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**Changes in Household Income Inequality over the Business Cycle:
Husbands' Earnings and Wives' Labor Supply in Japan during the Global Financial
Crisis**

Yoshio Higuchi*

Kayoko Ishii**

Kazuma Sato***

【Abstract】

This study examines how household income inequality in Japan is impacted by changes in a couple's income and employment status after economic crises, using the Keio Household Panel Survey (KHPS). Our analysis of the periods before and after the Global Financial Crisis yields three notable findings. First, during the recession, incomes stagnated for households in the middle- and high-income brackets, with many experiencing income declines. Conversely, many low-income households saw incomes increase even during the recession, and the overall income gap may have shrunk. Second, concerning the impact of changes in the husband's income on the wife's employment, we show that when the husband's income declines, the added worker effect is observed. This effect was larger in households whose income was originally low. Third, we calculate the Gini coefficient both by using only the husband's labor income, and also with the wife's labor income added. We find that the wife's labor income reduced household income inequality, in particular for several years following the 2008 recession. In conclusion, when focusing only on married households, income inequality appears to shrink during economic recessions.

* Faculty of Business and Commerce, Keio University

** Faculty of Economics, Keio University

*** Faculty of Political Science and Economics, Takushoku University

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Yoshio Higuchi[¶]

Kayoko Ishii^{¶¶}

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Summary

This study examines how household income inequality in Japan is impacted by changes in a couple's income and employment status after economic crises, using the Keio Household Panel Survey (KHPS). Our analysis of the periods before and after the Global Financial Crisis yields three notable findings. First, during the recession, incomes stagnated for households in the middle- and high-income brackets, with many experiencing income declines. Conversely, many low-income households saw incomes increase even during the recession, and the overall income gap may have shrunk. Second, concerning the impact of changes in the husband's income on the wife's employment, we show that when the husband's income declines, the added worker effect is observed. This effect was larger in households whose income was originally low. Third, we calculate the Gini coefficient both by using only the husband's labor income, and also with the wife's labor income added. We find that the wife's labor income reduced household income inequality, in particular for several years following the 2008 recession. In conclusion, when focusing only on married households, income inequality appears to shrink during economic recessions.

J11 Demographic Trends, Macroeconomic Effects, and Forecasts

J30 Wages, Compensation, and Labor Cost General

I31 General Welfare, Well-Being

* In conducting this research I received Keio Household Panel Survey microdata produced by the Panel Data Research Center at Keio University. I would like to take this opportunity to express my appreciation.

[¶] Faculty of Business and Commerce, Keio University

^{¶¶} Faculty of Economics, Keio University

^{¶¶¶} Faculty of Political Science and Economics, Takushoku University

1 Introduction

There has been a great deal of societal concern about income inequality since the lengthy recession that followed the bursting of the asset bubble in Japan. There has been a variety of research from an economics perspective in response, investigating the status of and background to income inequality. To summarize previous research, until the mid-2000s, analysis primarily focused on factors behind income inequality. This revealed the aging population and increase in single-person households as main causes (Ohtake 2005). From the mid-2000s onward, research focused on the question of whether income inequality was increasing, and found that it was not continuously widening¹ (Oshio 2010). For example, Oshio (2010), using the *Comprehensive Survey of Living Conditions*, found that the Gini coefficient rose from 1997 until 2000, but that it declined in 2003, and rose again in 2006. The latest data from the Ministry of Health, Labour and Welfare's 2014 *Survey on the Redistribution of Income*, released in September 2016, showed a slight decline in the Gini coefficient compared with the previous survey from 2011, based on equivalent income following redistribution in 2014. These results suggest that there has not been a continuous increase in income inequality since 2000.

What kinds of factors affect changes in income inequality? There is a variety of conceivable causes. This paper focuses on income inequality among married households of working age, focusing on the impact of economic fluctuations, which may affect household incomes via two pathways. The first is through the income of the head of the household (typically the husband in Japan), the main breadwinner. During an economic recession, the household head's income declines in many cases. If adjustments during a recession are made via reduced bonuses rather than redundancies and other employment adjustment measures, and there is a large income decline in high-income brackets, where bonuses are a large share of income, this may reduce income inequality. When the economy recovers, job creation, which provides major benefits to the low-income brackets, may indeed contribute to shrinking income inequality. However, when those in high-income brackets experience major benefits from rising income, this may work to widen income inequality.

The second pathway is female employment, particularly changes to the wife's employment. As pointed out in the Cabinet Office's 2014 *White Paper on Gender Equality*, in Japan an increasing number of males are in non-regular employment, and

¹ Sato (2013) conducts surveys on these instances of income inequality.

average incomes are trending downward, so the wife's income has come to play an increasingly important role in bolstering household income. If the head of the household's income declines in an economic recession, the shortfall may be filled by the wife getting a job or working longer hours. If the increased supply of labor from the wife is observed mainly among low household-income brackets, this could be expected to narrow income inequality. Conversely, if additional labor from the wife is supplied mainly in high household-income brackets, this could be expected to widen income inequality. In this manner, changes in female employment due to economic fluctuations, in particular changes in the employment of wives, may also contribute to widening or shrinking income inequality.

The impact of economic fluctuations on income inequality has not been adequately investigated, nor has the actual situation been clarified². However, investigating these issues would demonstrate the mechanism behind changes in income inequality, a matter of considerable research significance. This paper uses the *Keio Household Panel Survey* (KHPS) and focuses on working-age married households to investigate the impact on income inequality of changes in the incomes and employment statuses of husbands and wives due to economic fluctuations, through the following two pathways. The first analyzes the relationship between economic fluctuations and changes in the husband's income. It investigates how the husband's income changes by quintile, using the KHPS from 2004 until 2015. It focuses on what sort of impact the recession that followed the Global Financial Crisis in 2008 had on the incomes of married men. The second focuses on the interrelationship between the incomes and employment of married couples. This also uses the KHPS to perform quantitative analysis on changes to the wife's employment behavior when the husband's income declines, by income quintile. Further, in order to clarify the impact of the wife's employment on income inequality, we calculated the Gini coefficient using only the husband's income and also using the couple's combined incomes, and then compared them.

In consideration of income inequality, it is important to take into account of single-person, single-mother, and elderly households. However, the main focus of this paper is to analyze the impact on income inequality of the interrelationship between employment and incomes for married couples. Therefore, it restricts analysis to working-age married households. To this end, in the next section, we discuss the significance and issues

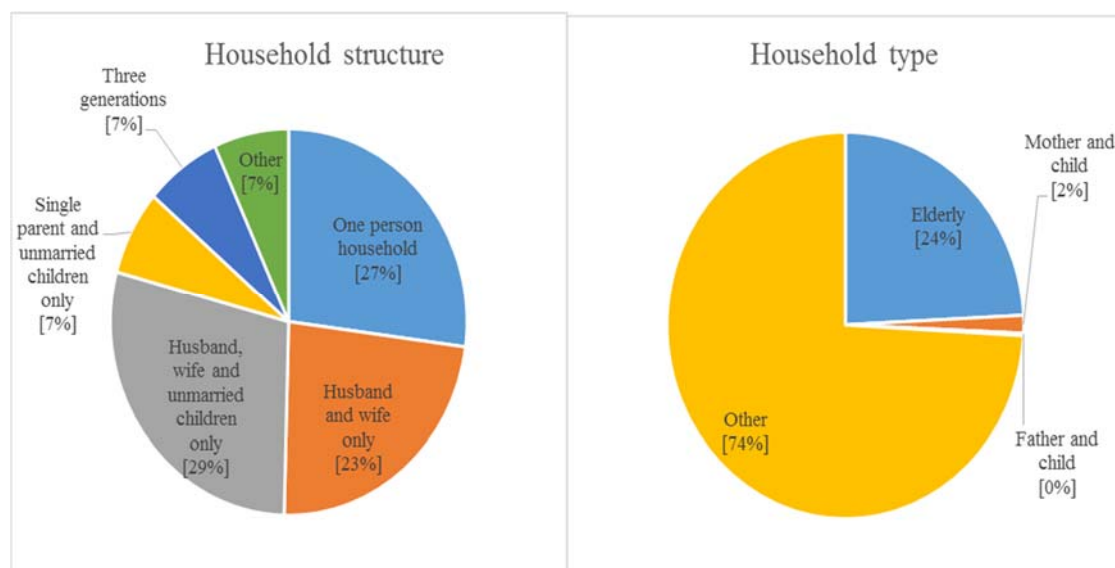
² Although Mori (2002), Hamada (2007), and Urakawa (2007) have investigated the impact of the wife's employment on income inequality, they have not explicitly considered the relationship with economic fluctuations.

involved in setting this restriction. In addition, we assess the impact of the Global Financial Crisis on the labor market, the subject of this analysis. In the third section, we investigate the relationship between economic fluctuations and changes in the husband's income. In the fourth section, we investigate changes in the wife's employment behavior when the husband's income declines. In the fifth section, we examine the impact of the wife's income on household income inequality.

2 Analysis subjects and characteristics

This section considers the significance of limiting analysis to married working-age households when researching income inequality. It then assesses what sort of impact the Global Financial Crisis had on the labor market, the focus of this analysis.

Figure 1: Household structure and household types in Japan (2014)



Source: Prepared by the author based on figures from the Ministry of Health, Labor and Welfare, Comprehensive Survey of Living Conditions 2014.

The subjects of this research are working-age married households—specifically, married households in the KHPS from 2004 until 2015 where the husband is aged between 20 and 59³ in the survey year. Limiting the scope to married households enabled analysis of not only what sort of impact changes in the household head's (husband's) income had on income inequality, but also the impact of changes in the wife's

³ Analysis confined to married men from couples where subject or spouse were aged from 20 to 59.

employment behavior. In recent years, as employment has become increasingly unstable, the wife's income has become more important to the household, so it is meaningful to focus on the impact of changes to the husband's and wife's combined income on income inequality among households.

However, we should note that limiting the discussion to working-age married households means that households that are at high risk of having low incomes, such as single-person, single-parent and elderly households are excluded from the analysis. Figure 1 shows household structures and household types in Japan from the Ministry of Health, Labor and Welfare's *Comprehensive Survey of Living Conditions 2014*. By structure, the only households excluded from this analysis are single-person households, which account for 27% of the total, and those with a sole parent and unmarried children, which account for 7%. By type, elderly households⁴, which account for 24% of the total, are excluded from the analysis.

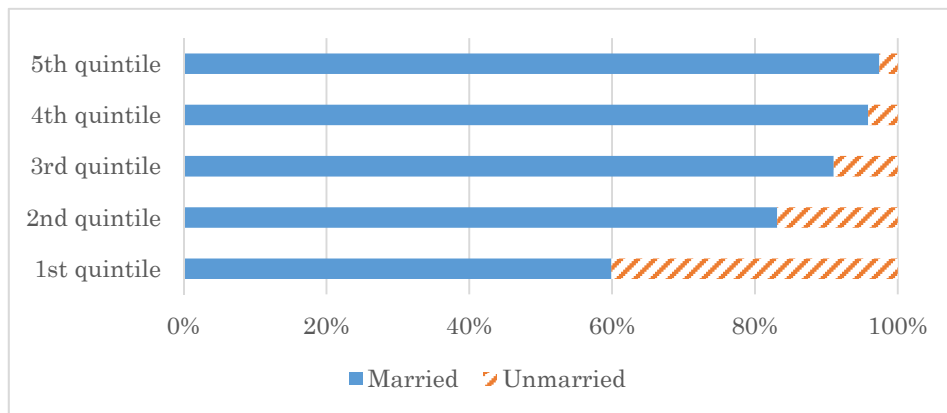
Limiting analysis to working-age⁵ households, Figure 2 from the KHPS shows where unmarried households (single-person and single-parent households, which are excluded from this analysis) lie in terms of income distribution. The lower the income bracket, the greater the share of unmarried households. However, it is necessary to point out that unmarried households form a very small proportion of working-age households in Japan. Incidentally, Figure 3 shows the Gini coefficient⁶ for all households where the head was aged 20–59 years, including single-person and single-parent households, calculated using the household head's income in the KHPS data. In 2003, when the unemployment rate reached 5.3%, near its historical peak, the Gini coefficient was high at 0.325, and subsequently as the unemployment rate dropped, the Gini coefficient also declined, reaching 0.307 in 2008. In 2009, when the unemployment rate jumped to 5.1% due to the Global Financial Crisis, the Gini coefficient rose to 0.314. Subsequently, in line with the falling unemployment rate, the Gini coefficient also fell. In 2013, when the unemployment rate was in the 4.0% range, the Gini coefficient was 0.292. In this manner, income inequality for all working-age households based on the household head's income behaves in a countercyclical fashion. It is necessary to reiterate that the research results of this paper do not address income inequality for society as a whole. The discussion is limited solely to income inequality among working-age married households.

⁴ Comprising households of people aged at least 65 years, or that also contain unmarried members under 18.

⁵ Defined here as households where the head (the husband in a couple) is aged 20–59 years.

⁶ Due to the nature of panel data, inequality may be in a secular decline, but aggregate results show considerable movement.

Figure 2: Proportion of married and unmarried households by income quintile



Note 1: Estimated by pooling data from the KHPS 2004–2015.

Note 2: Unmarried households are households where the head is not married and aged from 20–59 years, excluding students.

Note 3: Quintiles calculated every year based on labor income of the household head aged 20–59 years (husband in case of married households).

Source: Author’s estimates, based on KHPS 2004–2015

Figure 3: Unemployment rate and time-series estimates of Gini coefficient for all working-age households



Note 1: Gini coefficient calculated using labor income of household head, where the head (husband in case of married households) is aged 20–59 years. Households where the head is a student were excluded from calculations.

Note 2: Sample limited to cases where data on labor income for the next year available, so data are until 2013

(KHPS 2014).

Source: Author's estimates, based on Ministry of Health, Labour and Welfare *Labor Force Survey* and KHPS 2004–2015.

Features of the impact of the GFC, the focus of the analysis, on the labor market are summarized here⁷. The GFC was triggered by the collapse of the American investment bank Lehman Brothers in September 2008. It had a severe impact on Japan's labor market. According to the *Labor Force Survey* from the Ministry of Internal Affairs and Communications, the number of unemployed men grew by 440,000 from 2008 to 2009, and the number of unemployed women grew by 260,000. The unemployment rate for men rose by 1.2 percentage points, from 4.1% to 5.3%, and that for women rose by 1.0 percentage points, from 3.8% to 4.8%. Since the early 2000s, the number of unemployed people in Japan had been declining, partly due to economic recovery, so the large rise in the number of unemployed people illustrates the severity of the shock.

Also, the same survey showed changes in employment status from 2008 to 2009. Among men, the number of regular employees shrank by 220,000, and the number of non-regular employees shrank by 330,000. Among non-regular employees, the biggest decline was for temporary workers, with a fall of 180,000. In contrast, regular female employees grew in number by 70,000, and there was a decline of just 50,000 in the number of non-regular female employees. In the non-regular category, the number of female temporary workers declined by 130,000, less than the decline for male workers in this category. For women, the number of contract, short-term contract, and part-time workers rose from 2008 to 2009. This ameliorated the decline in non-regular employees

Looking at changes in employee numbers by industry from 2008 to 2009 in the *Labor Force Survey*, the number of male employees declined by 570,000 overall⁸. The decline was mainly in manufacturing, with about 340,000 fewer employees⁹. The number of female workers rose by 10,000. By industry, the number of women in manufacturing fell by 250,000, similar to the number for men, but there was an increase of 170,000 women in the medical and welfare sectors, as well as gains in other service industries, which offset the decline in manufacturing.

⁷ See Appendices 1-4 for detailed figures regarding impact of global financial crisis on labor market.

⁸ Changes in employee numbers by industry include changes in the numbers of executives and regular and non-regular employees.

⁹ Sectors with large drops in employment for males outside the manufacturing sector included construction (120,000) and services not elsewhere classified (140,000)

What sort of relationship was there between unmarried working-age households, which are excluded from this analysis, and the GFC? According to the *Labor Force Survey*, prior to the GFC (in 2007)¹⁰, married men accounted for 69% of the total among male employees overall¹¹ over age 15 years. Only 40% of male temporary workers, for whom the global financial crisis resulted in the most unemployment, were married. That is, more than half of the male temporary employees, who were greatly affected by the shock of the GFC, were unmarried at the time and so not included in this analysis. Nevertheless, it is important to note that they were strongly affected by the GFC.

To summarize the above results, the number of employees fell sharply during the GFC, with the effects particularly notable among male temporary workers. As pointed out by Nagahama (2012), the background to this was a strong impact from the GFC on the manufacturing sector, where men are heavily employed, due to a slump in global consumption. In contrast, female employment increased in some cases during the GFC, so the impact was the opposite. Female employment patterns and the industries they worked in showed employment growth even during the GFC, so it may have been easier for women to find work during this time.

Finally, we touch upon data used. The KHPS, which provided data used in the analysis in this paper, is a survey conducted in February every year. Questions on income ask about income in the previous year and those on employment status ask about employment status in the previous month (January). As a result, when data from KHPS from 2004 until 2015 are used, information on income covers the period from 2003 until 2014. In this paper, we refer to years according to the year the data are from, not the survey year.

3 Economic fluctuations and changes in husband's income

The section uses data from KHPS from 2004 to 2015 to investigate the relationship between economic fluctuations and changes in income, limiting analysis to married men. Specifically, we assess changes in husband's income from the current year (period t) to the next year (period $t+1$), by husband's income bracket. We examine the descriptive data to see whether there are differences between developments at the time of the GFC and

¹⁰ Refer to Appendix 4.

¹¹ Including agricultural workers.

other periods.

Before discussing analysis, Table 1 shows characteristics of the sample used in analysis in this section. They cover married men¹² aged from 20–59 years for each period t who were employed in period t . Table 1 shows aggregate values for pooled data from KHPS from 2004 to 2015, by income quintile. The income quintiles were calculated for each year based on the husband’s income from work over the year (before deducting taxes and insurance premiums). The sample contains self-employed respondents, so there is a possibility that business income is included. Looking at husband’s age by income quintile shows that in the fifth quintile, the highest, the husband’s age is greater; in the first, the lowest income quintile, the husband’s age is on average around the middle of the range. The husband’s employment status varies markedly between the lower quintiles and the others. For the lower income brackets, and for the first quintile in particular, the share of regular employment is notably low while that of non-regular employment is high. Furthermore, the share of self-employed and family-business workers is larger than that in the middle- and high-income brackets¹³.

Table 1: Characteristics of analysis subjects

	N	Husband’s average age (years)	Husband’s average income (million JPY)	Husband’s employment status (%)			
				Regular	Non-regular	Self-employed	Family business worker
1st quintile	2,485	44.9	250	46	19	30	4
2nd quintile	2,704	42.7	414	76	5	17	2
3rd quintile	2,911	43.9	543	82	3	14	1
4th quintile	2,720	46.6	709	91	1	8	0
5th quintile	2,624	49.3	1,049	90	1	9	0

Note 1: Pooled data from KHPS from 2004 to 2015.

Note 2: Subjects were married men aged 20–59 years employed during period t . Income brackets aggregated every year based on income (annual income before tax and social security deductions) of married men aged 20-59.

Source: Author’s estimates using KHPS from 2004 to 2015.

Figure 4 shows to what extent income increased (resp., declined) from period t to period $t+1$ by husband’s income quintile in period t , using pooled KHPS data from 2004 to 2015. As discussed previously, the KHPS asks about the previous year’s income, so the years shown in the figure do not refer to the survey year but the year in which income was

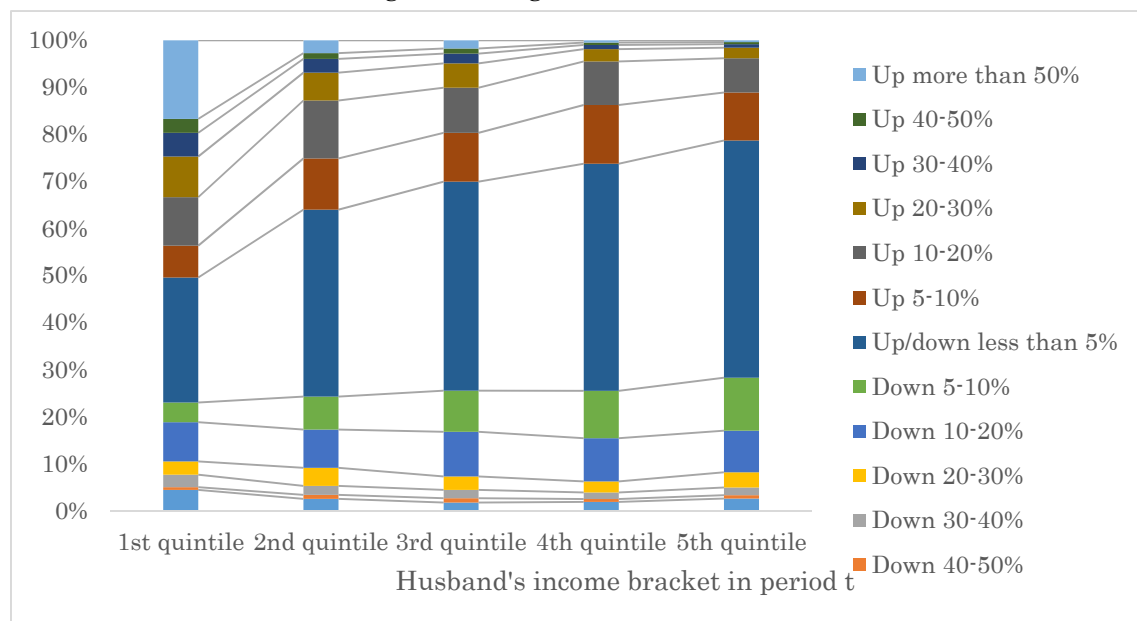
¹² Restricted to cases where the survey subject and partner are in that age range

¹³ Here we examine to what extent the first income quintile in this section’s analysis overlaps with the poor demographic in society overall. Comparing equivalent gross income of the subjects in this section with the relative poverty line (half of the median equivalent disposable income) published by the MHLW’s *Comprehensive Survey of Living Conditions*, 11.5% of the subjects in the first quintile are classified as poor under the relative poverty concept. The relative poverty line referenced in the *Comprehensive Survey of Living Conditions* covers 2003 to 2012, the closest corresponding periods to the KHPS survey years.

earned. As the figure clearly shows, the lower the income of the married man, the greater proportion of rising incomes the following year. Around half of those in the first quintile experienced income gains of more than 5% the next year (an increase of 120,000 JPY on average), and around 15% experienced income gains of more than 50% (1.25 million JPY on average). Wherever the cutoff point is set, the lower the income in the earlier period, the greater the share of respondents whose income grew in period t+1.

Looking at the share of respondents whose income declined a year later, there is not a great difference among income brackets, with roughly 20–30% of households in each experiencing declines of more than 5% in the husband’s income (120,000 JPY on average for the lowest quintile, and 500,000 JPY for the highest). The proportion of respondents who saw declines of more than 10% (250,000 JPY on average in the lowest quintile and more than 1 million JPY for the highest quintile) were generally higher for the lower income brackets.

Figure 4: Changes in husband’s income from t to t+1 by income classes
(Pooled data for income changes covering 2003/2004 to 2013/2014)



Note 1: Estimates using pooled KHPS data from 2004 to 2015.

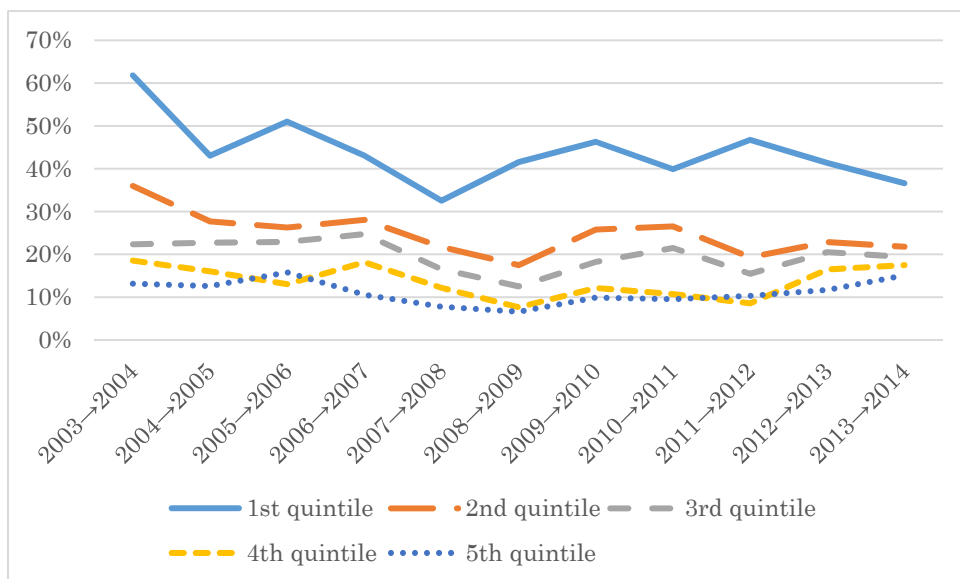
Note 2: Subjects were married men aged 20–59 years employed during period t. Income brackets aggregated every year based on income (annual income before tax and social security deductions) of married men aged 20–59 years.

Source: Author’s estimates using KHPS data from 2004 to 2015.

Figure 4 shows pooled movements in husband’s income over two-year periods from 2003

to 2014. If these movements are shown as a time series, will there be any differences around the time of the GFC? That is, is it possible to observe an impact of the GFC that varies by income bracket? Figure 5 shows the share of households in which the husband's income rose more than 10% from period t to period $t+1$, by husband's income bracket. As shown in Figure 4, there was a markedly high proportion of income gains in the first quintile, up to 60% in some years, and even in years when the proportion was less, 30% saw income gains of more than 10%. Of particular interest is that in income brackets outside the first quintile, there is a sharp decline in the number of households that experienced income gains of more than 10% during the GFC (2008–2009). However, in the first quintile, this phenomenon was not observed. A similar phenomenon was observed when we changed the cutoff point for income gains from 10% to 5%. That is, the lower the income bracket, the greater the share of households with income gains. Except for the first quintile, there was a large increase in the number of households whose income declined at the time of the GFC.

Figure 5: Share of respondents where husband's income increased more than 10% from period t to period $t+1$, by income bracket

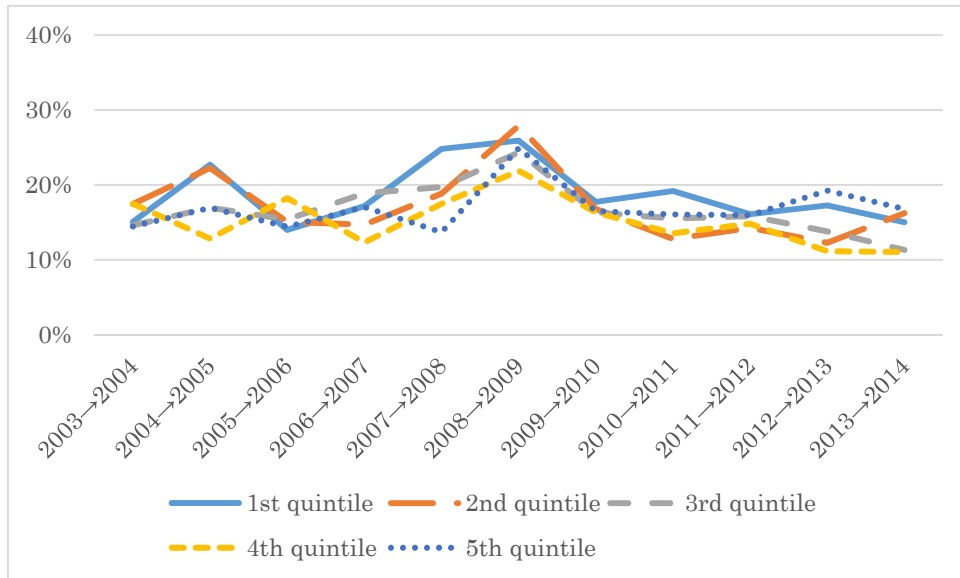


Note 1: The values in the figure show a time series of the percentage of households where the husband's income rose more than 10% from period t to period $t+1$ by husband's income bracket in period t .

Note 2: Subjects were married men aged 20-59 employed during period t . Income brackets aggregated every year based on income (annual income before tax and social security deductions) of married men aged 20-59.

Source: Author's estimates using KHPS from 2004 to 2015

Figure 6: Share of respondents where husband's income declined more than 10% from period t to period t+1, by income bracket



Note 1: The values in the figure show a time series of the percentage of households where the husband's income declined more than 10% from period t to period t+1 by husband's income bracket in period t.

Note 2: Subjects were married men aged 20–59 years employed during period t. Income brackets aggregated every year based on income (annual income before tax and social security deductions) of married men aged 20–59 years.

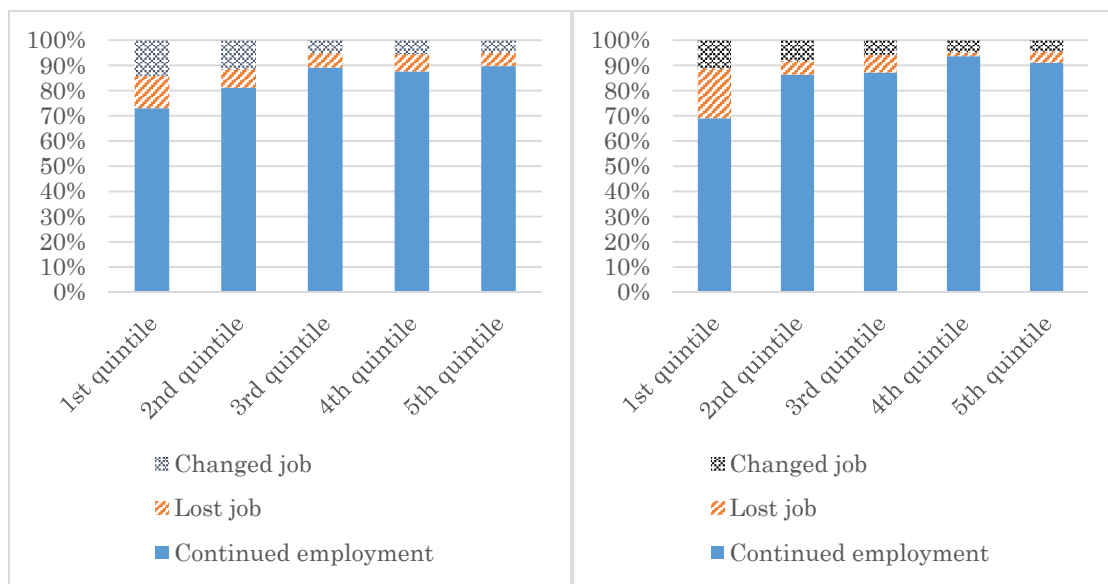
Source: Author's estimates using KHPS data from 2004 to 2015.

Figure 6 shows the share of households where the husband's income declined more than 10% from period t to period t+1, by income bracket. It is apparent that in each income bracket, a higher proportion of households experienced lower income from 2008 to 2009. While there is not a major difference among the income brackets in the share of households where income declined more than 10%, if the cutoff point is set at a relatively small income drop of 5%, the lower the income bracket, the smaller the shock. Surprisingly, incomes in the middle- and high-income brackets were particularly stagnant during the GFC, and not just low-income brackets but medium- and high-income brackets were subject to the shock of lower incomes, suggesting that the GFC may have reduced income inequality.

As a check, we review data on why married working males experienced a decline in income. Figure 7 shows the share of respondents who lost or changed jobs by income bracket among respondents who experienced income declines of more than 10%. On the left side, it shows the aggregate results pooled from 2003 to 2014. On the right side, it

shows aggregates for the GFC period alone. Married males in the first quintile were most likely to experience job loss: around 10% over the entire time frame and 20% at the time of the GFC. There is also a difference among income brackets regarding changing jobs. Similarly, a greater proportion of those in the lower-income brackets tend to change jobs. In the lower-income bracket, job loss or changing jobs is one factor in income decline, but it is not the primary cause.

Figure 7: Proportion who lost or changed jobs among those whose income declined by more than 10% from period t to period t+1 (by husband's income bracket)



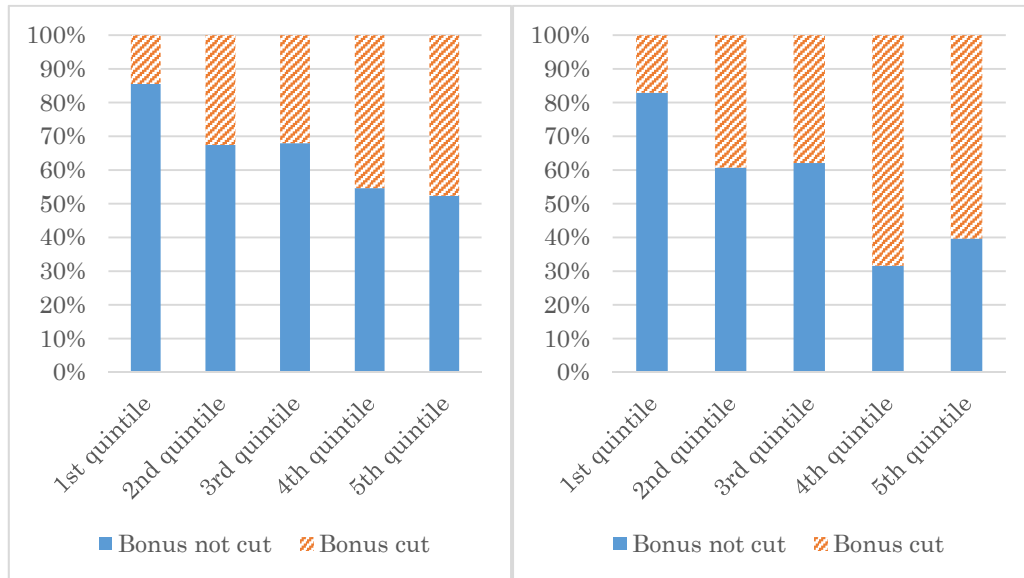
Note 1: Subjects were married men aged 20–59 years employed during period t, whose income declined more than 10% from period t to period t+1. Income brackets aggregated every year based on income (annual income before tax and social security deductions) of married men aged 20-59.

Source: Author's estimates using KHPS from 2004 to 2015.

What then, is the cause of income decline among high-income brackets? Figure 8 shows aggregate figures on whether respondents who experienced income declines of more than 10% while continuing employment at the same company experienced decreased bonuses. Similar to before, the left-hand side shows aggregate data pooled for 2003 through 2014, while the right-hand side shows aggregate data for the time of the GFC alone. This shows that the higher the income bracket, the greater the proportion of respondents who experienced decreased bonuses. Further, this proportion is particularly large at the time of the GFC¹⁴.

¹⁴ In the low-income brackets, there are more workers in non-regular employment and other formats with no

Figure 8: Share of employees who experienced decreased bonuses while continuing employment at the same company among employees whose income fell more than 10% from period t to period t+1



Note 1: Subjects were married men aged 20–59 years employed during period t, whose income declined more than 10% from period t to period t+1. Income brackets aggregated every year based on income (annual income before tax and social security deductions) of married men aged 20–59 years.

Source: Author’s estimates using KHPS data from 2004 to 2015.

From the above results, the following two points are clear. First, incomes stagnate for middle- and high-income brackets in particular when there is a major economic recession. Also, not just low-income brackets, but middle- and high-income brackets experience the risk of decreasing incomes, so the GFC may have reduced income inequality. The second point is that in a recession, while there is a higher risk of job loss or unemployment for lower-income brackets, other changes, such as adjustments via bonuses and other wage measures, are common, particularly for high-income brackets. It is not the case that during recessions, only low-income brackets experience damage from unemployment. No matter what the bracket, there are widespread declines in income, suggesting this may also reduce income inequality during recessions.

4 Relationship between decline in husband’s income and changes in wife’s employment

bonuses than in other income brackets.

This section focuses on the impact of changes in the husband's income, declines in particular, on the wife's employment status. When the husband's income declines due to an economic recession or unemployment, it is possible that a working wife will increase her overtime hours or one who has not been in the workforce will start working, thus increasing the supply of labor, in order to maintain a certain living standard. This is called the "added worker effect"¹⁵ (Higuchi 2001). This added worker effect is thought to be related to household income inequality. Specifically, when a household's income level is originally high, the impact of lowered income from the husband is negligible, and the added worker effect from the wife is also small. However, if the household income is low to start with, the impact of a decline in the husband's income is severe, so the added worker effect from the wife is expected to be larger. As such, even if the husband's income declines, it is possible that there will be a strong added worker effect among brackets with low household-income levels, which will work to suppress the expansion of household income inequality. This section examines the mechanisms by which the wife's employment reduces household income inequality. The data used are from the KHPS from 2004 to 2015. The subjects are married couples where the husband is younger than 60 years.

4.1 Estimation methodology

We estimate three models to analyze the added worker effect attributable to the wife. The first analyzes whether a wife who had withdrawn from the labor market re-enters due to a decline in the husband's income. The second examines whether a working wife continues to work at her current job due to a decline in the husband's income. The third analyzes whether a working wife increases her employment hours due to a decline in the husband's income.

The discussion below starts with the first estimated model. Analysis of the wife re-entering the labor market uses the logit model below.

¹⁵ There has been a great deal of research into the added worker effect in Japan and abroad. Much non-Japanese research points to the existence of the added worker effect (Heckman and MaCurdy 1980, 1982; Lundberg 1985; Stephens 2002; Skoufias and Parker 2006). One representative study is by Stephens (2002). It analyzes the wife's labor supply before and after the husband's unemployment. This showed that the wife's added worker effect is not apparent just at the time of the husband's unemployment, but subsequently as well. Much Japanese research points out the presence of the added worker effect, similar to outside Japan (Higuchi and Abe 1999, Kuroda and Yamamoto 2007; Kohara 2007; Kohara 2010; and Sato 2012). One representative study by Kohara (2007) analyzes the impact of the husband's unemployment on the wife's labor supply. This shows that the husband's unemployment increases the wife's working hours and that the fewer financial assets in a household, the larger the impact.

$$Y_{it}^* = x'_{it}\beta + \delta D_{it} + \gamma I_{it-1} + \theta D_{it} \cdot I_{it-1} + \mu_i + \epsilon_{it} \quad (1)$$

Y_{it} is a dummy variable that takes a value of 1 when the wife changes her status to employed or looking for work from not in the labor force, and 0 if she remains out of the labor force. x_{it} is a vector of individual attributes, including educational history dummies for the husband and wife, wife's age, a dummy for presence of a child under three years old, number of children, savings (in millions of JPY 10,000), debts (in millions of JPY), job-offers-to-applicants ratio by prefecture, and a year dummy. D_{it} is a dummy variable that takes a value of 1 when the husband's income declines more than 10% from period t-1 to period t and 0 otherwise. I_{it-1} is a household income quintile dummy, and indicates equivalent household income at period t-1. In this analysis we prepared by quintile dummies (for the first, second, third, fourth, and fifth quintiles). The first quintile dummy (for the lowest household income quintile) and the fifth quintile dummy (for the highest household income quintile) were used as explanatory variables. Reference group are second, third, and fourth quantiles. $D_{it} \cdot I_{it-1}$ is the cross term between whether the husband's income declines more than 10% dummy and the household-income fifth-quintile dummy. μ_i are unobservable fixed effects and ϵ_{it} indicates error terms.

Of these variables, those of most interest in this analysis are the estimation results for the cross term $D_{it} \cdot I_{it-1}$ for the husband's income declines more than 10% dummy and the household-income fifth-quintile dummy. This cross term shows for which household income brackets the impact of declining husband's income is greatest. If the sign is positive, the wife's added worker effect is stimulated; if negative or found to be insignificant, it means there is no added worker effect from the wife. We examine this using pooled logit and random effect logit models¹⁶. In the estimates, we incorporated analysis using the cross term for the job-offers-to-applicants ratio by prefecture and the year-ago household-income dummy as an additional independent variable to investigate whether changed labor market supply-and-demand conditions affect the wife's re-entering the workforce.

The second analysis regarding continued employment is estimated using the logit model below.

$$C_{it}^* = x'_{it}\beta + \delta D_{it} + \gamma H_{it-1} + \theta D_{it} \cdot H_{it-1} + \mu_i + \epsilon_{it} \quad (2)$$

¹⁶ We investigated using a fixed-effect model, but there was not enough variation in the dependent variable, making it impossible to obtain estimates, so we abandoned this approach.

The dependent variable C_{it} is a dummy variable set to 1 if a wife who was working at period $t-1$ continued working at the same company at period t and 0 if not. This analysis applies to only employed workers. Just as in Formula (1), it uses (x_{it}) for individual attributes and a dummy for when the husband's income declines by more than 10% (D_{it}). Whereas Formula (1) used a dummy for household income at $t-1$, Formula (2) uses (H_{it-1}) as a dummy for husband's income quintile at period $t-1$. This is because in the case of a working wife, her labor income is reflected in household income at period $t-1$, becoming an endogenous variable and potentially causing a bias in the estimation results. The use of a dummy for the husband's income quintile deals with this bias. Formula (2) uses the cross term $(D_{it} \cdot H_{it-1})$ for the dummy of whether husband's income declines by more than 10% against husband's income quintile dummy, and we focus on the estimation results. Estimations are made using the pooled logit and random-effect logit models.

Third, analysis regarding an increase in the wife's working hours is estimated using ordinary-least-squares minimization in the model below.

$$\Delta W_{it} = x'_{it}\beta + \delta D_{it} + \gamma H_{it-1} + \theta D_{it} \cdot H_{it-1} + \mu_i + \epsilon_{it} \quad (3)$$

ΔW_{it} is the difference in the wife's weekly working hours between period $t-1$ and period t . The analysis covered only workers with jobs and the explanatory variables include a regular employment dummy added to Formula (3). Note that the estimates use pooled OLS, fixed-effect OLS, and random-effect OLS.

Using the above estimation methodology, we investigated the impact of a decline in husband's income on wife's employment behavior. An examination of previous research, including that by Kuroda and Yamamoto (2007) and Kohara (2010), shows that the wife's added worker effect primarily takes the form of an unemployed wife entering the workforce (by a wide margin). In this research as well, we focus on whether similar trends are apparent. Basic statistics regarding the variables used in the estimations are shown in Table 2.

Table 2: Basic statistics

Variable	Analysis of wife's new employment		Analysis of wife's continued employment		Analysis of changes to wife's work hours	
	Average	Standard deviation	Average	Standard deviation	Average	Standard deviation
Wife's new employment dummy	0.13	0.34				
Wife's continued employment dummy			0.95	0.21		
Difference in wife's weekly work hours					0.51	15.02
Husband's income declined more than 10% dummy	0.15	0.36	0.18	0.38	0.17	0.38
Year-ago household-income quintile 5th quintile	0.15	0.36				
2nd-4th quintile	0.61	0.49				
1st quintile	0.24	0.43				
Year-ago husband's income quintile 5th quintile			0.19	0.39	0.19	0.39
2nd-4th quintile			0.62	0.49	0.62	0.48
1st quintile			0.19	0.39	0.19	0.39
Job-offers-to-applicants ratio by prefecture	0.87	0.33	0.89	0.34	0.89	0.35
Husband's education dummy Junior/senior high	0.44	0.50	0.54	0.50	0.53	0.50
Technical/junior c	0.06	0.24	0.07	0.26	0.08	0.27
University gradua	0.45	0.50	0.34	0.47	0.34	0.47
Wife's education dummy Junior/senior high	0.45	0.50	0.50	0.50	0.50	0.50
Technical/junior c	0.32	0.47	0.29	0.45	0.29	0.45
University gradua	0.16	0.37	0.13	0.34	0.13	0.34
Wife's age	42.47	8.36	45.12	7.29	44.75	7.28
Wife's employment status dummy Regular employment					0.28	0.45
Non-regular employment					0.72	0.45
Child under three dummy	0.23	0.42	0.05	0.22	0.06	0.24
Number of children	1.83	0.98	1.88	0.92	1.88	0.92
Savings millions of JPY	6.42	10.93	5.26	8.45	5.07	8.23
Debt millions of JPY	8.63	11.73	8.17	11.95	8.17	11.78
Sample size	3,185		5,926		5,742	

Source: Author's estimates using KHPS data from 2004 to 2015.

4.2 Estimation results

Table 3 shows the results of investigating the impact of the decline in husband's income on wife's entry into the labor market. (A1) and (A3) in the table are pooled logit estimation results, and (A2) and (A4) are estimation results from the random-effect logit model. The values in the table are marginal effects.

Looking at the husband's income decline dummy and year-ago household income dummy cross terms for (A1) and (A2) shows that, in both cases, the cross terms for the decline of 10% or more dummy and first-quintile household income dummy are significant and positive. This result means that when the husband's income declines, the percentage of wives newly entering the labor market in the low household-income bracket increases. In contrast, the cross term for the husband's income declines more than 10% dummy and the fifth-quintile household income dummy was not significant. This means that even if the husband's income declines by more than 10%, in households that were originally in a high-income bracket, there is no impact on the wife's employment behavior. The above results mean that the lower the household's household income level, the more sensitive to a decline in husband's income, and the more labor supply is increased. Because the added worker effect from the wife is present, there is a possibility that the wife's employment suppresses the widening of income inequality

among households¹⁷.

In other variables, the coefficient for the job-offers-to-applicants ratio by prefecture, which shows changes to supply-and-demand conditions in the labor market due to economic fluctuations, shows positive and significant results for (A1) and (A2). These results mean that new employment by the wife increases when the job-offers-to-applicants ratio rises in an economic recovery. Further, these results may also show that new job creation is suppressed during an economic downturn and there is a discouraged worker effect, whereby an increasing number of wives remain outside the labor force. If the discouraged worker effect has a different impact on different household income brackets, the impact of the added worker effect on reducing household income inequality may vary. In order to assess this point, we conducted estimations with the addition of cross terms between the job-offers-to-applicants ratio by prefecture and year-ago household income dummy in (A3) and (A4). The results (A3) and (A4) showed that cross terms between the job-offers-to-applicants ratio by prefecture and year-ago household income dummy were not significant. This implied that there were no variations in the impact of the discouraged worker effect among different household income brackets.

Table 3: Impact of decline in husband's income on wife's entry into labor market

¹⁷ This research focuses on households where there is an unemployed wife during recessions, but it is possible that there are households in which a wife who had already been working loses income due to a recession. In this case, particularly in low-income households, if the wife loses her job and the household faces a decline in income, an economic recession will not necessarily reduce household income inequality. In order to assess this, we carried out logit analysis using an unemployment dummy a dependent variable with a value of 1 when the working wife lost her job and 0 when she continued working. This analysis focused on the cross terms of the job-offers-to-applicants ratio by prefecture and year ago household income dummy. The analysis showed that neither of the cross terms for the job-offers-to-applicants ratio by prefecture or year ago household income dummy was significant. This means that wives in low-income households do not necessarily lose their jobs and face a decline in income.

Explanatory variables	(A1)	(A2)	(A3)	(A4)
Husband's income declined more than 10% dummy	-0.018 (0.022)	-0.027 (0.023)	-0.018 (0.022)	-0.027 (0.023)
Year-ago household-income quintile dummy: 5th quintile ref: 2nd-4th quintile	-0.034 (0.025)	-0.026 (0.029)	-0.076 (0.058)	-0.034 (0.062)
1st quintile	0.019 (0.016)	0.025 (0.019)	-0.004 (0.038)	0.013 (0.043)
Year-ago household-income quintile dummy: 5th quintile	0.043 (0.057)	0.044 (0.054)	0.042 (0.057)	0.044 (0.054)
Husband's income declined more than 10% dummy 1st quintile	0.059* (0.034)	0.064* (0.038)	0.061* (0.035)	0.065* (0.038)
Job-offers-to-applicants ratio by prefecture	0.094*** (0.025)	0.093*** (0.032)	0.083*** (0.028)	0.088** (0.035)
Year-ago household-income quintile dummy: 5th quintile			0.046 (0.058)	0.009 (0.057)
Job-offers-to-applicants ratio by prefecture 1st quintile			0.025 (0.039)	0.013 (0.043)
Estimation methodology	Pooled Probit	RE Probit	Pooled Probit	RE Probit
Log-likelihood	-1166.851	-1144.097	-1166.424	-1144.053
Sample size	3,185	3,185	3,185	3,185

Note 1: ***, **, and * indicate that the respective estimated coefficients are significant at the 1%, 5% and 10% levels.

Note 2: Figures in parentheses () are standard errors robust to non-uniform distribution.

Note 3: Table figures show marginal effects.

Note 4: In the estimates, educational history dummies for the husband and wife, wife's age, number of children, savings in millions of JPY, debts in millions of JPY, and a year dummy are used as explanatory variables.

Source: Author's estimates using KHPS from 2004 to 2015.

Table 4 shows the results of investigating the impact of a decline in husband's income on wife's continued employment. Among the estimation results, looking at the cross terms between the dummy for decline in husband's income and husband's year-ago income quintile dummy, no cross terms were significant. These results mean that even if income levels were different, there was no difference in the probability that the wife would continue working due to a decline in husband's income. We considered that there may be a higher probability of the wife remaining employed if a decline in the husband's income prevented her from leaving her job, but we found no impact on this from changes in the husband's income¹⁸.

Table 4 : Impact of decline in husband's income on wife's continued employment

¹⁸ We also conducted analysis dividing wife's employment status one year prior into regular and non-regular employment, but the cross terms with the husband's income decline dummy and year-ago household income dummy were not significant. Further, we also conducted analysis taking into consideration not just the wife leaving employment, but whether or not she changed jobs, but none of the cross terms was significant.

Explanatory variables	(B1)	(B2)
Husband's income declined more than 10% dummy	-0.011 (0.009)	-0.284 (0.222)
Year-ago husband's income quintile dummy: 5th quintile ref: 2nd-4th quintile	-0.013* (0.008)	-0.357 (0.220)
1st quintile	-0.003 (0.008)	-0.082 (0.219)
Year-ago husband's income quintile dummy: 5th quintile	-0.006	-0.118
Husband's income declined more than 10% dummy	(0.017)	(0.410)
1st quintile	0.006 (0.017)	0.221 (0.435)
Job-offers-to-applicants ratio by prefecture	0.000 (0.010)	0.022 (0.288)
Estimation methodology	Pooled Probit	RE Probit
Log-likelihood	-1073.519	-1065.804
Sample size	5,926	5,926

Note 1: ***, **, and * indicate that the respective estimated coefficients are significant at the 1%, 5% and 10% levels.

Note 2: Figures in parentheses () are standard errors robust to non-uniform distribution.

Note 3: Table figures show marginal effects.

Note 4: In the estimates, educational history dummies for the husband and wife, wife's age, number of children, savings in millions of JPY, debts in millions of JPY, and a year dummy are used as explanatory variables.

Source: Author's estimates using KHPS data from 2004 to 2015

Table 5 shows the results of investigating the impact of a decline in husband's income on wife's work hours. Looking at the cross terms for (C3) husband's income decline dummy adopted using the Hausman test and husband's year-ago income quintile dummy, none of the cross terms was significant. This means that even at different income levels, there is no impact on the wife's working hours from a decline in the husband's income. Just as in previous research by Kuroda and Yamamoto (2007) and Kohara (2010), there is no observable added worker effect from changes in the working wife's work hours.

Table 5 : Impact of decline in husband's income on working wife's work hours

Explanatory variables		(C1)	(C2)	(C3)
Husband's income declined more than 10% dummy		0.385 (0.676)	0.513 (0.860)	0.385 (0.676)
Year-ago husband's income quintile dummy ref: 2nd-4th quintile	5th quintile	0.514 (0.606)	0.160 (1.332)	0.514 (0.606)
	1st quintile	-0.706 (0.595)	-0.554 (1.161)	-0.706 (0.595)
Year-ago husband's income quintile dummy x Husband's income declined more than 10% dummy	5th quintile	-0.724 (1.418)	-0.959 (1.850)	-0.724 (1.418)
	1st quintile	0.607 (1.328)	0.905 (1.632)	0.607 (1.328)
Job-offers-to-applicants ratio by prefecture		0.411 (0.823)	1.457 (2.106)	0.411 (0.823)
Estimation method		Pooled OLS	FE OLS	RE OLS
Hausman test				0.999
R2		0.004	0.004	0.004
Sample size		5,742	5,742	5,742

Note 1: ***, **, and * indicate that the respective estimated coefficients are significant at the 1%, 5% and 10% levels.

Note 2: Figures in parentheses () are standard errors.

Note 3: In the estimates, educational history dummies for the husband and wife, wife's age, a dummy for wife's regular employment, number of children, savings (JPY10,000)/100, debts (JPY10,000)/100, and a year dummy are used as explanatory variables.

Source: Author's estimates using KHPS data from 2004 to 2015.

Summarizing the above results, two points have become clear. First, when the husband's income declines, there is an added worker effect observed, whereby a wife who had not been previously working supplies additional labor. This effect was observed mainly in households that originally had low incomes. Because the added worker effect is stronger in the lower income households, it is possible that the wife's employment helps to constrain the expansion of household income inequality when the husband's income declines. The second point is that when the husband's income declines there is no observable change in the supply of labor from working wives¹⁹.

5 Impact of wife's income on household income inequality

Regarding income inequalities in society as a whole, publications from the Ministry of Health, Labor and Welfare (*Survey on the Redistribution of Income*) and Ministry of Internal Affairs and Communications (*Comprehensive Survey of Living Conditions*) both show that from the late 2000s through the 2010s, the representative indicator of income

¹⁹ In Table 4 and Table 5, we added cross terms for the job-offers-to-applicants ratio by prefecture and husband's year-ago income quintile dummy to analyze the impact of economic fluctuations on working hours and continued employment, but virtually all of the cross terms were insignificant. This result suggests that even if there are differences in the husband's income, economic fluctuations do not result in changes to the wife's working hours or continued employment.

inequality, the Gini coefficient, was declining²⁰. It is impossible to grasp yearly fluctuations in the Gini coefficient or the impact of income source on the Gini coefficient from official published statistics. Therefore, in this section, we look at a time series of the Gini coefficient estimated using only the husband's income, versus one that includes the wife's income as well, to see the impact of wife's income on reducing household income inequality²¹.

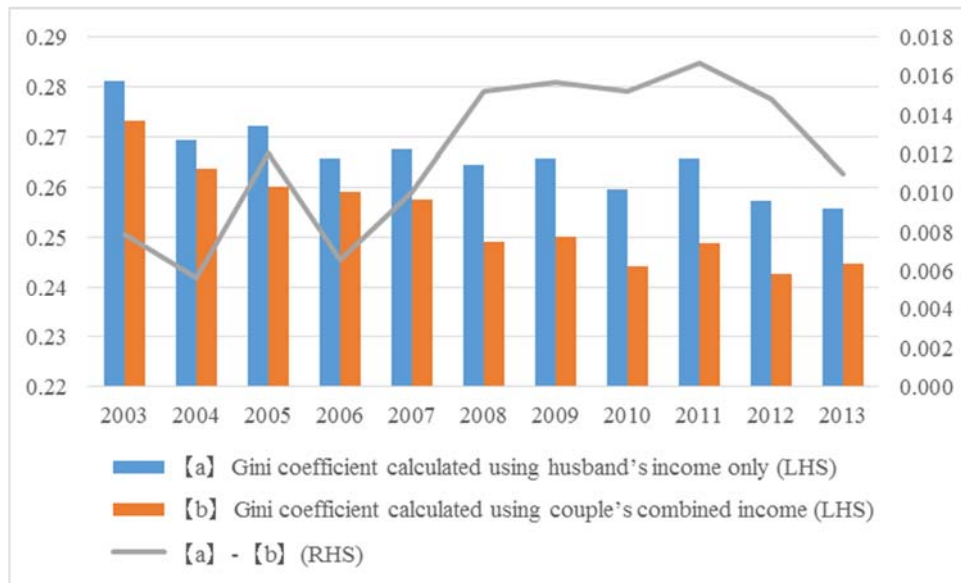
Figure 9 shows the time series for the Gini coefficient calculated using only the husband's income from work and that using the husband's and wife's combined income from work. From the figure, it is clear that the wife's income has a leveling effect on household income inequality. There is a secular downtrend in the Gini coefficient²². The most salient feature is that there is a watershed around the GFC in 2008 and subsequently until 2011: there is a major impact on lessening the Gini coefficient due to the wife's income. As shown in the previous section, in particular for low-income brackets, disparities among households improved as wives began to work to compensate a decline in the husband's income due to the GFC.

Figure 9 : Gini coefficient calculated using only husband's income and including wife's income

²⁰ According to the Ministry of Health, Labour and Welfare's *Survey on the Redistribution of Income*, the Gini coefficient measured using equivalent disposable income was 0.322 in 2004 (from survey year 2005, here and after), 0.327 in 2007, 0.322 in 2010, and 0.316 in 2013. According to the Ministry of Internal Affairs and Communications' Comprehensive Survey of Living Conditions, the Gini coefficient measured using equivalent disposable income was 0.278 in 2004, 0.283 in 2009, and 0.281 in 2014.

²¹ In Europe and the US there is much reported research into what sort of impact the wife's income has on household income inequality against the backdrop of rising wives' employment. Researchers have come to different conclusions. Lerman and Yitzhaki (1985) analyze the Gini coefficient in the US and report that since 1979, female incomes have widened household income inequality. Using the same methodology, Urakawa comments that from the early 1990s to the beginning of the 2000s in Japan, the wife's income has contributed to widening the household income inequality in working-age households. Conversely, Harkness, Machin and Waldfogel (1997) and Cancinan and Reed (1999) conclude from their analysis that wives' income reduces household income inequality or, if it does widen it, the impact is negligible.

²² Changes in the Gini coefficient time series may be affected by problems such as sample dropouts in the panel data and aging of the sample.



Note 1: Analysis subjects are the same as used in the analysis in Section 3, married males aged 20–59 years in employment in period t for whom information was available through period $t+1$, so aggregate results are until 2013. Income (before deducting tax and social security payments) for husband and wife obtained through their respective work over the period of a year was used for income.

Source: Author's estimates using KHPS data from 2004 to 2015.

6 Conclusions

This study examines how household income inequality in Japan is impacted by changes in a couple's income and employment status after economic crises, using the Keio Household Panel Survey (KHPS). Our analysis of the periods before and after the Global Financial Crisis yields three notable findings. First, during the recession, incomes stagnated for households in the middle- and high-income brackets, with many experiencing income declines, typically bonus declines. Conversely, many low-income households saw incomes increase even during the recession, and this suggests that during economic downturns, income inequality between low-income and high-brackets shrinks. Second, concerning the impact of changes in the husband's income on the wife's employment, we show that when the husband's income declines, the added worker effect is observed. This effect was larger in households whose income was originally low. Third, we calculate the Gini coefficient both by using only the husband's labor income, and also with the wife's labor income added. We find that the wife's labor income reduced household income inequality, in particular for several years following the 2008 recession.

To summarize the above, when focusing only on married households, income inequality appears to shrink during economic recessions. The background to this is income declines by the husband in medium- and high-income brackets and assumption of work by wives in low-income brackets. These results show that a couple's employment and income affect income inequality at times of economic fluctuation, a new finding not pointed out in previous research.

We showed that the Gini coefficient for all households by considering household head's income, including that of unmarried households (single-person and single-parent households) shows countercyclical movements. During economic recoveries, income inequality shrinks. When the economy worsens, inequality expands. Single-person and single-parent households suffer a strong impact from increased unemployment when the economy worsens, but the effect is smaller on household heads in married households, and indeed there is a strong impact from bonuses and overtime pay. Furthermore, in addition, increased employment opportunities for women encourage wives to start working, particularly in low-income households, increasing income and reducing income inequality during recessions. In the future, it will be necessary to ascertain whether these developments are specific to the Global Financial Crisis, or whether they may be observed as general trends during other processes in the economic cycle. It is nonetheless undeniable that changes in labor supply by household and attribute have a major impact on household income inequality.

Appendix 1 Number of unemployed persons and changes in unemployment rate by gender

	Unemployed males				Unemployed females			
	Numbers (10,000 persons)	Year-on-year change	Unemployment rate	Year-on-year change	Numbers (10,000 persons)	Year-on-year change	Unemployment rate	Year-on-year change
2002	219		5.5		140		5.1	
2003	215	-4	5.5	0	135	-5	4.9	-0.2
2004	192	-23	4.9	-0.6	121	-14	4.4	-0.5
2005	178	-14	4.6	-0.3	116	-5	4.2	-0.2
2006	168	-10	4.3	-0.3	107	-9	3.9	-0.3
2007	154	-14	3.9	-0.4	104	-3	3.7	-0.2
2008	159	5	4.1	0.2	107	3	3.8	0.1
2009	203	44	5.3	1.2	133	26	4.8	1
2010	207	4	5.4	0.1	127	-6	4.6	-0.2
2011	187	-20	4.9	-0.5	115	-12	4.2	-0.4
2012	173	-14	4.6	-0.3	112	-3	4	-0.2
2013	162	-11	4.3	-0.3	103	-9	3.7	-0.3
2014	141	-21	3.7	-0.6	95	-8	3.4	-0.3
2015	134	-7	3.6	-0.1	88	-7	3.1	-0.3

Source: Labor Force Survey, Statistics Bureau, Ministry of Internal Affairs and Communications

Appendix 2 Number of workers by employment status and gender

(A) males (10,000 persons)

	Employees	Employment status									
		Employees excluding executives	Regular employee	Non-regular employee	Part-time/temporary worker			Dispatched worker from temporary labor agency	Contract employee	Entrusted employee	Other
					Part-time worker	Temporary worker	Part-time worker				
2002	3165	2867	2437	431	229	63	166	10	122	70	
2003	3152	2853	2410	444	235	63	171	13	125	71	
2004	3152	2851	2385	466	236	70	166	28	136	66	
2005	3165	2864	2357	507	247	77	171	42	149	69	
2006	3194	2897	2378	519	247	79	168	49	151	71	
2007	3240	2947	2408	539	255	83	172	54	162	69	
2008	3220	2928	2367	560	248	82	166	55	180	77	
2009	3162	2874	2345	527	250	84	166	37	174	67	
2010	3148	2865	2324	540	259	87	172	35	181	66	
2011	3163	2885	2313	571	276	94	182	39	197	62	
2012	3147	2865	2300	566	272	97	175	36	197	61	
2013	3140	2878	2267	610	301	101	200	48	147	72	
2014	3151	2889	2259	630	304	103	201	48	159	76	
2015	3158	2896	2261	634	312	108	204	50	154	75	
Change from 2008 to 2009	-58	-54	-22	-33	2	2	0	-18	-6	-10	

(B) females (10,000 persons)

	Employees	Employment status									
		Employees excluding executives	Regular employee	Non-regular employee	Part-time/temporary worker			Dispatched worker from temporary labor agency	Contract employee	Entrusted employee	Other
					Part-time worker	Temporary worker	Part-time worker				
2002	2172	2073	1052	1021	825	655	170	33	108	55	
2003	2191	2095	1034	1061	855	685	170	37	111	58	
2004	2220	2124	1025	1098	860	693	166	57	119	62	
2005	2243	2144	1018	1126	872	703	169	64	130	60	
2006	2292	2195	1036	1159	878	713	165	78	133	70	
2007	2332	2237	1041	1196	911	741	170	81	137	68	
2008	2337	2248	1043	1205	906	741	165	85	142	71	
2009	2341	2250	1050	1200	906	733	173	72	149	73	
2010	2361	2273	1051	1223	937	764	172	62	152	73	
2011	2369	2279	1039	1241	954	779	173	59	163	66	
2012	2375	2288	1041	1247	969	792	177	55	157	67	
2013	2405	2323	1027	1296	1019	826	192	68	126	43	
2014	2436	2351	1019	1332	1042	840	202	71	133	44	
2015	2473	2388	1042	1345	1053	852	201	76	133	43	
Change from 2008 to 2009	4	2	7	-5	0	-8	8	-13	7	2	

Source: Labor Force Survey, Statistics Bureau, Ministry of Internal Affairs and Communications

Appendix 3 Number of male and female employees by industry

Source: Labor Force Survey, Statistics Bureau, Ministry of Internal Affairs and Communications

(A) males (10,000 persons)

	Total	Industry																			
		Culture and recreational industries	Fisheries	Mining and quarrying of stone and gravel	Construction	Manufacturing	Electricity, gas, heat supply and water	Information and communications	Transport and postal activities	Wholesale and retail trade	Finance and insurance	Real estate and goods rental and leasing	Scientific research, professional and technical services	Accommodations, eating and drinking services	Living related and personal services and amusement services	Education learning support	Medical health care and welfare	Compound services	Services, not elsewhere classified	Government, except elsewhere classified	
2008	3226	25	3201	6	2	372	760	29	137	268	470	76	63	97	113	73	123	123	34	255	173
2009	3169	27	3142	5	3	360	726	31	140	272	462	77	62	97	114	74	124	129	31	241	172
Change from 2008 to 2009	-57	2	-59	-1	1	-12	-34	2	3	4	-8	1	-1	0	1	1	1	6	-3	-14	-1

(B) females (10,000 persons)

	Total	Industry																			
		Culture and recreational industries	Fisheries	Mining and quarrying of stone and gravel	Construction	Manufacturing	Electricity, gas, heat supply and water	Information and communications	Transport and postal activities	Wholesale and retail trade	Finance and insurance	Real estate and goods rental and leasing	Scientific research, professional and technical services	Accommodations, eating and drinking services	Living related and personal services and amusement services	Education learning support	Medical health care and welfare	Compound services	Services, not elsewhere classified	Government, except elsewhere classified	
2008	2320	21	2298	2	0	67	324	3	45	60	474	82	35	53	187	105	136	444	22	188	51
2009	2321	24	2297	3	0	66	299	4	46	63	476	84	35	51	193	109	138	461	20	180	52
Change from 2008 to 2009	1	3	-1	1	0	-1	-25	1	1	3	2	2	0	-2	6	4	2	17	-2	-8	2

Appendix 4 Marital status of male employees over 15-years-old by employment status

(2007 average)

Source: *Labor Force Survey*, Statistics Bureau, Ministry of Internal Affairs and Communications

	Never married	Married	Widowed or divorced
Total employees	27%	69%	4%
Agriculture	12%	82%	6%
Non-agriculture	27%	69%	4%
Self-employed	12%	82%	6%
Piece worker	0%	100%	0%
Family worker	52%	43%	4%
Employee	29%	67%	4%
Executive	7%	90%	4%
Regular employee	28%	68%	3%
Part-time/temporary worker	58%	37%	5%
Dispatched worker from temporary labor agency	55%	40%	6%
Contract/entrusted employee	26%	68%	6%
Other	30%	64%	6%

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