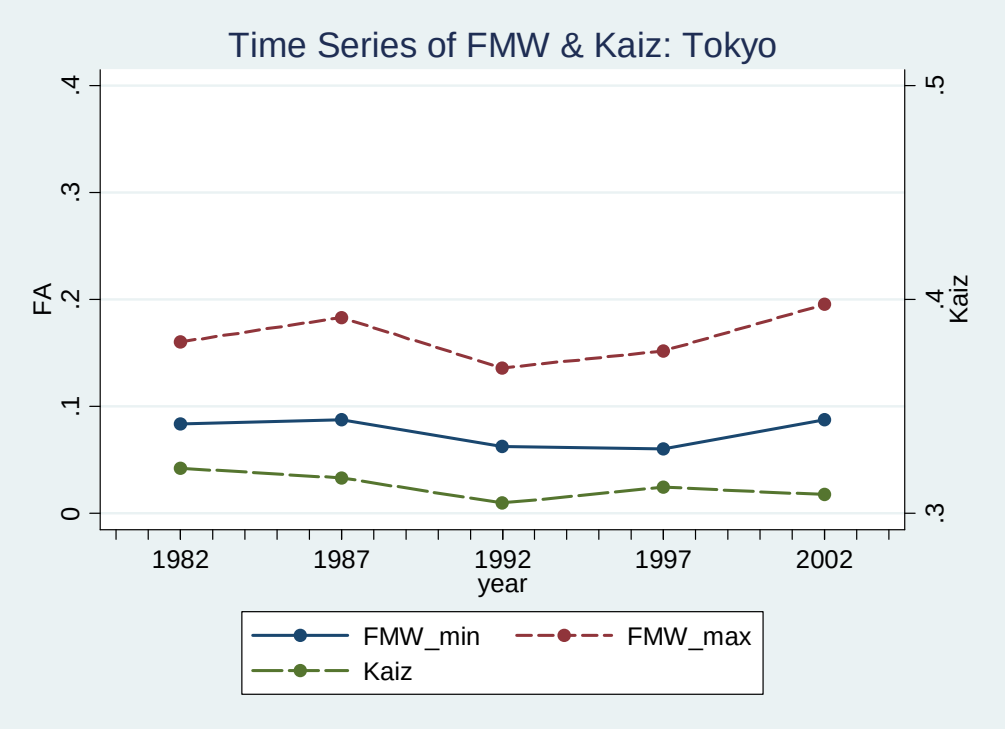


Figure 4A: MW Fraction Maximum among Junior-High School and High-School Graduates: Male

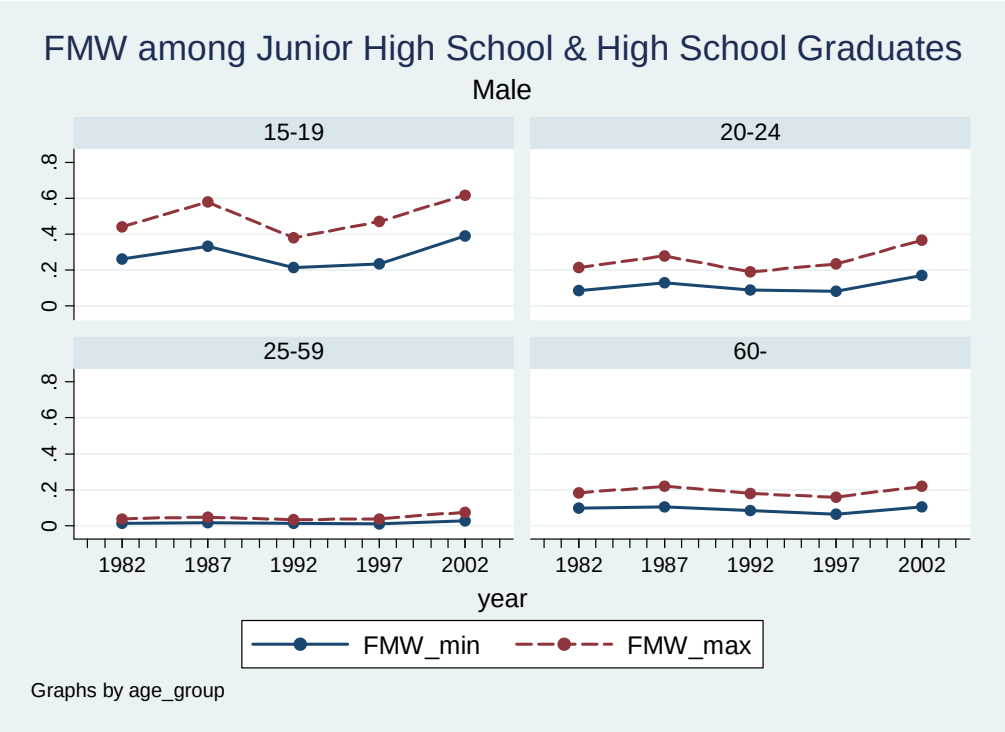


Figure 4B: Female

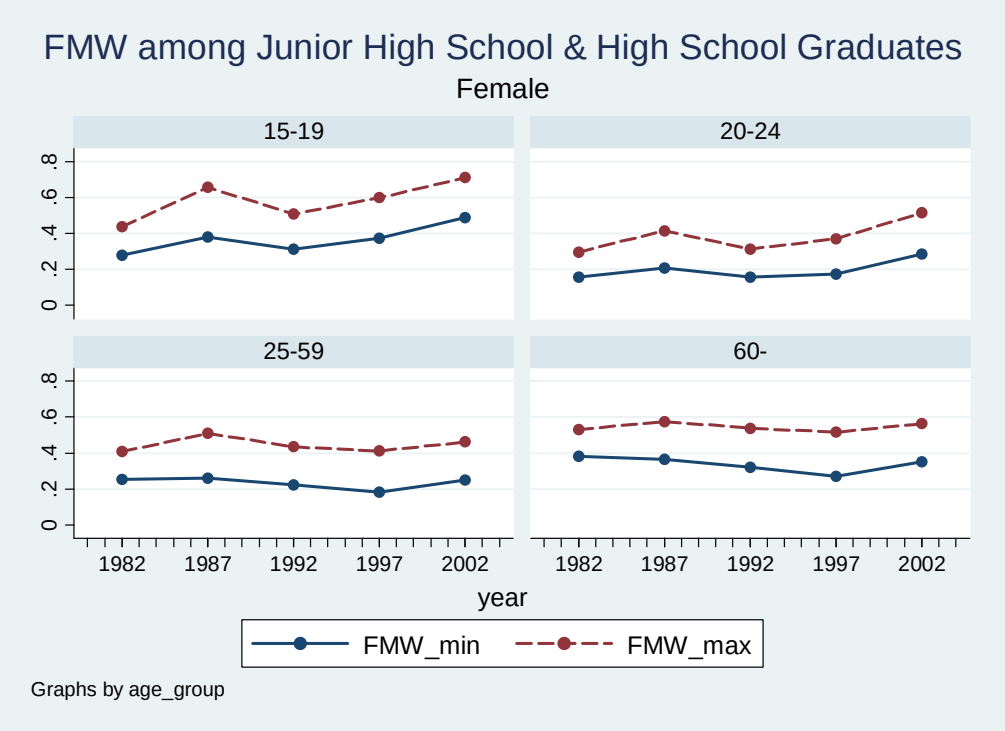


Figure 5A: Fraction of Workers Affected by the Minimum-Wage Hike and Change of Employment Rate, 1997-2002, Male 15-19

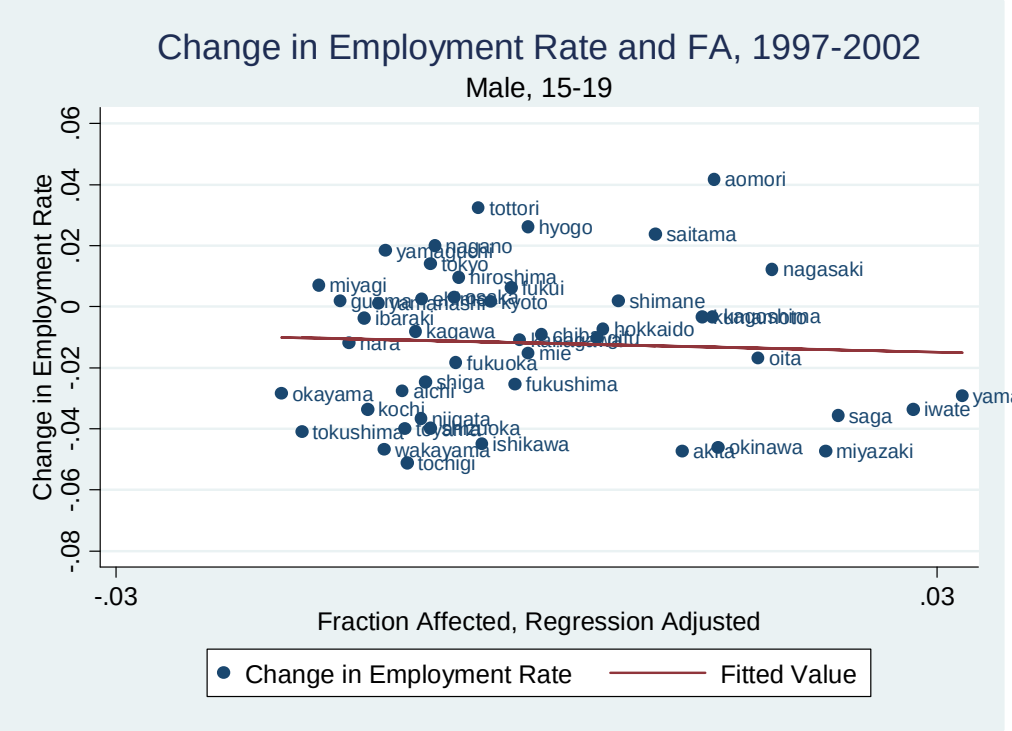


Figure 5B: Fraction of Workers Affected by the Minimum-Wage Hike and Change of Employment Rate, 1997-2002, Female 15-19