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# DO YOU PREFER STOCKS FOR YOUR PENSION PORTFOLIO?

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**A B S T R A C T**

In this paper, we will try to investigate the pension preferences, how demographic and financial factors affect pension allocation using Binomial Logit Model. The dataset includes variables such as age, education, income, wealth, and stock investments, marital status, race, years in pension. The key questions explored are how factors like age, pension in years, education, wealth, profit sharing plan and investment choice influence pension decisions, mainly trying to capture the effects on the inclusion of stock investments in the pension portfolio. Since stocks are considered risky assets, this paper tries to represent the inclusion of stocks into the portfolio as the determinant of the risk aversion during the pension plan.

**K E Y W O R D S**

Stock, Pension plan, Variable, Multicollinearity, Heteroscedasticity, Investment, Risk Aversion, Portfolio.

## Introduction

The impact of age, income, and other demographic factors on pension investment decisions made by samples of participants with choice has been the subject of several recent research [1]. Numerous econometric studies link pension asset selection to demographic traits [1]. According to these studies, pension assets generally show that the standard investment advice states that the equity share of a portfolio should decrease with age (more precisely, that the equity percent should equal 100 minus one's age) and increase with income (indicating a greater ability to bear risk) [1]. However, it is assumed that participants optimize across all of their assets, including retirement assets [1].

Over the past few decades, the world's population has been aging at an accelerated rate. As a result, a growing percentage of people are either past or close to retirement age. Growing research in recent years has demonstrated that people's risk aversion tends to increase with age [4][3]. According to Dohmen, who used a representative sample of Germans from the German Socio-Economic Panel in 2004, demographic characteristics like age and gender help to explain part of the variation in risk aversion levels among people [2]. They discovered that older persons are more risk apprehensive than younger people, and women are generally more risk averse than men. They also concluded that a person's degree of risk aversion in financial concerns is influenced by their height and the educational attainment of their parents[4]. In particular, taller people are generally less risk averse. People with highly educated parents are generally less risk averse than people with less educated parents.

**Economic theory of model and variable relationships**

Theoretical framework is based on the people's preference for the inclusion of stocks in pension asset allocation. **Stock ownership** is dependent dummy variable and theoretical proxy for the measurement of risk aversion (the higher, the lower risk aversion). **Investment choice** (Choice = 1 if participant can choose investments). Papke suggest that People who have options are more likely to match their asset allocation to their own return expectations and risk tolerance. Plan administrators might make more conservative investments if they have no other option, especially when it comes to interest-bearing assets [1]. Consequently, it is anticipated that choice has a positive correlation with stock investing [1]. Also, including the **age** factor in the model as the independent variable is hypothesized being negatively correlated with stock investments. As an age increases people tend to lean on more safe umbrellas like bonds. Next, **Education** is anticipated to contribute to the ownership of stocks in pension portfolio. It is quite clear that people with higher financial literacy and education tend towards the stock ownership because of understanding of markets, asset characteristics and so on. Furthermore, **Wealth** factor is crucial in this model. Because they can more easily withstand possible losses, people who are richer prefer to devote a bigger percentage of their portfolio to riskier assets like equities, according to the notion of decreasing absolute risk aversion (DARA)[5]. **Duration** of the pension plan is also important factor that effects the stock ownership. The hypothesis is that as the number of years increase in the pension plan, it should affect negatively to the stock allocation because the longer the duration is, the more uncertain the future will be, thus it increases the risks. Finally, Profit sharing variable will be included in the model, the rationale behind this decision is that people think that profit sharing plan usually incentivize pension plan managers to provide better returns, which might lead to the more of weighting on the stocks during the asset allocation process.

**Data Discussion**

Data includes 194 observations which were recorded in 1980s. Most of the variables are dummy variables which includes min 0 or max of 1, and they are profit sharing and choice, stock ownership (dependent dummy) variables. However, pension in years has a min value of 0 and max 45 with mean of 11.30 and standard deviation of 9.51. Also, kurtosis of 3.767 means distributions is almost normally distributed with positive skewness of 1.13. Education variables is about the highest grade completed having min value of 8 with highest of 18. It has a mean value of 13.57 which means people on average have completed sophomore level in the college. It has kurtosis of 2.29 which platykurtic distribution with skewness being almost symmetrical with the value of 0.3112. Finally, Wealth variable measuring the net worth of 194 participants in the dataset. The person that had highest net worth valued at 1484.99 and with lowest valued at -579.997. Average person was worth of 207.37 with standard deviation 251.23. Kurtosis of 9.76 means leptokurtic distribution with extreme deviations and skewness of 2.11.

**Model Results**

The dependent variable is dummy variable, meaning percentage of stock ownership in percentages, thus we faced unboundedness problem and used Binomial logit model to mitigate it. Variables signs are similar to what has been expected.

```
. logit stckin89 choice wealth89 edu pyears age prftshr

Iteration 0:  Log likelihood = -122.47753
Iteration 1:  Log likelihood = -109.97953
Iteration 2:  Log likelihood = -109.91636
Iteration 3:  Log likelihood = -109.91633
Iteration 4:  Log likelihood = -109.91633

Logistic regression                                     Number of obs =    191
                                                        LR chi2(6)    =  25.12
                                                        Prob > chi2   = 0.0003
Log likelihood = -109.91633                             Pseudo R2     = 0.1026
```

| stckin89 | Coefficient | Std. err. | z | P>\|z\| | [95% conf. | interval] |
|---|---|---|---|---|---|---|
| choice | .3703094 | .3587117 | 1.03 | 0.302 | -.3327525 | 1.073371 |
| wealth89 | .0027273 | .0007957 | 3.43 | 0.001 | .0011678 | .0042868 |
| educ | .0114057 | .0670828 | 0.17 | 0.865 | -.1200742 | .1428857 |
| pyears | -.0352264 | .0197067 | -1.79 | 0.074 | -.0738509 | .0033981 |
| age | .0287461 | .0413323 | 0.70 | 0.487 | -.0522638 | .1097559 |
| prftshr | .6273548 | .409279 | 1.53 | 0.125 | -.1748172 | 1.429527 |
| _cons | -3.14491 | 2.672705 | -1.18 | 0.239 | -8.383316 | 2.093496 |

Coefficient estimates cannot be trusted, we calculated average marginal effects.

```
Marginal effects after logit
      y  = Pr(stckin89) (predict)
         =  .32900179
```

| variable | dy/dx | Std. err. | z | P>\|z\| | [ 95% | C.I. ] | X |
|---|---|---|---|---|---|---|---|
| choice* | .0804211 | .0762 | 1.06 | 0.291 | -.068921 | .229763 | .612565 |
| wealth89 | .0006021 | .00018 | 3.35 | 0.001 | .00025 | .000954 | 211.983 |
| educ | .0025179 | .0148 | 0.17 | 0.865 | -.026499 | .031535 | 13.534 |
| pyears | -.0077766 | .00433 | -1.80 | 0.072 | -.016261 | .000708 | 11.3037 |
| age | .006346 | .00912 | 0.70 | 0.486 | -.011523 | .024215 | 60.5183 |
| prftshr* | .1453534 | .09764 | 1.49 | 0.137 | -.046026 | .336733 | .209424 |

(*) dy/dx is for discrete change of dummy variable from 0 to 1

### Test for Multicollinearity

Since this model is non-linear, VIF uncentered model used to detect multicollinearity between variables. We detected significant multicollinearity since both are greater than 10 between age and education explanatory variables. The course of action taken was to drop education variable.

**Before**

```
. vif, uncentered
```

| Variable | VIF | 1/VIF |
|---|---|---|
| age | 27.80 | 0.035975 |
| educ | 25.90 | 0.038617 |
| choice | 2.75 | 0.363992 |
| pyears | 2.63 | 0.379788 |
| wealth89 | 1.83 | 0.547751 |
| prftshr | 1.33 | 0.749349 |
| Mean VIF | 10.37 | |

**After**

```
. vif, uncentered
```

| Variable | VIF | 1/VIF |
|---|---|---|
| age | 5.96 | 0.167677 |
| choice | 2.71 | 0.369473 |
| pyears | 2.62 | 0.380968 |
| wealth89 | 1.79 | 0.557737 |
| prftshr | 1.33 | 0.752501 |
| Mean VIF | 2.88 | |

**Test for Heteroskedasticity**

The Breusch-Pagan test was used to determine heteroskedasticity. Calculated test-statistic was 33.58 which is higher than critical value of chi-squared (11.0705) table on 5 percent significance level with two tailed. Thus, we reject the null hypothesis that no heteroskedasticity.

```
. regress residsquared choice wealth89 age pyears prftshr
```

| Source | SS | df | MS | | | |
|---|---|---|---|---|---|---|
| Model | 69.8062379 | 5 | 13.9612476 | Number of obs | = | 191 |
| Residual | 327.338794 | 185 | 1.76939889 | F(5, 185) | = | 7.89 |
| | | | | Prob > F | = | 0.0000 |
| | | | | R-squared | = | 0.1758 |
| | | | | Adj R-squared | = | 0.1535 |
| Total | 397.145032 | 190 | 2.09023701 | Root MSE | = | 1.3302 |

| residsquared | Coefficient | Std. err. | t | P>\|t\| | [95% conf. | interval] |
|---|---|---|---|---|---|---|
| choice | -.1870125 | .2037444 | -0.92 | 0.360 | -.5889737 | .2149486 |
| wealth89 | .0021163 | .0004012 | 5.28 | 0.000 | .0013248 | .0029078 |
| age | .0341289 | .0242414 | 1.41 | 0.161 | -.0136963 | .0819541 |
| pyears | -.0223369 | .0107524 | -2.08 | 0.039 | -.0435501 | -.0011238 |
| prftshr | -.1880662 | .2426612 | -0.78 | 0.439 | -.6668052 | .2906727 |
| _cons | -1.081131 | 1.436706 | -0.75 | 0.453 | -3.915565 | 1.753302 |

To adjust the heteroskedasticity problem, we used heteroskedasticity-corrected (HC) standard errors. Even though HC standard errors are biased upward due to the intentional adjustment, they should be more accurate, improving the accuracy of hypothesis testing and statistical inference.

```
. logit stckin89 choice wealth89 age pyears prftshr, robust

Iteration 0:   Log pseudolikelihood = -122.47753
Iteration 1:   Log pseudolikelihood = -109.99101
Iteration 2:   Log pseudolikelihood =  -109.9308
Iteration 3:   Log pseudolikelihood = -109.93077
Iteration 4:   Log pseudolikelihood = -109.93077

Logistic regression                                     Number of obs =    191
                                                        Wald chi2(5)  =  15.39
                                                        Prob > chi2   = 0.0088
Log pseudolikelihood = -109.93077                       Pseudo R2     = 0.1024

------------------------------------------------------------------------------
             |               Robust
    stckin89 | Coefficient  std. err.      z    P>|z|     [95% conf. interval]
-------------+----------------------------------------------------------------
      choice |   .3736571   .3691439     1.01   0.311    -.3498517    1.097166
    wealth89 |   .0027573   .0010881     2.53   0.011     .0006247    .0048899
         age |   .0280674    .038319     0.73   0.464    -.0470365    .1031713
      pyears |  -.0347738    .017935    -1.94   0.053    -.0699258    .0003781
     prftshr |   .6189862   .3823553     1.62   0.105    -.1304164    1.368389
       _cons |  -2.960361   2.250119    -1.32   0.188    -7.370512     1.44979
------------------------------------------------------------------------------
```

**Interpretation of Results**

Coefficient signs and results were as expected. Wealth factor being quite significant, we can expect it to have huge impact on the stock ownership in the pension portfolio. However, all other variables also were expected to be significant, they were not. Multicollinearity and Heteroskedasticity problems were detected but dropping the extra independent variable variable and using the heteroskedasticity-corrected (HC) standard errors approaches, the model was effectively adjusted for both problems.

**Summary**

In order to capture the effects on the inclusion of stock investments in the pension portfolio, the main questions examined were how age, asset allocation choice, and profit sharing plan, age, years in pension and wealth affect pension decisions. This study attempted to depict the inclusion of stocks in the portfolio as the determinant of risk aversion during the pension plan because equities are regarded as hazardous assets. As a result, wealthier individuals tended to invest a larger percentage of their pension account in equities which showed lower risk aversion.

**References**

1-Papke, Leslie E. "Individual Financial Decisions in Retirement Plans: The Role of Participant-Direction." *Journal of Public Economics*, vol. 88, no. 1–2, 2003, pp. 39–61.
2-Dohmen, Thomas, et al. "Risk Attitudes Across the Life Course." *Journal of the European Economic Association*, vol. 15, no. 4, 2017, pp. 745–784.
3-Schurer, Stefanie. "Lifecycle Patterns in the Socioeconomic Gradient of Risk Preferences." *Journal of Economic Behavior & Organization*, vol. 119, 2015, pp. 482–495.
4-Dohmen, Thomas, et al. "Individual Risk Attitudes: Measurement, Determinants, and Behavioral Consequences." *Journal of the European Economic Association*, vol. 9, no. 3, 2011, pp. 522–550
5-Arrow, K. J. (1971). *Essays in the Theory of Risk-Bearing*. North-Holland Publishing Company.