いては，以前に比べ失業率が上昇し，長期失業による貧困も無視しえないため，失業貧困と低所得による貧困との区別を重視するのが妥当だろう」(p.5)

↓

○ 労働市場での活動の規定

- 3ヶ月以上労働市場で活動するという「活動の期間」を基本に，以下の処置を行った。
  - ① 学生を除く(分子・分母双方から)
  - ② 仕事の主従のうち「主に仕事」の層を対象とする(分子・分母双方)
- 福原(2008)の指摘については，考慮の必要がある。基本的に本報告推計の対象となる層は，福原(2008)の言うアクティブ・プアであり，それを失業貧困者とワーキングプアに分けることは可能。失業率の高まり・長期失業者の増加はあるが，福原(2008)の言う②については，日本に当てはまるか否かについて議論の余地があるだろう。

5. 推計結果

○尺度

- 失業・就労貧困率＝ワーキングプア÷(ワーキングプア＋非ワーキングプア)×100
- Poverty Share：ワーキングプア内部での各項目の構成比(ワーキングプア総数を100とする。)
- 「学生を除いた失業・就労貧困率」と「学生を除き仕事が主な者を対象とした失業・就労貧困率」をグラフ化し，左右に並べて掲載している(資料p.6～)。

5-1 ワーキングプア(学生を除く)の規模と構成(全体表：資料5参照)

- 失業・就労貧困率：学生を除いているため，岩井・村上(2007a)(2007b)(2007c)の結果よりも低くなっている。
- 総数：
  - 1992年【3.7%(男性3.0%，女性4.7%)】，1997年【3.9%(男性3.1%，女性5.0%)】，2002年【6.2%(男性5.2，女性7.5%)】
  - 全体では，男性よりも女性の失業・就労貧困率が高い
- 年齢別：(図1参照)
  - 若年層(15～24歳，特に男性)の1997～2002年の間での急増
  - 高齢層・中高齢女性で失業・就労貧困率が高い(最低生活基準に母子加算・高齢加算を含めたためだと考えられる。)
- 学歴別：(図2参照)
  - 明確な学歴間格差。学歴が低いほど失業・就労貧困率が高い。
- 従業上の地位別：(図3参照)

- ➢ 日雇，雇人なし自営業主で失業・就労貧困率が高い。

・ 雇用形態別：(図 4 参照)
- ➢ 正規の職員とそれ以外(パート・アルバイト・派遣職員・嘱託)との格差

・ 従業員規模：(資料 pp.3-4，資料 5 参照)
- ➢ 明確な従業員規模別格差。従業員規模が小さいほど失業・就労貧困率が高まる。

5-2 仕事が主の者を対象としたワーキングプア(全体表：資料 pp. 4-5，資料 6 参照)

○ 失業・就労貧困率：学生を除いた表(資料 5)と比較すると，失業・就労貧困率はそれほど大きく下落していない。

・ 総数：
- ➢ 1992 年【3.4%(男性 2.9%，女性 4.5%)】，1997 年【3.7%(男性 3.0%，女性 4.9%)】，2002 年【5.9%(男性 5.0，女性 7.5%)】

・ 年齢別：(図 5 参照)
- ➢ 若年層(15～24 歳，特に男性)の急増をここでも確認できる。

・ 学歴別：(図 6 参照)
- ➢ より鮮明になった(特に女性において)学歴間格差。学歴が低いほど失業・就労貧困率が高い。

・ 従業上の地位別：(図 7 参照)
- ➢ 全体的に(各従業上の地位において)女性の失業・就労貧困率が上昇した。

・ 雇用形態別：(図 8 参照)
- ➢ 正規の職員とそれ以外(パート・アルバイト・派遣職員・嘱託)との格差がより鮮明な形であらわれるようになった。

・ 従業員規模：(資料 pp.4-5，資料 6 参照)
- ➢ 明確な従業員規模別格差。(資料 5 に同じ)

6. まとめと課題

○ 世帯所得と個人の労働力状態をリンクさせる形でワーキングプアを規定し，学生を除き，仕事が主なものを対象に推計。
- ➢ 男女間，学歴間，就業・雇用形態間，従業員規模間での違い。正規の職員とそれ以外で大きな違いが出ている。(ワーキングプアの増大は，少なくとも非正規雇用の増大とパラレル)
- ➢ 若年層のワーキングプアの急増，雇人なし自営業主の貧困率の高さ

○ 上記の特徴は先進諸国共通のものなのか否か。国際比較(<課題>進行中。)

○ 2007 年の状態はどうなるか(<課題>マイクロデータの提供がまだ。)

○ 流動化する層をどう捉えるか(就調は 5 年毎。この間の変動。そもそも漏れはないか。)

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Labor Supply Behavior of Japanese Husbands and Wives

Koyo, Miyoshi*

Abstract

This paper analyzes labor supply behaviour for Japanese married men and women taking account for their joint decision. The estimation results by simultaneous tobit implies that Japanese wives reduce their labor supply when husbands increase their labor supply while husbands do not change their labor supply regardless wives' labor supply. According to estimation results, both increase in wages of husbands and wives reduce wives' labor supply while increase in wages of husbands increase husbands' labor supply.

Keywords: Simultaneous Tobit, Labor Supply

JEL Classi cation Number: J16 J22

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1 Introduction

OECD (2008) devotes a chapter for the discussion surrounding Japanese labor market, where the population of the working-age group has rapidly decreasing[1]. OECD (2008) points out it is necessary to increase labor input from females to cope with population aging trend because Japanese females have stronger tendency to leave the labor market than in any other developed country when they marry (OECD (2002)). Although many females return to labor market after withdrawl at the marriage, many of them don't choose to work full time. The proportion of females who work part-time is one of the highest in OECD countries at 41% (OECD (2008)).

The aim of this paper is to examine what discourage Japanese married female from working. To achieve this aim, this paper follows Lundberg (1988) who analyzes labor supply behaviour of U.S. married couples taking account for possibility that their decisions are jointly determined. Labor supply functions for husbands and wives are estimated using simultaneous Tobit (model 4 in terms of Maddala (1983), explained in detail by Matsuura and McKenzie (2009)).

Compared to existing empirical studies of Japanese married female labor supply, for example, Hill (1989), Higuchi (2001), Takeuchi (2004), and Ma (2007), this paper has following features. The estimation method used in this paper takes account of the possibility that both wife's labor supply and husband's labor supply are simultaneously determined, unlike previous studies which assumes husband's labor supply is predetermined.

The empirical results can be summarized as follows. Husband's market work reduces wife's market work while wife's market work does not affect husband's market work at least according to the results for pooled whole sample. Wage effects differ: both wages of husbands and wives affect wives' labor supply negatively while husbands' wages affect husband's labor supply positively.

The remainder of this paper is as follows. Section 2 explains the empirical model, the data and the characteristics of hours of work and housework of each married couple in our sample. Section 3 presents the empirical results, and Section 4 contains a conclusion.

2 Model

There are a lot of studies which analyze a family joint labor supply behaviour, both theoretically and empirically. Chiappori (1988) introduces a sophisticate approach which eases an assumption that there is one only decision maker. Chiappori (1988) assumes there are not one but two decision makers (typically, a husband and a wife)

[1] According to Japanese National Institute of Population and Social Security Research, the share of the population of the working-age group has been declining and will be below 60% in 2020.

cooperate each other so as to maximize each other utility. However, empirical researches in this setting like van Soest (1995), or Blundell et al. (2007) must make some restriction to estimate. This paper uses much more simpler approach.

This paper uses follows Lundberg (1988) who analyzes labor supply behaviour of U.S. married men and women treating each spouse's labor supply as endogenous.

This paper assumes a family consists of a husband and a wife maximize following utility function. Each member of couple maximize

$$U_i(T - h_i, C), \tag{1}$$

where h represents hours of market work and C represents consumption of the family. In this sense, a family is assumed to share their consumption. A subscript h, w represents a husband and a wife.

Each family faces following budget constraint,

$$C \leq Y + w_h h_h + w_w h_w + H(T - h_h, T - h_w) \tag{2}$$

where w represents each wage and Y represents a couple's non-labor income. A function H represents a household production function. Hereafter, this paper denotes the budget constraint above as $B(h_h, h_w, .)$.Because the model is static in this paper, so

$$C = B(h_h, h_w, .) \tag{3}$$

Each member of a couple chooses hours of work to maximize above utility, so their reaction functions of hours of work $h_h^*, h^*{}_{,w}$ are

$$\begin{cases} h_h^* = \arg\max_{h_h} U_h(T - h_h, B(h_h, h_w^*, .)) \\ h_w^* = \arg\max_{h_w} U_w(T - h_w, B(h_h^*, h_w, .)) \end{cases} \tag{4}$$

where $\bar{H} \geq h_i^* \geq 0$ $(i = h, w)$.

This paper assumes following closed linear labor supply reaction function,

$$H_h^* = \alpha_h + \gamma_h H_w^* + \delta_h Z_h + \beta_h^h w_h + \beta_h^w w_w + \epsilon_h, \tag{5}$$

$$H_w^* = \alpha_w + \gamma_w H_h^* + \delta_w Z_w + \beta_w^h w_h + \beta_w^w w_w + \epsilon_w, \tag{6}$$

$$H_i = \begin{cases} H_i^* & \text{if} \quad H_i^* > 0 \\ 0 & \text{if} \quad H_i^* \leq 0 \end{cases} \qquad i = h, w, \tag{7}$$

where H represents hours worked, w represents market wages, and Z represents other variables which affects their preferences for leisure, or a productivity in household production such as number of children or non-labor income.

Because this paper assumes a couple share their consumption completely, it is necessary to use variables which affect not productivity (and consumption) but taste for identification. This paper uses information of parents of each member of a couple. First, this paper uses each parent's age to take account for the possibility that a taste of each member of couple is affected by his/her parent's taste varied by cohort. Second, this paper uses information of parent's job at each member of a couple is 15 years old to take account for the possibility that the memory of childhood affect his/her taste.

This paper estimates those equation by two-step simultaneous tobit. Generated regressor problem is removed by variance correction proposed by Murphy and Topel (1985) which explained by Matsuura and McKenzie (2009) in detail. To estimate, this paper regresses hours of work on whole exogenous explanatory variables as explanatory variables by Tobit in the first step. In the second step, (5) and (6) will be estimated using predicted hours of work obtained by the result of the first step as an explanatory variable.

Explanatory variables, Z_i, includes the variables proxy taste for leisure/consumption or productivity in household production. This paper uses following variables. First, to take account for child care which is large part in housework, the number of children are used as explanatory variables. Hours of child care can be thought to be decreasing as a child gets older, the number of children aged 0-2, the number of children aged 3-5, and the number of children aged 6-18, are defined separately. Second, to take account of the possibility that co-residence with parent who help housework decrease an individual's hours of housework, dummy variables which denote whether the individual live with his/her parent or not are defined as explanatory variables.

To take account of the possibility that hours of housework depend on size of dwellings and households, both number of rooms and number of households are defined as explanatory variables. To proxy non-labor income, variables which proxy each couple's wealth level, saving, securities, liabilities and income not earned by a couple are also used as explanatory variables.

To estimate above labor supply reaction function, it is necessary to obtain market wage regardless an individual works or not. To obtain market wage, this paper uses an auxiliary regression for wages in standard settings and uses inputed wage for all individuals. This paper uses an individual's education level, and work experience as proxy variable of human capital accumulation which affects market wage level following Mincer (1985). In order

to measure an individual's education level, this paper uses the following schooling dummy variables, junior high school dummy, 2-year college dummy, and university dummy, as proxy variables for education. As a result, senior high school is the base level of education. To take account of possibility that wages rise with job seniority, as Topel (1991) pointed out, this paper distinguishes work experience as a whole, denoted by Exp, and work experience in the current work place, denoted by Tenure[2].

This paper utilizes data from the Keio Household Panel Survey (KHPS) conducted by Keio University from 2005 to 2009. Kimura (2005) contains details of the sampling methods used to obtain KHPS and the sample characteristics of KHPS. The first wave of KHPS, KHPS2004, sampled about 4000 households with respondents who were aged between 20 and 69, and includes married and unmarried males and females. This KHPS contains not only respondent information but also spouse's respondent information. This feature enables us to estimate labor supply functions using spouse's information. Descriptive statistics is summarized in Table 1.

3 Estimation Results

Estimation results are summarized in table 2. In this table, the estimation results for whole couples are shown in columns [1] to [2], for couples with children aged 0-18 in columns [3] to [4], and for couples without children aged 0-18 in columns [5] to [6].

It should be noted parents' information, which is necessary for an identification, affects labor supply and the fathers' effects and mothers' effects differ. For wives, the younger their father, the less they work while the younger their mother, the more they work. Husbands' labor supply seem not to be affected by their parent's ages.

The factors that affect the labor supply differ between husbands and wives. For example, the saving and income not earned by the couple significantly decreases labor supply for wives regardless the couple has a child, but not for husbands. The effects of having children on labor supply differ between husband and wives, and differ with age of children. The number of children aged 0-2 and 3-5 significantly reduce wives' labor supply. The variables proxy Non-labor income like liabilities, securities, saving, or income not earned by couple significantly affect both couple's labor supply, but the magnitude differs between husbands and wives. In general, the effect is larger for females than males, except for liabilities which positively affect husband's labor supply while not for wife's.

The effects of wages also differ. Increase in husbands' wage reduce wives' labor supply while increase husbands' labor supply. Increase in wives' wage reduce both husbands' and wives' labor supply.

According to estimation results, although husband's market work reduces wife's market work, wife's market work does not affect husband's market work. In contrast, wife's housework increase husband's market work, husband's

[2]The auxiliary regression results are omitted.

housework does not affect wife's market work.

4 Conclusion

The empirical results can be summarized as follows. Although husband's market work reduces wife's market work, wife's market work does not affect husband's market work. The effects of wages differ. Increase in husbands' wage reduce wives' labor supply while increase husbands' labor supply. Increase in wives' wage reduce both husbands' and wives' labor supply.

There are two channels which a wife's decrease in hours of market work affects the utility of husband. First channel is a decrease in a labor market income of a wife caused by a wife's decrease in hours of market work. Second channel is an increase in a household production caused by a wife's decrease in hours of market work. The estimation results here implies these two channel is mixed and cannot be observed effects. When a wife's wage increases, both two channels seems to increase the utility of a husband.

These results imply that husbands tend to specialize themselves in market work while wives tend to specialize themselves in housework in Japan. The possible reasons of this tendency are as follows. First, Japanese gender gap in pay is the largest among developed developed countries (See Mincer (1985), Jacobsen (1998) Blau and Kahn (2003), and Miyoshi (2008)). Second, the productivity of housework for husbands may be lower than that of wives. In Japan, husbands were not taught "home economics" which was a subject about how to do housework before 1991 in junior high school.

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Table 1: Descriptive Statistics

	Mean	Std.err
Number of Children 6-18	0.95	1.00
Number of Children 3-5	0.19	0.44
Number of Children 0-2	0.13	0.37
Number of Household	3.97	1.27
Saving (10 thousand yen)	596.55	899.36
Securities (10 thousand yen)	142.67	601.50
Liabilities (10 thousand yen)	834.30	1273.47
Number of Room	5.42	2.00
Income not earned by the couples (10 thousand yen)	55.10	274.29
Live With Husband's parent	3.9%	
Live with other parent	11.1%	
Age of Husbands	45.23	8.75
University (Husbands)	38.5%	
Other School (Husbands)	9.9%	
Junior High (Husbands)	4.8%	
Work Exp (Husbands in 1/10 years)	2.36	0.95
Tenure (Husbands in 1/10 years)	0.99	1.17
Hours worked in a week (husbands)	49.36	12.55
Wage Rate (hourly, yen husnands)	2717.56	1617.11
Age of Wives	43.01	8.26
University (Wives)	15.8%	
Other School (Wives)	31.6%	
Junior High (Wives)	3.0%	
Work Exp (Wives in 1/10 years)	1.35	0.84
Tenure (Wives in 1/10 years)	0.21	0.52
Hours worked in a week (wives)	17.77	17.55
Wage Rate (houley, yen Wives)	1891.55	2556.82

Notes:
(1) Source: KHPS2004-2009.

Table 2: Estimation Results: Labor Supply Response Funciton: Tobit

	Whole		With Children		Without Children	
	Wives	Husbands	Wives	Husbands	Wives	Husbands
Spouse's hours of working	-0.563**	0.009	-0.326	0.072	-0.234	-0.064
	[0.246]	[0.047]	[0.295]	[0.054]	[0.259]	[0.088]
Imputed Husband's wage	-0.003***	0.001***	-0.004***	0.001	-0.003*	0.003***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.002]	[0.001]
Imputed Wive's wage	-0.006***	-0.002***	-0.009***	-0.002*	0.003	-0.001
	[0.001]	[0.001]	[0.002]	[0.001]	[0.002]	[0.001]
Own Father's birth year	-0.380**	0.032	-0.523***	0.055	-0.578**	0.088
	[0.153]	[0.069]	[0.182]	[0.091]	[0.261]	[0.129]
Own Mother's birth year	0.504***	0.028	0.331	-0.004	0.957***	-0.016
	[0.178]	[0.081]	[0.211]	[0.102]	[0.321]	[0.153]
Own age	-0.101	-0.257***	0.188	-0.170*	-0.364	-0.454***
	[0.182]	[0.078]	[0.215]	[0.099]	[0.303]	[0.146]
Own Farther's Job	6.498	-0.135	11.428**	2.773*	-	-
Self Employee	[4.125]	[1.439]	[4.864]	[1.637]	-	-
Own Farther's Job	4.856	5.471	-0.331	5.839	3.07	-7.936***
Self Employed Profession	[7.261]	[5.655]	[21.286]	[5.334]	[6.213]	[3.049]
Own Farther's Job	17.920***	-0.706	21.603***	1.331	1.487	-6.860*
Family Worker	[5.449]	[2.018]	[6.223]	[2.446]	[9.418]	[3.682]
Own Farther's Job	6.222	-0.319	12.567***	1.239	0.354	-5.044*
Employed	[4.081]	[1.382]	[4.783]	[1.557]	[6.220]	[2.785]
Own Farther's Job	-32.063***	-9.108***	-24.891**	-10.003***	-14.748	-12.816***
Work at Home Job	[11.141]	[2.677]	[11.583]	[3.059]	[8.971]	[3.834]
Own Farther's Job	-4.324	-4.499*	9.195	4.193	3.55	-3.496
Contract for Work (Ukeoi)	[5.351]	[2.594]	[6.182]	[3.798]	[6.968]	[3.589]
Own Farther's Job	4.775	-0.911	10.734**	0.313	-	-
Not in Employed	[4.472]	[1.656]	[5.301]	[1.882]	-	-
Own Mother's Job	7.404	-8.386***	11.679	5.909	-	-
Self Employee	[6.587]	[3.056]	[12.604]	[6.124]	-	-
Own Mother's Job	-1.084	-13.180**	-5.577	0.489	3.312	-15.755***
Self Employed Profession	[10.848]	[6.286]	[24.678]	[8.038]	[8.066]	[4.311]
Own Mother's Job	10.37	-9.364***	10.296	3.499	9.974	-14.380***
Family Worker	[6.450]	[3.069]	[12.532]	[6.143]	[7.772]	[4.279]
Own Mother's Job	13.181**	-10.419***	12.916	2.86	11.814	-15.011***
Employed	[6.450]	[3.047]	[12.343]	[6.070]	[7.751]	[4.387]
Own Mother's Job	2.336	-10.737***	2.226	3.694	6.675	-19.572***
Work at Home Job	[6.863]	[3.163]	[12.546]	[6.180]	[8.900]	[4.603]
Own Mother's Job	21.052***	-16.847***	16.678	1.732	10.522	-16.921***
Contract for Work (Ukeoi)	[7.723]	[3.762]	[13.056]	[6.613]	[7.993]	[4.198]
Own Mother's Job	12.157*	-10.390***	11.803	2.946	-	-
Not in Employed	[6.457]	[3.008]	[12.349]	[6.031]	-	-
Live with Husband's parent	6.240**	-1.265	5.853*	-1.534	1.622	-1.403
	[2.954]	[1.422]	[3.325]	[1.668]	[5.440]	[2.865]
Live with Wife's parent	3.065	-0.798	4.764**	-0.223	-2.562	-2.682
	[1.983]	[0.940]	[2.419]	[1.172]	[3.180]	[1.662]
Number of room	0.209	-0.545***	0.890*	-1.060***	0.08	0.254
	[0.365]	[0.164]	[0.498]	[0.212]	[0.567]	[0.295]
Number of household	1.181	0.269	0.841	0.174	1.488	0.645
	[0.732]	[0.332]	[1.000]	[0.489]	[1.005]	[0.531]
Num of Children 6-18	-1.535*	1.169***	-0.18	-0.025	-	-
	[0.908]	[0.409]	[0.157]	[0.064]	-	-
Num of Children 3-5	-12.728***	0.441	-0.288***	0.089**	-	-
	[1.785]	[0.957]	[0.101]	[0.045]	-	-
Num of Children 0-2	-16.907***	-1.128	-2.451*	1.304**	-	-
	[2.227]	[1.125]	[1.305]	[0.614]	-	-
Securities	-0.235*	-0.095**	-9.522***	1.659	-0.298	-0.198**
	[0.135]	[0.046]	[2.037]	[1.022]	[0.193]	[0.089]
Savings	-0.159**	0.019	-12.712***	0.1	0.09	-0.006
	[0.079]	[0.034]	[2.339]	[1.160]	[0.117]	[0.057]
Liabilities	-0.013	0.034*	-0.073	0.072***	0.066	-0.019
	[0.045]	[0.020]	[0.061]	[0.025]	[0.070]	[0.040]
Income earned by other couple	-0.897***	-0.212**	-1.102***	-0.27	-0.648*	-0.203
	[0.272]	[0.106]	[0.280]	[0.291]	[0.343]	[0.146]
Rivers-Vuong Test	-2.26**	-0.86	0.84	2.47**	-1.06	-0.24
Observations	2312		1615		697	

Notes:

(1) Standard errors are in brackets.

(2) *, **, *** indicate significance at the 10%, 5%,and 1% levels, respectively.

(3) Coefficients of the regional dummies and constants are not reported.

(4) Middle two column reports the estimation result for the sample with pre-school children and right two column reports the result for the sample without pre-school children.

Does Health Status Matter to People's Retirement Decision in Japan?: An Evaluation of "Justification Hypothesis" and Measurement Errors in Subjective Health

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1 Introduction

The Japanese society has been facing a rapid aging and a decrease in a birthrate for the last couple of decades. The large shortage of workforce will be one of the most critical socio-economic issues. Lately, numbers of health economists focus on the relation between health status and job continuation around retirement age, since healthy elderly persons are expected to offset the lack of labor force. Health status is often one of major reasons for the retirement of workers in Japan. For example, the basic statistics based on the data using in this study shows that bad health and/or deteriorating health is the second significant reasons for males and females to leave the labor market which follows the mandatory retirement by the employers and the retirement after marriage, respectively (Table 1). However, since self-reported health status which is sometimes unreliable would cause statistical bias, we have to use this variable very carefully in econometric analysis.

This study identifies the significance of the endogeneity biases in the estimated health effects. We address the biases arose from the following two sources: (1) "justification hypothesis," wherein retired respondents are assumed to justify their leaving labor force (e.g. early retirement) by false poor health (Chirikos and Nestel, 1984; Anderson and Burkhauser, 1985; Bazzoli, 1985; Bound, 1991; Waidmann et al., 1995; Dwyer and

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Mitchell, 1999), and (2) classical measurement errors in the health variables. If the hypothesis holds true, poorer health is more frequently reported by the retired respondents, all other things being equal. Hence, health effects on labor market participation can be overestimated, as opposed to the attenuation bias of the measurement error.

Since the retirement age of Japan is much higher than other countries, "justification hypothesis" may be more applicable to this nation. However, only a few works (Iwamoto, 2000; Oishi, 2000) have tackled this problem previously. Iwamoto (2000) and Oishi (2000) compare the effects of several health indicators on wage income, labor market participation, and retirement behavior, controlling for the endogeneity bias. Both studies find the different health effects between those measurements. In particular, Iwamoto (2000) points out that subjective health indicators (self-rated health and presence of work limitations) have more obvious effects on income and employment status than objective ones, suggesting that the measurement error in subjective health is not so severe that researchers can use it in empirical analysis. However, this clearer effect of subjective health itself may be an evidence of the severity of the justification bias.

This study therefore evaluates the endogeneity biases by the following three strategies: (1) comparing the properties and effects on employment status of various health measurements, (2) using three instrumental variables (IVs) for health status that have never been used in previous studies, and (3) analyzing a relation of seemingly unrelated variables to verify "justification hypothesis." We use several kinds of health measurements such as binary subjective health (self-reported poor health and limitations of daily activities at home and/or on the job), number of chronic diseases which have not been completely recovered by the latest timing of the survey, and our original health status scoring based on principle component analysis. Our IVs are distance in a straight line from respondent's home to the nearest low-volume hospital, variations in the number of clinics among different medical spheres, and a body mass index (BMI) in respondent's 30 years of age. First, we mainly evaluate how the results differ between objective and subjective health measures. Since the objective health is generally less affected by the justification behavior and measurement errors, its bias should be smaller than subjective one. Second, compared to being not-instrumented, instrumented health effects will decrease if people actually justify their unemployed status by poor health and will expand if the measurement error is a serious problem in a model. Finally, we examine the relation between the ratio of the retirement due to bad health status and a job openings-to-applications ratio. If "justification hypothesis" makes sense, those variables can be correlated because the respondents who retired in the period of the high job openings ratio may be more likely to justify their retirement by false poor health.

In this study, we apply a Japanese version of Health and Retirement Survey conducted by the National Institute of Population and Social Security Research in 2008 and 2009, which was funded by a research grant from the Ministry of Health, Labor and Welfare. The survey focuses on those who are around retirement age and includes detailed information on various objective and subjective health conditions, retirement behavior, job status, working hours, and financial status.

As a result, we obtain several evidences for "justification hypothesis" and the measure-

ment errors in the health variables. First, our objective health measures widely distribute in the poorer subjective health. This indicates a possibility of the endogeneity problems in subjective health. Second, the limitation of daily activities is strongly correlated with one's employment status in spite of its weak correlation with exogenous factors determining health. A likely explanation of this result is that respondents report the poorer health status than true one to justify their employment status or they may not be able to assess their own health status accurately oneself. Third, instrumented health effects are larger than not-instrumented ones, as would be consistent with an alleviation of attenuation bias. Finally, the intrinsically unrelated variables are positively correlated with each other both in time series and cross section. This demonstrates a noticeable tendency of justifying the retirement in good economic condition.

This paper is organized as follows. Section 2 formulates our empirical specification. Section 3 describes the data source and our variables, including employment status variables and health measures. Section 4 looks for the exogenous determinants of health status. Section 5 shows the estimation results. Section 6 adduces an evidence supporting "justification hypothesis." Section 7 presents the conclusions of this paper.

2 Empirical specifications

This paper employs various empirical specifications, including probit, linear probability model (LPM), two-stage least squares (2SLS), and Tobit models, in order to accomplish the evaluation of the endogeneity problems. We can expect that attenuation bias will occur in LPM if measurement errors exist in the subjective health indicator. Meanwhile, the direction of the bias is theoretically ambiguous in the maximum likelihood estimate (MLE).[1] Hence, we compare the outcomes of LPM and 2SLS regressions to check the seriousness of attenuation bias. However, since LPM has some deficiencies (e.g. some of the LPM fitted value may be outside the unit interval), we also use the probit model in appraising "justification hypothesis."

We specify the following three econometric models: (1) univariate probit model, (2) IV probit model, and (3) Tobit model. Dichotomous employment status indicators and censored working hours are dependent variables in (1)-(2) and (3), respectively. Here, we omit a specification of LPM because it is a simple OLS which has a binary variable in the left-hand side.[2]

[1]Levine (1985) considers the measurement error bias in MLE, including probit and censorship type model estimates. He suggests that MLE is affected not only by the classical attenuation bias but also by the additional effects which determine the direction of the bias due to measurement error, differently from normal linear model. Hsiao (1991) and Wang (1998) explore identification conditions for binary choice and censored models, respectively. Two- or three-step procedures for estimating a consistent estimate and the corresponding asymptotic covariance matrices are proposed in their papers. Recently, Edgerton and Jochumzen (2003) reveal by the Monte Carlo and empirical studies that attenuation occurs in the coefficient of independent variable(s) of probit model that is measured with error. They also derive multi-step LIML estimator and find its consistency and good small-sample property under some assumptions.

[2]Since a binary response in the left-hand side is a Bernoulli random variable in LPM, its conditional variance is expressed as $X\beta(1 - X\beta)$, where X and β are a vector of covariates and its coefficients,

First, we explain the probit models. Let y_i be a binary employment status variable; for example, it takes unity if an individual has retired or has no jobs and zero otherwise. Consider the following binary choice model:

$$y_i = 1(y_i^\star = \alpha h_i + \beta X_{1i} + \epsilon_i > 0), \tag{1}$$

where $y_i^\star$ denotes an unobserved latent variable; h_i, an observed health measure; X_{1i}, a vector of other household characteristics; and ϵ, a stochastic error term which has a standard normal distribution. If h_i is an exogenous health variable, α will be estimated to be consistent. However, if h_i is measured with error, the attenuation bias will occur in the estimate of α. Moreover, under the "justification hypothesis," the health effect on retirement can be overestimated because people try to justify their early retirement by false poor health.

In order to address those endogeneity biases, we employ IV probit model. This model is formulated as follows:

$$\begin{aligned} y_i &= 1(y_i^\star = h_i\alpha + X_{1i}\beta + \epsilon_i > 0), & (2)\\ h_i &= X_{1i}\gamma + X_{2i}\delta + \upsilon_i, & (3) \end{aligned}$$

where X_{2i} is a vector of additional instruments and (ϵ_i, υ_i) has a zero-mean and bivariate normal distribution. The error terms are permitted to be correlated one another, $Cov(\epsilon_i, \upsilon_i) = \rho$. On the other hand, this simultaneous model breaks into two parts for y_i and h_i when $\rho = 0$, implying that it is appropriate to use the univariate probit model, eq. (1). Even if h_i is a binary endogenous variable, the above simultaneous model will still generate a consistent estimate, but the estimate may not be efficient. In this case we have to use the recursive bivariate probit model, wherein the first-stage equation eq. (2) is a reduced form probit model for binary health indicator, in order to obtain an efficient estimate.

Next, we show the standard censored Tobit model that is adopted to estimate the health effect on hours worked. Let y_i denote working hours, and then we formulate it as follows:

$$\begin{aligned} y_i^\star &= \alpha h_i + \beta X_{1i} + \epsilon_i, & (4)\\ y_i &= \max(0, y_i^\star), & (5) \end{aligned}$$

where $y_i^\star$ is a latent variable which is observed for values greater than 0 and censored otherwise; and $\epsilon_i \sim N(0, \sigma^2)$. IV Tobit model allows h_i be endogenous through a correlation of the error terms in the health and working hours equations. However, we do not use it due to a severe weak identification problem in this model.

respectively. Apparently, heteroskedasticity is the case we have to consider in this variance unless all coefficients are zero; therefore, we use heteroskedasticity-robust standard errors in LPM to deal with this issue.

3 Data and variables

3.1 Data source and sample selection

The data in this paper is the *Survey on Health and Retirement*, conducted by the National Institute of Population and Social Security Research in March of 2008 and 2009. In order to examine various effects of people's health status on retirement behavior, the survey focuses on males and females who are 45 and older and younger than 80 years old. For the first wave of the survey in the year of 2008, 2,747 people are randomly extracted out of 39,311 monitoring samples owned by the *Central Research Services, Inc* (CRS). The monitoring samples are collected by the monthly omnibus survey conducted by CRS. The CRS extracts samples randomly from the residents' administrative registration records every month and creates the master sample including those who agree to be monitored for all kinds of surveys. For adjusting the distributions of respondents' sex and age to the National Census, the CRS carefully extracts the samples in a way that the number of respondents becomes proportional to the number of population in each sex and 5-year age group based on the residents' administrative registration records in each municipal city. The remuneration paid for respondents is a 500 yen coupon ticket for purchasing books. Out of those, 1,074 people responded the survey (valid response rates: 39%) in the first wave. Then, the second wave is a follow-up survey on these 1,074 respondents. Out of 1,074, 862 respondents (response rate: 80%) answered the survey and so 212 (approximately 20%) dropped out from the sample. Further, in the second wave, 578 people are newly chosen at random from CRS monitoring samples. Out of 578, 257 people (response rate: 44%) responded the survey.

This survey has a couple of unique characteristics which is different from the data used in previous studies such as Iwamoto (2000) and Oishi (2000). First, the survey asked respondents diseases in detail which were diagnosed by physicians. Hence, we can control for respondents' both subjective and relatively objective chronic health status more accurately than previous works. Second, the survey includes the data on a respondent's retirement and re-employment history in the past. Therefore, this study would distinguish respondents who have not been retired yet from those who have been re-employed either on full-time or part-time basis since the first compulsory retirement.

Among whole sample, we use only male respondents in our econometric analysis because of some complications of the female retirement behavior. Since a number of life-cycle related factors (e.g. getting married, baring children, and providing long-term care to family members) make female workers leave labor market more often compared to male workers, a simple analytic framework probably cannot describe the mechanism of female retirement behavior.[3] Moreover, compared to males, females are less likely to feel embarrassed by leaving labor market in young and having no job, which is not uncommon for women in Japan. Therefore, "justification hypothesis" probably does not matter to female workers. For the same reason, Iwamoto (2000) also does not include female work-

[3] 11.5% of female respondents choose "Other reasons" as a reason for retirement while only 5.3% male respondents choose it. This is an evidence of the variety in the causes of the female retirement.

ers into the empirical work.[4] Consequently, the number of remaining sample is 465 that excludes outliers of health measures.[5]

3.2 Employment status and working hours

This paper uses three kinds of binary variables as a proxy of employment status. The definition of those variables depends on the following ten alternatives in *Survey on Health and Retirement*: (1) a regular employee on full-time basis, (2) a contract worker, (3) a temporary staff (including day worker), (4) a part-time worker, (5) self-employed (including farmer, forestry, and fishery), (6) a freelance profession (e.g. writer), (7) working at home (e.g. doing side business), (8) a skilled worker or profession (e.g. physician or lawyer), (9) other working status, and (10) no job (including a full-time domestic worker or a retired person). The first variable takes unity if the respondent is working as a regular employee ([1]). The second one indicates whether the respondent is working as an irregular employee ([2], [3], and [4]). The last one depends on whether the respondent has already retired or has no jobs ([10]). We compare the possibility of the justification behavior among those three employment status. For example, a comparison between not working as a regular employee and not working at all is an interesting subject of our study. Further, we use hours of work per week as an alternative variable that describes the retirement process. This variable is continuous, and therefore, it can describe the intermediate retirement status, contrary to the employment dummy variable.

In Japan, elderly males often become non-regular employees in a time period between the first compulsory retirement and the time when they left completely from the labor market. Figure 1 shows males' age-specific ratio of employees by type of employment status and hours of work per week. The ratio of regular employees is obviously decreasing, but its slope does not seem to be very steep. The average working hours also do not decline drastically even after the general mandatory retirement age of 60 years. This is because a proportion of the male elderly are likely to be reemployed as a non-regular employee after the mandatory retirement, as described by a hump-shaped curve of the irregular employee. Thus, the retirement ratio gradually approaches to unity as the ratio of regular to non-regular employees decreases, suggesting that people gradually proceed to full retirement over their 60s and 70s. Compared to male workers, the ratio of non-regular out of total employees is much higher than that of regular employees for female workers. Further, the retirement ratio in the earlier 60s for females exceeds 50 percent, compared to 14 percent for male workers. As mentioned in the previous section, females may be unlikely to feel ashamed of her non-regular status and early retirement due to this high retirement ratio.

[4]Oishi (2000) also focuses on the male elderly though the reason is not mentioned clearly.

[5]Specifically, 4 respondents report extreme values in the number of disease (19, 20, and 23). Those values correspond to the largest number of disease score (more than 10). They are excluded from our sample to avoid a bias due to outliers.