Preferences for Early Retirement among Older Government Employees in Egypt

by

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Abstract

The objective of this study is to examine the factors affecting the early retirement preferences of Egyptian government sector employees. In line with the existing literature, we consider the possibility that the early retirement and post-retirement employment decisions are made jointly. We do this by estimating a recursive bivariate probit model in which the endogenous "post-retirement work" variable is among the explanatory variables in the "early retirement" equation. Estimation results based on a 2005 survey reveal that the two decisions are in fact correlated. As expected, people who plan to work after retirement are more likely to choose early retirement. Among the other findings of the study are that women are more likely to chose early retirement than men, and a good health status and more years of education are associated with longer stays on the job.

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Keywords: early retirement, post-retirement work, recursive bivariate probit.

I. Introduction

One of the prominant features of the Egyptian economy is the dominance of the public sector and state owned enterprises which are characterized by overstaffing and excess employment.

Beginning in the early 90's, Egypt has embarked on a program of economic liberalization and reform as part of the stabilization and structural adjustment policies suggested by the World Bank and the IMF. At the heart of this program was the privatization of state-owned enterprises and other branches of the public and government sectors. During the process, early retirement was considered as one of the most effective tools of downsizing. Often financed or heavily subsidized by the government, early retirement was expected to facilitate the privatization process and mitigate the adverse social impacts of layoffs when unemployment benefits are unavailable. Privatization and structural adjustment proponents believe this process would not be efficiently realized without a voluntary early retirement program that compensates workers for the loss of guaranteed lifetime employment and benefits. Early retirement incentives are often used where labor laws ban layoffs, or where labor unions are strong. Based on the proceeds generated from privatization in Egypt, a fund was created in 1997 to implement early retirement programs. More recently, with pension reforms high on their reform agenda, the ministries of social insurance and finance have put together a new reform package, which went into effect in January 2006. Under the new package, women are eligible for early retirement at the age of 45 provided they have worked at the same enterprise for 20 years; whereas men are eligible at the age of 50.

Shortly before the package went into effect, a survey was conducted to determine the potential consequences of accepting early retirement. Issues under examination included how the retirees were planning to spend their compensation and whether they had sufficient information to make a rational decision. In the empirical work, we utilize this survey to identify the variables affecting the decision to retire before the legal retirement age of 60. While the focus of the study is on the early retirement decision, preferences regarding post-retirement employment also play a central role in our empirical analysis due to the theoretical reason that the two decisions are made jointly. What the joint decision implies is that when examining the retirement decision, the choice regarding post-retirement work can not be treated as an exogenous factor since it is the combination of the two decisions that determines the path of future earnings, and hence the optimal timing of retirement. In practice, the link between the two decisions is made even more intricate by a widely-implemented policy known as the "earnings test", i.e. a reduction in pension payments if earnings from post-retirement work exceed a certain amount. In line with the tradition that goes back to Burtless and Moffitt (1985), we consider the possibility that the early retirement and post-retirement employment decisions are made jointly by estimating a two-equation model in which the endogenous "post-retirement work" variable is among the explanatory variables in the "early retirement" equation.

A considerable amount of research focusing on developed countries has been carried out concerning early retirement programs and their important economic impact. However, it is well agreed upon that employment problems in developed countries vary significantly from those of developing countries. Developed countries are challenged with the threat of an aging labor force and low replacement rates, whereas, developing countries suffer from the backlog of unemployment lines, coupled with increased rates of population growth and growing labor force participation rates, especially youth and women in Latin America and the Middle East (ILO, 2006). Although several studies have discussed retirement benefits and related problems in Egypt such as the need to reform the pay-as-you-go system and the different investment strategies regarding the fund assets (Maait, Ismail and Khorasanee, 2000; Osman and Salah, 2001), this is the first study dealing with the early retirement preferences of government sector workers.

II. The Data

The empirical analysis is based on a survey conducted by the Information and Decision Support Center in December 2005. The sample resulted in over 3,400 current employees of government sector personnel, ranging in age between 50 and 57, from seven governorates: Cairo, Giza, Behira, Sharqia; Suez, Asyout, and EL-Menya. The survey provides data on basic demographics, experience, occupation, wages, health, income, skills, attitude towards early retirement, and planned investment after retirement. In what follows, we use the words "preferred" and "intended" interchangeably. That is, the preferred age of retirement refers to the age at which the respondent plans to retire. Since the actual retirement and post-retirement work decisions have not yet materialized, we rely on information regarding intentions, hoping that we are painting an accurate picture of the actual decisions of employees.

In an empirical study on retirement, one would ideally like to work with a representative sample of retirees and non-retirees. Since our sample excludes retirees, our sample suffers from selectivity bias which becomes more severe as we get to older ages which can be observed by the decline in frequencies with age (There are 766 fifty year olds vs. 298 fifty-seven year olds.). Instead, we have a representative sample of workers who have chosen not to retire up to whatever age they are. According to the information about the survey design provided in Ramadan (2006), the population of study is "workers between the ages of 50 and 57 currently working in the Egyptian government sector". The choice of the 50-57 age group is not arbitrary. In an effort to alleviate the impact of early retirement on the social security system, Egypt's retirement law imposes a 10 percent reduction in pension payments for those retiring before the age of 50 and a 5 percent reduction for those retiring before the age of 55. Therefore, the sample we work with consists of those who have chosen to remain employed beyond the critical age of 50.[1] Another reason for the choice of the age group has to do with the purposes of the agency for conducting the survey. As mentioned above, the survey was conducted at a time when preparations were underway for a new retirement law. One of the proposed early retirement plans applies only to 50 to 57 year olds, and the survey includes a question on whether this plan would be preferred by the employees.

Due to the lack of information on the exact age distribution of workers, a random access approach was employed with respect to age. However, there is stratification with respect to the work types of the respondents (i-administrative, ii-organizational and iii-local) and their professional rank which is closely related with the level of education (i-3rd and 4th levels, ii-1st and 2nd levels; and iii-superior rank). Since the empirical work is carried out at the individual level, the sampling weights employed in the estimations are defined as the product of the two weights generated for the two components discussed above. In other words, we have different weights for the $3\times3 = 9$ stratas of the data.

In Egypt, a government employee is eligible for early retirement if he or she has worked in the government sector for at least 20 years. Unfortunately, the only available experience variable in the data set refers to years of employment in the current institution. Therefore, we do not know whether the respondents are eligible for early retirement at the time of the survey or whether they will be before they are 60. To ensure that we are working with a sample of

[1] As expected, there's a clustering of respondents at the age of 55 in response to a question on the preferred age of retirement. About two-thirds of the respondents aged 50-54 say that they would prefer to retire at the age of 55. However, due to the lack of information regarding the time of eligibility for retirement in the data, we are unable to estimate a model of the determination the age of retirement that incorporates this structure.

people who *do* have the option to retire early, we excluded from the sample the respondents who will be not completing 20 years in their firms by the time they are sixty. The proportion of such respondents was about 3 percent of the original sample.

The importance of financial incentives has long been recognized and confirmed in the literature on retirement. Generosity of pension plans and the availability of retiree health insurance are among the various factors that have been found to be closely related with the retirement decision. Pensions that are actuarially unfair encourage early retirement, and countries with more generous social security benefits tend to have a lower average retirement age (Gruber and Wise, 1998).[2] However, the lack of detailed data on such critical variables precludes us from investigating (and controlling for) the effect of financial incentives in the early retirement preferences of Egyptian workers. Instead, we focus on several socio-demographic and current-job related factors that may impact the joint decision of early retirement and post-retirement work.

III. The Econometric Model

The bivariate probit model relies on the joint estimation of two equations that may have a common set of regressors or be seemingly unrelated. The signs of the two latent variables y_1^* and y_2^* determine the values of the observed dependent variables y_1 and y_2. The recursive bivariate probit is a slight variation of the basic model with y_2 appearing on the right hand side of the equation for y_1^* such that

$$y_1^* = \beta' x_1 + \gamma \cdot y_2 + u_1, \qquad \text{and} \qquad y_2^* = \alpha' x_2 + u_2$$

where the u's are jointly standard normally distributed with correlation coefficient ρ.

The method of maximum likelihood is the obvious candidate to estimate the model, and it turns out that despite the issue of endogeneity, the terms that enter the likelihood function for the recursive bivariate probit model are the same as those for the usual bivariate probit (Maddala, 1983). Therefore, the probabilities of the four cells for this model are given by

$$\begin{aligned}
\text{Prob}[y_1 = 1, y_2 = 1] &= \Phi_2 (\beta' x_1 + \gamma, \alpha' x_2, \rho) , \\
\text{Prob}[y_1 = 0, y_2 = 1] &= \Phi_2 (-\beta' x_1 - \gamma, \alpha' x_2, -\rho) , \\
\text{Prob}[y_1 = 1, y_2 = 0] &= \Phi_2 (\beta' x_1, -\alpha' x_2, -\rho) , \\
\text{Prob}[y_1 = 0, y_2 = 0] &= \Phi_2 (-\beta' x_1, -\alpha' x_2, \rho) .
\end{aligned}$$

where Φ_2 denotes the bivariate normal cumulative distribution function. Below, Φ and ϕ will respectively denote the univariate normal cumulative distribution and density functions.

Maddala (1983, p.122) mentions the problem of identification in the recursive probit model that arises when none of the explanatory variables in the equation for the endogenous dummy are excluded from the other equation. More recently, Wilde (2000) has clarified the matter and has shown that 'identification by functional form' *is* present in the absence of exclusion restrictions. However, the common practice is to impose restrictions whenever appropriate to improve the identification of the model. In our model, all exclusions were decided by first

[2] Boskin (1977) was one of the first to pay close attention to the effects of incentives on early retirement. Others followed suit were Fields and Mitchell (1984), Stock and Wise (1990), and Meghir and Whitehouse (1996). See Herbertsson (2001) for more detailed information.

including the variables in both equations and omitting them from the equation(s) in which they were insignificant.

Since the bivariate probit's coefficient estimates by themselves are of limited use when interpreting the model's results, it is customary to report the marginal effects of the explanatory variables on the probability of observing a certain outcome. The marginal effects are usually evaluated at the sample means of the variables, but one could also evaluate them at each observation and report the average of those figures. In the recursive bivariate probit model, the calculation of the marginal effects is more complicated than in the usual bivariate probit. First of all, one needs to decide which magnitude should be defined as the marginal effect since there are several conditional and unconditional probabilities that might serve as the basis for the calculations (Greene, 2003). The definition of a marginal effect also depends on whether the explanatory variable in question is binary or continuous. Furthermore, one needs to account for the fact that the explanatory variables that appear in the equation for the endogenous dummy have an indirect effect (through the endogenous dummy) on the outcome of primary interest as well as a direct effect if they also appear in the first equation. Following Greene (1998) where the relevant definitions and formulas are provided (for the special case of $\rho=0$), we now show that if one is interested in changes in the expectation of y_1 (which equals the probability that $y_1 = 1$ due to the fact that y_1 is a zero-one variable), the marginal effect of a change in a variable will be the sum of a direct and/or indirect effect depending on which equation(s) the variable is included in.

First, we observe that $E[y_1 \mid x_1,x_2,y_2]$

$= \text{Prob}[y_2 = 1] \cdot E[y_1 \mid x_1,x_2,y_2 = 1] + \text{Prob}[y_2 = 0] \cdot E[y_1 \mid x_1,x_2,y_2 = 0]$

$= \text{Prob}[y_2 = 1] \cdot \text{Prob}[y_1 = 1 \mid y_2 = 1] + \text{Prob}[y_2 = 0] \cdot \text{Prob}[y_1 = 1 \mid y_2 = 0]$

$= \text{Prob}[y_1 = 1,y_2 = 1] + \text{Prob}[y_1 = 1,y_2 = 0]$

$= \Phi_2(\beta'x_1 + \gamma, \alpha'x_{2,}\rho) + \Phi_2(\beta'x_1, -\alpha'x_{2,}-\rho).$

The marginal effect of a continuous explanatory variable, z, is

$$\partial E[y_1|x_1,x_2,y_2] / \partial z = \partial \Phi_2(\beta'x_1 + \gamma, \alpha'x_{2,}\rho) / \partial z + \partial \Phi_2(\beta'x_1 , -\alpha'x_{2,}-\rho) / \partial z$$

$$= \{\phi(\beta'x_1+ \gamma)\Phi[(\alpha'x_2 - \rho(\beta'x_1 + \gamma))/\sqrt{1-\rho^2}\,]\}\cdot\beta_z + \{\phi(\alpha'x_2)\Phi[(\beta'x_1+ \gamma)- \rho(\alpha'x_2))/\sqrt{1-\rho^2}\,]\}\cdot\alpha_z$$
$$+\{\phi(\beta'x_1)\Phi[(-\alpha'x_2 - (-\rho)(\beta'x_1))/\sqrt{1-\rho^2}\,]\}\cdot\beta_z + \{\phi(-\alpha'x_2)\Phi[(\beta'x_1 - (-\rho)(-\alpha'x_2))/\sqrt{1-\rho^2}\,]\}\cdot -\alpha_z,$$

where β_z and α_z are the coefficients on z in the two equations. Rearranging the expression so that the two terms multiplied by β_z (and two terms multiplied by α_z) are brought together, we obtain the expression for the 'total' marginal effect:

$$= \{\phi(\beta'x_1 + \gamma)\Phi[(\alpha'x_2 - \rho(\beta'x_1 + \gamma))/\sqrt{1-\rho^2}\,] + \phi(\beta'x_1)\Phi[(-\alpha'x_2 - (-\rho)(\beta'x_1))/\sqrt{1-\rho^2}\,]\} \cdot \beta_z$$
$$+ \{\phi(\alpha'x_2)\Phi[(\beta'x_1 + \gamma) - \rho(\alpha'x_2))/\sqrt{1-\rho^2}\,] - \phi(-\alpha'x_2)\Phi[(\beta'x_1 - (-\rho)(-\alpha'x_2))/\sqrt{1-\rho^2}\,]\}\cdot \alpha_z\,.$$

Greene refers to the first part of this expression as the 'direct' effect and the second part as the 'indirect' effect. This formulation could be applied to binary explanatory variables especially if one is interested in decomposing the total effect into its direct an indirect components. However, a more accurate definition for the total marginal effect of a binary variable q, which belongs in x_1 and/or x_2, is

$E[y_1 \mid x_1, x_2, y_2, q=1] - E[y_1 \mid x_1, x_2, y_2, q=0]$

$= \{ [\Phi_2(\beta' x_1 + \gamma, \alpha' x_2, \rho) + \Phi_2(\beta' x_1, -\alpha' x_2, -\rho)] \}$ calculated at q=1
$- \{ [\Phi_2(\beta' x_1 + \gamma, \alpha' x_2, \rho) + \Phi_2(\beta' x_1, -\alpha' x_2, -\rho)] \}$ calculated at q=0.

Finally, the marginal effect of the endogenous binary variable, y_2, is defined in terms of univariate normal probabilities since

$E[y_1 \mid x_1, x_2, y_2 = 1] - E[y_1 \mid x_1, x_2, y_2 = 0] = \Phi(\beta' x_1 + \gamma) - \Phi(\beta' x_1)$.

Since the expectation of y_2 is conditioned only on x_2, i.e. $E[y_2|x_2] = \text{Prob}[y_2 = 1] = \Phi(\alpha' x_2)$, marginal effects for this equation are defined in terms of univariate normal probabilities as in the univariate probit model.

Calculation of the marginal effects will be especially useful in our model since, in all instances, the coefficients on the same variable have the opposite signs in the two equations, meaning that the total (or net) effect of the variable needs to be computed to determine the sign as well as the size of the impact of the variable on the early retirement decision.

IV. Empirical Results

In this section, we report the empirical findings from our examination of the joint decision of early retirement and post-retirement employment. The (weighted) sample percentages from the cross-tabulation of the two variables provide no evidence of such a relationship. While 58 percent of the 3,277 respondents would like to retire early, and 33 percent of the respondents would like to engage in post-retirement work, there is very little variation in the row and column percentages across different outcomes. Therefore, if there is any link between the two decisions, we will need to rely on a multivariate analysis to uncover its nature.

The bivariate probit results are summarized in Table 1. The estimated value of ρ is –0.67 with a standard error of 0.13. Since the null hypothesis that ρ=0 is rejected at conventional levels, and the coefficient on post-retirement work in the early retirement equation is significant, we are convinced that the recursive bivariate probit model is the appropriate set-up to examine the early retirement decision. The negative estimate of ρ, which may at first seem counter-intuitive given that the coefficient on post-retirement work is positive, is in fact of the expected sign. It implies that unobserved characteristics – such as a lower taste for work – that make an individual more likely to choose early retirement, also make them less likely to engage in post-retirement work. The coefficient on the post-retirement work dummy is the largest in magnitude and implies a positive marginal effect of 0.43, i.e. 43 percentage points, on the probability of choosing early retirement (See Table 2).

Age is the only explanatory variable that appears only in the early retirement equation. As mentioned before, the sample we work with suffers from a selectivity problem due to the exclusion of retirees. Furthermore, when broken down by age from younger to older respondents, the sample is likely to consist of those less likely to prefer early retirement since those people have ‘survived’ for more years in the state of employment. Viewed in this respect, we expect the age variable to capture the effect of this pattern and alleviate the problem of selectivity. The negative coefficient on the age variable is consistent with this

interpretation. Each passing year reduces the probability of choosing early retirement by 1.5 percentage points.

Dummy variables indicating females, household heads, and the health status of the respondent as well as the log-wage and years of education variables appear in both equations. The coefficients on the gender dummy indicate that females are more likely to prefer early retirement, but are also less likely to seek post-retirement work. Marginal effects calculations reveal that the net effect of being a female on the probability of early retirement is close to zero and statistically insignificant. Being a household head, being in good health, and having completed more years of education all have a negative direct effect on the probability of early retirement, but a positive indirect effect on the likelihood of post-retirement work. In each case, the direct effects dominate, and so the net effects turn out to be negative. The finding pertaining to the years of education is consistent with Quinn et al.'s (1990) suggestion that education may increase non-monetary benefits associated with work.

Within the framework of a simple leisure – consumption analysis, the age of retirement is determined by a present value of lifetime earnings calculation. The effect of the wage rate on retirement is ambiguous as changes in the wage rate lead to both income and substitution effects. The finding of many empirical studies has been that the substitution effect is dominant, meaning that higher wages are associated with retirement at an older age. However, if the wage rate is also taken as an indicator of unobserved productivity or stronger attachment to the labor market, its influence on retirement should be interpreted as a combination of the effects through both of these channels.[3] In our model, the logarithm of the wage rate has a positive direct effect on early retirement which is suggestive of a dominant income effect. However, the variable also has a negative indirect effect which is almost large enough to offset the direct one. As a result, we conclude that the current wage is not a significant determinant of the early retirement decision.

Finally, the three variables that appear only in the post-retirement work equation are years of experience in the current institution and dummy variables that indicate municipality employees and individuals residing in rural locations. All variables have negative coefficients which means that they make post-retirement work, and so early retirement less likely. Apparently, municipality employees and those residing in rural locations have more difficulty in finding jobs following retirement which in turn discourages them from retiring early.

For purposes of comparison, Tables 1 and 2 also contain results from a univariate probit model of early retirement that ignores the endogeneity issue. In some instances, we see marked differences in the inferences that one would make from the two models. Most noticeably, the univariate model produces the finding that post-retirement work does not have a significant effect on the early retirement decision. Another shortcoming of the univariate model is that it fails to account for the indirect effect of the three variables that are significant in only the post-retirement work equation. On the other hand, it must be noted that the

[3] A similar story could be told about the non-labor income variable. Even though an increase in non-labor income causes only an income effect that encourages earlier retirement, a relationship in the opposite direction could be expected to the extent that non-labor income reflects the accumulation of wealth through previous market earnings, and thus a stronger attachment to the labor market. It might be for this reason that the non-labor income variable we experimented with failed to yield statistically significant results.

marginal effects calculated for the remainder of the variables are not far off the total marginal effects produced by the bivariate model.

V. Conclusion

The objective of this study was to examine the factors affecting the early retirement preferences of Egyptian government sector employees. We considered the possibility that the early retirement and post-retirement employment decisions are made jointly by estimating a recursive bivariate probit model. Estimation results have confirmed that the two decisions are in fact correlated. As expected, people who plan to work after retirement are more likely to choose early retirement. Since a sizable proportion of early retirees are likely to seek work after retirement, and they will be fighting over limited jobs with other unemployed, programs that facilitate early retirement may not have the desired effect on the unemployment rate.

Early retirement programs are usually motivated primarily by the need for public sector downsizing rather than unemployment concerns. When designing early retirement plans, it is important to do that in a way to avoid encouraging the most productive people to take advantage of them. Therefore, the model's findings should also be of some value to policy makers in identifying the characteristics of employees most likely to choose early retirement in case the retirement law is amended in ways that encourage early retirement. As more surveys become available, it may also be possible to compare the planned retirement decisions investigated here with the actual ones and determine the factors responsible for any discrepancies.

References

Boskin, M. J. (1977), "Social Security and Retirement Decisions", *Economic Inquiry*, 15, pp. 1-25.

Burtless, G. and R. A. Moffitt (1985), "The Joint choice of Retirement age and Post-retirement hours of work" *Journal of Labor Economics*, 3 (2), pp. 209-36.

Fields, G. S., and O. Mitchell, (1984), "The Effects of Social Security Reforms on Retirement Ages and Retirement Incomes", *Journal of Public Economics* 25, pp.143-59.

Greene, W. (1998), "Gender Economics Courses in Liberal Arts Colleges: Further Results", *Journal of Economic Education*, 29 (4), pp. 291-300.

Greene, W. (2003), *Econometric Analysis*, 5th edition. Prentice Hall, Upper Saddle River, NJ.

Gruber, J. and D. Wise (1998) *Social Security and Retirement Around the World*, University of Chicago Press.

ILO (2006) *Global Employment Trends for Youth*. ILO, Geneve.

Herbertsson, T. T. (2001) "The Economics of Early Retirement", *Journal of Pensions Management* 6 (4), pp. 326-35.

Maait, I. and Z. Khorasanee (2000) "The Effects of privatisation and liberalisation of the economy on the actuarial soundness of the Egyptian funded and defined benefits social

security scheme". Paper presented at the Year 2000 International Research Conference on Social Security; Helsinki, 25-27 September 2000.

Maddala, G. S. (1983), *Limited Dependent and Qualitative Variables in Econometrics*, Cambridge: Cambridge University Press.

Meghir, C. , and E. Whitehouse (1996), "The Evolution of Wages in the UK: Evidence from Micro Data", *Journal of Labor Economics* 14, 1-25.

Osman, O. M. and M. A. H. Salah (2001), *Exploring Reform Potentials for the Pension System in Egypt*. Economic Policy Initiative Consortium.

Quinn, Joseph F., R. V. Burkhauser, and D.A. Myers, (1990), *Passing the Torch: The Influence of Economic Incentives on Work and Retirement* (Upjohn Institute for Employment Research).

Ramadan, M. (2006). "Analysis of the Early Retirement Survey", in Arabic; IDSC, January 2006.

Stock, J. and D. Wise, (1990), "Pensions, the Option Value of Work and Retirement", *Econometrica* 58, 1151-1180.

Wilde J. (2000), "Identification of Multiple Equation Probit Models with Endogenous Dummy Regressors", *Economics Letters*, 69 (3), pp.309-12.

Table 1: Univariate and Recursive Bivariate Probit Estimates

	Univariate probit		Recursive bivariate probit			
	Early retirement equation		Equation 1: Early retirement		Equation 2: Post-retirement work	
	Coef.	St. error	Coef.	St. error	Coef.	St. error
Constant	3.582	0.547	2.410	0.575	-0.485	0.184
Post-ret. work	0.098*	0.053	1.154	0.182		
Age	-0.054	0.010	-0.037	0.010		
Female	0.081*	0.078	0.489	0.107	-1.150	0.091
H'hold head	-0.255	0.078	-0.341	0.075	0.374	0.095
Healthy	-0.215	0.062	-0.251	0.061	0.238	0.069
Education	-0.034	0.010	-0.061	0.011	0.086	0.012
Log-wage	0.056*	0.054	0.101	0.052	-0.198	0.068
Experience					-0.018	0.004
Municipality					-0.163	0.054
Rural					-0.381	0.076
ρ			-0.672	0.125		

Note: "*" denotes statistical *in*significance at the 5% level. The standard errors in the table are those produced by Limdep. The standard errors produced by STATA using the 'robust' option (which is automatically invoked when sampling weights are used) are larger, but the variables remain significant with the exception of log-wage in equation 1.

Table 2: Marginal Effects of variables on $E[y_1 \mid x_1, x_2, y_2] = Prob[y_1 = 1]$.

	Univariate probit	Recursive bivariate probit				
	Marginal Effect	Direct effect	Indirect effect	Total effect	St. error	*p*-value
Post-ret. work	0.038*	0.452		0.452 (0.425)	0.074	0.000
Age	-0.021	-0.015		-0.015	0.004	0.000
Female	0.032*	0.192	-0.188	-0.004* (-0.009*)	0.030	0.893
H'hold head	-0.098	-0.134	0.061	-0.073 (-0.027*)	0.030	0.014
Healthy	-0.082	-0.099	0.039	-0.060 (-0.024*)	0.023	0.010
Education	-0.013	-0.024	0.014	-0.010	0.004	0.010
Log-wage	0.022*	0.040	-0.032	0.007*	0.020	0.705
Experience			-0.003	-0.003	0.001	0.001
Municipality			-0.027	-0.027 (-0.016)	0.010	0.008
Rural			-0.062	-0.062 (-0.037)	0.017	0.000

Note: "*" denotes statistical *in*significance at the 5% level. The marginal effects are computed at the means of the x's (See Table 3). Table entries for the bivariate probit are the marginal effects obtained when all variables are treated as continuous variables. Figures in parentheses are the marginal effects obtained using the formulations given in the text for binary explanatory variables and the endogenous dummy variable.

Table 3: Sample means of explanatory variables

Early ret.	= 0			=1			All		
Post-ret. work	= 0	=1	All	= 0	=1	All	= 0	=1	All
Share in sample (%)	27.7	14.2	41.8	39.4	18.8	58.2	67.0	33.0	100.0
Age	53.4	53.3	53.4	52.8	53.0	52.9	53.1	53.1	53.1
Female	0.50	0.14	0.37	0.62	0.13	0.46	0.57	0.13	0.42
H'hold head	0.60	0.91	0.70	0.48	0.88	0.61	0.53	0.89	0.65
Healthy	0.84	0.90	0.86	0.81	0.84	0.82	0.82	0.87	0.84
Education	5.58	5.74	5.63	5.57	5.27	5.47	5.57	5.47	5.54
Log-wage	-0.39	-0.38	-0.39	-0.37	-0.49	-0.41	-0.38	-0.44	-0.40
Experience	27.8	26.7	27.4	27.0	25.3	26.4	27.3	25.9	26.9
Municipality	0.34	0.35	0.35	0.34	0.26	0.31	0.34	0.30	0.33
Rural	0.14	0.12	0.13	0.09	0.10	0.09	0.11	0.11	0.11