Discussion Paper, Series A, No. 2008-200

A Decomposition Analysis of Earnings Inequality for Wives in Japan

Yukiko Abe & Akiko S. Oishi

May, 2008

Graduate School of Economics & Business Administration
Hokkaido University
Kita 9 Nishi 7, Kita-Ku, Sapporo 060-0809, JAPAN

A decomposition analysis of earnings inequality for wives in Japan*

Yukiko Abe† Akiko S. Oishi‡

May 20, 2008

Abstract

We present a simple variance decomposition framework to assess the development of earnings inequality for married women, and apply it to microdata for married women in Japan.

JEL classification: D31, J21

Key words: Coefficient of variation, 1.03 million yen ceiling, Japan

1 Introduction

The role of wives' earnings in the inequality of family earnings is a subject that has attracted much attention (Karoly and Burtless, 1995; Cancian and Reed, 1998;

*The analysis in Section 3 uses resampled microdata from the National Survey of Family Income and Expenditure (NSFIE) made available through the Research Centre for Information and Statistics of Social Science, Institute of Economic Research, Hitotsubashi University. The resampled microdata cannot be released owing to the terms of usage of the data. This research was supported by Grants-in-Aid for Scientific Research from the Japan Society for Promotion of Science (Abe, C-17530188; Oishi, C-19530198). Remaining errors are our own.

†Graduate School of Economics and Business Administration, Hokkaido University, Kita 9 Nishi 7, Kita-ku, Sapporo, 060-0809 Japan. Phone: +81-11-706-3860, Fax: +81-11-706-4947, E-mail: abey@econ.hokudai.ac.jp.

‡Corresponding author. Faculty of Law and Economics, Chiba University, Yayoi-cho 1-33, Inage-ku, Chiba, 263-8522 Japan. Phone: +81-43-290-3579; Fax: +81-43-290-2403. E-mail address: oishi@le.chiba-u.ac.jp.

Reed and Cancian, 2001; Pencavel, 2006). Furthermore, understanding earnings inequality among married women is of interest in Japan because wives' earnings are much more unequal than husbands' earnings (Abe and Oishi, 2007).

In this paper, we present a simple variance decomposition framework to assess the development of earnings inequality for married women in Japan. We focus on the role of the "1.03 million yen ceiling", which refers to the tendency of married women in Japan who work part-time to limit their earnings to no more than 1.03 million yen (approx. 10,000 US dollars). This ceiling means that the earnings of married women who work part-time are heavily concentrated around 1.03 million yen.[1]

We first present a framework for variance decomposition and then apply it to cross-sectional data from the National Survey of Family Income and Expenditure (NSFIE) in 1994 and 2004, a nationally representative data that contains information on household earnings.

2 Earnings decomposition when the ceiling is present

Let $\bar{y}$ be the mean earnings for married women, $V(y)$ be their variance, and CV^2 be the square of the coefficient of variation ($CV^2 = V(y)/\bar{y}^2$).

We denote y_i as the earnings of individual (wife) i and θ is the threshold value around which the earnings of wives are concentrated (i.e., 1.03 million yen). For the purpose of our analysis, wives are classified into one of the following four categories, depending on their earnings level (notations in parentheses are the labels for each group): (1) zero earnings (Z); (2) earnings between 0 and θ (I_0); (3) earnings equal to θ (T) ; and (4) earnings over θ (I_1).

[1]Recent papers that report this pattern include Nagase and Nawata (2005), Akabayashi (2006), Sakata and McKenzie (2006), and Abe (2008).

The variance of wives' earnings, $V(y)$, is decomposed as follows:

$$
\begin{aligned}
V(y) &= \frac{1}{N}\Big[\sum_{i\in Z}(0-\bar{y})^2 + \sum_{i\in I_0}(y_i-\bar{y})^2 + \sum_{i\in T}(\theta-\bar{y})^2 + \sum_{i\in I_1}(y_i-\bar{y})^2\Big] \\
&= \frac{1}{N}\Big[\sum_{i\in Z}(\bar{y})^2 + \sum_{i\in I_0}\{(y_i-\bar{y_0})^2 + (\bar{y_0}-\bar{y})^2\} \\
&\quad + \sum_{i\in T}(\theta-\bar{y})^2 + \sum_{i\in I_1}\{(y_i-\bar{y_1})^2 + (\bar{y_1}-\bar{y})^2\}\Big],
\end{aligned} \tag{1}
$$

where $\bar{y_0}$ is the mean earnings for wives in group I_0, and $\bar{y_1}$ is the mean earnings for wives in group I_1.

Dividing $V(y)$ in Eq. (1) by $\bar{y}^2$ and simplifying yields the following expression for CV^2, which is the sum of the between-group term and the within-group term:

$$
\begin{aligned}
CV^2(y) = &\Big\{\frac{n_Z}{N} + \frac{n_{I0}}{N}\frac{(\bar{y_0}-\bar{y})^2}{\bar{y}^2} + \frac{n_\theta}{N}\frac{(\theta-\bar{y})^2}{\bar{y}^2} + \frac{n_{I1}}{N}\frac{(\bar{y_1}-\bar{y})^2}{\bar{y}^2}\Big\} \\
&+ \Big\{\frac{n_{I0}}{N}\frac{V(y_i \mid i\in I_0)}{\bar{y}^2} + \frac{n_{I1}}{N}\frac{V(y_i \mid i\in I_1)}{\bar{y}^2}\Big\}.
\end{aligned} \tag{2}
$$

The first line of Eq. (2) is the "between-group" component; it is the sum of the squared deviations of the group means from the population mean, weighted by the population share of each group. The second line is the sum of the within-group variances for the groups I_0 and I_1. Workers in groups I_0 and I_1 choose working hours as an interior solution.[2] For non-workers and those with earnings equal to θ, earnings are equal for everyone and thus the within-group variance is zero.[3]

The decomposition of Eq. (2) shows the following: (1) a decrease in the number of wives with zero earnings (i.e., decrease in n_Z/N) reduces CV^2; (2) CV^2 is the sum of six terms, where each term is the product of the population share and the square of the deviation of the group mean from $\bar{y}$, or the product of the

[2]On the other hand, zero earnings and threshold earnings are corner solutions in the optimization problem for labor supply of married women.

[3]However, in the empirical analysis below we assume that individuals with earnings around θ are in the T category, so the variance of earnings for group T is not zero but is still very small.

population share and the within-group variance. The decomposition of CV^2 in Eq. (2) is summarized in Table 1.

3 Empirical analysis

We apply the above procedure to wage-salary earnings data for married women in Japan. The data are microdata from the National Survey of Family Income and Expenditure (NSFIE, Statistics Bureau, Ministry of Internal Affairs and Communications) in 1994 and 2004. The earnings figures are annual earnings in the previous year (1993 and 2003). The sample is restricted to women married to male household-heads aged 25–59 years; the sample size is 31,166 for 1994 and 24,434 for 2004. The threshold value is set to 0.9 million yen for separating I_0 and T and to 1.3 million yen for separating T and I_1. This selection is made because earnings between 0.9 and 1.3 million yen are typical levels that married women who intend to limit their annual earnings would choose. The results are reported in Table 2.

In the sample for 2003, 53 percent had no wage-salary earnings, 16 percent had positive earnings below 0.9 million yen, 11 percent had earnings around 1.03 million, and the remaining 20 percent had earnings above 1.3 million. The mean is 0.92 million, which is close to the earnings threshold θ.

The major components of CV^2 are: (1) the between-group component for zero earnings (group Z, row c); (2) the between-group component for earnings over θ (group I_1, row c); and (3) the within-group component for group I_1. The other components are quite small compared to these three. Of the three components above, the largest is the between-group component for group I_1, which corresponds to more than half of CV^2. Therefore, the primary source of inequality in married women's earnings is that "high earners" (wives with earnings above θ, approx. 20 percent of married women) earn much more than the average earnings of married women. The second largest component is the within-group variance for group I_1, which accounts for approximately 30 percent of CV^2. Comparison of the two years indicates the following. CV^2 decreased from 3.42 to 3.17, and thus the inequality in wage-salary earnings of married women decreased. The component that contributed most to this decline is the between-group component for group I_1. An increase in the average earnings of all married women ($\bar{y}$) reduced the differential between the mean earnings of ”high eaners” and those of all married women. Note that the proportion in group I_1 remained at approximately 20 percent for the two years. The decrease in the proportion of women with zero earnings between 1993 and 2003 also contributed to the decrease in CV^2. There is a common source for the decrease in the two components: an increase in labor force participation by married women. This reduces the proportion of women with zero earnings (fall in n_Z/N) and increases $\bar{y}$.

4 Conclusion

This paper presents a framework for decomposing the earnings inequality for married women, and then applies it to microdata for married women in Japan. The empirical results show that the following three components constitute most (more than 98 percent) of the squared coefficient of variation for wage-salary earnings of married women: (1) high mean earnings for women earning more than the threshold compared with the overall mean; (2) within-group earnings variance for those who earn more than the threshold; and (3) the proportion of zero earners. Of these, the first is the largest and accounts for over 50 percent of the coefficient of variation. Inequality decreased between 1993 and 2003, mainly because the average earnings of married women increased, and thus the earnings differential between high-earning women and all married women narrowed.

References

Abe, Y., 2008. The effects of the 1.03 million yen ceiling in a dynamic labor supply model, Contemporary Economic Policy, forthcoming.

Abe, Y., Oishi, A. S., 2007. The role of married women's labor supply on family earnings distribution in Japan. Journal of Income Distribution 16 (3-4), 110–127.

Akabayashi, H., 2006. The labor supply of married women and spousal tax deduction in Japan- a structural estimation. Review of Economics of the Household 4 (4), 349–378.

Cancian, M., Reed, D., 1998. Assessing the effects of wives'earnings on family income inequality. Review of Economics and Statistics 80 (1), 73–79.

Karoly, L., Burtless, G., 1995. Demographic change, rising earnings inequality, and the distribution of personal well-being, 1959-1989. Demography 32 (3), 379–405.

Nagase, N., Nawata, K., 2005. Changes in taxes and social security system on part-time labor supply (Part no zeisei, shakai-hoken seido no henkou to roudou kyoukyu heno eikyo) (in Japanese), Paper presented at the 2005 Fall Meeting of the Japanese Economic Association.

Pencavel, J., 2006. A life cycle perspective on changes in earnings inequality among married men and women. Review of Economics and Statistics 88 (2), 232–242.

Reed, D., Cancian, M., 2001. Sources of inequality: Measuring the contributions of income sources to rising family income inequality. Review of Income and Wealth 47 (3), 321–333.

Sakata, K., McKenzie, C. R., 2006. The impact of the tax reform in 2004 on the female labour supply in Japan, mimeo, Ritsumeikan University.

Table 1: Decomposition of CV^2

Group	Z	I_0	T	I_1
Income range	$y_i = 0$	$0 < y_i < \theta$	$y_i = \theta$	$y_i > \theta$
(a) Population	n_Z/N	n_{I0}/N	n_θ/N	n_{I1}/N
(b) Between	1	$(\bar{y_0} - \bar{y})^2/\bar{y}^2$	$(\theta - \bar{y})^2/\bar{y}^2$	$(\bar{y_1} - \bar{y})^2/\bar{y}^2$
(c) Total, Between ((a) × (b))	n_Z/N	$(n_{I0}/N)(\bar{y_0} - \bar{y})^2/\bar{y}^2$	$(n_\theta/N)(\theta - \bar{y})^2/\bar{y}^2$	$(n_{I1}/N)(\bar{y_1} - \bar{y})^2/\bar{y}^2$
(d) Within	-	$V(y_{i0})/\bar{y}^2$	-	$V(y_{i1})/\bar{y}^2$
(e) Total, Within ((a) × (d))	-	$(n_{I0}/N)V(y_{i0})/\bar{y}^2$	-	$(n_{I1}/N)V(y_{i1})/\bar{y}^2$

Table 2: Decomposition results for married women's earnings

Year	1993				2003			
Group	Z	I_0	T	I_1	Z	I_0	T	I_1
	$y_i=0$	$0<y_i≤0.9$	$0.9<y_i≤1.3$	$y_i>1.3$	$y_i=0$	$0<y_i≤0.9$	$0.9<y_i≤1.3$	$y_i>1.3$
(a) Population	0.5887	0.1348	0.0751	0.2014	0.5341	0.1583	0.1082	0.1995
(b) Between	1	0.0831	0.0398	9.2539	1	0.1253	0.0203	8.2993
(c)Total, Between	0.5887	0.0112	0.0030	1.8635	0.5341	0.0198	0.0022	1.6555
(d) Within	0	0.0712	0.0165	4.6934	0	0.0688	0.0138	4.7302
(e) Total, Within	0	0.0096	0.0012	0.9452	0	0.0109	0.0015	0.9436
CV^2	3.4224				3.1675			

Note: Earnings figures are in million yen.
Source: Authors' calculation from the micro data of the NSFIE (1994 and 2004).