Institutions and Economies
Vol. 9, No. 1, January 2017, pp. 81-98

Determinants of Retirement Wealth Adequacy: A Case Study in Malaysia

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Abstract: *This paper aims to study the demographic and socioeconomic determinants of retirement wealth adequacy in Malaysia, and further investigates the effects of Employees Provident Fund (EPF) contribution rate and income replacement ratio on the retirement wealth adequacy. The retirement wealth adequacy is estimated using the Malaysian Household Income Survey (HIS) 2009 data which is based on 5881 sample households that contains information on income, demographic and socioeconomic characteristics of each household. The adequacy of retirement income is assessed by comparing the accumulated projected wealth of an individual's work life at retirement age with his/her total consumption (needs) during retirement. The Ordinary Least Squares (OLS) and logistic regression models are then performed to determine the demographic and socioeconomic determinants of retirement wealth adequacy. The results from the projection of wealth-need ratio showed that 69% of households in the sample have adequate retirement income. The OLS model showed that Region 4 (P. Pinang, Selangor, Kuala Lumpur, Putrajaya), urban strata, married status, college graduate, government servant, younger respondent (age 30-34), and average annual income (RM25,000 - RM40,000) were positively associated with retirement wealth adequacy. On the contrary, the results from the logistic model show that only strata (urban) and marital status (single-female) were positively associated with retirement wealth adequacy. This paper further discusses the study implications.*

Keywords: Consumption, regression, retirement adequacy, wealth
JEL classification: C10

Article received: 18 March 2016; Article Accepted: 27 December 2016

1. Introduction

Adequacy of retirement wealth is important for a retiree to maintain his/her standard of living; otherwise, one may be forced to return to the work force

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to improve one's income status, or compromise on quality of life during the retirement period.

The issue of inadequate retirement wealth has a significant impact on the social support system. In Malaysia, the size of elderly population is 1.4 million in 2010, and it is expected to rise to 4.4 million in 2040 due to increased life expectancy. In 2013, 69% of Employees Provident Fund (EPF) contributors aged 54 have RM50,000 or less in their savings, which would only sustain them for five years if they spend RM800 (poverty threshold) a month (Ismail, 2015). Hence, it is crucial to understand the determinants that influence retirement wealth adequacy to formulate appropriate financial strategies that can help retires have more savings, invest in financial and nonfinancial assets, or defer their retirement age.

The main objectives of this paper are to study the demographic and socioeconomic determinants of retirement wealth adequacy and to investigate the effects of EPF contribution rate and income replacement ratio on retirement wealth adequacy. The adequacy of retirement income is determined using wealth-needs ratio, which is equal to the projected accumulated wealth of an individual's work life at retirement age divided by the total consumption (needs) during retirement. The retirement income is adequate if the wealth-needs ratio is equal to or greater than one.

2. Literature Review

Under a life cycle model, assets are mainly accumulated during an individual's work life to finance consumption during retirement, which means that an individual will save while young and employed, then dissave when old and retired (Ando & Modigliani, 1963). According to the life cycle hypothesis, each person desires to maintain the level of consumption over his entire lifetime (Ando & Modigliani, 1963). With respect to retirement adequacy, the life cycle model implies that the accumulated financial resources for retirement is equal to or greater than the financial requirements during retirement at the point of retirement (Hatcher, 1997; Yuh, Hanna, & Montalto, 1998a).

There are several methods for estimating consumption (or needs) during retirement and the most common is to identify the percentage of pre-retirement income that represents the desired consumption level during retirement, also known as a replacement rate (RR). The RR is the best way in measuring retirement adequacy since it can be easily interpreted by employers and employees (Bajtelsmit, Rappaport, & Foster, 2013). Previous researchers have set a range of adequate RR. Palmer (1989, 1994) suggested RR which ranges from 65% to 85% depending on income level, and Duncan, Mitchell, and Morgan (1984) suggested RR ranging from 70% to 90%.

Several researchers have applied Palmer's RR to determine retirement consumption in their studies (Moore & Mitchell 1997; Mitchell & Moore, 1998).

Besides the RR, other approaches have been used to calculate retirement consumption (Yuh, 1998; Yuh et al., 1998a; Yao, Hanna, & Montalto, 2003) who applied the Consumer Expenditure Survey to predict spending for households where the dataset was considered as a proxy for retirement consumption. On the other hand, Binswanger and Schunk (2012) used a calibration method for estimating the retirement consumption where information on individuals' preferences was taken into account.

Retirement adequacy was analysed in detail in Yuh (1998) who identified the explanatory variables which were significantly associated with retirement wealth adequacy using multivariate ordinary least squares (OLS) and logistic regression models. Yuh (1998) concluded that unmarried male, self-employed households who were have defined benefit pension plan, retire at a later age, have higher income level, have investment in stocks or shares and have larger investment horizons were positively related to the adequacy of retirement wealth. In contrast, households whose members worked as operators, lived in houses with mortgage loans or rents, and spent more than their income had negative relationship with the adequacy of retirement wealth.

Several studies on the effects of household characteristics on the adequacy of retirement wealth have also been carried out. Yuh, Montalto and Hanna (1998b) and Montalto, Yuh, and Hanna (2000) found that planned retirement age has a substantial effect on retirement wealth adequacy, while Li, Montalto, and Geistfeld (1996), Moore and Mitchell (1997) and Denton, Finnie, and Spencer (2011) concluded that retirement age is positively associated with retirement income.

A summary of linkages of the explanatory variables and the response variables are shown in Table 1.

3. Methodology

3.1 Data and Sample

This study uses cross sectional data from Household Income Survey (HIS) 2009 conducted by the Department of Statistics Malaysia that contains information on income, demographic and socioeconomic characteristics of each household. The selected sample consists of 5881 household heads who are full time workers, aged between 30 and 54 years old, and earning an annual income above the poverty threshold (which is above RM9,600).

3.2 Model Specification and Estimation Techniques

This study uses the OLS and logistic regression models to investigate the demographic and socioeconomic determinants of retirement wealth adequacy. The models for OLS and logistic regression are as follows:

Model 1: OLS regression model

$$Y_i = \beta_0 + \sum_{i=1}^{n} \beta_i X_i + \varepsilon_i \quad (1)$$

where Y is the percentage of wealth-needs ratio, which is equal to the accumulated retirement wealth divided by the estimated retirement needs (or consumption), X is the demographic and socioeconomic determinants such as marital status, strata and age group, and β is the parameter that indicates the average change in Y that is associated with a unit change in X while controlling for other explanatory variables in the model. The estimator $\hat{\beta}$ can be obtained by solving the minimisation equation.

$$\min \sum_{i=1}^{n} (Y_i - \hat{\beta}_0 - \hat{\beta}_i X_i) \quad (2)$$

$$\hat{\beta} = \frac{\sum_{i=1}^{n} (Y_i - \bar{Y})}{\sum_{i=1}^{n} (X_i - \bar{X})} \quad (3)$$

Model 2: Logistic regression model

$$Y_i \sim B(n_i, \pi_i) \quad (4)$$

where Y is a binary variable equal to one if the household has adequate retirement wealth (or when the wealth-need ratio is equal to or greater than one), and zero otherwise, n_i is the binomial denominator and π_i is the probability. The maximum likelihood estimation is used to obtain the regression estimators. The log likelihood is:

$$\text{logL}(\beta) = \sum_{i=1}^{n} \{y_i \log(\pi_i) + (n_i - y_i) \log(1 - \pi_i)\} \quad (5)$$

where π_i depends on the covariates (explanatory variables) X_i and a vector of parameters through the logit transformation:

$$\text{logit}(\pi_i) = x_i' \beta \quad (6)$$

where *x* is a vector of covariates and **β** is a vector of regression estimators.

Table 1: Summary on linkages of explanatory variable and response variable

Author & Year	Explanatory Variable	Response Variable	Linkage	Signs of influence
Yuh (1998)	Unmarried male	wealth-needs ratio (%)	Unmarried males have shorter retirement period due to shorter life expectancy	Positive
	Self-employed	wealth-needs ratio (%)	Self-employed has more business assets and self-directed pension plans	Positive
	Defined benefit pension plan	wealth-needs ratio (%)	Defined benefit plan provides a fixed and scheduled income during retirement period	Positive
	Home owner	wealth-needs ratio (%)	Home owner has no mortgage or rent commitment	Positive
	Later retirement age	wealth-needs ratio (%)	Households with later retirement age have longer period to accumulate retirement wealth	Positive
	Higher income level	wealth-needs ratio (%)	Households with higher income accumulate more assets	Positive
	Operators (less skilled)	wealth-needs ratio (%)	Operators lack knowledge and skills on retirement saving and investment	Negative
	Mortgage loans or rents	wealth-needs ratio (%)	Households with mortgage loans/rents lack housing assets	Negative
	Over-spending	wealth-needs ratio (%)	Household which overspends accumulates less assets	Negative
Li et al. (1996)	Planned retirement age	indicator variable for individual with adequate retirement financial resources	Individuals who plan their retirement age accumulate more resources for retirement	Positive
Moore & Mitchell (1997)	Retirement age (62 and 65)	Projected wealth	Individual with later retirement age has longer period to accumulate retirement wealth	Positive

As indicated by the above models, the demographic and socioeconomic characteristics considered in this study are marital status, household educational attainment, occupational group, employment type and household size, which may have a significant effect on the adequacy of retirement wealth. Based on previous researches, the following five hypotheses are proposed for this study.

First, educational level has a positive effect on retirement wealth adequacy since well-educated households have better access to information understanding of financial markets, which increases the probability of adequate wealth preparation of retirement. Second, larger households have a negative relationship with retirement wealth adequacy because households with more members tend to spend more and save less. Third, households with defined benefit plan (or pension schemes for government servants) are positively related to adequacy of retirement wealth because they usually have a fixed and scheduled income, which is proportional to his their salary prior to retirement, in retirement age. Fourth, households employed in craft and repair occupations or engaged as technicians or operators are expected to have less adequate retirement than households engaged in administrative work, professionals and legislators with better job security and higher income level. Finally, married households are expected to have more than one source of income, and thus, are expected to have higher retirement adequacy.

3.3 Response Variable Measurement

The response variable for the OLS model is expressed as a percentage of wealth-needs ratio, which is equal to the accumulated retirement wealth divided by the estimated retirement needs (or consumption). On the other hand, the response variable for the logistic regression model is a binary variable which is equal to one if the household has adequate retirement wealth (or when the wealth-need ratio is equal to or greater than one), or zero otherwise.

Retirement wealth is defined as the retirement income from either defined benefit plan (pension schemes for government servants) or defined contribution plan (EPF for corporate employees). The accumulated EPF is projected using appropriate assumptions on the rate of EPF contribution, rate of EPF dividend, rate of salary increment, and years of future service from the age of first year salary to the age of retirement, whereas the accumulated retirement wealth for government pension scheme is projected using the formulas provided by the Public Service Department, Malaysia (Department of Public Service Malaysia, 2014).

Retirement needs can be defined as the total wealth needed to finance desired consumption during retirement. The consumption during retirement

is projected using appropriate assumptions on the expected annual salary prior to retirement, RR (percentage of pre-retirement income that represents the desired consumption level during retirement), real interest rate from the retirement age to the expected age of death, and retirement period which is the number of years from the retirement age to the expected age of death.

3.4 Explanatory Variables Measurement

The explanatory variables comprise income and demographic as well as socioeconomic characteristics of each household which act as predictors of the response variable. For the OLS, a positive (negative) coefficient indicates that the variable increases (decreases) the percentage of wealth-needs ratio, and thus, increases the percentage of adequacy of retirement income. On the other hand, for the logistic regression model, a positive (negative) coefficient indicates that the variable increases (decreases) the probability of retirement adequacy (or the probability that the wealth-needs ratio is equal to or greater than one).

Locations are categorised into five regions: North, East, Central, South and East Malaysia. Strata is divided into urban and rural areas, while marital status is categorised as married, single-male and single-female. Ethnics are categorised as Bumiputera, Chinese, Indian and other races. Education levels, which measure the highest grade completed, are grouped as university graduate, high school graduate, less than high school education and others for those who attend religious education, or those who do not attend formal education, or those who do not finish school.

Occupational group is categorised into professionals and legislators, technicians, administrative support, agriculture and fishery, craft and repair, elementary occupations, and operators. Employment type is divided into six groups, namely government professional and administrative, government technicians and below, private professional and administrative, private technicians and below, employer and self-employed.

The age range of household heads is: 30-34, 35-39, 40-44, 45-49 and 50-54 years old. In terms of annual income (Ringgit Malaysia), the households are categorised as earning in the range of: RM9,600 - RM15,000, RM15,000 - RM25,000, RM25,000 - RM40,000, RM40,000 - RM60,000, and above RM60,000. Higher income households are expected to have higher retirement wealth adequacy. Household size is defined as the total number of members in each household. The unit of analysis is household.

4. *Result and Discussion*

Table 2 provides the summary statistics for the sample. The statistics show that more than half of the respondents (65%) are located in urban areas, a large majority (87%) are married, more than half (68%) are Bumiputera while Chinese and Indians represent 23% and 8% of the respondents respectively. Almost a quarter (20%) of the respondents are university graduates while almost half (45%) graduated from high school. In terms of occupational groups, 17.1% of respondents are professionals and legislators, followed by almost a quarter (22.3%) who are technicians and operators (16.2%). With respect to employment type, 12.1% are government professionals and legislators, 11.3% are government technicians and below, almost a quarter (22.9%) are private professionals and administrators, and private technicians and below contribute almost half (46%) of the sample. The balance are employers (1.6%) and self-employed respondents (6.1%).

The age categories and the subjective life expectancy- indicate that the sample contains a balanced representation of age groups within the range of 30 to 54 years old.

With the exception of the lowest income group (RM9,600 to RM15,000), the income groups are quite equally divided, where the annual income of a quarter of respondents (25%) is RM25,000 - RM40,000, followed by almost a quarter (23%) earning annual income of RM60,000 and above. The proportions also indicate that the sample contains a balanced representation of income groups above the poverty level (RM9,600 and above).

Table 2: Summary statistics for HIS sample 2009

Variables	**Proportion of households (%)**
Total	100.0
Region	
1 (Kelantan, Pahang, Terengganu)	16.2
2 (Johor, Melaka, Negeri Sembilan)	15.9
3 (Kedah, Perak, Perlis)	15.0
4 (P. Pinang, Selangor, Kuala Lumpur, Putrajaya)	35.0
5 (Sabah, Sarawak)	17.9
Strata	
Urban	64.6
Rural	35.4
Marital status	
Married	87.4
Single Female	6.4
Single Male	6.2

Table 2: (Continued)

Ethnic	
Bumiputera	68.4
Chinese	23.4
Indian	7.6
Others	0.6
Educational level	
College/University	20.3
High School Grad	44.8
Less than High School	16.3
Others (not attending formal education, religious education, not finishing school)	18.6
Occupational group	
Professionals and Legislators	17.1
Administrative Supports	21.4
Technicians	22.3
Operators	16.2
Agriculture and Fishery	3.8
Craft and Repair	9.8
Elementary Occupations	9.4
Employment type	
Government Professional and Administrative	12.1
Government Technicians and below	11.3
Private Professional and Administrative	22.9
Private Technicians and below	45.9
Employer	1.6
Self Employed	6.1
Subjective life expectancy	
live ≤ 34	18.3
$35 \leq$ live ≤ 39	19.9
$40 \leq$ live ≤ 44	21.2
$45 \leq$ live ≤ 49	22.2
$50 \leq$ live ≤ 54	18.4
Household income (RM)	
9.6k – 15k	13.0
15k – 25k	21.6
25k – 40k	24.5
40k – 60k	18.4
60k and above	22.5

Based on the results of the projected wealth-needs ratio, 69% of households in the sample have adequate retirement income (or wealth-needs ratio equal to or greater than one).

Table 3 shows the results of analysis of variance from the OLS. The response variable for OLS is the measure of retirement wealth adequacy expressed as a percentage of wealth-needs ratio. All characteristics are statistically and significantly associated with the wealth-needs ratio at 95% confidence level.

Table 3: Analysis of variance

Variable	**Wealth-Need Ratio**	***p*-value**
Region	72.64	0.00
Strata	4.37	0.04
Marital status	8.62	0.00
Ethnicity	797.08	0.00
Education level	1457.25	0.00
Occupational group	216.55	0.00
Employment type	3364.42	0.00
Expected life expectancy	3050.44	0.00
Household income	7.01	0.00
Household size	6.40	0.01

Table 4: OLS of retirement wealth adequacy

Variable	**Estimate**	**Std. Error**	***p*-value**
Intercept	276.55	7.18	0.0000
Region 1: reference			
Region 2	4.27	2.47	0.0800
Region 3	0.69	2.48	0.7900
Region 4	7.87	2.18	0.0000
Region 5	3.60	2.39	0.1300
Rural: reference			
Urban	3.30	1.55	0.0330
Married: reference			
Single Female	-5.71	2.88	0.0477
Single Male	-7.35	2.94	0.0123
Bumiputera: reference			
Chinese	4.27	1.86	0.0219
Indian	-1.30	2.72	0.6333
Other ethnics	4.09	8.92	0.6469
University: reference			
High School Grad	-13.80	2.26	0.0000
Less than High School	-16.36	2.91	0.0000
Other educational levels	-10.20	3.03	0.0000

Table 4: (Continued)

Administrative Supports: reference			
Professionals and Legislators	-10.20	2.69	0.0000
Technicians	-9.83	5.91	0.0965
Operators	-9.73	5.80	0.0936
Agriculture and Fishery	2.31	5.99	0.6995
Craft and Repair	-13.48	5.86	0.0214
Elementary Occupations	-2.57	5.95	0.6659
Employer: reference			
Government Professional and Administrative	249.34	6.06	0.0000
Government Technicians and below	240.55	7.15	0.0000
Private Professional and Administrative	-8.05	5.81	0.1660
Private Technicians and below	-10.80	6.83	0.1140
Self Employed	0.41	6.36	0.9485
live ≤ 34: reference			
35 ≤ live ≤ 39	-86.29	2.23	0.0000
40 ≤ live ≤ 44	-144.43	2.22	0.0000
45 ≤ live ≤ 49	-192.35	2.21	0.0000
50 ≤ live ≤ 54	-231.48	2.38	0.0000
9.6k – 15k: reference			
15k – 25k	8.65	2.45	0.0000
25k – 40k	8.84	2.51	0.0000
40k – 60k	3.73	2.77	0.1794
60k and above	0.29	2.98	0.9200
Household Size	-0.90	0.36	0.0100

Table 4 provides estimates, standard errors and *p*-values of the covariates. The results reveal that Region 4 (P. Pinang, Selangor, Kuala Lumpur, Putrajaya), urban strata, married status, Chinese race, college graduate, government servant (government professional and administrative, and government technicians and below), younger respondent (age 30-34), and average annual income (RM25,000-RM40,000) are positively associated with retirement wealth adequacy. On the other hand, negative relationships are shown by single (male and female) status, below high school education, craft and repair occupation, older respondent (age 50-54) and household size. The results support all five hypotheses stated in this study: educational level is expected to increase the adequacy of retirement wealth, household size is expected to decrease the adequacy of retirement wealth, defined benefit plan (or pension scheme for government servant) is expected to have positive

relationship with retirement wealth adequacy, craft and repair occupations have negative relationship with the adequacy of retirement wealth, and married households have higher retirement wealth adequacy.

The result of average annual income households (RM25,000-RM40,000) who have higher retirement adequacy is rather unexpected. However, since the RR is used as a proxy for consumption level and is assumed to be directly proportional to the annual income, it is expected that households with larger income have larger consumption, and thus, reducing the adequacy of retirement wealth. Discretionary spending and modest lifestyles are perhaps the additional contributing factors to the lower consumption level of this group.

Married households have a higher retirement adequacy probably because they usually have more than a single source of income (if their spouses are also employed).

The most dominant influence on the percentage of wealth-needs ratio is employment type where retirement adequacy increased more than 200% among government servants compared with non-government workers. This result is expected since the accumulated retirement wealth of government pensioners (which is under defined benefit plan) is generally higher than retirees with EPF (which is under defined contribution plan).

Table 5 shows the analysis of variance from the logistic regression model. The response variable for the logistic regression model is expressed as a binary variable which is equal to one if the households have adequate retirement wealth (or the projected wealth-need ratio is equal to or greater than one), and zero otherwise.

Table 5: Analysis of variance from logistic regression

Variable	**Deviance**	***p*-value**
Region	15.4	0.0040
Strata	3.6	0.0569
Marital status	19.3	0.0000
Ethnicity	143.1	0.0000
Education level	642.6	0.0000
Occupational group	58.3	0.0000
Employment type	879.6	0.0000
Expected life expectancy	4689.1	0.0000
Household income	2.5	0.6450
Household size	0.1	0.7896

Table 6: Logistic regression of probability of adequate retirement wealth

Variable	**Estimate**	**Std. error**	***p*-value**
Intercept	44.89	2207.38	0.9838
Region 1: reference			
Region 2	-0.09	0.33	0.7845
Region 3	-0.45	0.33	0.1710
Region 4	0.14	0.30	0.6472
Region 5	0.04	0.33	0.8945
Rural: reference			
Urban	0.56	0.21	0.0063
Married: reference			
Single Female	1.44	0.62	0.0214
Single Male	0.15	0.38	0.7022
Bumiputera: reference			
Chinese	-0.03	0.23	0.9058
Indian	-0.42	0.30	0.1613
Other ethnics	-0.03	1.11	0.9809
College/University: reference			
High School Grad	-21.98	962.54	0.9818
Less than High School	-21.99	962.54	0.9818
Other educational levels	-22.48	962.54	0.9814
Administrative Supports: reference			
Professionals and Legislators	0.39	0.37	0.2923
Technicians	0.54	0.32	0.0918
Operators	0.27	0.29	0.3509
Agriculture and Fishery	0.60	0.53	0.2623
Craft and Repair	0.28	0.33	0.3885
Elementary Occupations	0.71	0.40	0.0768
Employer: reference			
Government Professional and Administrative	61.63	1952.04	0.9748
Government Technicians and below	61.39	2417.63	0.9797
Private Professional and Administrative	-0.87	0.81	0.2814
Private Technicians and below	-1.23	1.12	0.2705
Self Employed	-0.46	0.89	0.6029
live $\leq$ 34: reference			
35 $\leq$ live $\leq$ 39	0.17	2.78	1.0000
40 $\leq$ live $\leq$ 44	-20.91	1986.46	0.9916
45 $\leq$ live $\leq$ 49	-44.51	2207.38	0.9839
50 $\leq$ live $\leq$ 54	-64.32	2456.76	0.9791

Table 6: (Continued)

9.6k – 15k: reference			
15k – 25k	-0.04	0.28	0.8988
25k – 40k	0.32	0.32	0.3070
40k – 60k	-0.07	0.36	0.8367
60k and above	-0.05	0.37	0.8955
Household Size	0.01	0.05	0.7898

Notes: Null deviance: 7278.48 on 5880 degree of freedom.
Residual deviance: 824.84 on 5847 degrees of freedom.
AIC: 892.84. Number of Fisher scoring iterations: 22.

Table 6 provides the results for the logistic regression model. Significant variables at 5% level are strata (urban) and marital status (single-female). The probability of adequate retirement wealth increases in urban areas compared with rural areas, and single-female households compared with married households.

It should be noted that the OLS and logistic regression models are two different analyses as the models have different interpretations of results. As mentioned before, the response variable for the OLS is expressed as a percentage of wealth-needs ratio, while the response variable for the logistic regression model is expressed as zero (inadequate retirement wealth) or one (adequate retirement wealth). Since the logistic regression model simplifies the response variable in the OLS (which is stated as a percentage of wealth-needs ratio) and categorises the percentage of wealth-needs ratio into two groups (one if adequate and zero if inadequate), it is expected that the OLS have more significant explanatory variables compared with the logistic regression model, and thus, a more meaningful interpretation can be obtained from the OLS.

The optimistic and pessimistic scenarios are also projected in this study to investigate the effects of EPF contribution rates and income RR on retirement wealth adequacy. The results in Table 7 and Figure 1 indicate that the EPF contribution rate has a positive relationship with the adequacy of retirement wealth. At 20% contribution rate (pessimistic scenario), the proportion of households with adequate retirement wealth is 47%. The proportion increases to 68% at 26% contribution rate (optimistic scenario), implying that households with higher EPF contribution rate have a higher retirement adequacy.

The results in Table 8 and Figure 2 show that the income RR has a negative relationship with retirement wealth adequacy. The proportion of households with adequate retirement income is 76% at 65% RR (optimistic scenario). The proportion drops to 63% at 85% RR (pessimistic scenario), indicating that higher RR contributes to lower retirement wealth adequacy.

Table 7: Effects of EPF contribution rate on retirement wealth adequacy

EPF Contribution Rates (%)	20 (pessimistic)	23 (mean)	26 (optimistic)
Adequate (%)	47.0	60.0	68.0
Inadequate (%)	53.0	40.0	32.0

Figure 1: Retirement wealth adequacy by EPF contribution rate

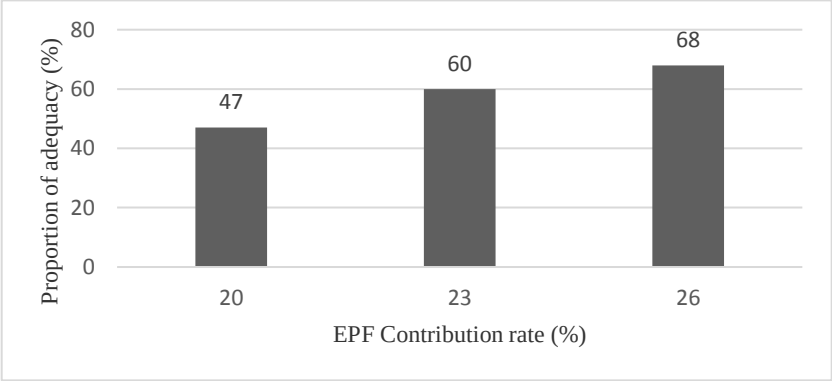
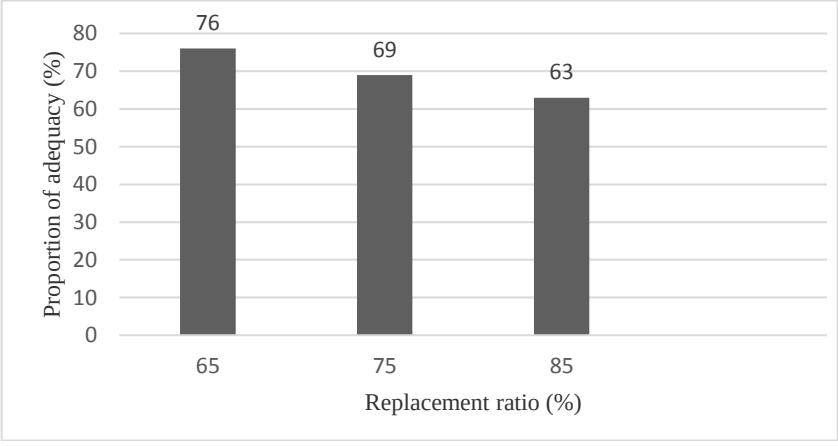


Table 8: Effects of income replacement ratios on retirement wealth adequacy

Replacement Ratio (%)	65 (optimistic)	75 (mean)	85 (pessimistic)
Adequate (%)	76.0	69.0	63.0
Inadequate (%)	24.0	31.0	37.0

Figure 2: Retirement wealth adequacy by replacement ratio



5. Implications

This study investigated the effects of income, and demographic and socioeconomic characteristics on retirement wealth adequacy using the multivariate OLS and logistic regression models. In addition, the effects of EPF contribution rates and income RR on retirement wealth adequacy were studied by projecting pessimistic and optimistic scenarios.

The results from the estimated wealth-need ratio show that 69% of households in the sample have adequate retirement income, indicating that more than 30% of households will not be able to maintain the current level of spending during retirement.

The results from the OLS show that the adequacy of retirement wealth is higher for Region 4 (P. Pinang, Selangor, Kuala Lumpur, Putrajaya), urban strata, married status, Chinese race, college graduate, government servant, younger respondent (age 30-34), and average annual income (RM15,000 - RM40,000). On the other hand, negative relationships are seen among single households (male and female), those who possess education lower than high school, craft and repair occupations, older respondents (age 50-54) and household sizes.

The results from the logistic regression model show that the retirement wealth adequacy increases for households living in urban areas and single-female households.

The results from the projected scenarios indicate that households with higher EPF contribution rate and lower income RR have a higher proportion of retirement income adequacy.

The government may propose an increment in EPF employer contribution rate (but not employee contribution rate), especially for the group of households that have insufficient retirement income such as those with lower education level, lower occupation skills, and living in rural areas. The affected households should also plan their expenditure wisely so that they can allocate more on savings. In addition, they should actively seek to enhance their financial knowledge in terms of savings and investment. The government and financial institutions may also help by introducing savings schemes which are suitable for the affected households.

This study could not carry out a more detailed analysis of the subject due to limited data. The accumulated retirement wealth at retirement ages should be projected from the households' current portfolio where information on all accessible wealth is available such as financial assets (equities, bonds and money markets), nonfinancial assets (housing, real estate and business assets), total accumulation of defined contribution plan (EPF) and benefits from defined benefit plan (pensions). Due to lack of information, we considered only benefits from the defined benefit (pensions) and defined contribution (EPF) plans respectively for government servants and

employees of corporate sector in projecting retirement wealth adequacy. The retirement benefits are projected using the current salary of each household from the HIS 2009 data.

For future studies, the determinants of retirement wealth adequacy using the quantile regression model and Bayesian approach are recommended. The quantile regression model is an extension of the classical least squares estimation of the conditional mean models to the estimation of an ensemble of models for several conditional quantile functions, whereas the Bayesian interpretation of probability can be used to obtain a more reasonable hypothesis. In addition, we plan to use simulation approach for including a certain range of rates (discount or interest rate, dividend rate and contribution rate) so that the uncertainty and random effects of the related variables can be studied and included in the retirement wealth adequacy model.

Acknowledgement

This paper utilised data from the Malaysian Household Income Survey (HIS) 2009 conducted by the Department of Statistics Malaysia (DOSM). The authors gratefully acknowledge the financial support received in the form of research grants (FRGS/1/2013/SG04/UKM/02/5 and AP-2012-021) from the Ministry of Higher Education (MOHE), Malaysia.

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