The determinant of hours of work (the empirical case for Indonesian old–age)

S Subanti1,2, A L Riani3, E P Lestari4, A R Hakim2,4, S Susiyanti5
1Department of Statistics Faculty of Mathematics and Natural Science, Universitas Sebelas Maret
2Institute for Research and Community Services, Universitas Sebelas Maret
3Department of Management Faculty of Economics and Business, Universitas Sebelas Maret
4Department of Development Economics Faculty of Economics, Universitas Terbuka
5Department of Development Economics Faculty of Economics and Business, Universitas Trilogi

Corresponding author: sri_subanti@yahoo.co.id, srisubanti@staff.uns.ac.id

Abstract. The increase in the population of old - age or elderly had become an inevitable thing for both developed and developing countries, Indonesia is one of them. With increasing life expectancy, getting healthier, and the desire to stay active; this encourages old – age individuals to carry out economic activities, one of them by working. This activity is not only to fulfill basic needs but also not all individuals of old – age receive pension social security. This paper aims to examine the determinants of the hours of work for old – age or elderly individuals in Indonesia. The paper findings, for old – age individuals who are under 75 years old, the factors influence the hours of work are economic factors (such as wages and non-labor income), the head of household status, marital status, education, urban rural, and industrial origin. However, the old – age individuals who are above 75 years old, these factors have no real influence. Activities carried out by this elderly group, both economic and non-economic, are more about efforts to maintain their routines so that they still feel healthy, they can meet many people, they do not depend on others, and become independent individuals. The suggestion, the government needs to pay attention to working hours and determine the proper industrial origin for elderly who still want to work; they should encourage the care programs for the elderly who come from their families, this is more beneficial for the elderly because it is expected to minimize the risk of illness and death. Furthermore, for old – age individuals who previously worked in the informal sector, the government needs to improve retirement security.

1 Introduction
The growth of an aging population tends to increase, not only in developing countries but also in developed countries. This is not surprising, because the rapid population growth is driven by individuals who have a longer life expectancy, are healthier, and remain active in old age [1]. This phenomenon also occurs in Indonesia, several studies predict that Indonesia will be ranked third in the world population aging in 2025 [2]. According to the findings of the 2010 census, Indonesia’s demographic scenario shows similar results where there is a rapid increase in the old – age population. In that year, the aging population contributed 7.6 percent of the total population, this percentage increased by 3.1
percent compared to the previous four decades. The projection results estimate that there will be 15.8 percent of the proportion of the old-age population in 2035 [3].

On the other hand, as a developing country, Indonesia is often faced with old age individuals who still work as a necessity to survive when the pension system cannot reach all the old-age individuals. Old-age individuals can work in the formal and informal sectors [4]. Formal sector employment includes types of work where individuals can be referred to as employees who earn returns or income on a regular basis and obtain certain benefits or schemes such as employment guarantee schemes and pension system guarantee schemes. Employment in the informal sector can be categorized to individuals who work as self-employed, self-employed and assisted by unpaid temporary workers (usually family members), casual workers, and unpaid family workers. Most informal workers face challenges such as high income uncertainty and lack of social security. So, they often have to keep working even though they are old, so they can fulfill their daily needs [3].

Traditionally, Indonesia still adheres to a high family system and usually older individuals live with their adult children. Of course, it provides motivation for individuals both emotionally and economically. However, this does not guarantee that older individuals do not carry out economic activities or do certain jobs [5]. Some previous studies provide a number of reasons why older individuals continue to work, including still physically and mentally strong, because of economic pressure or to fulfill their daily needs, lack of adequate social security, and self-actualization where work is a routine that is not will be abandoned and if staying at home can lead to decreased health [6,7]. In addition, other factors that also encourage older individuals to carry out economic activities are higher life expectancies, where the higher life expectancy has a positive impact on individual productivity in old age, we can see from a reduction in leisure time and allocating other time to work, in other words if the individual works then tends to increase the hours of work [8].

Based on the description above, the increase in the population of old-age needs to be immediately anticipated, it must be received attention and treatment, because the population of old age is different from other age groups, both when individuals decide to continue to carry out economic activities or not. So, this paper wants to provide empirical results on determinants of the hours of work for elderly in Indonesia.

2 Methods
This section wants to explain the approaches used to answer the research goals, namely data and estimation techniques. This analysis uses data from Sakernas, the most representative of which is the data, since data from Sakernas is primarily intended to collect data that can clarify the current condition of employment for a certain period of time. The Heckman two-step estimation technique is applied to resolve the issue of selection bias that usually occurs when researchers estimate the labor supply models.

2.1 Data
The data in this study using a national labor force survey data (Sakernas). The data from Sakernas is labor data gathered through a survey by the Central Statistics Agency (BPS). Sakernas is intended primarily to collect data that can explain the general state of employment between periods of the census. The 2015 Sakernas data is used in this paper. The number of observations obtained was 5334, they were elderly, with the main activity is working in the last week. In this sakernas data, we can find information about worker characteristics both from the social demographic to the economic side. Information such as gender, age, education, hours of work, distance to work place, industrial origin, wages, reasons for work, reasons for stopping, and information on work experience. This paper gathers information on wages, age, gender, marital status, regional characteristics, industrial origin, and the highest level of education obtained. This information is used to see which factors influence working hours for the elderly in Indonesia.
2.2 The Estimation Technique and The Empirical Model

The model in this paper is based on the traditional model of labor supply. This standard model refers to the Mincer wage equation model known as Mincerian Earning Function. The use of OLS techniques to estimate this equation can cause sample selection bias in some literature, so the heckman selection model is suggested to be applied. We may obtain the value $\lambda_i$ from this calculation, which is also referred to as the inverse mill ratio \[7,9\]. To explain this, the exact form of the two-step Heckman process is shown below, where the first equation represents the selection equation.

\[ Y = \alpha Z + \delta \] (1)

The selection equation is estimated using the probit regression, $Y$ is the dependent variable which is dichotomous, $Y$ has two values namely 1 denotes elderly who work a week ago and get wages, while 0 denotes elderly who work but do not get wages. $Z$ is the independent variable consisting of wages, age, gender, marital status, regional characteristics, industrial origin, and the highest level of education obtained. Then, $\alpha$ is the $Z$ coefficient, and $\delta$ represents the normally distributed error term. Estimation of equation (1) would be biased by simply regressing $Y$ on $Z$ due to the sigma term, which represents the omitted variable. We can solve this problem in two steps. The first, we estimated it using probit and it preserves the expected values as estimates of $(T - \alpha Z)$. In each case, the inverse Mills ratio can be calculated by dividing the normal density function evaluated at $-\frac{T - \alpha Z}{\phi}$ by one minus the normal cumulative distribution function estimated at $-\frac{T - \alpha Z}{\phi}$, as follows.

\[ \lambda(T - \alpha Z) = \frac{\phi(T - \alpha Z)}{1 - \phi(T - \alpha Z)} \] (2)

Next step, we used the ordinary least square regression with X and the inverse Mills ratio used as regressors. Then, the empirical model equation is presented in equation (3), where $i$ represents elderly individuals, and variable descriptions are described in Table 1.

\[ lhours_i = \delta_0 + \delta_1 lwage_i + \delta_2 lnonlaborinc_i + \delta_3 noprimary_i + \delta_4 primary_i + \delta_5 juniorhigh_i + \delta_6 seniorhigh_i + \delta_7 male_i + \delta_8 headofhh_i + \delta_9 urban_i + \delta_{10} married_i + \delta_{11} secondary_i + \delta_{12} tertiary_i + \gamma \lambda_i + \epsilon_i \] (3)

| Variable      | Description                                                      |
|---------------|------------------------------------------------------------------|
| lhours        | hours of work. This variables in the logarithms form.            |
| lwage         | wages in the form of money and goods (which can be valued in rupiah). This variables in the logarithms form. |
| lnonlaborinc  | non labor income (in Rupiah). This variables in the logarithms form. |
| noprimary     | 1 = not finished primary school; 0 = other                       |
| primary       | 1 = finished primary school; 0 = other                           |
| juniorhigh    | 1 = finished junior high school; 0 = other                       |
| seniorhigh    | 1 = finished senior high school; 0 = other                       |
| male          | 1 = male; 0 = others                                            |
| headofhh      | 1 = head of household; 0 = others                                |
| urban         | 1 = who lived in urban; 0 = others                               |
| married       | 1 = if married; 0 = others                                      |
| secondary     | 1 = work in secondary sector; 0 = others                         |
| tertiary      | 1 = work in tertiary sector; 0 = others                          |
| lambda        | invers mills ratio                                               |
3 Results and Discussion

We want to explain the demographic characteristics of elderly people in this section, the information is obtained from a number of observations from sakernas data. From Table 2, the majority of old-age workers are men and live in rural areas and have spouse or married. Besides that, the majority of old-age workers are still head of household with the main employment status not being employees anymore. Most older workers are dominated by those who have not completed primary school and have completed primary school. Old-age workers mostly work in the informal sector before retiring and do not get social security pensions. In addition, the sector that is of interest to work is the primary sector, which tends to be low-skilled, although there are also those who work in the tertiary sector who usually work as teachers or lecturers with retirement ages 65 and 70 years. In addition, the higher the level of education tends to encourage individuals to shift to professional, technical, and administrative work; where this job type in the tertiary sector.

The hours of work need to be a concern when talking about elderly workers. The elderly with declining physical condition certainly shouldn't overwork. Excessive hours in the context of Indonesia are defined based on a threshold of 48 hours per week, if the working hours exceed that limit, the work is classified as inappropriate. Table 2 shows that almost half of the elderly workers are full-time workers, that is, working 40 hours or more a week. In other words, they have excessive working hours. This condition needs to be a concern considering that excessive working hours can threaten the physical and mental condition of the elderly in the long term, and reduce productivity at work [10].

Table 2. Demographic Characteristics

| Char.          | Percent | Char.          | Percent | Char.          | Percent |
|----------------|---------|----------------|---------|----------------|---------|
| Sex            |         | Education      |         | Industrial Origin |       |
| Male           | 71.03   | No Primary     | 45.90   | Primary        | 59.11   |
| Female         | 28.97   | Primary        | 33.75   | Secondary      | 10.96   |
| Urban-Rural    | 41.29   | Junior High School | 9.44   | Tertiary      | 29.93   |
| Rural          | 58.71   | Senior High School | 7.81  | Working Hours and |         |
| Marital Status |         | University     | 3.10    | Have Wage      |         |
| Married        | 76.61   | Workers / Employees | 10.46 | > 40 Hours / Week | 43.93   |
| Other          | 23.39   | Other          | 89.54   | < 40 Hours / Week | 52.27   |

We estimate the empirical model, and we present it in Table 3. Here, we classify the empirical estimation results into three, namely the estimation results for the whole elderly, the estimation results for the elderly aged 60 to 74, and the estimation results for the elderly above 75 years. For the old-age group 60-74, the economic factors have a significant effect on working hours. The wage factor encourages old-age individuals to increase working hours with an elasticity of 4 to 5 percent, where 1 percent increase in wages will add the hours of work between 4 and 5 percent. This value is not large given the limited physical capacity of old-age individuals who are still working, even though they still capable and healthy. When old-age individuals have reached more than 75 years, those who are female tend to have higher hours of work if they decide to work, even though wages and non-labor income are usually not the main considerations. This happens because the life expectancy of women tends to be higher than men. A report shows that when men and women have reached the age of 70, their life expectancy is 10 and 15 years, in other words women's life expectancy is higher than men [4]. In addition, when family relations fade away, there is a need for old-age individuals to do routines, one of them is to work, because if they are still able to do activities, then it is better than staying at home, they feel healthy if they stay active [2].

The old-age individuals who get married usually have greater needs, when there is no guarantee of retirement and the transfer of children has the potential to encourage them to work, as opposed to whether they live alone, they are generally not in the risk category. They are described as a risk category.
for the elderly who live alone and need special care [11]. The issue of elderly people living alone will be even more interesting if we know the things behind this phenomenon, whether living alone is part of the life choices of the elderly because they do not have children, they do not have a partner (spouse), they do not have a family, and they neglected or excluded from their big family life.

In fact, as people reach old age and they are referred to as elderly, there are implications for them, including changes in physical, emotional, social, and health. We also find elderly people who feel alone, frustrated, and who lose faith [11]. In this case, it can be seen that the elderly rely both economically and socially on other residents for help or assistance. Ideally, the best place to spend old – age is close to family, given that family is the most possible source of help for their survival. If they have good health, a healthy social climate, sufficient economic conditions and good interpersonal relationships, then the elderly can be a happy. Having a family or spouse can significantly enable the elderly to be able both physically and mentally to live their daily lives. Assistance from a spouse or family can mean more than assistance from other individuals who are not linked at all. The studies state that the most important social support comes from the family [12]. The family provides effective health care interventions to improve the optimal quality of life for the elderly and to fulfill the daily activities of the elderly, including their health status. With this help and assistance, it is possible to reduce the risk of illness and death among the elderly [13].

| Table 3. Estimation Results |
|----------------------------|
| 60 + | Age 60 - 74 | Age 75 + |  |
| **Dependent** | Coef. | Std.Err | Sign | Coef. | Std.Err | Sign | Coef. | Std.Err | Sign |
| earnings | 0.049 | 0.006 | *** | 0.050 | 0.006 | *** | 0.027 | 0.023 |  |
| nonlaborincome | 0.017 | 0.007 | *** | 0.014 | 0.007 | * | 0.019 | 0.019 |  |
| male | 0.021 | 0.023 | 0.013 | 0.026 | -0.051 | 0.046 |  |
| headofhh | 0.070 | 0.028 | *** | 0.047 | 0.025 | * | 0.218 | 0.151 |  |
| married | -0.076 | 0.044 | * | -0.051 | 0.045 | ** | -0.129 | 0.156 |  |
| nonprimary | 0.132 | 0.024 | *** | 0.138 | 0.024 | *** | 0.172 | 0.120 |  |
| primary | 0.155 | 0.024 | *** | 0.158 | 0.024 | *** | 0.238 | 0.125 | * |
| juniorhighschool | 0.117 | 0.033 | *** | 0.133 | 0.032 | *** | -0.102 | 0.331 |  |
| seniorhighschool | 0.053 | 0.049 | 0.076 | 0.048 | 0.182 | 0.260 |  |
| urban | 0.069 | 0.017 | *** | 0.057 | 0.018 | *** | 0.143 | 0.037 | *** |
| secondary | 0.205 | 0.075 | *** | 0.154 | 0.076 | ** | 0.270 | 0.138 | ** |
| tertiary | 0.234 | 0.058 | *** | 0.196 | 0.057 | *** | 0.294 | 0.168 | * |
| lambda | 0.257 | 0.179 | 0.143 | 0.182 | 0.382 | 0.378 |  |
| cons | 2.403 | 0.232 | *** | 2.538 | 0.235 | *** | 2.376 | 0.528 | *** |

Num of Obs: 5334, 5057, 277  
F – Stat: 47.070, 43.310, 7.350  
Prob F – Stat: 0.000, 0.000, 0.000  
R – Squared: 0.112, 0.109, 0.208

The residency status of elderly people also plays an important role, and the findings of the empirical estimate indicate that older people living in urban areas have higher working hours than in rural areas. Low working hours for elderly people in rural areas can be attributed to the fact that most elderly people in rural areas work in the informal sector, especially in the agricultural sector, which does not require long working hours. The education variables, the old – age individuals who did not graduate from the university, had higher hours of work where older individual workers who finished primary school were the highest compared to others. Old-age individual workers who graduate from university tend to have lower hours of work, this is understandable because most of them previously worked in the formal sector which had good retirement social security so they did not have to work [14].
The empirical results also show that there are differences in the pattern of the elderly working according to the industrial origin, because the elderly have a higher interest in working outside the agricultural sector, especially in the service sector. Related to this, it provides an explanation that the higher the level of education the elderly have, the elderly who work with primary school education/ equivalent and below are concentrated in the agricultural sector. Meanwhile, the elderly who work with a junior high school level education or equivalent and above are concentrated in the tertiary sector [13,14]. From working status, most of the elderly who work in the informal sector. Informal workers, especially elderly workers, need special attention because they generally lack social protection, a legal basis for employment, or decent work benefits. This can be due to the lack of job opportunities for the elderly in the formal sector because the formal sector prioritizes workers' qualifications and skills. With the ability of the elderly who have decreased physically and psychologically, of course the informal sector is an option for these elderly workers [15].

4. Conclusion
Based on the analysis and findings above, this paper concludes that the economic factors (such as wages and non-labor income) and other demographic factors (such as the head of household status, marital status, education, urban rural, and industrial origin) have significant influence on the hours of work for old-age individuals. Based on 75+ age groups, these factors tend to have no real influence. For individuals of old age, they carry out economic and non-economic activities, tend to maintain routines so that they consider themselves still healthy, can meet many people, do not feel dependent on others, and remain independent; besides activities can reduce the loneliness that usually touches the old-age individuals.

Suggestion, with the high interest of older individuals to work, it is necessary to pay attention to the industrial origin and the right type of work. They can become development capital without having to reduce employment opportunities because they can still be productive. The government must encourage the elderly care program from their families, because the family social support is more important, they can be at the forefront of offering more effective health care interventions to improve the quality of life of elderly people and to carry out their everyday activities, including tracking their health status. In addition, government support is needed to expand retirement social security for old–age individuals who previously worked in the informal sector.

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