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Factors Influencing the Decision to Extend Working Life: A Case Study of Thailand

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Kaewkwan Tangtipongkul¹

Abstract

The changes in the population structure have led Thailand to become an aged society since 2005. Thailand's old-age dependency ratio (64+ per 15-64) increased from 5.44% in 1965 to 20.97% in 2023. Utilizing the 2018-2023 data from Thailand's National Labor Force Survey, this paper examines the factors influencing the decision to remain in the labor force. The analysis focuses on two groups: individuals ages 24-59 and 60-80 years old at the time of the survey. This study applies Beehr's framework (1986), which identifies the extension of working decisions by individual characteristics and the position of family members in the co-residence composition. Retirement is defined as the individual leaving the labor force with the intention to stay out permanently (Lazear, 1986). The logistic regression model shows that geographic regions, age, gender, education, marital status, and the position of family members in the co-residence composition influence an individual's decision to remain in the labor force. Married or single individuals ages 60-80 years old have a significantly higher propensity to remain in the labor force compared to those who are divorced, widowed, or separated. Individuals ages 60-80 years old as grandparents to the head of household have a significant negative impact on the decision to remain in the labor force; however, those as either spouse or married children to the head of household have a significantly higher propensity to remain in the labor force. These findings have important implications for Thailand's old-age policies, encouraging productive aging through employment opportunities to ensure independence while recognizing the importance of family support in enhancing the well-being of older adults.

Keywords: Elderly, Labor Force, Household Co-residence, Thailand

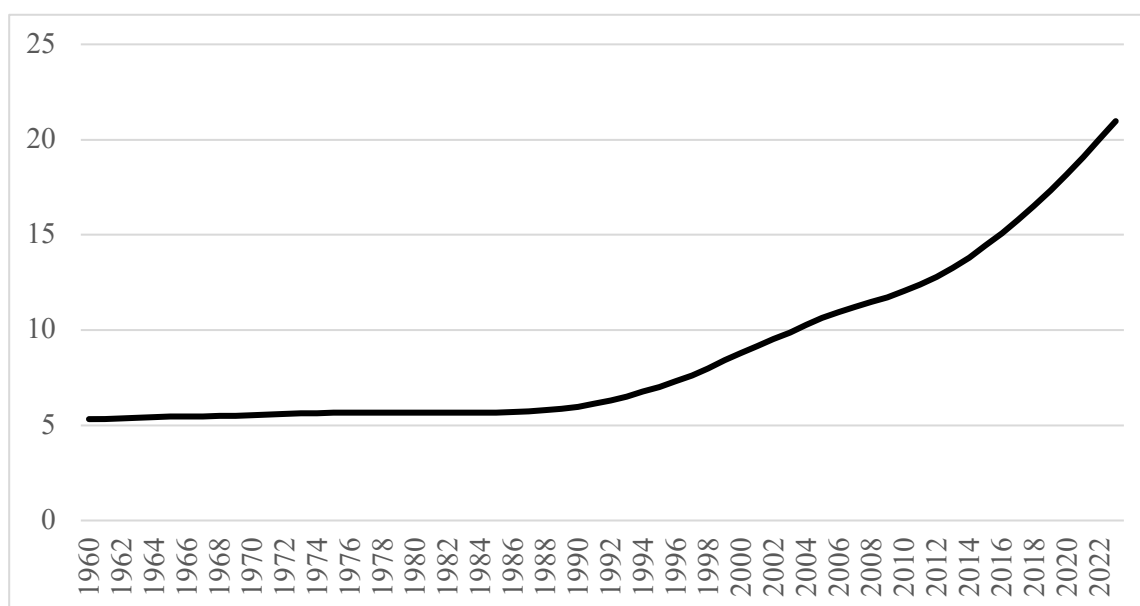
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I. Introduction

The changes in the population structure have led Thailand to become an aged society since 2005. Thailand's old-age dependency ratio (64+ per 15-64) increased from 5.44% in 1965 to 20.97% in 2023 (Figure 1). The proportion of the population aged 60 years old or over is forecasted to reach 28.3% by 2030, 33.9% by 2040, and 38.3% by 2050 (Figure 2). Policies related to extending the retirement age and designing older workers' reemployment are essential to support the current and future population structure. These policies will allow older workers to have financial protection. The labor force participation rate of people aged 65 years or over in 2021 is 19.1% for females and 35.8% for males (Figure 3). The percentage of informal employment out of total employment of people aged 65 years or over in 2018 was 87.1% for females and 81% for males (Figure 4). Information and Communications Technology (ICT) will become crucial in education. Anantanasuwong (2021) stated that strengthening lifelong learning skills is one of the main goals of building an active and healthy aging society. The literacy rate of older persons aged 65 years or over in 2015 was 73.3% for females and 85.4% for males (Figure 5). The percentage of internet users of each age group is presented in Figure 6.

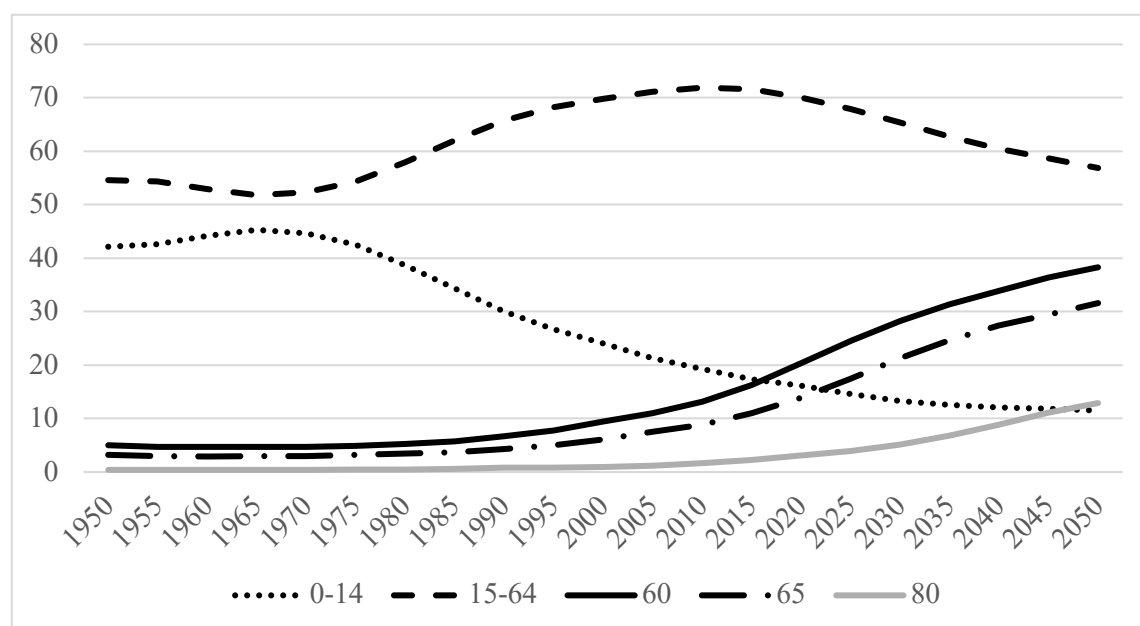
This study explores the challenges and developments related to the labor market trends of the aging society in the fourth industrial revolution in Malaysia, Singapore, and Thailand (United Nations, Economic and Social Commission for Asia and the Pacific [ESCAP], 2022) as well as various policies in countries across the Asia-Pacific region to promote employment, education, and financial support for older persons (Henning, Roncarati, & ESCAP, 2022). Nagarajan and Sixsmith (2023) discussed factors influencing older persons' decisions to remain in the workforce and that technology plays a significant role in accommodating the needs of older and younger workers. Studies investigate workplace perceptions of older workers (Frøyland & Terjesen, 2020; Blomé et al., 2020; Roman, 2016). Frøyland and Terjesen (2020) found that positive perceptions of older workers include high levels of expertise and knowledge, but they were less flexible and willing to adapt to new situations and not as productive compared to younger workers. The policies regarding retirement extension and reemployment may argue that knowledge and experience from older workers are transferable to younger workers which is beneficial for employers (Tangtipongkul & Srisuchart, 2018).

Figure 1: Age-dependency Ratio, Old (% of Working-age Population), Thailand



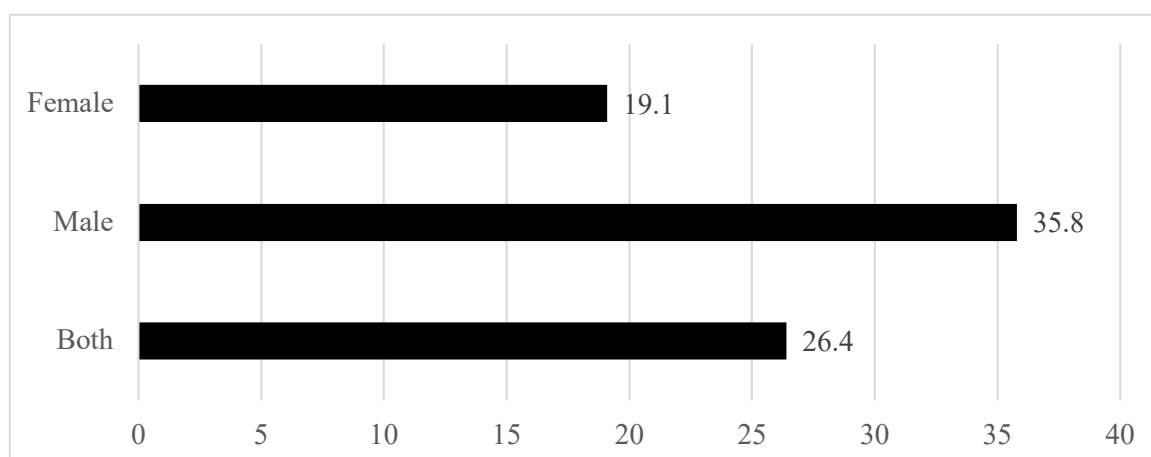
Source: The World Bank. Age-dependency ratio is the ratio of older dependents—people older than 64—to the working-age population—those aged 15-64. Data depict the proportion of dependents per 100 working-age population.

Figure 2: Proportion of the Total Population by Broad Age Group, 1950-2050, Thailand



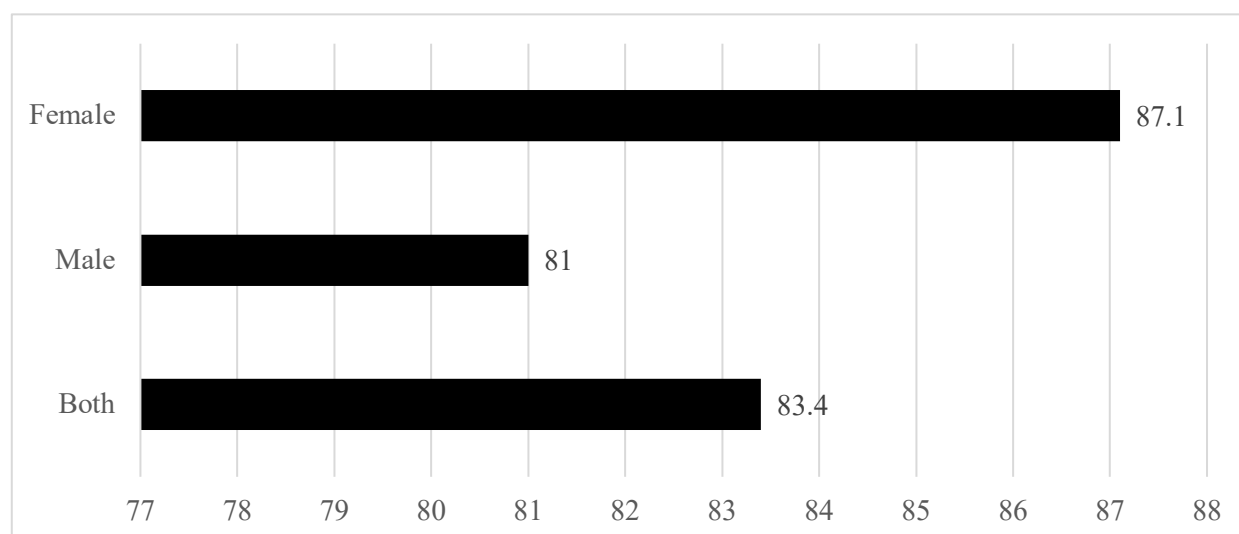
Source: ESCAP 2022. Ageing in Asia and the Pacific: key facts. <https://www.population-trends-asiapacific.org/data>. United Nations, Department of Economic and Social Affairs, Population Division (2022). World Population Prospects 2022, Online Edition.

Figure 3: Labor Force Participation Rate of 65+, Percentage, 2021, Thailand



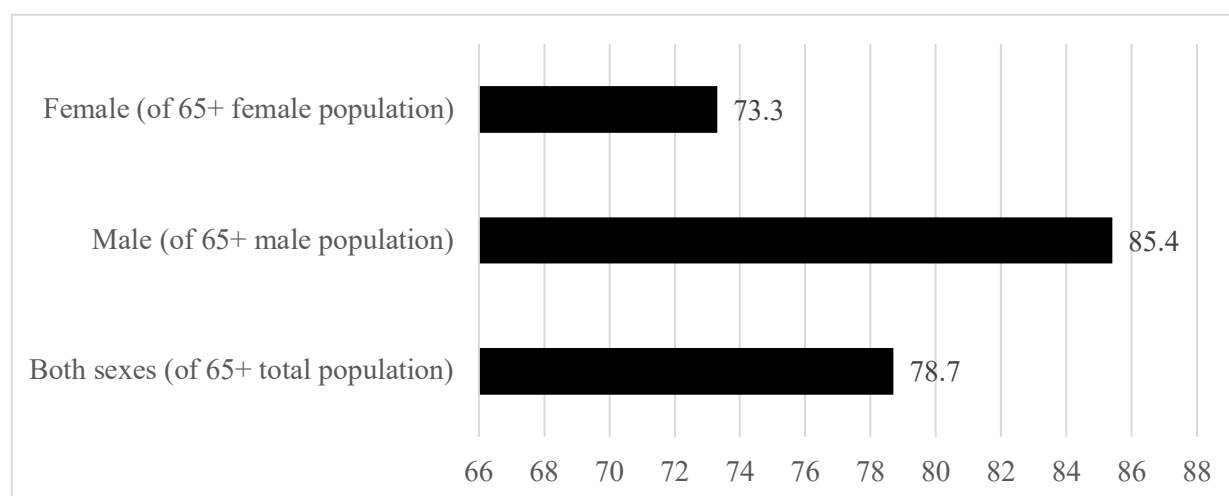
Source: ESCAP 2022. Ageing in Asia and the Pacific: key facts. <https://www.population-trends-asiapacific.org/data>. International Labour Organization, ILOSTAT Data. <https://ilostat ilo.org/data/> (accessed on 3 March 2023).

Figure 4: Informal Employment Rate of 65+ (percentage of informal employment out of total employment in that age group), 2018, Thailand



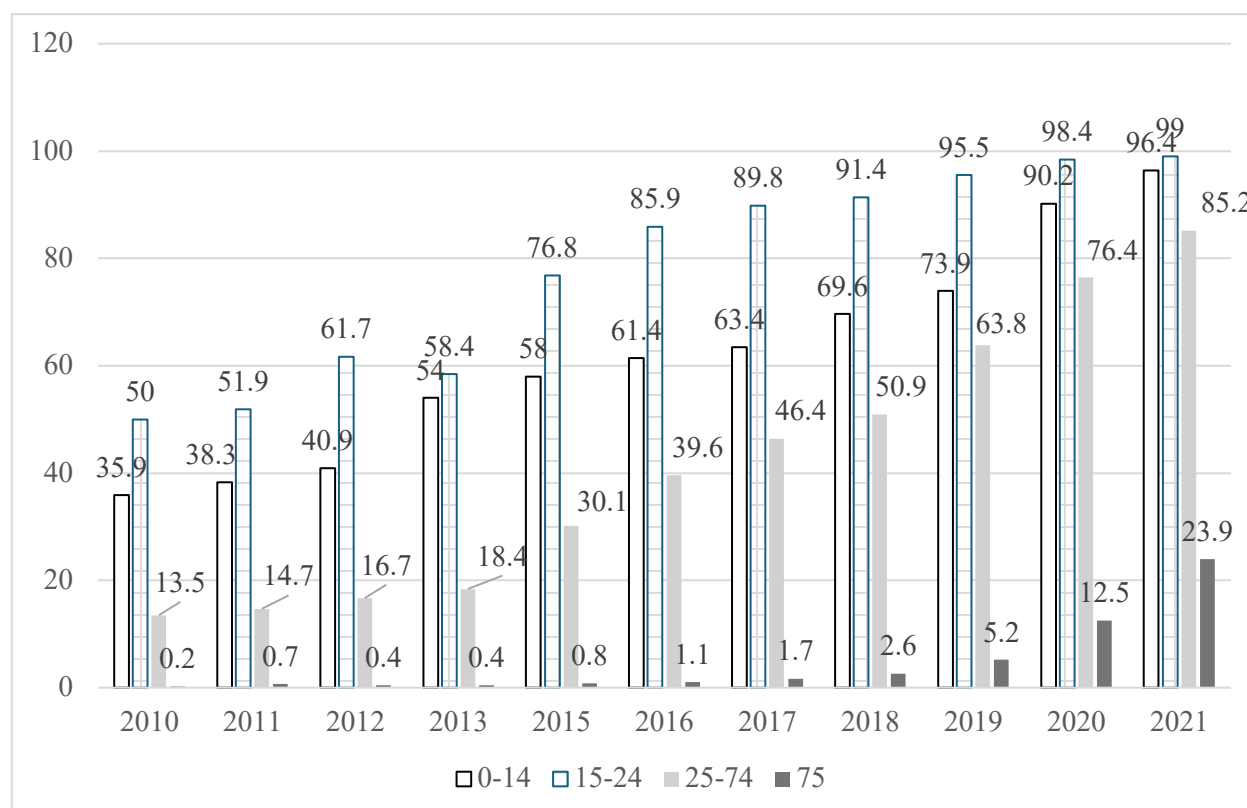
Source: ESCAP 2022. Ageing in Asia and the Pacific: key facts, available at: <https://www.population-trends-asiapacific.org/data>. International Labour Organization, ILOSTAT Data. Available at <https://ilostat ilo.org/data/> (accessed on 3 March 2023).

Figure 5: Literacy Rate of Older Persons Aged 65+, percentage, 2015, Thailand



Source: ESCAP 2022. Ageing in Asia and the Pacific: key facts. <https://www.population-trends-asiapacific.org/data>. World Bank, Databank. <https://databank.worldbank.org/> (accessed on 3 March 2023).

Figure 6: Internet Users, as a Percentage of Their Age Group, Latest Available Years, Thailand



Source: ESCAP 2022. Ageing in Asia and the Pacific: key facts. <https://www.population-trends-asiapacific.org/data>. ITU (2022). ITU, Digital Development Dashboard.

<https://www.itu.int/en/ITU-D/Statistics/Dashboards/Pages/Digital-Development.aspx>
(accessed on 20 February 2023).

Several studies explore the determinants of the labor supply of older workers in Thailand (Kantachote & Wiroonsri, 2023; Paweenawat & Liao, 2021; Arkornsakul et al., 2020; Sirisub et al., 2019; Thanapop & Thanapop, 2021). Paweenawat and Liao (2021) found that pensions and poor health status negatively influence labor force participation. Sirisub et al. (2019) analyzed the associations between general characteristics, quality of work life, and job characteristics to extend the work life of Thai registered nurses in the Ministry of Public Health. Thanapop and Thanapop (2021) explored the differences in the Work Ability Index (WAI) between formal and informal workers ages 45-70 years old working in Nakhon Si Thammarat in Thailand and found that workers in the oldest group of 55 years old or over are at risk of poor to moderate workability as health problems occur more frequently which affects their productivity and performance. Arkornsakul et al. (2020) found that macroeconomic indicators such as GDP growth rate, GPP growth rate, inflation, unemployment rate, and average allowance per elderly have no impact at the aggregate level. In the private sector, Soonthornchawakan and Cintakulchai (2009) analyzed Thailand's household socio-economic survey data and recommended extending retirement based on workers' productivity in wholesale, retail, hotel, and restaurant industries. In addition, Soonthornchawakan and Kulthanavit (2013) found that the productivity of workers ages 55-59 years old declined significantly in the manufacturing industry due to poor health. Tangtipongkul and Srisuchart (2018) found that individuals working in retail have an approximately 9% higher propensity to delay their retirement compared to other industries.

The objective of this study is to examine the factors influencing the decision to extend working life. The paper is organized as follows. Section II discusses the background of the pension system and retirement policy in Thailand. Section III describes the conceptual framework. Section IV gives an overview of the data and methodology. Section V discusses empirical results. Section VI highlights the policy implications and conclusion.

II. Background on the Pension System and Retirement Policy in Thailand

The Thai pension system is funded by the annual government budget and grants pensions to all government officials based on the recipient's final month's salary. Thailand's pension system is illustrated in Table 1. The government-provided pension includes the Government Pension Fund for civil servants and the universal old-age allowance for those without any formal pension payment to secure basic needs. The Social Security Fund, or the compulsory savings, is contributed by employers, employees, and the government. It is a Pay-As-You-Go scheme where contributions from existing members are used to pay retirees. The financial sustainability of the fund depends on the balance between the amount contributed and the amount of pension paid out. Voluntary savings include the provident fund, retirement mutual fund, and national savings fund, which are privately financed personal provisions. It is incentivized with tax advantages and intends to cover Thai citizens, especially informal workers, who are not covered by any pension scheme.

Table 1: Thai Pension System

Government-provided	Compulsory saving	Voluntary savings
Government Pension Fund	Social Security Fund	Provident Fund
Universal old-age allowance		Retirement Mutual Fund
		National Saving Fund

Source: Government Pension Fund, Thailand (2012).

The retirement age and the age to receive a pension in the Thai employment system is illustrated in Table 2. All formal workers in the public sector retire at 60 years old and are eligible to receive a pension and senior allowance at 50-60 years old. Formal workers in the private sector have no specific legal age for retirement. The retirement age for these workers can be negotiated between employers and employees in the employment contract. The retirement age usually agreed upon is 55 and is based on the eligibility to receive a pension from the social security fund. Informal workers, such as agricultural workers and self-employed individuals, have no specific legal requirement for retirement and are not eligible to receive pensions.

Table 2: Age of Retirement and Pension Eligibility in the Thai Employment System

Employment sector	Formal workers		Informal workers
	Public Sector	Private Sector	
Age of retirement	60 years old	No specific legal requirement. Depends on the agreement between employer and employee.	No specific legal requirement.
Age eligibility to receive pension and senior allowances	50-60 years old	55 years old (with Social Security)	None

Source: Chamchan (2008).

III. Methodology

Several studies have been done based on different theories on determinants of employee retirement. Wang and Shultz (2010) review literature based on five corresponding theories on retirement as decision-making conceptualization as shown in Table 3. These corresponding theories include rational choice theory (Hatcher, 2003; Gustman & Steinmeier, 1986; Quinn et al., 1990), image theory (Feldman, 1994; Beach & Frederickson, 1989), role theory (Talaga & Beehr, 1995; Ashforth, 2001; Moen et al., 1992; Brougham & Walsh, 2007), theory of planned behavior (Cron et al., 1993; Ajzen, 1991; Adams & Beehr, 1998; Huuhtanen & Piispa, 1992; Shultz et al., 2003; Wang et al., 2008), and expectancy theory (Vroom, 1964; Kim, 2003; Belgrave & Haug, 1995; Cron et al., 1993; DeVaney & Kim, 2003; Karpansalo et al., 2004). The limitation of retirement decision-making is mostly involuntary (Gallo et al., 2000; Hanisch & Hulin, 1990; Shultz et al., 1998); Szinovacz & Davey, 2004; van Solinge & Henkens, 2007). They stated that the voluntariness of the retirement decision could be viewed as a boundary condition for applying the informed decision-making approach in testing predictors of the retirement decision. This study applies Beehr's framework (1986), which identifies the extension of working decisions by individual characteristics and household co-residence composition. Individual characteristics involve geographic region, gender, marital status, age, and education level. The definition of retirement is applied as the individual leaving the labor force with the intention to stay out permanently (Lazear, 1986).

Table 3: Five Corresponding Theories on Retirement

Corresponding theories	Description	Research examples
Rational choice theory	The rational choice theory has been used to connect financial status and the external economic environment to retirement decisions.	Hatcher, 2003 Gustman & Steinmeier, 1986 Quinn et al., 1990
Image theory	Both image theory and role theory connect workers' demographic status, work experience, marital life, type of industries, and productivity to their retirement decisions.	Feldman, 1994 Beach & Frederickson, 1989
Role theory		Talaga & Beehr, 1995 Ashforth, 2001 Moen et al., 1992 Brougham & Walsh, 2007
Theory of planned behavior	The theory of planned behavior connects workers' attitudes, job satisfaction, organizational commitment, and workplace norms to their retirement decisions.	Cron et al., 1993 Ajzen, 1991 Adams & Beehr, 1998 Huuhtanen & Piispa, 1992 Shultz et al., 2003 Wang et al., 2008
Expectancy theory	The expectancy theory connects workers' productivity, job characteristics, and health status to their retirement decisions.	Vroom, 1964 Kim, 2003 Belgrave & Haug, 1995 Cron et al., 1993 DeVaney & Kim, 2003 Karpansalo et al., 2004

Source: Wang and Shultz (2010)

I use the logistic regression model to describe factors associated with the decisions to remain in the labor force. Borsch-Supan et al. (2004) applied this model to estimate retirement decisions. Based on Maddala (1983) and Wooldridge (2002), the logistic analysis model assumes that there is an underlying response variable y^* defined by the regression relationship in equation (1):

$$y^* = x\beta + u \quad (1)$$

where x_i represents individual and economic characteristics and the disturbance term u . A dummy variable y is defined by equation (2):

$$\begin{aligned} y &= 1 \text{ if } y^* > 0 \\ y &= 0 \text{ otherwise} \end{aligned} \quad (2)$$

From (1) and (2) we get

$$P(y = 1|x) = P(y^* > 0|x)P(u > -x\beta) = 1 - F(-x\beta) = F(x\beta) \quad (3)$$

where F is the cumulative distribution function for u . u has a standard logistic distribution. The logit model is shown by equation (4):

$$F(x\beta) = \frac{\exp(x\beta)}{1 + \exp(x\beta)} \quad (4)$$

For the nonlinear model interpretation, the marginal effects of individual and household characteristics are calculated to interpret β_j on both continuous and discrete explanatory variables. The marginal effects derivations are taken from Wooldridge (2002) and Cameron and Trevedi (2009). When x_j is continuous, the marginal effect is computed by equation (5):

$$\frac{\partial p(x)}{\partial x_j} = f(x\beta) \beta_j, \text{ where } f(x\beta) = \frac{dF}{d(x\beta)}(x\beta) \quad (5)$$

There are two important properties to consider when explanatory variables are continuous. First, if $F(x\beta)$ is strictly increasing the CDF function, then the sign of marginal effect is determined by the sign of β_j . Second, concerning the relative effects for continuous variables x_j and x_h , the ratio of the partial effects is constant and is given by the ratio of corresponding coefficients by equation (6):

$$\frac{\partial p(x)/\partial x_j}{\partial p(x)/\partial x_h} = \frac{\beta_j}{\beta_h} \quad (6)$$

When x_K is the binary explanatory variable, the marginal effect of changing x_K from zero to one while holding all other variables fixed is computed by equation (7):

$$F(\beta_1 + \beta_2 x_2 + \dots + \beta_{K-1} x_{K-1} + \beta_K x_K) - F(\beta_1 + \beta_2 x_2 + \dots + \beta_{K-1} x_{K-1}) \quad (7)$$

For other discrete variables, such as number of family members in the household, the effect on the probability of x_K going from C_K to $C_K + 1$ is computed by equation (8):

$$F(\beta_1 + \beta_2 x_2 + \dots + \beta_{K-1} x_{K-1} + \beta_K (C_K + 1)) - F(\beta_1 + \beta_2 x_2 + \dots + \beta_{K-1} x_{K-1} + \beta_K C_K)$$

(8)

IV. Data

This study is based on the 2018-2023 data from Thailand's National Labor Force Survey conducted by the National Statistical Office. The sample is drawn randomly from different households in Thailand. In each year, the survey consists of four quarterly sets of data: a) January–March (dry or nonagricultural season), b) April–June (large groups of new workers entering the labor force after graduation), c) July–September (rainy and agricultural season), and d) October–December. The analysis is limited to two groups: individuals ages 24-59 years old and 60-80 years old at the time of the survey. Variables' names, means, and standard deviations are summarized in Tables 4 and 5. The dependent variable is the decision to remain in the labor force. The explanatory variables are geographic region, gender, marital status, age, education level, and relationships with head of household in co-residence composition. The dummy variables are geographic region, gender, marital status, education level, and position of family members in the co-residence composition. The geographic region is classified into five groups: Bangkok and its metropolitan region, central region, north region, northeastern region, and southern region. For municipality as proxy for urban characteristics in the zero-one dummy variable, zero is given to non-municipality or rural area and one is given to municipality or urban area. For gender in the zero-one dummy variable, zero is given to females and one is given to males. The marital status is classified into three groups: married, single, and divorced, widowed and separated. The education level is classified into four groups: no education, primary education or below, secondary and postsecondary education, university level or above. For head of household in the zero-one dummy variable, zero is given to the individual who is not the head of the household, and one is given to individual who is head of household. The positions of family members in the co-residence composition are categorized as grandparent, spouse, unmarried children, married children, in-laws, or grandchildren to the head of household.

Table 4: Descriptive Statistics of Dependent and Explanatory Variables, 24-59 years old

Variable	Description	Year 2018 Mean (Standard deviation)	Year 2019 Mean (Standard deviation)	Year 2020 Mean (Standard deviation)	Year 2021 Mean (Standard deviation)	Year 2022 Mean (Standard deviation)	Year 2023 Mean (Standard deviation)
Sample size (N)		433,340	422,117	420,645	417,924	403,040	394,915
Dependent variable							
Inlaborforce	Individual remains in the labor force	0.8507 (0.3564)	0.8483 (0.3587)	0.8512 (0.3559)	0.8548 (0.3523)	0.8586 (0.3485)	0.8644 (0.3423)
Explanatory variables							
Age	Age of individuals (years)	43.1874 (10.0094)	43.3027 (10.0322)	43.3260 (10.0892)	43.2620 (10.1579)	43.3382 (10.1742)	43.5341 (10.1442)
Male§	Gender (male=1, female=0)	0.4711 (0.4992)	0.4706 (0.4991)	0.4700 (0.4991)	0.4718 (0.4992)	0.4769 (0.4995)	0.4780 (0.4995)
Bangkok§	Living in Bangkok (Yes=1, No=0)	0.0570 (0.2319)	0.0554 (0.2287)	0.0573 (0.2324)	0.0556 (0.2292)	0.0500 (0.2179)	0.0520 (0.2220)
Southern§	Living in the southern region (Yes=1, No=0)	0.1797 (0.3840)	0.1842 (0.3876)	0.1822 (0.3860)	0.1863 (0.3894)	0.1849 (0.3882)	0.1847 (0.3881)
Central§	Living in the central region (Yes=1, No=0)	0.3052 (0.4605)	0.3050 (0.4604)	0.3101 (0.4625)	0.3074 (0.4614)	0.3023 (0.4592)	0.3026 (0.4594)
Northern§	Living in the northern region (Yes=1, No=0)	0.2044 (0.4033)	0.2027 (0.4020)	0.2001 (0.4000)	0.2018 (0.4013)	0.1978 (0.3983)	0.1964 (0.3973)
Northeastern §	Living in the northeastern region (Yes=1, No=0)	0.2536 (0.4351)	0.2527 (0.4346)	0.2504 (0.4333)	0.2489 (0.4324)	0.2651 (0.4414)	0.2642 (0.4409)
Urban§	Living in the municipality (Yes=1, No=0)	0.5578 (0.4966)	0.5578 (0.4966)	0.5587 (0.4965)	0.5557 (0.4969)	0.5360 (0.4987)	0.5375 (0.4986)
Educ1§	Education attainment (Primary education =1, otherwise=0)	0.4241 (0.4942)	0.4124 (0.4923)	0.3918 (0.4882)	0.3751 (0.4842)	0.3542 (0.4783)	0.3470 (0.4760)
Educ2§	Education attainment (Secondary and postsecondary education =1, otherwise=0)	0.3747 (0.4840)	0.3872 (0.4871)	0.3993 (0.4897)	0.4094 (0.4917)	0.4250 (0.4944)	0.4412 (0.4965)

Variable	Description	Year 2018 Mean (Standard deviation)	Year 2019 Mean (Standard deviation)	Year 2020 Mean (Standard deviation)	Year 2021 Mean (Standard deviation)	Year 2022 Mean (Standard deviation)	Year 2023 Mean (Standard deviation)
Educ3§	Education attainment (University level or higher=1, otherwise=0)	0.1661 (0.3722)	0.1662 (0.3723)	0.1759 (0.3808)	0.1821 (0.3859)	0.1894 (0.3918)	0.1854 (0.3886)
Married§	Marital status (married=1, otherwise=0)	0.7303 (0.4438)	0.7246 (0.4467)	0.6538 (0.4757)	0.4131 (0.4924)	0.4002 (0.4899)	0.3910 (0.4880)
Single§	Marital status (single=1, otherwise=0)	0.1742 (0.3793)	0.1796 (0.3839)	0.1888 (0.3914)	0.2013 (0.4009)	0.2178 (0.4128)	0.2232 (0.4164)
Family size	Number of family member in the household	3.5880 (1.7487)	3.5395 (1.7294)	3.5828 (1.7813)	3.5621 (1.7787)	3.2517 (1.5448)	3.2012 (1.5317)
Hhousehold§	Head of household (Yes=1, No=0)	0.4103 (0.4919)	0.4132 (0.4924)	0.4074 (0.4914)	0.4089 (0.4916)	0.4383 (0.4962)	0.4403 (0.4964)
Grandparent§	Relationship with head of household: Is the respondent the grandparent to the head of household? (Yes=1, No=0)	0.0051 (0.0713)	0.0048 (0.0694)	0.0191 (0.1370)	0.0567 (0.2313)	0.0045 (0.0670)	0.0043 (0.0652)
Spouse§	Relationship with head of household: Is the respondent the spouse to the head of household? (Yes=1, No=0)	0.2735 (0.4458)	0.2702 (0.4441)	0.2633 (0.4404)	0.2575 (0.4372)	0.2559 (0.4363)	0.2521 (0.4342)
Child§	Relationship with head of household: Is the respondent the unmarried children to the head of household? (Yes=1, No=0)	0.0920 (0.2891)	0.0922 (0.2893)	0.1240 (0.3296)	0.2079 (0.4058)	0.1056 (0.3073)	0.1073 (0.3095)
Child2§	Relationship with head of household: Is the respondent the married children to the head of household? (Yes=1, No=0)	0.1055 (0.3072)	0.1061 (0.3080)	0.0823 (0.2749)	0.0034 (0.0582)	0.0927 (0.2900)	0.0939 (0.2917)

Variable	Description	Year 2018 Mean (Standard deviation)	Year 2019 Mean (Standard deviation)	Year 2020 Mean (Standard deviation)	Year 2021 Mean (Standard deviation)	Year 2022 Mean (Standard deviation)	Year 2023 Mean (Standard deviation)
In-laws§	Relationship with head of household: Is the respondent the in-laws to the head of household? (Yes=1, No=0)	0.0584 (0.2346)	0.0574 (0.2325)	0.0432 (0.2033)	0.0002 (0.0137)	0.0470 (0.2117)	0.0462 (0.2100)
Grandchildren§	Relationship with head of household: Is the respondent the grandchildren to the head of household? (Yes=1, No=0)	0.0684 (0.2525)	0.0681 (0.2519)	0.0519 (0.2218)	0.0004 (0.0201)	0.0585 (0.2347)	0.0583 (0.2344)
Q1§	Quarter 1 (Yes=1, No=0)	0.2398 (0.4270)	0.2454 (0.4303)	0.2407 (0.4275)	0.2436 (0.4292)	0.2517 (0.4340)	0.2520 (0.4342)
Q2§	Quarter 2 (Yes=1, No=0)	0.2541 (0.4354)	0.2534 (0.4350)	0.2515 (0.4339)	0.2519 (0.4341)	0.2524 (0.4344)	0.2517 (0.4340)
Q3§	Quarter 3 (Yes=1, No=0)	0.2601 (0.4387)	0.2565 (0.4367)	0.2597 (0.4385)	0.2573 (0.4372)	0.2484 (0.4321)	0.2489 (0.4324)
Q4§	Quarter 4 (Yes=1, No=0)	0.2460 (0.4307)	0.2446 (0.4299)	0.2481 (0.4319)	0.2471 (0.4313)	0.2475 (0.4315)	0.2474 (0.4315)

§ is dummy variable.

Table 5: Descriptive Statistics of Dependent and Explanatory Variables, 60-80 years old

Variable	Description	Year 2018 Mean (Standard deviation)	Year 2019 Mean (Standard deviation)	Year 2020 Mean (Standard deviation)	Year 2021 Mean (Standard deviation)	Year 2022 Mean (Standard deviation)	Year 2023 Mean (Standard deviation)
Sample size (N)		161,513	166,355	173,734	175,539	176,374	183,519
Dependent variable							

Variable	Description	Year 2018 Mean (Standard deviation)	Year 2019 Mean (Standard deviation)	Year 2020 Mean (Standard deviation)	Year 2021 Mean (Standard deviation)	Year 2022 Mean (Standard deviation)	Year 2023 Mean (Standard deviation)
Inlaborforce	Individual remains in the labor force	0.4061 (0.4911)	0.3976 (0.4894)	0.4091 (0.4917)	0.4163 (0.4929)	0.4165 (0.4930)	0.4276 (0.4947)
Explanatory variables							
Age	Age of individuals (years)	67.5190 (5.7640)	67.4928 (5.6999)	67.5123 (5.6333)	67.5668 (5.6099)	67.6215 (5.5988)	67.6428 (5.5723)
Male§	Gender (male=1, otherwise=0)	0.4426 (0.4967)	0.4424 (0.4967)	0.4441 (0.4969)	0.4453 (0.4970)	0.4407 (0.4965)	0.4409 (0.4965)
Bangkok§	Living in Bangkok (Yes=1, No=0)	0.0454 (0.2083)	0.0409 (0.1980)	0.0438 (0.2046)	0.0445 (0.2062)	0.0346 (0.1827)	0.0349 (0.1836)
Southern§	Living in the southern region (Yes=1, No=0)	0.1370 (0.3438)	0.1358 (0.3425)	0.1355 (0.3423)	0.1373 (0.3442)	0.1344 (0.3411)	0.1332 (0.3398)
Central§	Living in the central region (Yes=1, No=0)	0.2833 (0.4506)	0.2826 (0.4503)	0.2834 (0.4507)	0.2778 (0.4479)	0.2723 (0.4452)	0.2732 (0.4456)
Northern§	Living in the northern region (Yes=1, No=0)	0.2512 (0.4337)	0.2548 (0.4358)	0.2536 (0.4351)	0.2576 (0.4373)	0.2577 (0.4374)	0.2580 (0.4375)
Northeastern §	Living in the northeastern region (Yes=1, No=0)	0.2831 (0.4505)	0.2859 (0.4519)	0.2836 (0.4507)	0.2828 (0.4503)	0.3009 (0.4587)	0.3007 (0.4586)
Urban§	Living in the municipality (Yes=1, No=0)	0.5550 (0.4970)	0.5565 (0.4968)	0.5552 (0.4969)	0.5505 (0.4974)	0.5247 (0.4994)	0.5278 (0.4992)
Educ1§	Education attainment (Primary education =1, otherwise=0)	0.7597 (0.4272)	0.7577 (0.4285)	0.7450 (0.4359)	0.7384 (0.4395)	0.7312 (0.4433)	0.7306 (0.4436)
Educ2§	Education attainment (Secondary and postsecondary education =1, otherwise=0)	0.0999 (0.2999)	0.1020 (0.3027)	0.1099 (0.3128)	0.1149 (0.3189)	0.1221 (0.3274)	0.1271 (0.3331)
Educ3§	Education attainment (University level or higher=1, otherwise=0)	0.0660 (0.2483)	0.0713 (0.2574)	0.0804 (0.2719)	0.0835 (0.2767)	0.0888 (0.2845)	0.0905 (0.2869)
Married§	Marital status (married=1, otherwise=0)	0.6628 (0.4728)	0.6673 (0.4712)	0.6507 (0.4767)	0.5710 (0.4949)	0.5577 (0.4967)	0.5538 (0.4971)

Variable	Description	Year 2018 Mean (Standard deviation)	Year 2019 Mean (Standard deviation)	Year 2020 Mean (Standard deviation)	Year 2021 Mean (Standard deviation)	Year 2022 Mean (Standard deviation)	Year 2023 Mean (Standard deviation)
Single§	Marital status (single=1, otherwise=0)	0.0475 (0.2127)	0.0492 (0.2163)	0.0517 (0.2213)	0.0533 (0.2245)	0.0562 (0.2303)	0.0585 (0.2346)
Family size	Number of family member in the household	3.2269 (1.7103)	3.1666 (1.6774)	3.1832 (1.7013)	3.1782 (1.7011)	2.9100 (1.4724)	2.85220 (1.4484)
Hhousehold§	Head of household (Yes=1, No=0)	0.6064 (0.4886)	0.6057 (0.4887)	0.6020 (0.4895)	0.6019 (0.4895)	0.6160 (0.4864)	0.6169 (0.4861)
Grandparent§	Relationship with head of household: Is the respondent the grandparent to the head of household? (Yes=1, No=0)	0.0715 (0.2577)	0.0689 (0.2533)	0.0521 (0.2222)	0.0037 (0.0607)	0.0554 (0.2287)	0.0532 (0.2244)
Spouse§	Relationship with head of household: Is the respondent the spouse to the head of household? (Yes=1, No=0)	0.2765 (0.4473)	0.2798 (0.4489)	0.2806 (0.4493)	0.2786 (0.4483)	0.2743 (0.4462)	0.2749 (0.4465)
Child1§	Relationship with head of household: Is the respondent the unmarried children to the head of household? (Yes=1, No=0)	0.0037 (0.0606)	0.0034 (0.0585)	0.0053 (0.0724)	0.0098 (0.0985)	0.0035 (0.0587)	0.0040 (0.0628)
Child2§	Relationship with head of household: Is the respondent the married children to the head of household? (Yes=1, No=0)	0.0057 (0.0751)	0.0060 (0.0775)	0.0048 (0.0690)	0.0002 (0.0151)	0.0055 (0.0741)	0.0059 (0.0765)
In-laws§	Relationship with head of household: Is the respondent the in-laws to the head of household? (Yes=1, No=0)	0.0033 (0.0574)	0.0036 (0.0602)	0.0029 (0.0534)	0.00002 (0.0041)	0.0030 (0.0550)	0.0035 (0.0593)
Grandchildren§	Relationship with head of household: Is the respondent the	0.0034 (0.0578)	0.0037 (0.0609)	0.0029 (0.0536)	0.00003 (0.0058)	0.0031 (0.0552)	0.0035 (0.0594)

Variable	Description	Year 2018 Mean (Standard deviation)	Year 2019 Mean (Standard deviation)	Year 2020 Mean (Standard deviation)	Year 2021 Mean (Standard deviation)	Year 2022 Mean (Standard deviation)	Year 2023 Mean (Standard deviation)
	grandchildren to the head of household? (Yes=1, No=0)						
Q1§	Quarter 1 (Yes=1, No=0)	0.2406 (0.4275)	0.2412 (0.4278)	0.2402 (0.4272)	0.2416 (0.4281)	0.2465 (0.4310)	0.2482 (0.4320)
Q2§	Quarter 2 (Yes=1, No=0)	0.2498 (0.4329)	0.2503 (0.4332)	0.2480 (0.4319)	0.2500 (0.4330)	0.2506 (0.4334)	0.2491 (0.4325)
Q3§	Quarter 3 (Yes=1, No=0)	0.2569 (0.4369)	0.2573 (0.4371)	0.2591 (0.4382)	0.2571 (0.4370)	0.2515 (0.4339)	0.2507 (0.4334)
Q4§	Quarter 4 (Yes=1, No=0)	0.2526 (0.4345)	0.2512 (0.4337)	0.2527 (0.4345)	0.2513 (0.4337)	0.2514 (0.4338)	0.2520 (0.4342)

§ is dummy variable.

v. Empirical Results

This study is based on the 2018-2023 data from Thailand's National Labor Force Survey conducted by the National Statistical Office. The sample is drawn randomly from different households in Thailand. The analysis is limited to two groups: individuals ages 24-59 years old and 60-80 years old at the time of the survey. The estimated effect on the probability of individuals who decide to remain in the labor force is shown in Table 6-9. Individuals who decide to remain in the labor force was estimated as a function of the following explanatory variables: geographic region, gender, marital status, age, education level, and the position of family members in the co-residence composition. The dependent variable is given the value of 1 if individuals decide to remain in the labor force and 0 if otherwise. The definition of retirement in this paper is applied as the individual is out of the labor force.

Several points can be discussed from Table 6 and 7 for individuals ages 24-59 years old in 2018-2023. The results show that individuals in Bangkok and its metropolitan area have higher propensity to be in the labor force compared to individuals in the central region in 2021-2023. As individuals age, they have a lower propensity to remain in the labor force. Males have significantly higher propensity to remain in the labor force compared to females in all years by approximately more than 13%. Married individuals have significantly higher propensity to be in the labor force compared to divorced, widowed and separated individuals in all years. There is a presumption that married individuals are more motivated, work harder, and earn higher incomes (Byron & Manaloto, 1980). Individuals whose highest education attainment was primary, secondary and postsecondary, university level or higher have a higher propensity to remain in the labor force compared to individuals with no education in all years. Individuals who are head of household have a significantly higher propensity to remain in the labor force in all years by approximately more than 5%.

The position of family members in the co-residence composition have a significant impact on individual's decision to remain in the labor force. As family size increases, they have a lower propensity of remaining in the labor force. Chen, Zhao, Chou, and Lien (2021) found that an increase in family size has negative effects on the labor supply of mothers but not of fathers. Individuals living with the elderly have lower propensity of remaining in the labor force in all years except in 2021. In contrast, Shen, Yan, and Zeng (2016) revealed that intergenerational co-

residence allows women to share the burden of housework with their parents, thus, leading to increased labor supply. The position of family members in co-residence composition of individuals ages 24-59 years old as either spouse, married children, or in-laws to the head of household have a significantly higher propensity to remain in the labor force; however, those as either grandparent, unmarried children, or grandchildren to the head of household will lower their propensity to remain in the labor force in all years except in 2021. Ma (2021) found that caring for grandchildren prevents many middle-aged grandmothers from working.

Table 8 and 9 illustrated the estimated effect on the probability of individuals ages 60-80 years old in 2018-2023. The results show that individuals in Bangkok and its metropolitan area and the northeastern region have a lower propensity to remain in the labor force compared to individuals in the central region, and the central region has a lower propensity to remain in the labor force compared to individuals in the northern and southern regions. Individuals in the urban area have a lower propensity to remain in the labor force compared to individuals in the rural area. As individuals age, they have a lower propensity to remain in the labor force by approximately 3%. Males have a significantly higher propensity to remain in the labor force compared to females in all years by approximately more than 16%. Married or single individuals have a significantly higher propensity to remain in the labor force compared to divorced, widowed, or separated in all years. Individuals whose highest educational attainment was primary level have a higher propensity to remain in the labor force compared to individuals with no education attainment. Individuals with no education attainment have a higher propensity to remain in the labor force compared to individuals whose highest educational attainment was secondary and postsecondary, university level or higher.

The position of family members in the co-residence composition has a significant impact on individual's decision to remain in the labor force. As family size increases, they have a lower propensity of being in the labor force. Individuals who are head of household have a significantly higher propensity to remain in the labor force in all years by approximately more than 9%. Individuals ages 60-80 years old as grandparents to the head of household have a significant negative impact on the decision to remain in the labor force; however, those as either spouse or married children to the head of household have a significantly higher propensity to remain in the labor force.

Table 6: Marginal Effect of Variables of Individuals in the Labor Force, 24-59 years old, 2018-2020

Explanatory variables	2018			2019			2020		
	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X
Constant	1.2475*** (0.0439)			1.1665*** (0.0442)			1.4349*** (0.0417)		
Age	-.0208*** (0.0006)	-0.0022*** (0.0001)	43.1874	-0.0210*** (0.0006)	-0.0023*** (0.0001)	43.3027	-0.0199*** (0.0005)	-0.0021*** (0.0001)	43.3260
Male§	1.3447*** (0.0109)	0.1423*** (0.0011)	0.4711	1.3555*** (0.0109)	0.1455*** (0.0011)	0.4706	1.3189*** (0.0109)	0.1405*** (0.0011)	0.4700
Geographic region									
Bangkok§	-0.1673*** (0.0205)	-0.0188*** (0.0024)	0.0570	-0.1898*** (0.0212)	-0.0218*** (0.0026)	0.0554	-0.1088*** (0.0214)	-0.0121*** (0.0025)	0.0573
Southern§	0.0033 (0.0134)	0.0003 (0.0014)	0.1797	-0.0174 (0.0134)	-0.0019 (0.0015)	0.1842	-0.0010 (0.0135)	-0.0001 (0.0015)	0.1822
Northeastern§	-0.0112 (0.0120)	-0.0012 (0.0013)	0.2536	-0.0671*** (0.0121)	-0.0073*** (0.0013)	0.2527	-0.0344*** (0.0123)	-0.0037*** (0.0013)	0.2504
Northern§	0.1179*** (0.0130)	0.0122*** (0.0013)	0.2044	0.0496*** (0.0131)	0.0053*** (0.0014)	0.2027	-0.0146 (0.0130)	-0.0016 (0.0014)	0.2001
Urban§	-0.1080*** (0.0093)	-0.0114*** (0.0010)	0.5578	-0.1071*** (0.0094)	-0.0115*** (0.0010)	0.5578	-0.0973*** (0.0094)	-0.0104*** (0.0010)	0.5587
Education attainment									
Educ1§	0.6182*** (0.0207)	0.0637*** (0.0021)	0.4241	0.6953*** (0.0210)	0.0721*** (0.0021)	0.4124	0.6644*** (0.0214)	0.0678*** (0.0021)	0.3918
Educ2§	0.6570*** (0.0211)	0.0659*** (0.0020)	0.3747	0.7445*** (0.0213)	0.0759*** (0.0021)	0.3872	0.7486*** (0.0215)	0.0763*** (0.0021)	0.3993
Educ3§	1.5597*** (0.0244)	0.1149*** (0.0012)	0.1661	1.6393*** (0.0246)	0.1209*** (0.0012)	0.1662	1.5754*** (0.0246)	0.1182*** (0.0013)	0.1759

Explanatory variables	2018			2019			2020		
	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X
Marital status									
Married§	0.2864*** (0.0158)	0.0320*** (0.0019)	0.7303	0.2400*** (0.0160)	0.0269*** (0.0019)	0.7246	0.1436*** (0.0138)	0.0156*** (0.0015)	0.6538
Single§	0.0511** (0.0238)	0.0054** (0.0025)	0.1742	0.0310 (0.0237)	0.0033 (0.0025)	0.1796	-0.2028*** (0.0194)	-0.0228*** (0.0023)	0.1888
Household living characteristics									
Family size	-0.0494*** (0.0029)	-0.0052*** (0.0003)	3.5880	-0.0552*** (0.0029)	-0.0060*** (0.0003)	3.5395	-0.0422*** (0.0029)	-0.0045*** (0.0003)	3.5828
Hhousehold§	0.5616*** (0.0234)	0.0576*** (0.0023)	0.4103	0.6099*** (0.0234)	0.0635*** (0.0024)	0.4132	0.5903*** (0.0220)	0.0609*** (0.0022)	0.4074
Grandparent§	-0.7314*** (0.0503)	-0.1009*** (0.0087)	0.0051	-0.6268*** (0.0519)	-0.0846*** (0.0085)	0.0048	-0.1176*** (0.0365)	-0.0131*** (0.0043)	0.0191
Spouse§	0.0835*** (0.0246)	0.0087*** (0.0025)	0.2735	0.1528*** (0.0247)	0.0160*** (0.0025)	0.2702	0.0911*** (0.0228)	0.0096*** (0.0024)	0.2633
Child1§	-0.2910*** (0.0258)	-0.0338*** (0.0033)	0.0920	-0.2300*** (0.0257)	-0.0266*** (0.0032)	0.0922	-0.0785*** (0.0226)	-0.0086*** (0.0025)	0.1240
Child2§	0.2594*** (0.0264)	0.0255*** (0.0024)	0.1055	0.3398*** (0.0265)	0.0331*** (0.0023)	0.1061	0.2239*** (0.0264)	0.0223*** (0.0024)	0.0823
In-laws§	0.6354*** (0.0479)	0.0545*** (0.0032)	0.0584	0.6370*** (0.0464)	0.0555*** (0.0032)	0.0574	0.5388*** (0.0509)	0.0478*** (0.0037)	0.0432
Grandchildren§	-0.3937*** (0.0463)	-0.0474*** (0.0063)	0.0684	-0.3883*** (0.0448)	-0.0474*** (0.0061)	0.0681	-0.3815*** (0.0481)	-0.0464*** (0.0066)	0.0519
Q1§	-0.0928*** (0.0127)	-0.0100*** (0.0014)	0.2398	-0.00004 (0.0128)	-4.49e-06 (0.0014)	0.2454	-0.2471*** (0.0139)	-0.0278*** (0.0016)	0.2407
Q2§	-0.0173 (0.0126)	-0.0018 (0.0014)	0.2541	0.0053 (0.0127)	0.0006 (0.0014)	0.2534	-0.2783*** (0.0137)	-0.0314*** (0.0016)	0.2515

	2018			2019			2020		
Explanatory variables	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X
Q3§	0.0396*** (0.0126)	0.0042*** (0.0013)	0.2601	0.0103 (0.0126)	0.0011 (0.0014)	0.2565	-0.1124*** (0.0139)	-0.0123*** (0.0015)	0.2597
Sample size	433,340	433,340		422,117	422,117		420,645	420,645	
Pseudo R-squared	0.0935			0.0938			0.0879		

Note. Numbers are reported as marginal effects at a representative value. Numbers in parentheses represent standard errors. (§) dy/dx stands for the discrete change of the dummy variable from 0 to 1. *Indicates that the variable coefficient in the underlying logit regression differs significantly from zero at the 10 percent level. ** Indicates that the variable coefficient in the underlying logit regression differs significantly from zero at the 5 percent level. *** Indicates that the variable coefficient in the underlying logit regression differs significantly from zero at the 1 percent level.

Table 7: Marginal Effect of Variables of Individuals in the Labor Force, 24-59 years old, 2021-2023

Explanatory variables	2021			2022			2023		
	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X
Constant	1.3179*** (0.0411)			1.4869*** (0.0460)			1.4041*** (0.0485)		
Age	-0.0208*** (0.0006)	-0.0022*** (0.0001)	43.2620	-0.0219*** (0.0006)	-0.0022*** (0.0001)	43.3382	-0.0214*** (0.0006)	-0.0021*** .00006	43.5341
Male§	1.3084*** (0.0109)	0.1367*** (0.0011)	0.4718	1.3018*** (0.0111)	0.1328*** (0.0011)	0.4769	1.3370*** (0.0115)	0.1307*** (0.0011)	0.4780
Geographic region									
Bangkok§	0.0947*** (0.0225)	0.0096*** (0.0022)	0.0556	0.0452* (0.0245)	0.0045* (0.0024)	0.0500	0.0934*** (0.0254)	0.0088*** (0.0023)	0.0520
Southern§	0.0323** (0.0136)	0.0034** (0.0014)	0.1863	-0.0111 (0.0141)	-0.0011 (0.0014)	0.1849	-0.0749*** (0.0144)	-0.0074*** (0.0015)	0.1847
Northeastern§	-0.0127 (0.0124)	-0.0013 (0.0013)	0.2489	-0.0255** (0.0127)	-0.0026** (0.0013)	0.2650	-0.0186 (0.0131)	-0.0018 (0.0013)	0.2642
Northern§	0.0532*** (0.0132)	0.0055*** (0.0014)	0.2018	0.0114 (0.0137)	0.0012 (0.0014)	0.1978	0.0190 (0.0142)	0.0018 (0.0014)	0.1964
Urban§	-0.1051*** (0.0095)	-0.0110*** (0.0010)	0.5557	-0.0932*** (0.0098)	-0.0094*** (0.0010)	0.5360	-0.0757*** (0.0100)	-0.0073*** (0.0010)	0.5375
Education attainment									
Educ1§	0.5979*** (0.0217)	0.0594*** (0.0021)	0.3751	0.5685*** (0.0232)	0.0545*** (0.0021)	0.3542	0.6842*** (0.0249)	0.0617*** (0.0021)	0.3470
Educ2§	0.6904*** (0.0218)	0.0694*** (0.0021)	0.4094	0.6905*** (0.0232)	0.0680*** (0.0022)	0.4250	0.8369*** (0.0249)	0.0791*** (0.0023)	0.4412
Educ3§	1.4597*** (0.0247)	0.1103*** (0.0014)	0.1821	1.4212*** (0.0260)	0.1058*** (0.0014)	0.1894	1.5622*** (0.0277)	0.1073*** (0.0014)	0.1854

	2021			2022			2023		
Explanatory variables	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X
Marital status									
Married§	0.1160*** (0.0110)	0.0121*** (0.0011)	0.4131	0.1147*** (0.0114)	0.0116*** (0.0011)	0.4002	0.1152*** (0.0117)	0.0111*** (0.0011)	0.3910
Single§	-0.3283*** (0.0148)	-0.0370*** (0.0018)	0.2013	-0.0660*** (0.0202)	-0.0068*** (0.0021)	0.2178	-0.0682*** (0.0208)	-0.0067*** (0.0021)	0.2232
Household living characteristics									
Family size	-0.0409*** (0.0029)	-0.0043*** (0.0003)	3.5621	-0.0626*** (0.0035)	-0.0064*** (0.0004)	3.2517	-0.0689*** (0.0036)	-0.0067*** (0.0004)	3.2012
Hhousehold§	0.7307*** (0.0196)	0.0733*** (0.0019)	0.4089	0.7172*** (0.0239)	0.0710*** (0.0023)	0.4383	0.6901*** (0.0248)	0.0654*** (0.0023)	0.4403
Grandparent§	0.2768*** (0.0269)	0.0264*** (0.0023)	0.0567	-0.6118*** (0.0546)	-0.0780*** (0.0085)	0.0045	-0.5246*** (0.0571)	-0.0622*** (0.0081)	0.0043
Spouse§	0.1867*** (0.0199)	0.0189*** (0.0020)	0.2575	0.2125*** (0.0250)	0.0208*** (0.0023)	0.2559	0.1888*** (0.0259)	0.0177*** (0.0023)	0.2521
Child§	0.1830*** (0.0188)	0.0184*** (0.0018)	0.2079	-0.2624*** (0.0257)	-0.0289*** (0.0031)	0.1056	-0.2545*** (0.0266)	-0.0267*** (0.0030)	0.1073
Child2§	0.0090 (0.0754)	0.0009 (0.0078)	0.0034	0.3502*** (0.0279)	0.0319*** (0.0023)	0.0927	0.3370*** (0.0288)	0.0294*** (0.0023)	0.0939
In-laws§	0.6708 (0.4871)	0.0543* (0.0294)	0.0002	0.8320*** (0.0464)	0.0634*** (0.0026)	0.0470	0.7336*** (0.0477)	0.0550*** (0.0027)	0.0462
Grandchildren§	-0.0254 (0.2735)	-0.0027 (0.0292)	0.0004	-0.5078*** (0.0440)	-0.0612*** (0.0062)	0.0585	-0.4576*** (0.0453)	-0.0519*** (0.0059)	0.0583
Q1§	-0.0273** (0.0130)	-0.0029** (0.0014)	0.2436	-0.1201*** (0.0132)	-0.0125*** (0.0014)	0.2517	-0.0747*** (0.0136)	-0.0074*** (0.0014)	0.2520
Q2§	-0.0045 (0.0129)	-0.0005 (0.0014)	0.2519	-0.0491*** (0.0133)	-0.0050*** (0.0014)	0.2524	-0.0441*** (0.0137)	-0.0043*** (0.0014)	0.2517

	2021			2022			2023		
Explanatory variables	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X
Q3§	0.0265** (0.0129)	0.0028** (0.0013)	0.2573	0.0281** (0.0136)	0.0028** (0.0014)	0.2484	0.0162 (0.0139)	0.0016 (0.0013)	0.2489
Sample size	417,924	417,924		403,040	403,040		394,915	394,915	
Pseudo R-squared	0.0865			0.0889			0.0904		

Note. Numbers are reported as marginal effects at a representative value. Numbers in parentheses represent standard errors. (§) dy/dx stands for the discrete change of the dummy variable from 0 to 1. *Indicates that the variable coefficient in the underlying logit regression differs significantly from zero at the 10 percent level. ** Indicates that the variable coefficient in the underlying logit regression differs significantly from zero at the 5 percent level. *** Indicates that the variable coefficient in the underlying logit regression differs significantly from zero at the 1 percent level.

Table 8: Marginal Effect of Variables of Individuals in the Labor Force, 60-80 years old, 2018-2020

Explanatory variables	2018			2019			2020		
	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X
Constant	8.5379*** (0.0915)			8.3378*** (0.0910)			8.3830*** .0863769		
Age	-0.1487*** (0.0012)	-0.0347*** (0.0003)	67.5190	-0.1475*** (0.0012)	-0.0340*** (0.0003)	67.4928	-0.1475*** (0.0011)	-0.0346*** (0.0003)	67.5123
Male§	0.7183*** (0.0138)	0.1678*** (0.0032)	0.4426	0.7001*** (0.0134)	0.1619*** (0.0031)	0.4424	0.7308*** (0.0127)	0.1716*** (0.0030)	0.4441
Geographic region									
Bangkok§	-0.5619*** (0.0326)	-0.1204*** (0.0063)	0.0454	-0.5593*** (0.0337)	-0.1179*** (0.0063)	0.0409	-0.4487*** (0.0314)	-0.0989*** (0.0064)	0.0438
Southern§	0.2453*** (0.0188)	0.0584*** (0.0046)	0.1370	0.2017*** (0.0185)	0.0474*** (0.0044)	0.1358	0.2648*** (0.0181)	0.0634*** (0.0044)	0.1355
Northeastern§	-0.0279* (0.0153)	-0.0065* (0.0036)	0.2831	-0.0864*** (0.0151)	-0.0198*** (0.0034)	0.2859	-0.0910*** (0.0147)	-0.0213*** (0.0034)	0.2836
Northern§	0.1181*** (0.0157)	0.0277 (0.0037)	0.2512	0.0818*** (0.0154)	0.0190*** (0.0036)	0.2548	0.0501*** (0.0150)	0.0118*** (0.0036)	0.2536
Urban§	-0.1449*** (0.0118)	-0.0338*** (0.0028)	0.5550	-0.1485*** (0.0116)	-0.0343*** (0.0027)	0.5565	-0.1436*** (0.0113)	-0.0338*** (0.0027)	0.5552
Education attainment									
Educ1§	0.3782*** (0.0238)	0.0856*** (0.0052)	0.7597	0.4654*** (0.0243)	0.1032*** (0.0052)	0.7578	0.4465*** (0.0241)	0.1014*** (0.0053)	0.7450
Educ2§	-0.2476*** (0.0297)	-0.0561*** (0.0065)	0.0999	-0.1199*** (0.0298)	-0.0273*** (0.0067)	0.1020	-0.1456*** (0.0289)	-0.0337*** (0.0066)	0.1099
Educ3§	-1.3718*** (0.0352)	-0.2513*** (0.0045)	0.0660	-1.2504*** (0.0347)	-0.2315*** (0.0047)	0.0713	-1.3632*** (0.0334)	-0.2556*** (0.0045)	0.0804

	2018			2019			2020		
Explanatory variables	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X
Marital status									
Married§	0.6019*** (0.0168)	0.1358*** (0.0036)	0.6628	0.6119*** (0.0165)	0.1361*** (0.0035)	0.6673	0.5024*** (0.0151)	0.1151*** (0.0034)	0.6507
Single§	0.4157*** (0.0327)	0.1006*** (0.0081)	0.0475	0.5006*** (0.0314)	0.1209*** (0.0078)	0.0492	0.4915*** (0.0287)	0.1199*** (0.0072)	0.0517
Household living characteristics									
Family size	-0.0557*** (0.0036)	-0.0130*** (0.0008)	3.2269	-0.0475*** (0.0036)	-0.0109*** (0.0008)	3.1666	-0.0382*** (0.0034)	-0.0090*** (0.0008)	3.1832
Hhousehold§	0.4343*** (0.0378)	0.0997*** (0.0085)	0.6064	0.4319*** (0.0372)	0.0980*** (0.0083)	0.6057	0.6483*** (0.0295)	0.1486*** (0.0065)	0.6020
Grandparent§	-0.7410*** (0.0477)	-0.1546*** (0.0086)	0.0715	-0.7495*** (0.0476)	-0.1535*** (0.0083)	0.0689	-0.5692*** (0.0441)	-0.1231*** (0.0086)	0.0521
Spouse§	0.0848** (0.0405)	0.0199** (0.0095)	0.2765	0.0835** (0.0398)	0.0194** (0.0093)	0.2798	0.3379*** (0.0317)	0.0805*** (0.0076)	0.2806
Child§	-0.1076 (0.0975)	-0.0247 (0.0221)	0.0037	0.1393 (0.0983)	0.0327 (0.0235)	0.0034	0.3082*** (0.0777)	0.0746*** (0.0192)	0.0053
Child2§	0.3212*** (0.0808)	0.0774*** (0.0200)	0.0057	0.2554*** (0.0774)	0.0607*** (0.0189)	0.0060	0.7387*** (0.0811)	0.1818*** (0.0200)	0.0048
In-laws§	0.2421 (0.9088)	0.0580 (0.2225)	0.0033	1.4053** (0.6572)	0.3364** (0.1391)	0.0036	-0.2301 (1.0990)	-0.0523 (0.2409)	0.0029
Grandchildren§	0.5304 (0.9040)	0.1296 (0.2259)	0.0034	-0.6544 (0.6517)	-0.1341 (0.1146)	0.0037	1.3224 (1.0940)	0.3174 (0.2327)	0.0029
Q1§	0.0111 (0.0163)	0.0026 (0.0038)	0.2406	0.0603*** (0.0160)	0.0140*** (0.0037)	0.2412	-0.1681*** (0.0158)	-0.0390*** (0.0036)	0.2402
Q2§	0.1037*** (0.0161)	0.0243*** (0.0038)	0.2498	0.0906*** (0.0159)	0.0210*** (0.0037)	0.2503	-0.1187*** (0.0156)	-0.0277*** (0.0036)	0.2480

	2018			2019			2020		
Explanatory variables	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X
Q3§	0.1157*** (0.0160)	0.0272*** (0.0038)	0.2569	0.0319** (0.0158)	0.0074** (0.0037)	0.2573	-0.0300* (0.0154)	-0.0070* (0.0036)	0.2591
Sample size	161,513	161,513		166,355	166,355		173,734	173,734	
Pseudo R-squared	0.1734			0.1677			0.1657		

Note. Numbers are reported as marginal effects at a representative value. Numbers in parentheses represent standard errors. (§) dy/dx stands for the discrete change of the dummy variable from 0 to 1. *Indicates that the variable coefficient in the underlying logit regression differs significantly from zero at the 10 percent level. ** Indicates that the variable coefficient in the underlying logit regression differs significantly from zero at the 5 percent level. *** Indicates that the variable coefficient in the underlying logit regression differs significantly from zero at the 1 percent level.

Table 9: Marginal Effect of Variables of Individuals in the Labor Force, 60-80 years old, 2021-2023

Explanatory variables	2021			2022			2023		
	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X
Constant	8.4556*** (0.0843)			9.0820*** (0.0878)			9.2250*** (0.0864)		
Age	-0.1520*** (0.0011)	-0.0360*** (0.0003)	67.5668	-0.1555*** (0.0011)	-0.0369*** (0.0003)	67.6215	-0.1587*** (0.0011)	-0.0381*** (0.0003)	67.6428
Male§	0.7915*** (0.0122)	0.1873*** (0.0028)	0.4453	0.8138*** (0.0120)	0.1927*** (0.0029)	0.4407	0.8034*** (0.0117)	0.1923*** (0.0028)	0.4409
Geographic region									
Bangkok§	-0.2598*** (0.0305)	-0.0597*** (0.0068)	0.0445	-0.2176*** (0.0334)	-0.0503*** (0.0075)	0.0346	-0.1693*** (0.0324)	-0.0399*** (0.0075)	0.0349
Southern§	0.2389*** (0.0179)	0.0576*** (0.0044)	0.1373	0.1468*** (0.0181)	0.0352*** (0.0044)	0.1344	0.1853*** (0.0178)	0.0450*** (0.0044)	0.1332
Northeastern§	-0.0875*** (0.0147)	-0.0207*** (0.0035)	0.2828	-0.0668*** (0.0146)	-0.0158*** (0.0034)	0.3009	-0.0114 (0.0142)	-0.0027 (0.0034)	0.3007
Northern§	0.0722*** (0.0150)	0.0172*** (0.0036)	0.2576	0.0347** (0.0151)	0.0082** (0.0036)	0.2577	0.0919*** (0.0148)	0.0221*** (0.0036)	0.2580
Urban§	-0.1597*** (0.0112)	-0.0379*** (0.0027)	0.5505	-0.1386*** (0.0112)	-0.0329*** (0.0027)	0.5247	-0.1275*** (0.0109)	-0.0306*** (0.0026)	0.5278
Education attainment									
Educ1§	0.4392*** (0.0240)	0.1011*** (0.0053)	0.7384	0.4260*** (0.0249)	0.0983*** (0.0056)	0.7312	0.4765*** (0.0257)	0.1112*** (0.0058)	0.7306
Educ2§	-0.1369*** (0.0286)	-0.0320*** (0.0066)	0.1149	-0.2447*** (0.0290)	-0.0566*** (0.0066)	0.1221	-0.1072*** (0.0293)	-0.0255*** (0.0069)	0.1271
Educ3§	-1.4092*** (0.0331)	-0.2671*** (0.0045)	0.0835	-1.4385*** (0.0332)	-0.2720*** (0.0048)	0.0888	-1.3914 (0.0333)	-0.2724*** (0.0049)	0.0905

Explanatory variables	2021			2022			2023		
	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X
Marital status									
Married§	0.3319*** (0.0132)	0.0781*** (0.0031)	0.5710	0.3083*** (0.0131)	0.0727*** (0.0031)	0.5577	0.3126*** (0.0129)	0.0747*** (0.0031)	0.5538
Single§	0.4546*** (0.0267)	0.1113*** (0.0067)	0.0533	0.3272*** (0.0274)	0.0796*** (0.0068)	0.0562	0.3369*** (0.0266)	0.0827*** (0.0066)	0.0585
Household living characteristics									
Family size	-0.0294*** (0.0034)	-0.0070*** (0.0008)	3.1782	-0.0395*** (0.0039)	-0.0094*** (0.0009)	2.9100	-0.0277*** (0.0039)	-0.0067*** (0.0009)	2.8522
Hhousehold§	0.9220*** (0.0224)	0.2106*** (0.0048)	0.6019	0.6424*** (0.0320)	0.1486*** (0.0072)	0.6160	0.6401*** (0.0314)	0.1501*** (0.0072)	0.6169
Grandparent§	1.2549*** (0.0940)	0.3021*** (0.0202)	0.0037	-0.4922*** (0.0436)	-0.1094*** (0.0090)	0.0554	-0.4583*** (0.0426)	-0.1042*** (0.0090)	0.0532
Spouse§	0.7273*** (0.0244)	0.1760*** (0.0059)	0.2786	0.4040*** (0.0339)	0.0973*** (0.0083)	0.2743	0.3990*** (0.0333)	0.0970*** (0.0082)	0.2749
Child§	0.7216*** (0.0568)	0.1780*** (0.0140)	0.0098	-0.1486 (0.0970)	-0.0346 (0.0221)	0.0035	-0.1627* (0.0892)	-0.0384*** (0.0206)	0.0040
Child2§	0.1802 (0.3826)	0.0435 (0.0938)	0.0002	0.5710*** (0.0760)	0.1407*** (0.0190)	0.0055	0.4860*** (0.0730)	0.1201*** (0.0182)	0.0059
In-laws§	0.2961 (1.8496)	0.0721 (0.4592)	0.00001	13.8325 (798.0885)	0.6234*** (0.5726)	0.0030	-12.4678 (835.7886)	-0.4109 (0.7155)	0.0035
Grandchildren§	1.0204 (1.3535)	0.2496 (0.3134)	0.00003	-12.8370 (798.0885)	-0.3958*** (0.5800)	0.0031	13.4155 (835.7886)	0.6110 (0.7003)	0.0035
Q1§	-0.0351** (0.0155)	-0.0083** (0.0037)	0.2416	-0.0564*** (0.0154)	-0.0133*** (0.0036)	0.2465	-0.0407*** (0.0150)	-0.0097*** (0.0036)	0.2482
Q2§	-0.0051 (0.0153)	-0.0012 (0.0036)	0.2500	-0.0547*** (0.0153)	-0.0129*** (0.0036)	0.2506	-0.0678*** (0.0150)	-0.0162*** (0.0036)	0.2491

Explanatory variables	2021			2022			2023		
	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X	Coefficient (Standard error)	Marginal effects of variables for individuals in the labor force	X
Q3§	0.0040 (0.0152)	0.0009 (0.0036)	0.2571	-0.0030 (0.0153)	-0.0007 (0.0036)	0.2515	-0.0062 (0.0150)	-0.0015 (0.0036)	0.2507
Sample size	175,539	175,539		176,374	176,374		183,519	183,519	
Pseudo R-squared	0.1645			0.1662			0.1684		

Note. Numbers are reported as marginal effects at a representative value. Numbers in parentheses represent standard errors. (§) dy/dx stands for the discrete change of the dummy variable from 0 to 1. *Indicates that the variable coefficient in the underlying logit regression differs significantly from zero at the 10 percent level. ** Indicates that the variable coefficient in the underlying logit regression differs significantly from zero at the 5 percent level. *** Indicates that the variable coefficient in the underlying logit regression differs significantly from zero at the 1 percent level.

v. Conclusion and Policy Implications

This study aims to analyze the factors that lead to the individual's decision to remain in the labor force in Thailand. This study is based on the 2018-2023 data from Thailand's National Labor Force Survey conducted by the National Statistical Office. The sample is drawn randomly from different households in Thailand. The analysis is limited to two groups: individuals ages 24-59 years old and 60-80 years old at the time of the survey. The definition of retirement is applied as the individual leaving the labor force with the intention to stay out permanently (Lazear, E. P., 1986). Kikkawa and Gasper (2023) reviewed relevant literature and suggested that the structure of social security and pension, education, health status of workers, household structures and gender norms, and technological change and adoption at the workplace explain the observed patterns of labor supply among older persons in advance economies, which some of these factors are relevant in developing Asian countries. This study supports the assumption that geographic regions, age, gender, education, marital status, and position of family members in the co-residence composition impacts the individual's decision to remain in the labor force. The estimated effect on the probability of individuals who decide to remain in the labor force for individuals ages 60-80 years old in 2018-2023. This study finds that older adults have a lower probability of remaining in the labor force by approximately 3%. Thanapop and Thanapop (2021) applied the Work Ability Index (WAI) on Thai older workers working in Nakhon Si Thammarat province and found that older workers and the presence of NCDs were negatively associated with good to excellent workability. Males have a significantly higher propensity to be in the labor force compared to females by approximately more than 14%. Minhat and Suwanmannee (2023) find that having good health and being a male worker were the most common factors influencing the individual's decision to work beyond retirement age. Married or single individuals have a significantly higher propensity to remain in the labor force compared to divorced, widowed, or separated individuals. Boonyasana and Chinnakum (2020) investigated the determinants of planned retirement age of informal workers in Chiang Mai province and found that singles positively impact planned retirement age. Individuals who are head of household have significantly higher propensity to remain in the labor force. Individuals ages 60-80 years old whose highest educational attainment was secondary and postsecondary, bachelor's degree, or master's degree or above have a lower propensity to remain in the labor force compared to individuals with no education attainment. Adhikari, Soonthorndhada, and Haseen (2011) found

that the elderly with low education attainment were more likely to remain in the labor force. Kikkawa and Gasper (2023) also found that the lack of career options upon the first retirement can explain the early exit from the labor market among skilled workers.

The position of family members in the co-residence composition of individual ages 60-80 years old has a significant impact on the individual's decision to remain in the labor force. Individuals ages 60-80 years old as grandparents to the head of household have a significant negative impact on the decision to remain in the labor force; however, those as either spouse to the head of household, or married children to the head of household have a significantly higher propensity to remain in the labor force. Cools, Markussen, and Strøm (2017) found persistent and growing career penalties linked to family size among women. He (2023) found that the presence of unmarried adult children increases the likelihood of elderly parents remaining in the labor force. Conversely, Tong, Chen, and Su (2019) found that co-residence with married children has the lowest labor force participation among older adults, while living with unmarried children, particularly sons, increased the likelihood of employment. Pazim and Hanim (2019) found that older adults receiving support from their adult children were less likely to engage in the labor market, and co-residence was not a statistically significant factor.

These findings have important implications for Thailand's old-age policies, encouraging productive aging through employment opportunities to ensure independence while recognizing the importance of family support in enhancing the well-being of older adults.

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