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Are There Jobs for Everyone?

An analysis of the relationship between the employment of older and younger persons in Indonesia[1]

May 23, 2024

Executive summary

Against the backdrop of aging, Indonesia has started to address important policy challenges, including by gradually raising the retirement age. Based on the United Nations World Population Prospects 2022, in the year 2023, 7 percent of Indonesia's population is estimated to be aged 65 or older, making Indonesia an aging society by international standards. At the same time, Indonesia's life expectancy has been gradually rising in recent decades. This gives rise to several policy challenges, including on income security, employment, future growth, and fiscal sustainability. Indonesia introduced Presidential Regulation 68/2021 – Indonesia's National Aging Strategy to provide a framework to begin to comprehensively address these multidimensional challenges. One of the steps that Indonesia has taken to address these challenges is to gradually raise the retirement age. Between 2014 and 2022, the retirement age had been raised from 55 to 58. This will continue until the retirement age reaches 65 by 2043 (OECD 2023).

The increase in the retirement age and the prospect of longer employment of older persons raises concerns on its potential impact on the employment of younger persons. This notion relates to what is often called the lump of labor fallacy, or the belief that there is a fixed number of jobs in an economy, which means that increasing employment opportunities for older persons would decrease employment opportunities for younger persons (Gruber, Milligan and Wise 2010). In practice, a growing economy with an increasing demand for older workers will likely also experience an increase in demand for other workers, including younger workers (Apella 2024). However, evidence on the relationship between the employment of older persons and the labor market outcomes of younger persons is largely concentrated in high-income OECD countries, and there is no evidence on how this relationship plays out in Indonesia.

This paper analyzes the relationship between the employment rate of older persons and the labor market outcomes of younger persons in Indonesia. Using data from the Indonesia Labour Force Survey (Sakernas) for the years 2016 to 2023, the analysis explored the relationship between the labor market outcomes – that is, employment rates, unemployment rates, hours worked, and income – of younger persons and older persons using ordinary least squares regression. Younger persons include youth aged 15 to 24 and prime-aged persons aged 25 to 54, while older persons refer to those aged 55 to 64. The analysis is conducted at the province level.

Findings show that overall, an increase in the employment rate of older persons is significantly associated with an increase in the employment rate of youth and prime-aged persons. More specifically, an increase in the employment rate of older persons by 1 percentage point is associated with an increase in the employment rate of youth by 0.5 percentage points, and an increase in the employment rate of prime-aged persons by 0.7 percentage points. The positive relationship is robust and is found across most specifications tested, that is, across genders,

[1] This paper was prepared by Amanina Abdur Rahman. Critical inputs were provided by Sara Giannozzi, Anastasiya Denisova, Robert Palacios, and Abror Tegar Pradana.

education levels, sectors, and within the formal sector. In other cases, the coefficient is not statistically significant, suggesting no significant relationship between the employment of older persons and younger persons. Encouragingly, there is no evidence of a significant negative relationship between the employment of older persons and younger persons.

When there is a significant negative relationship between the employment of older persons and other employment outcomes of younger persons, the magnitude is small. The analysis found some evidence of significant negative relationships between the employment rate of older persons with the hours worked and income earned by younger persons. However, the coefficients are small. The largest magnitude was found for male youth, with an increase in the employment rate of older men by 1 percentage point was found to be significantly associated with a decrease the monthly income of male youth by 2 percent. The magnitude of the significant negative coefficients reflecting the relationship between the employment rate of older persons with hours worked and income earned of other groups of workers are much smaller. Thus, while there may be negative relationships, the potential practical impacts are likely small.

These findings support the notion that raising the retirement age can address some of the challenges faced by an aging society. This includes the financial and economic vulnerability of older persons, the lack of coverage and adequacy of social assistance and social insurance programs, fiscal sustainability of the pension system, and in the long run, declining economic growth from a smaller working population. create the need for older persons to work longer. Even though the retirement age only affects formally employed workers or those covered by the pension system, it sends a strong signal to the labor market on the productive capacity of older people and the importance of hiring and retaining them. Increasing the retirement age should be accompanied by policies that can support the productivity, as well as the retention and hiring of older persons.

Lifelong learning, upskilling, and reskilling are important to facilitate longer working lives. They ensure that older workers remain employable in a changing economy. In the context of informal employment, this means ensuring that one's skills are up to date in key areas, such as financial literacy and digital skills. These skills allow workers to continue working – likely with less physical effort – against the backdrop of rapid technological advancements. Indeed, technological advancements have the potential to increase employment opportunities that are more compatible with the preferences and abilities of older persons. Higher levels of educational attainment and continuous skill development can help older workers reap the opportunities that technology provides.

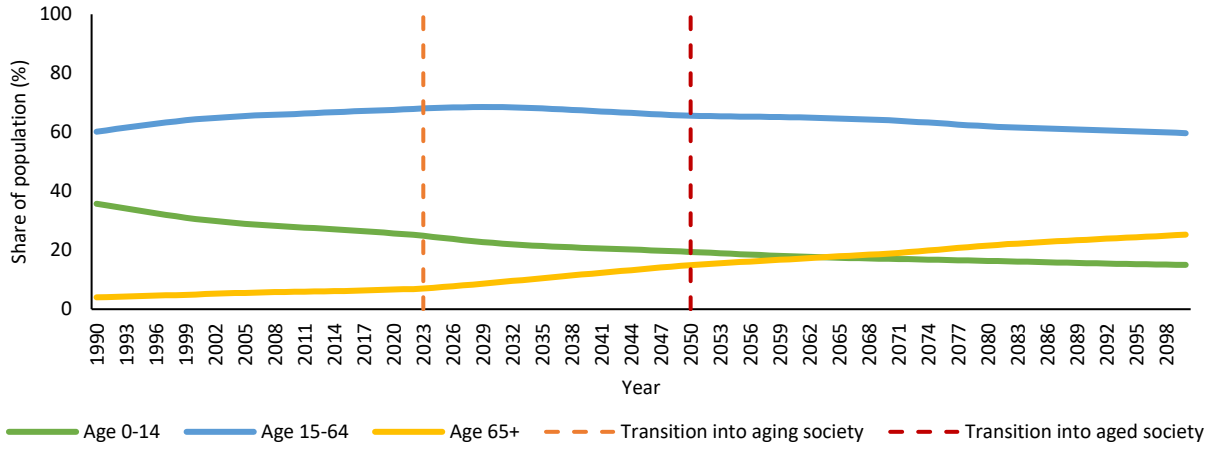
1 Introduction

As a result of improvements in life expectancy and a reduction in fertility rates, Indonesia has passed the threshold of an aging society by international standards. Based on the United Nations World Population Prospects 2022, in the year 2023, 7 percent of Indonesia's population is estimated to be aged 65 or older (see Figure 1). This makes Indonesia an aging society by international standards (World Bank 2016).[2,3] By 2050, 15 percent of Indonesia's population is estimated to be

[2] An ageing society is one with 7 to 14 percent of people aged 65 and older as a share of the total population. An aged society is one with 15 to 20 percent of people aged 65 and older as a share of the population.
[3] Indonesia defines an older person as one who is aged 60 or older.

aged 65 or older, thus making it an aged society by international standards. At the same time, Indonesia's life expectancy has been gradually rising in recent decades. In 1990, life expectancy at age 65 was 12.7 years. By 2019, it had increased to 14.2 years and is expected to continue increasing.[4] Together, the data points to the fact that there are increasingly more older Indonesians, and that they can expect to live longer on average.

Figure 1: Estimated share of population by age, 1990-2100



Source: UN World Population Prospects 2022

Aging and the rising share of older persons raises policy challenges in a number of areas, including income security and employment. At 36 percent, a large share of the elderly is either poor or vulnerable, a phenomenon that will only be exacerbated by rapid aging without adequate policy responses (Holmemo et al. 2020). Coverage of the elderly by existing social assistance programs is limited, thus increasing their vulnerability. At the same time, in 2023 only 18.2 and 14.3 million workers – making up 13 percent and 10 percent of all workers respectively – were covered for old age savings (*Jaminan Hari Tua*, JHT) and pensions (*Jaminan Pensiun,* JP) respectively (Holmemo et al. 2020). Further, the estimated adequacy for covered workers is also low, as reflected by low projected replacement rates (Holmemo et al. 2020).[5] The vulnerability of older persons, as well as the lack of coverage and adequacy of social assistance and social insurance programs and rising life expectancy create the need for older persons to work longer.

Indonesia has already started addressing these concerns by gradually raising the retirement age. The government started increasing the retirement age in 2014, with an increase in retirement age by one year every three years. Between 2014 and 2022, the retirement age had been raised from 55 to 58. This will continue until the retirement age reaches 65 by 2043 (OECD 2023). Aside from income security, this policy move also seeks to address the sustainability of the pension system (Holmemo et al. 2020). A study by Kudrna, Piggott and Poonpolkul (2021) models the impact of raising the retirement age on the economy, and finds positive effects on consumption, labor supply, and welfare of formal workers. Further, they find that the increase in the retirement age makes the

[4] Life expectancy at age 65 was lower between 2020 and 2022 due to the COVID-19 pandemic.

[5] Using the current contribution rate, Holmemo et al. (2020) estimate the future replacement rate by projecting the accumulated balance after 40 years of contributions plus interest, and converting it into an actuarially fair annuity. See Holmemo et al. (2020) for technical details of the estimation.

contributory pension system more sustainable. Raising the retirement age and extending working lives can therefore have positive impacts on the economy and is important to mitigate declines in GDP growth resulting from a fall in the working age population in aging societies.

A major consideration when thinking about if and how to support the employment of older persons is the potential impact on the employment of younger persons. This notion relates to what is often called the lump of labor fallacy, or the belief that there is a fixed number of jobs in an economy, which means that increasing employment opportunities for older persons would decrease employment opportunities for younger persons (Gruber, Milligan and Wise 2010). In practice, the number of jobs in an economy is not fixed, and an increase in labor demand (for older persons or otherwise) translates to an increase in aggregate demand in an economy through an increase in consumption by these workers. Subsequently, this increases the demand for labor further. In other words, a growing economy with an increasing demand for older workers will likely also experience an increase in demand for other workers, including younger workers (Apella 2024). Moreover, older and younger persons are not necessarily substitutes. They are likely to prefer different types of jobs, and have different skills. For example, jobs that are more physically demanding are less conducive for older persons (Acemoglu, Mühlbach and Scott 2022). Thus, older workers are less likely to crowd out younger workers in such jobs.

The high degree of informality in the Indonesian economy exacerbates concerns of substitutability between older and younger persons. Following the definition of informal employment put forward by the International Conference of Labour Statisticians in 2017 (ICLS-17), at 76.7 percent, informal employment made up more than two thirds of total employment in Indonesia in 2023 (see Footnote 6). Since informal work is more likely to be low-skilled and require minimal formal education (discussed in Section 2), there is a possibility that older and younger workers are more substitutable in Indonesia compared to economies with low informal employment. That said, more research is needed to establish the relationship between informality and the substitutability of older and younger workers. Further, Indonesia has a large youth population and a youth unemployment rate that is more than three times higher than the national unemployment rate. This makes it especially important to ensure that the employment of older persons does not crowd out opportunities for younger persons.

Despite these concerns, empirical analysis conducted in this paper finds evidence that an increase in the employment of older persons actually increases employment opportunities for younger persons. This finding is robust and is found across most specifications tested, that is, across genders, education levels, and sectors. It reflects the notion that a growing economy increases employment opportunities for older and younger workers alike. Positive relationships were also found between the formal employment rates of older and younger persons. Even though these findings do not reflect a causal relationship between the employment rates of older and younger persons, the consistency of the findings across various specifications provides confidence of its reliability. Most importantly, there is no evidence of a negative relationship between the employment rates of older and younger persons. The findings in this paper are also consistent with the findings made in OECD countries (Gruber et al. 2010, Munnell and Wu 2013).

The remainder of this paper is organized as follows. The next section provides an overview of the Indonesian labor market, with the objective of informing the findings made in this paper. The third section presents a brief literature review. The fourth section presents the data and methodology used

in this paper. The fifth section presents findings from the analyses conducted. The sixth section concludes.

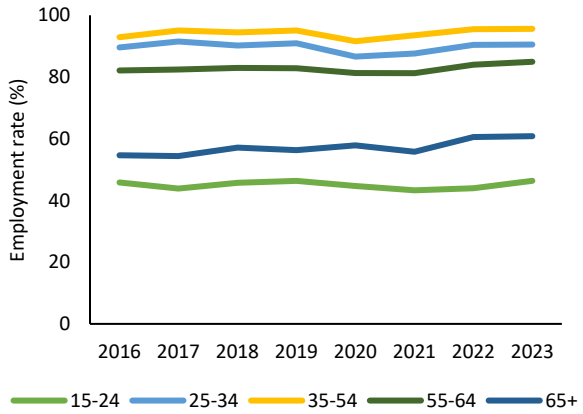
2 An overview of the Indonesian labor market

This section describes key characteristics of the Indonesian labor market with the objective of informing the findings from the upcoming analysis. Specifically, this section presents trends in employment in Indonesia by key demographic characteristics including gender, age group, sector of employment, and level of education. This section also presents trends in formal and informal employment by these same key demographic characteristics. Given that the analysis focuses on the relationship between the employment rates of the elderly and younger persons in Indonesia, understanding their labor market characteristics will be important to shed light on the findings. It will also provide insight on whether substitutability between older and younger persons is plausible.

The employment rate is highest for workers aged 35 to 54, followed by those aged 25 to 34, 55 to 64, and 65 and older. Young persons aged 15 to 24 have the lowest employment rate. This pattern is driven by the employment rate of men, who have substantially higher employment rates compared to women, and shown in Figure 2 and Figure 3. Nonetheless, between 2016 and 2023, the employment rate of women has increased at a faster rate compared to men, across all age groups. In the same period, the employment rate has increased for both gender and across all age groups.

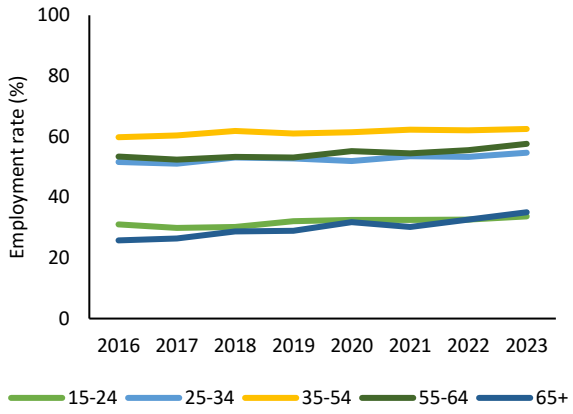
The employment rate of older persons aged 55 and older has experienced the largest increase in recent years. The employment rate for persons aged 55 to 64 has increased by 3.3 percentage points, while that of persons aged 65 and older has increased by 8.3 percentage points. The increase is higher for women (see Figure 3) compared to men (see Figure 2). To elaborate, the employment rates of women aged 55 to 64 and 65 and older have increased by 4.2 and 9.3 percentage points respectively in the period. On the other hand, the employment rates of men in the same age groups have increased by 2.8 and 6.2 percentage points respectively. That said, the employment rate for women remains to be lower than men despite the increase, given its relatively low starting point.

Figure 2: Male employment as a share of the population by age group, 2016-2023 (%)



Source: Author's calculations using Sakernas data

Figure 3: Female employment as a share of the population by age group, 2016-2023 (%)

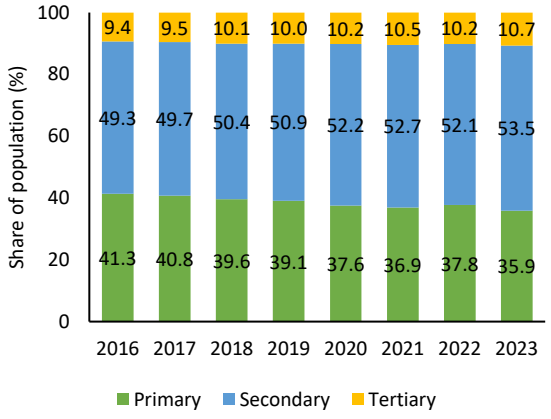


Source: Author's calculations using Sakernas data

The increase in the employment has occurred against the backdrop of rising educational attainment. Figure 4 shows that an increasing share of Indonesians have secondary and tertiary education. The share of the population with a secondary education increased from 49.3 percent in

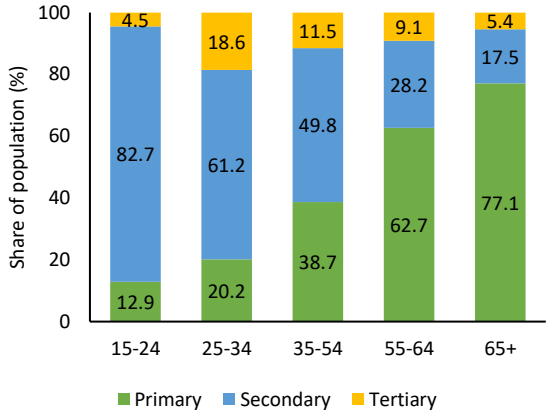
2016 to 53.5 percent in 2023. In the same period, the share of the population with a tertiary education had increased from 9.4 percent to 10.7 percent. Subsequently, the share of younger persons with a tertiary education is relatively high. In 2023, 18.6 percent of people aged 25 to 34 had a tertiary education, compared to 11.5 percent of people aged 35 to 54, 9.1 percent of people aged 55 to 64, and 5.4 percent of people aged 65 and older (see Figure 5). It should be noted that there is a relatively low share of people aged 15 to 24 with a tertiary education because they are likely still in the process of obtaining formal education.

Figure 4: Share of population by level of education, 2016-2023 (%)



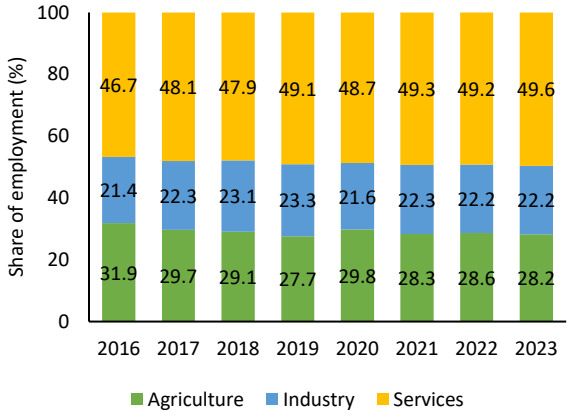
Source: Author's calculations using Sakernas data

Figure 5: Share of population by age group and level of education, 2023 (%)



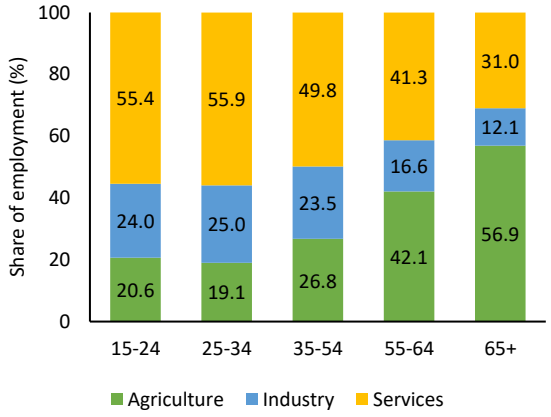
Source: Author's calculations using Sakernas data

Figure 6: Share of employment by sector, 2016-2023 (%)



Source: Author's calculations using Sakernas data

Figure 7: Share of employment by sector and age group, 2023 (%)



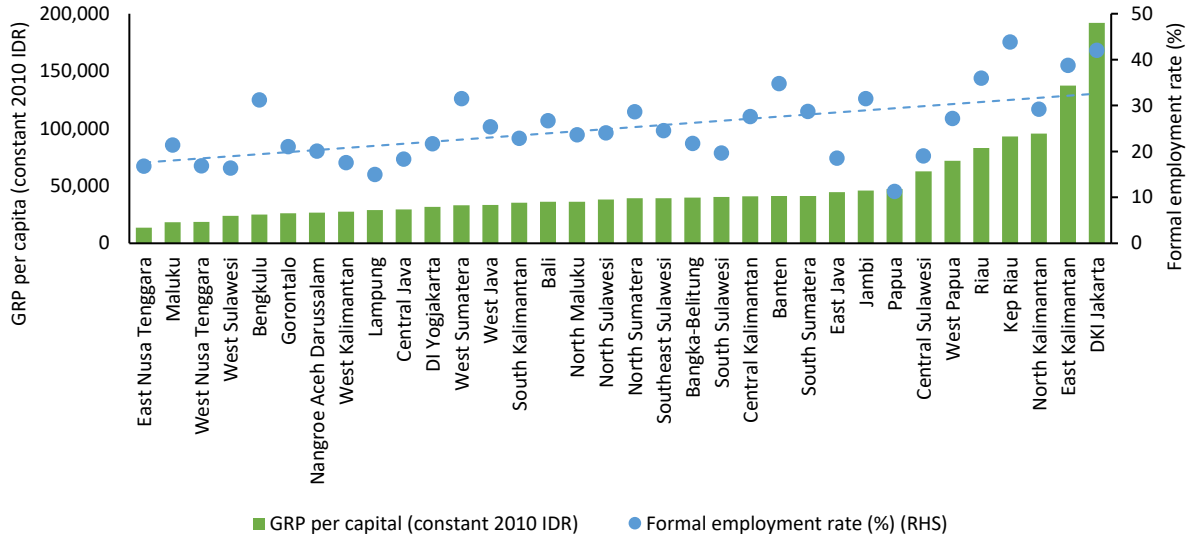
Source: Author's calculations using Sakernas data

Employment in the services sector has gradually increased over time, and the sector currently employs almost half of all workers. Between 2016 and 2023, employment in the services sector has increased from 46.7 percent to 49.6 percent, as shown in Figure 6. In the same period, the share of employment in the agriculture sector had decreased from 31.9 percent to 28.2 percent. The share of employment in the industrial sector was somewhat stagnant in the period. Figure 7 shows that

there is an age dimension to employment by sector. Older people are more likely to be employed in the agriculture sector, while younger people are more likely to be employed in the services sector. The increasing importance of the services sector and the declining importance of the agriculture sector reflects the process of structural transformation resulting from economic development (Lewis 1954, McMillan, Rodrik and Sepúlveda 2017).

Following the ICLS-17 definition of formal employment, less than one third of workers in Indonesia are formally employed, with higher levels of formal employment in more developed provinces.[6] In short, a worker is formally employed if they are covered by labor legislation (Wihardja and Cunningham 2021).[7] The ICLS-17 definition of formal employment is used throughout this paper. Figure 8 shows that there is a high positive correlation between Gross Regional Domestic Product (GRP) per capita and formal employment of 0.68. Moreover, Figure 9 shows that between 2016 and 2023, the share of formal employment in Indonesia has remained somewhat stagnant, with less than 25 percent of workers being formally employed throughout the period. Formal employment is highest among workers aged 25 to 34 at 33.5 percent, as shown in Figure 10**Figure *10***. Formal employment is lowest among workers aged 65 and older at 3.1 percent.

Figure 8: GRP per capita and formal employment rate by province, 2023

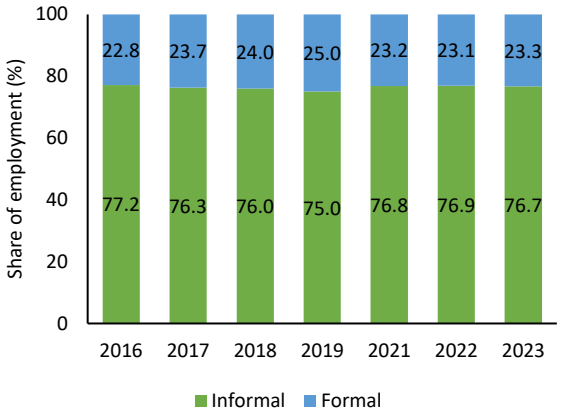


Source: Author's calculations using BPS and Sakernas data

[6] In comparison, the national statistics office of Indonesia (*Badan Pusat Statistik,* BPS) defines formal employment based on a matrix of occupation and job status. See Wihardja and Cunningham (2021) for details on both the BPS and ICLS-17 definitions of formal employment.

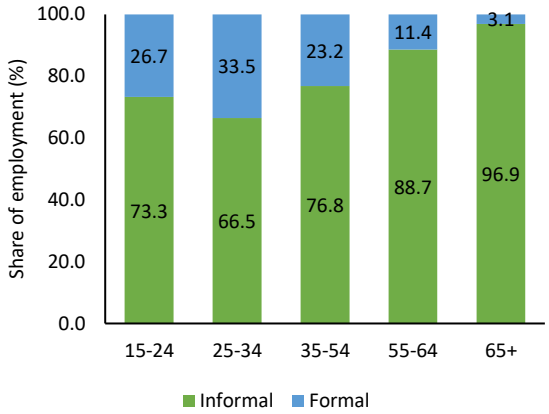
[7] Following ICLS-17, a formally employed worker is defined as: (1) a self-employed individual, or an employer assisted by temporary, unpaid, or permanent workers in a formal production unit, OR (2) an employee or casual worker who receives at least one social benefit and paid leave, OR (3) an employee or causal worker who receives neither social benefits nor paid leave but has a permanent contract. See Wihardja and Cunningham (2021) for details on both the BPS and ICLS-17 definitions of informal employment.

Figure 9: Share of employment by formality status, 2016-2023 (%)



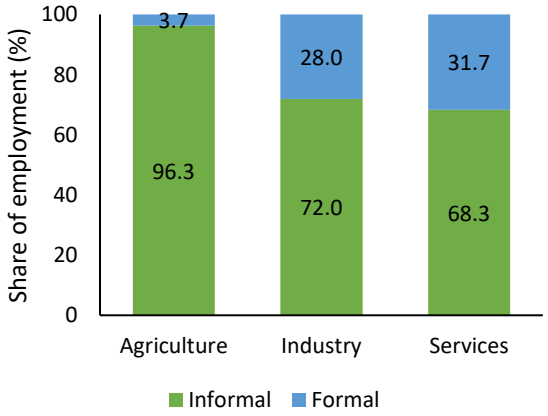
Source: Author's calculations using Sakernas data

Figure 10: Share of employment by formality and age group, 2023 (%)



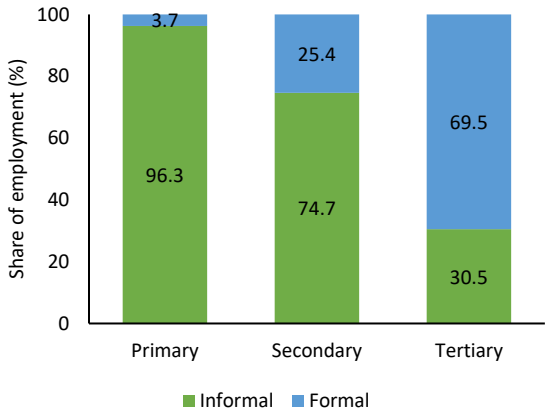
Source: Author's calculations using Sakernas data

Figure 11: Share of employment by formality and sector, 2023 (%)



Source: Author's calculations using Sakernas data

Figure 12: Share of employment by formality and education level, 2023 (%)



Source: Author's calculations using Sakernas data

Workers employed in the services sector and workers with higher levels of education are more likely to be formally employed. Around 31.7 percent of workers employed in the services sector are formally employed, compared to 28 percent and 3.7 percent of workers employed in the industrial and agriculture sectors respectively, shown in Figure 11. At the same time, Figure 12 shows that at 69.5 percent, the majority of tertiary educated workers are formally employed. This is followed by 25.4 percent of secondary educated workers and 3.7 percent of primary educated workers. In other words, workers with higher levels of education have greater access to formal employment.

Overall, data presented in this section highlight key differences between older and younger workers. First, younger workers are more highly educated than older workers. Second, younger workers are more likely to be employed in the services and industrial sectors, while older workers are more likely to be employed in the agriculture sector. Third, younger workers are more likely to be formally employed, which likely stems from the correlation between tertiary education and formal

employment. Formal employment is also more prevalent in the services and industrial sector. The differences in the labor market characteristics between older and younger workers will likely influence the relationship between the employment of older persons and the labor market outcomes of younger persons, which will be analyzed further in the upcoming sections.

3 Literature review

At the macroeconomic level, research in a number of high-income countries has found no adverse relationship – and even a positive relationship – between the employment of older persons and the labor market outcomes of younger persons. A study of 12 OECD countries[8] between 1960 to 2006 finds that an increase in the employment of older persons is estimated to decrease the unemployment rate of younger persons (Gruber et al. 2010). These findings hold both for analyses conducted within and between countries, as well as for causal analyses using natural experiments (Gruber et al. 2010). Focusing on the United States in the years 1977 to 2011, Munnell and Wu (2013) find no evidence that greater employment among older persons decreases either the job opportunities or wage rates of younger persons. This finding is consistent across genders and for groups with different levels of education. Munnell and Wu (2013) also conduct causal analysis using older male mortality rates as an instrumental variable, and do not find any consistent evidence that the employment of older persons adversely affects the labor market outcomes of younger persons. In Japan, using a firm-level survey, Kondo (2016) finds that increased elderly employment is not associated with a decline in the hiring of young full-time workers. They did, however, find that hiring elderly workers may lead to a decline in the hiring of female part-time workers (Kondo 2016). This is consistent with findings from the United States that suggests that age-friendly jobs (i.e. jobs that are more conducive for older workers) are also more desirable among women, who may prefer flexibility (Acemoglu et al. 2022). That aside, these findings generally suggest that in high-income countries, older and younger workers are not substitutes; instead, they are more likely to be complements (Kalwij, Kapteyn and De Vos 2010). For example, older workers may have job-specific knowledge resulting for their experience, while younger workers are yet to accumulate such experience but may be more technologically adept.

Similarly, there is virtually no evidence of an adverse relationship between elderly employment and the labor market outcomes of younger persons in developing countries at the macroeconomic level. In a sample of eleven Latin American countries (eight of which are developing countries),[9] Apella (2024) finds significant positive relationships between the employment of older persons and the labor market outcomes in terms of employment and wages of youth across genders. This analysis was conducted using a panel dataset that was built using household surveys from each of the countries. In their analysis of China, Zhang (2012) finds significant positive relationships between the employment rate of older persons and younger persons across genders. They also find some evidence of significant positive relationships between the employment rate of older persons and the income earned by younger men and women. This is

[8] The 12 OECD countries are Belgium, Canada, Denmark, France, Germany, Italy, Japan, the Netherlands, Spain, Sweden, the United Kingdom, and the United States.

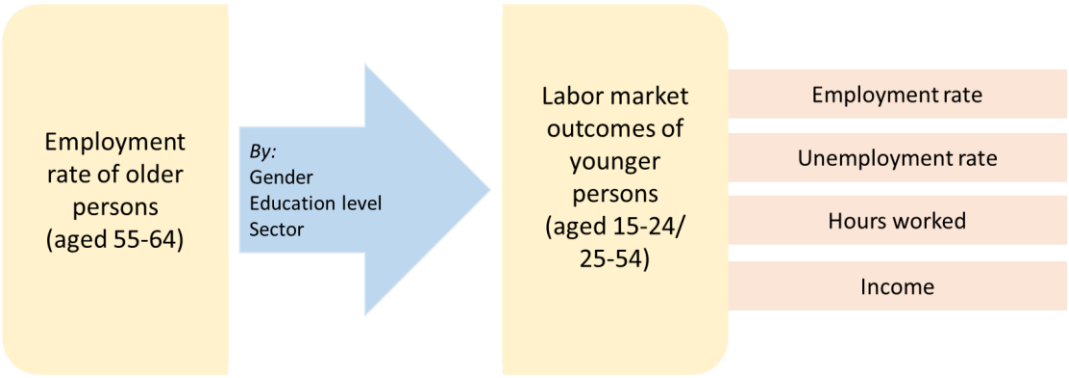
[9] The eleven countries are Argentina, Bolivia, Brazil, Chile, Costa Rica, Ecuador, Mexico, Panama, Paraguay, Peru, and Uruguay. Out of these, Chile, Panama, and Uruguay are categorized as high-income countries by the World Bank in 2023.

consistent with Munnell and Wu (2013), who do not find any evidence that the employment of older persons decreases the employment of younger persons in China. Both studies on China use data from the census. Jasmin and Abdur Rahman (2021) analyzed the same phenomenon in Malaysia using data from the Malaysia Household Income Survey and found that the relationship between the employment of older workers and younger workers is significant and positive for all workers and among women. They found that the relationship between the employment of older and younger men is not statistically significant. There was evidence of a significant negative relationship between the employment rate of older men and prime-aged men with primary education. The authors suggest that those with primary education may be more readily substitutable because of the similarities of the skills they provide (Jasmin and Abdur Rahman 2021).

Despite the positive evidence, there is some evidence of a negative relationship between the employment of older persons and younger persons. Vestad (2013) finds that in Norway, an older worker opting for early retirement creates room for one new labor market entrant, suggesting a 1:1 substitution ratio between older workers and younger workers. Analyzing the effects of the increase of the legal retirement age for women[10] in Portugal, Martins, Novo and Portugal (2009) find that firms employing older women significantly reduced hiring of younger women, also with a 1:1 substitution ratio. Bertoni and Brunello (2017) find that an increase in the supply of older persons in local labor markets by 1,000 persons resulting from an increase in the minimum retirement age increases the employment of older persons by 149 persons. At the same time, it decreases the employment of youth and prime-aged workers by 189 and 86 persons respectively (Bertoni and Brunello 2017). This suggests a net negative impact on employment due to the decrease in the employment of younger persons. That said, the paper finds that the net negative impact is smaller in a growing economy.

4 Data and methodology

Figure 13: Conceptual framework of the analysis



[10] A legislative reform introduced in Portugal in 1994 increased the legal retirement age for women from 62 to 65 but not for men (see Martins et al. 2009).

This paper analyzes the relationship between the employment rate of the elderly and the labor market outcomes of younger persons using data from the Indonesia Labour Force Survey (Sakernas). More specifically, the analysis utilizes data from the August wave of Sakernas for each year between the years 2016 and 2023. The analysis explores the relationship between the labor market outcomes – that is, employment rates, unemployment rates, hours worked, and income – of younger persons and older persons at the province level using ordinary least squares (OLS) regression. The employment rate for a given age group is calculated as a share of the population within the age group, while the unemployment rate for a given age group is calculated as a share of the labor force within the age group. The sample is divided into three age groups: 15 to 24 ("youth"), 25 to 54 ("prime-aged") and 55 to 64 ("old"). This relationship will be analyzed by gender, education level, and sector of employment, as shown in Figure 13. Formally, the basic model that will be analyzed is as follows:[11]

$$Y_{pt} = \beta_0 + \beta_1 oldemp_{pt} + X_{pt}\beta_2 + \gamma_t + \varepsilon_{pt}$$

where Y_{pt} is the labor market outcome of interest for province p in year t, that is, employment rate (as a share of the population), formal employment rate (as a share of employment), unemployment rate (as a share of the core labor force, i.e. those working and those looking for a job), hours worked in the previous week, and income of the young and prime-aged. The independent variable of interest is captured by $oldemp_{pt}$, which captures the employment rate of older persons in a given province and year. The vector X_{pt} includes a set of province-specific, time-varying explanatory variables, namely GRP per capita, GRP growth, the provincial unemployment rate, the provincial poverty rate, the structure of the economy (i.e. the relative shares of the industrial and service industries), the share of younger persons in the relevant age group (i.e. youth aged 15 to 24 or prime-aged persons aged 25 to 54) and the share of persons with a primary education or less. The variable γ_t is a set of year dummies to control for economic conditions in a given year. Given the small sample size and the inclusion of numerous province-specific, time-varying explanatory variables, province dummies are excluded to preserve degrees of freedom.

Variations to the basic model include analyses by gender, education level, and sector of employment. The relationship between the formal employment rate of older and the labor market outcomes of younger persons (including the formal employment rate of younger persons) is also analyzed. The motivation for this is because the planned increase in the retirement age is likely to affect workers who are formally employed rather than those who are informally employed. It would therefore be important to understand the relationship between the formal employment rates of older and younger persons.

The model used in this paper is similar to that used by Munnell and Wu (2013) for the United States and China. The reason is because like Munnell and Wu (2013), this paper uses household survey data to compute the variables of interest at the province level within a country and to study the relationships between the employment rates of older persons and the labor market outcomes of younger persons. A similar approach was taken by Jasmin and Abdur Rahman (2021). Gruber et al. (2010) and Apella (2024) utilized the same variables of interest, but both papers looked at the relationship between the employment rates of older persons and labor market outcomes of younger

[11] This model is similar to that analyzed by Munnell and Wu (2013) for the United States and China, and Bertoni and Brunello (2017) for Italy.

persons across several countries. Other papers such as Martins et al. (2009) and Kondo (2016) analyzed the relationship at the firm level.

5 Findings

5.1 Descriptive statistics and correlation analysis

Descriptive statistics and correlation analysis allow for an initial view of the relationship between the employment rates of older and younger persons. In short, this section presents summary statistics and correlations from Sakernas data, which allows for a preliminary understanding of the patterns within the data, focusing on the variables of interest. It provides insight into, for example, the average employment rate within different age groups and genders, and the average hours worked and income earned across these same groups. Correlation analysis provides an initial view into the relationship of interest, that is, between the employment rate of older persons and younger persons across provinces. However, unlike regression analysis, it does not take into account other factors that could be driving the employment rate of younger persons such as the level of development within a province. Therefore, while correlation analysis is useful, it is not sufficient to draw conclusions on the relationship of interest.

The employment rate is highest for prime-aged persons (25 to 54) compared to youth (15 to 24) and older persons (55 to 64). The descriptive statistics for the main variables used in the analysis are presented in Annex 1. These reflect 272 province-level observations for 34 provinces including the Special Capital Region of Jakarta for the years 2016 to 2023. The average employment rate of prime-aged persons for the period is 75.5 percent, while the average employment rate of youth and older persons are 38.5 percent and 68.6 percent respectively. The average formal employment rate is lower than the average employment rate across all age groups. Both the average employment rate and formal employment rate for men is higher than that for women, with the exception of the average formal employment rate of youth which is higher for women (28.5 percent) compared to men (21.8 percent). This reflects the higher level of tertiary education attainment among women. In 2023, 6.2 percent of women aged 15 to 24 had a tertiary education, compared to 2.9 percent of men. The average unemployment rate is highest for youth, driven by the high average unemployment rate among female youth. Average hours worked is highest for prime-aged persons. Average hourly income is highest among old persons, while average monthly income is generally highest for prime-aged persons.

There is a positive correlation between the employment rate of older persons aged 55 to 64 and the employment rate of younger persons, providing preliminary evidence of the lack of an adverse relationship. Positive correlations between the employment rate of older persons and youth aged 15 to 24 and prime-aged persons aged 25 to 54 across provinces suggest that a higher employment rate among older persons is associated with a higher employment rate among younger persons across provinces for the entire period. There is a substantially higher correlation between the employment rate of older persons and prime-aged persons. The correlation between the employment rate of older persons and youth over time is 0.43, while that between the employment rate of older persons and prime-aged persons is 0.84. The positive correlation holds across genders.

Similarly, there is a positive correlation between the formal employment rate of older persons aged 55 to 64 and the formal employment rate of younger persons. This indicates that a higher

formal employment rate among older persons is associated with a higher formal employment rate among younger persons across provinces for the period. The correlation between the formal employment rates of older and younger persons is high, with a correlation of 0.55 for that between older persons and youth across provinces and years, and 0.83 for that between older and prime-aged persons. These correlations are higher than that between the employment rate of older and younger persons. This reflects the relatively high rates of formal employment among younger persons compared to older persons. The strong positive correlation holds across genders, with a higher positive correlation among men relative to that for women, and between older and prime-aged persons relative to that between youth and older persons.

Overall, correlation analysis shows that an increase in employment opportunities for older persons is associated with an increase in employment opportunities for younger persons. Further, an increase in formal employment opportunities for older persons is associated with an increase in formal employment opportunities for younger persons. That said, the correlation analysis presented in this section only provides a preliminary view of the relationships described. These relationships will be analyzed more rigorously using regression analysis to draw more conclusive findings.

5.2 Regression analysis[12]

5.2.1 Analyzing the relationship between the employment rate of older persons and younger persons

Findings from the regression analysis generally find positive relationships between the employment of older and younger persons. Table 1 and Table 2 show that there are significant positive relationships between the employment rate of older persons with youth and prime-aged persons (column 1 in both tables), with a larger positive relationship for the latter. An increase in the employment rate of older persons by 1 percentage point is associated with an increase in the employment rate of youth by 0.4 percentage points, and an increase in the employment rate of prime-aged persons by 0.7 percentage points. Given that prime-aged persons includes people aged 25 to 54, this may reflect the notion that an economy that has more employment opportunities for people aged 55 to 64 also has more opportunities for people closer to that age group. This possibility is discussed in Section 5.2.5. There are significant negative relationships between the employment rate of older persons and the unemployment rate of youth and prime-aged persons (column 2 in both tables). The significant positive relationship between the employment rate of older persons and younger persons holds across genders.

There are no significant relationships between the employment rate of older persons and the hours worked by younger persons. This is shown in Table 1 and Table 2 (column 3 in both tables). The same holds for men. However, there is a significant negative relationship between the employment rate of older women and the hours worked by young women. That said, the magnitude this relationship is small. A one percentage point increase in the employment rate of older women is associated with a 0.2 percent decrease in the hours worked among young women. In comparison, there is a significant positive relationship between the employment rate of older women and the hours worked by prime-aged women. The magnitude of this relationship is also small, with a 0.2

[12] All of the relationships described in this section assume that all other variables are held constant.

percent increase in the hours worked among prime-aged women for every percentage point increase in the employment rate of older women.

There is evidence that an increase in the employment rate of older persons is negatively associated with income earned by younger persons. This is reflected by a significant negative relationship between the employment rate of older persons and the monthly income of youth in Table 1 (column 5). Significant negative relationships are also seen between the employment rate of older persons and the hourly wage and monthly income of prime-aged persons in Table 2 (columns 4 and 5). The magnitude of this relationship is small, with the largest significant association being a decrease in income by 0.5 percent for a one percentage point increase in the employment rate of older persons. Significant negative relationships are also seen for men and prime-aged women, with the largest association being a decrease in the monthly income of male youth of 2 percent for every percentage point increase in the employment rate of older men. It is worth noting that there is no significant relationship between the employment rate of older persons and the hourly wage of youth, as well as the employment rate of older persons and the hourly wage and monthly income of female youth.

The relationships between the other independent variables and labor market outcomes of younger persons provide some insight on the economy. First, an increase in GRP per capita is generally associated with better labor market outcomes in terms of higher employment rates, lower unemployment rates, more hours worked, and higher incomes. This reflects the fact that employment outcomes are better in more developed provinces. Second, a higher poverty rate is significantly positively associated with the unemployment rate, a decrease in the employment rate, and a decrease in the hours worked. This suggests adverse employment outcomes in states with higher levels of poverty (which are typically less developed) and is consistent with findings in the literature (Munnell and Wu 2013). Third, a higher unemployment rate is significant positively associated with hours worked, hourly wage, and monthly income. One reason for this is that when unemployment is higher, those who do work may have to work more and earn more to be able to sustain the livelihoods of their households.

5.2.2 Analyzing the relationship between the formal employment rate of older persons and younger persons

There are significant positive relationships between the formal employment rate of older persons and the formal employment rate of younger persons. This is seen in Table 3 and Table 4 for the relationship with the formal employment rate of youth and prime-aged persons respectively (column 1 in both tables). The magnitude of the relationship is larger for prime-aged persons, suggesting that an increase in formal employment opportunities for older persons increases formal employment opportunities for prime-aged persons more than it does for youth. This is consistent with the findings for the employment rate presented in Section 5.2.1, and will be discussed further in Section 5.2.5.

There are also significant positive relationships between the formal employment rate of older persons and the hourly wage and monthly income for both youth and prime-aged persons. This is presented in Table 3 and Table 4 (columns 4 and 5 in both tables). That said, the magnitude is small, with an increase in the employment rate of older persons by one percentage point being associated with an increase the income of younger persons by at most 1.3 percent. Nonetheless, this

finding may reflect the fact that formal employment is higher in provinces with higher levels of development (see Figure 8) and therefore higher levels of income, including for youth. The relationships between the formal employment rate of older persons and the unemployment rate and hours worked by younger persons are not statistically significant (columns 2 and 3 in both tables).

5.2.3 Analyzing the relationship between the employment rate of older persons and younger persons by sector

Significant positive relationships are found between the employment rate of older persons and younger persons within the agriculture and services sectors. Table 5 shows the significant positive relationships between the employment rate of older persons in the agriculture and services sector with the employment rate of younger persons in the same sectors. The magnitude of the relationship is higher for the agriculture sector. The relationships between the employment rate of older persons and younger persons in the industrial sector are not statistically significant. Similarly, there are significant positive relationships between the formal employment rate of older persons and younger persons in the same sector, as shown in Table 6.

5.2.4 Analyzing the relationship between the employment rate of older persons and the employment rate and hours worked by younger persons, by education level

Given the concern that older and younger people with similar skillsets are more likely to be substitutes, it is important to analyze the relationship between the employment rate of older persons and younger persons with the same level of educational attainment. More specifically, the relationship between the employment rate of older persons with primary, secondary, and tertiary education with the employment rate of younger persons with the same levels of education is analyzed. The relationship between the employment rate of older persons and the hours worked by younger persons with the same level of education is also analyzed.

There is a significant positive relationship between the employment rate of older and younger persons with the same education level. Table 7 shows that there are significant positive relationships between the employment rate of older people with secondary and tertiary education with youth with the same levels of education (columns 2 and 3). The same table shows that there are significant positive relationship between the employment rate of older people and prime-aged persons across all levels of education (columns 4 to 6). The significant positive relationship generally holds for both genders, with only some cases in which the relationship is not statistically significant. Importantly, there is no evidence of a significant negative relationship.

Findings reveal some evidence of a significant negative relationship between the employment rate of older persons and the hours worked by younger persons with the same education level, but the magnitude of the relationship is small. The significant negative relationship is seen between the employment rate of older persons and hours worked by youth with secondary education (Table 8**Table *8***, column 2), and between the employment rate of older persons and hours worked by prime-aged persons with secondary and tertiary education (Table 8, columns 5 and 6). That said, the effect is small, with a one percentage point in the employment rate of older persons being associated with a decrease in the hours worked by younger persons by a maximum of 0.2 percent. In other cases, the relationship is not statistically significant. Similar findings are made across both

genders. The relationship between the employment rate of older women and prime-aged women with primary education is positive and significant, but the magnitude of the relationship is small at 0.1 percent.

5.2.5 Analyzing the relationship between the employment rate of older women and the employment rate and hours worked by younger women across the lifecycle

In many countries there is a sharp decline in the employment rate for women in their mid-20s due to childbearing and child rearing, making it important to dissect the relationship between the employment rate of older women and younger women throughout the lifecycle. To do this, women's age is augmented into five groups: 15 to 24 years old, 25 to 34 years old, 35 to 44 years old, 45 to 54 years old, and 55 to 64 years old. The relationship between the employment rate of older women aged 55 to 64 with younger women across the four age groups is then analyzed. The relationship between the employment rate of older women and the hours worked by younger women is also analyzed.

An increase in the employment rate of older women aged 55 to 64 is associated with a significant increase in the employment rate of younger women across all age groups. More specifically, Table 9 shows that an increase in the employment rate of older women aged 55 to 64 is associated with a significant increase in the employment rate of women aged 15 to 24, 25 to 34, 35 to 44, and 45 to 54. The magnitude increases with age. An increase in the employment rate of women aged 55 to 64 by one percentage point is associated with a 0.4 percentage point and 0.8 percentage point increase in the employment rate of women aged 15 to 24 and 45 to 54 respectively. This may suggest that an environment that is conducive to the employment of women aged 55 to 64 is also more conducive to the employment of women closer to that age group, perhaps more so than younger women.

There are also significant positive relationships between the employment rate of older women aged 55 to 64 and hours worked by women aged 35 to 44 and women aged 45 to 54. These findings are presented in Table 10, and show that an increase in the employment rate of older women aged 55 to 64 by one percentage point is associated with increases in the hours worked by women aged 35 to 44 and 45 to 54 by 0.2 percent and 0.1 percent respectively. This is consistent with the finding presented above, that is, that more employment opportunities for the employment of older women aged 55 to 64 translates into more employment opportunities for women who are approaching that age group. In contrast, there is a negative relationship between the employment rate of older women aged 55 to 64 and the hours worked by youth aged 15 to 24. That said, the magnitudes of all of the significant relationships are small.

5.2.6 Robustness tests: Generalized least squares regression and using a lagged independent variable

Generalized least squares (GLS) regression and using a lagged independent variable were conducted as robustness tests for the main findings. This is because the OLS analysis does not account for the relative size of the different provinces, which can produce inefficient estimates (Munnell and Wu 2013). In comparison, GLS allows the weighting of the data by the size of the population within provinces. Using the employment rate of older persons from two years ago as an

independent variable is also a useful robustness test. The employment rate of younger persons today may be more affected by the employment rate of older persons in previous years, instead of the employment rate of older persons in the current year.

The robustness tests support the main findings of the positive relationship between the employment rate of older persons and younger persons. Table 11 and Table 12 show positive relationships between the employment rate of older persons and the employment rates of youth and prime-aged persons respectively, for both robustness tests (column 1 in both tables). The magnitude of the coefficients for prime-aged persons is larger, meaning that the increase in the employment rate of prime-aged persons resulting associated with the increase in the employment rate of older persons is higher. Reinforcing these findings are the negative relationships between the employment rate of older persons and the unemployment rates of youth and prime-aged persons (column 2 in both tables). There are sporadic statistically significant negative relationships between the employment rate of older persons and the hours worked and income earned by younger persons, but the magnitude of the coefficients are small. Other coefficients are not statistically significant, suggesting no association with the employment rate of older persons. The consistency of the findings throughout the analysis, including the robustness tests, provides support to the credibility of the findings even though they do not provide causal evidence.

Table 1: Relationship between the employment rate of older persons (55-64) and labor market outcomes of youth (15-24)

	(1) Youth Employment	(2) Youth Unemployment	(3) Youth Hours of work (log)	(4) Youth Hourly wage (log)	(5) Youth Monthly income (log)
Employment rate of old persons	0.453***	-0.529***	-0.001	-0.003	-0.005*
(55-64)	(0.070)	(0.071)	(0.001)	(0.003)	(0.003)
Natural log of hourly income of	0.661	3.520**	0.028		
youth (15-24)	(1.865)	(1.658)	(0.023)		
Unemployment rate			0.016***	0.033***	0.045***
			(0.004)	(0.010)	(0.011)
Poverty rate	-0.170***	0.158***	-0.003***	0.004	0.005
	(0.062)	(0.053)	(0.001)	(0.003)	(0.003)
Share of employment in the	0.025	-0.029	-0.002**	-0.002	-0.002
agriculture sector	(0.049)	(0.043)	(0.001)	(0.002)	(0.002)
Share of employment in the	0.070	0.088	0.002*	0.001	0.005*
industrial sector	(0.081)	(0.070)	(0.001)	(0.003)	(0.003)
Share of youth (15-24)	0.101	-0.288*	-0.011***	-0.001	-0.006
	(0.162)	(0.147)	(0.002)	(0.006)	(0.006)
Share of population with a primary	0.279***	-0.149***	0.001	0.001	0.003*
education or less	(0.045)	(0.042)	(0.001)	(0.002)	(0.002)
Natural log of GRP per capita	4.155***	-3.138***	0.044***	0.238***	0.286***
(constant 2010 IDR)	(0.698)	(0.760)	(0.009)	(0.027)	(0.029)
Growth in GRP per capita	-0.163**	0.054	0.002**	-0.004	-0.001
	(0.070)	(0.048)	(0.001)	(0.003)	(0.004)
Number of observations	272	272	272	272	272
R-squared	0.454	0.526	0.797	0.675	0.713
Year dummies	Yes	Yes	Yes	Yes	Yes

Source: Author's calculations using Sakernas data

Notes: Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Table 2: Relationship between the employment rate of older persons (55-64) and labor market outcomes of prime-aged persons (25-54)

	(1) Prime Employment	(2) Prime Unemployment	(3) Prime Hours of work (log)	(4) Prime Hourly wage (log)	(5) Prime Monthly income (log)
Employment rate of old persons	0.679***	-0.081***	0.000	-0.005**	-0.004**
(55-64)	(0.044)	(0.010)	(0.001)	(0.002)	(0.002)
Natural log of hourly income of	3.209**	-0.062	-0.057***		
prime-aged persons (25-54)	(1.319)	(0.335)	(0.021)		
Unemployment rate			0.005*	0.001	0.016**
			(0.003)	(0.007)	(0.008)
Poverty rate	-0.068*	0.061***	-0.001**	0.001	0.003
	(0.041)	(0.009)	(0.001)	(0.002)	(0.002)
Share of employment in the	-0.087***	-0.001	-0.004***	-0.003*	-0.005***
agriculture sector	(0.027)	(0.008)	(0.000)	(0.001)	(0.001)
Share of employment in the	-0.179***	0.050***	-0.001	-0.005**	-0.002
industrial sector	(0.036)	(0.014)	(0.001)	(0.002)	(0.002)
Share of prime-aged persons	0.044	0.047	0.001	0.032***	0.029***
(25-54)	(0.078)	(0.030)	(0.001)	(0.005)	(0.005)
Share of population with a primary	0.082***	-0.047***	0.001*	-0.003*	0.000
education or less	(0.023)	(0.007)	(0.000)	(0.001)	(0.001)
Natural log of GRP per capita	-0.055	-0.047	0.041***	0.116***	0.169***
(constant 2010 IDR)	(0.371)	(0.109)	(0.006)	(0.022)	(0.022)
Growth in GRP per capita	-0.010	-0.014	0.001	-0.002	-0.000
	(0.043)	(0.009)	(0.001)	(0.002)	(0.003)
Number of observations	272	272	272	272	272
R-squared	0.766	0.737	0.792	0.741	0.770
Year dummies	Yes	Yes	Yes	Yes	Yes

Source: Author's calculations using Sakernas data

Notes: Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Table 3: Relationship between the formal employment rate of older persons (55-64) and labor market outcomes of youth (15-24)

	(1) Youth Formal employment	(2) Youth Unemployment	(3) Youth Hours of work (log)	(4) Youth Hourly wage (log)	(5) Youth Monthly income (log)
Formal employment rate of old	0.299***	-0.009	-0.000	0.013***	0.013***
persons (55-64)	(0.115)	(0.094)	(0.001)	(0.003)	(0.004)
Natural log of hourly income of	12.524***	6.330***	0.043*		
youth (15-24)	(2.323)	(2.112)	(0.025)		
Unemployment rate			0.021***	0.032***	0.048***
			(0.003)	(0.009)	(0.010)
Poverty rate	-0.067	-0.011	-0.004***	0.003	0.002
	(0.072)	(0.052)	(0.001)	(0.003)	(0.003)
Share of employment in the	-0.508***	-0.129***	-0.002***	-0.001	-0.002
agriculture sector	(0.056)	(0.049)	(0.001)	(0.002)	(0.002)
Share of employment in the	0.243**	0.033	0.001	0.002	0.005*
industrial sector	(0.115)	(0.081)	(0.001)	(0.003)	(0.003)
Share of youth (15-24)	-0.815***	0.247	-0.010***	-0.005	-0.007
	(0.193)	(0.199)	(0.002)	(0.006)	(0.006)
Share of population with a primary	0.102*	-0.131**	0.001	0.003*	0.006***
education or less	(0.060)	(0.055)	(0.001)	(0.002)	(0.002)
Natural log of GRP per capita	2.829***	-1.863*	0.040***	0.204***	0.262***
(constant 2010 IDR)	(0.929)	(0.962)	(0.010)	(0.026)	(0.030)
Growth in GRP per capita	-0.020	0.007	0.002**	-0.000	0.004
	(0.088)	(0.056)	(0.001)	(0.004)	(0.006)
Number of observations	238	238	238	238	238
R-squared	0.854	0.357	0.794	0.703	0.727
Year dummies	Yes	Yes	Yes	Yes	Yes

Source: Author's calculations using Sakernas data

Notes: Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Table 4: Relationship between the formal employment rate of older persons (55-64) and labor market outcomes of prime-aged persons (25-54)

	(1) Prime Formal employment	(2) Prime Unemployment	(3) Prime Hours of work (log)	(4) Prime Hourly wage (log)	(5) Prime Monthly income (log)
Formal employment rate of old	0.684***	0.024	0.000	0.009***	0.010***
persons (55-64)	(0.077)	(0.015)	(0.001)	(0.003)	(0.004)
Natural log of hourly income of	8.028***	0.334	-0.059**		
prime-aged persons (25-54)	(2.044)	(0.387)	(0.023)		
Unemployment rate			0.004*	0.012*	0.023***
			(0.002)	(0.006)	(0.007)
Poverty rate	0.029	0.034***	-0.001**	-0.001	0.001
	(0.045)	(0.009)	(0.001)	(0.002)	(0.002)
Share of employment in the	-0.219***	-0.007	-0.004***	-0.002	-0.005***
agriculture sector	(0.035)	(0.008)	(0.000)	(0.002)	(0.002)
Share of employment in the	0.095	0.044***	-0.001	-0.005*	-0.003
industrial sector	(0.061)	(0.012)	(0.001)	(0.003)	(0.003)
Share of prime-aged persons	0.185	0.076*	0.001	0.027***	0.024***
(25-54)	(0.162)	(0.039)	(0.001)	(0.005)	(0.005)
Share of population with a primary	-0.109***	-0.045***	0.001	0.000	0.002
education or less	(0.036)	(0.008)	(0.001)	(0.002)	(0.001)
Natural log of GRP per capita	0.743	-0.028	0.039***	0.115***	0.162***
(constant 2010 IDR)	(0.604)	(0.111)	(0.007)	(0.021)	(0.023)
Growth in GRP per capita	0.015	-0.022**	0.001	0.003	0.004
	(0.048)	(0.010)	(0.001)	(0.003)	(0.004)
Number of observations	238	238	238	238	238
R-squared	0.893	0.569	0.780	0.769	0.786
Year dummies	Yes	Yes	Yes	Yes	Yes

Source: Author's calculations using Sakernas data

Notes: Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Table 5: Relationship between the employment rate of older persons (55-64) and youth (15-24) and prime-aged persons (25-54) by sector

	(1) Youth Agriculture	(2) Youth Industry	(3) Youth Services	(4) Prime-aged Agriculture	(5) Prime-aged Industry	(6) Prime-aged Services
Employment rate of old	1.312***	-0.274	0.518**	0.409**	-0.022	0.174**
persons in the relevant sector	(0.416)	(0.200)	(0.244)	(0.179)	(0.085)	(0.069)
Natural log of hourly income of	0.839*	0.274	0.226	0.256	0.103	-0.011
younger persons (15-24/25-54)	(0.474)	(0.246)	(0.173)	(0.158)	(0.087)	(0.052)
Poverty rate	-0.052**	-0.010	-0.006	-0.012**	-0.000	0.004*
	(0.023)	(0.010)	(0.008)	(0.006)	(0.004)	(0.002)
Share of employment in the	0.021	0.004	-0.005	0.010**	0.001	0.003*
relevant sector	(0.013)	(0.008)	(0.009)	(0.004)	(0.002)	(0.002)
Share of population of younger	0.153*	0.021	0.011	0.019*	-0.012	0.009*
persons (15-24/25-54)	(0.087)	(0.023)	(0.021)	(0.009)	(0.010)	(0.005)
Share of population with a primary	0.021	0.018**	-0.006	0.000	-0.001	-0.000
education or less	(0.023)	(0.008)	(0.007)	(0.004)	(0.003)	(0.002)
GRP per capita (constant 2010 IDR)	0.402*	0.113	0.037	-0.037	0.030	-0.060**
	(0.239)	(0.142)	(0.102)	(0.100)	(0.035)	(0.026)
Growth in GRP per capita	-0.009	-0.014	-0.006	-0.001	0.000	0.002
	(0.013)	(0.009)	(0.011)	(0.006)	(0.001)	(0.002)
Observations	271	272	272	272	272	272
R-squared	0.589	0.489	0.837	0.561	0.393	0.837
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes

Source: Author's calculations using Sakernas data

Notes: Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 6: Relationship between the formal employment rate of older persons (55-64) and formal employment rate of youth (15-24) and prime-aged persons (25-54) by sector

	(1) Youth Agriculture	(2) Youth Industry	(3) Youth Services	(4) Prime-aged Agriculture	(5) Prime-aged Industry	(6) Prime-aged Services
Formal employment rate of old	0.460	0.878***	0.224***	1.037***	0.817***	0.600***
persons in the relevant sector	(0.691)	(0.184)	(0.054)	(0.344)	(0.103)	(0.059)
Natural log of hourly income of	0.592	7.313*	12.003***	1.554	2.375	13.054***
younger persons (15-24/25-54)	(1.723)	(4.363)	(1.922)	(2.355)	(3.309)	(2.471)
Poverty rate	-0.401***	0.124	0.010	-0.359***	0.036	0.309***
	(0.108)	(0.178)	(0.074)	(0.065)	(0.112)	(0.060)
Share of employment in the	0.006	1.295***	0.420***	0.092***	0.738***	0.114*
relevant sector	(0.063)	(0.171)	(0.059)	(0.031)	(0.094)	(0.062)
Share of population of younger	0.412**	-1.306***	-0.749***	0.048	0.839**	-0.059
persons (15-24/25-54)	(0.209)	(0.431)	(0.191)	(0.229)	(0.339)	(0.188)
Share of population with a primary	0.116**	-0.138	0.198***	-0.035	-0.083	0.011
education or less	(0.048)	(0.105)	(0.065)	(0.039)	(0.072)	(0.062)
GRP per capita (constant 2010 IDR)	6.185***	9.455***	1.919**	3.799***	8.834***	-0.013
	(2.124)	(2.471)	(0.886)	(1.043)	(1.467)	(1.000)
Growth in GRP per capita	-0.113	-0.137	0.159	-0.154**	-0.190	0.050
	(0.097)	(0.205)	(0.120)	(0.071)	(0.128)	(0.079)
Observations	237	238	238	238	238	238
R-squared	0.309	0.721	0.677	0.580	0.820	0.718
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes

Source: Author's calculations using Sakernas data

Notes: Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1

Table 7: Relationship between the employment rate of older persons (55-64) and the employment rate of youth (15-24) and prime-aged persons (25-54) by education level

	(1) Youth Primary	(2) Youth Secondary	(3) Youth Tertiary	(4) Prime-aged Primary	(5) Prime-aged Secondary	(6) Prime-aged Tertiary
Employment rate of old persons	0.106	0.355***	0.267***	0.634***	0.468***	0.169***
(55-64)	(0.126)	(0.051)	(0.088)	(0.050)	(0.048)	(0.026)
Natural log of hourly income of	-2.192	-2.427	-0.357	0.320	-2.885**	-0.990
younger persons (15-24/25-54)	(2.530)	(1.706)	(1.923)	(1.767)	(1.422)	(0.988)
Poverty rate	-0.146	-0.165***	-0.020	-0.016	-0.042	-0.029
	(0.092)	(0.053)	(0.104)	(0.061)	(0.039)	(0.036)
Share of employment in the	0.191**	0.028	-0.289***	0.007	-0.109***	-0.060**
agriculture sector	(0.088)	(0.052)	(0.081)	(0.036)	(0.038)	(0.028)
Share of employment in the	-0.252*	0.191**	-0.054	-0.129**	-0.186***	-0.070
industrial sector	(0.149)	(0.082)	(0.172)	(0.056)	(0.052)	(0.045)
Share of population with a	0.510***	0.218***	0.443***	0.038	0.166***	0.239***
primary education or less	(0.078)	(0.051)	(0.094)	(0.029)	(0.033)	(0.030)
Natural log of GRP per capita	2.000*	3.645***	5.071***	0.228	0.266	-0.045
(constant 2010 IDR)	(1.140)	(0.628)	(1.466)	(0.533)	(0.468)	(0.403)
Growth in GRP per capita	-0.040	-0.164**	-0.149	-0.074	-0.003	0.069*
	(0.090)	(0.066)	(0.118)	(0.056)	(0.042)	(0.040)
Number of observations	272	272	272	272	272	272
R-squared	0.530	0.406	0.292	0.754	0.590	0.527
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes

Source: Author's calculations using Sakernas data

Notes: Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Table 8: Relationship between the employment rate of older persons (55-64) and hours worked by youth (15-24) and prime-aged persons (25-54) by education level

	(1) Youth Primary	(2) Youth Secondary	(3) Youth Tertiary	(4) Prime-aged Primary	(5) Prime-aged Secondary	(6) Prime-aged Tertiary
Employment rate of old persons	-0.002	-0.002*	-0.000	-0.001	-0.002***	-0.001***
(55-64)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)
Natural log of hourly income of	-0.081***	0.040*	-0.023	-0.076***	0.004	-0.071***
youth (15-24)	(0.031)	(0.023)	(0.029)	(0.022)	(0.018)	(0.021)
Unemployment rate	0.008	0.013***	0.003	0.000	-0.000	0.000
	(0.006)	(0.004)	(0.004)	(0.003)	(0.003)	(0.003)
Poverty rate	-0.005***	-0.003***	0.002*	-0.002**	0.000	0.000
	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Share of employment in the	-0.005***	-0.002***	-0.002*	-0.006***	-0.002***	-0.002***
agriculture sector	(0.001)	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)
Share of employment in the	-0.001	0.002*	0.002	-0.003***	0.000	0.001
industrial sector	(0.002)	(0.001)	(0.002)	(0.001)	(0.001)	(0.001)
Share of population with a	0.003***	0.002**	0.002**	0.002***	0.001	0.002***
primary education or less	(0.001)	(0.001)	(0.001)	(0.000)	(0.001)	(0.001)
Natural log of GRP per capita	0.069***	0.058***	0.068***	0.045***	0.039***	0.037***
(constant 2010 IDR)	(0.015)	(0.009)	(0.013)	(0.008)	(0.007)	(0.007)
Growth in GRP per capita	0.003*	0.001	-0.000	0.000	0.001	0.001
	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)	(0.001)
Number of observations	272	272	272	272	272	272
R-squared	0.672	0.746	0.464	0.805	0.755	0.675
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes

Source: Author's calculations using Sakernas data

Notes: Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Table 9: Relationship between the employment rate of older women (55-64) and the employment rate of younger women by age group

	(1)	(2)	(3)	(4)
	15-24	25-34	35-44	45-54
Employment rate of old women (55-64)	0.416***	0.738***	0.777***	0.849***
	(0.056)	(0.057)	(0.052)	(0.034)
Poverty rate	0.005	0.070	-0.076	-0.180***
	(0.103)	(0.102)	(0.084)	(0.051)
Share of employment in the	-0.027	-0.266***	0.004	-0.025
agriculture sector	(0.073)	(0.059)	(0.048)	(0.039)
Share of employment in the	0.231**	-0.353***	-0.159**	-0.213***
industrial sector	(0.112)	(0.091)	(0.069)	(0.066)
Share of younger women	-0.275	0.325*	0.327	-0.548*
(15-24/25-34/35-44/45-54)	(0.202)	(0.182)	(0.280)	(0.293)
Share of population with a primary	0.192***	0.197***	0.092**	0.066
education or less	(0.067)	(0.052)	(0.042)	(0.043)
Natural log of GRP per capita	6.703***	2.424***	-0.141	-0.627
(constant 2010 IDR)	(0.985)	(0.829)	(0.824)	(0.571)
Growth in GRP per capita	-0.308***	-0.070	-0.003	-0.084
	(0.103)	(0.102)	(0.059)	(0.069)
Number of observations	272	272	272	272
R-squared	0.422	0.648	0.791	0.865
Year dummies	Yes	Yes	Yes	Yes

Source: Author's calculations using Sakernas data

Notes: Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Table 10: Relationship between the employment rate of older women (55-64) and the natural log of hours worked by younger women by age group

	(1)	(2)	(3)	(4)
	15-24	25-34	35-44	45-54
Employment rate of old women (55-64)	-0.004***	-0.001	0.002***	0.001**
	(0.001)	(0.001)	(0.000)	(0.000)
Poverty rate	-0.003***	0.000	-0.001*	0.001
	(0.001)	(0.001)	(0.001)	(0.001)
Share of employment in the	-0.001	-0.004***	-0.005***	-0.005***
agriculture sector	(0.001)	(0.001)	(0.001)	(0.001)
Share of employment in the	0.004***	-0.000	-0.001	-0.002*
industrial sector	(0.001)	(0.001)	(0.001)	(0.001)
Share of younger women	-0.016***	-0.007***	0.004	0.008**
(15-24/25-34/35-44/45-54)	(0.003)	(0.002)	(0.003)	(0.004)
Share of population with a primary	-0.001	0.001*	0.002***	0.001
education or less	(0.001)	(0.001)	(0.001)	(0.001)
Natural log of GRP per capita	0.071***	0.052***	0.050***	0.046***
(constant 2010 IDR)	(0.011)	(0.009)	(0.007)	(0.008)
Growth in GRP per capita	-0.000	0.001	0.000	-0.000
	(0.001)	(0.001)	(0.001)	(0.001)
Number of observations	272	272	272	272
R-squared	0.740	0.658	0.719	0.726
Year dummies	Yes	Yes	Yes	Yes

Source: Author's calculations using Sakernas data

Notes: Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Table 11: Robustness tests – Relationship between the employment rate of older persons (55-64) and the labor market outcomes of youth (15-24)

	(1) Youth Employment	(2) Youth Unemployment	(3) Youth Hours of work (log)	(4) Youth Hourly wage (log)	(5) Youth Monthly income (log)
Generalized least squares					
Employment rate of old persons	0.492***	-0.509***	-0.002**	-0.001	-0.004
(55-64)	(0.058)	(0.055)	(0.001)	(0.003)	(0.003)
Lagged independent variable					
Lag of employment rate of old	0.406***	-0.491***	-0.001	-0.003	-0.005*
persons (T-2) (55-64)	(0.071)	(0.073)	(0.001)	(0.003)	(0.003)

Source: Author's calculations using Sakernas data

Notes: Province-level control variables included are the log of hourly income of youth (for models 1-3), the unemployment rate (for models (3-5), the poverty rate, share of employment in the agriculture sector, share of employment in the industrial sector, share of youth, share of population with a primary education or less, log of GRP per capita (constant 2010 IDR), and growth in GRP per capita . Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

Table 12: Robustness tests – Relationship between the employment rate of older persons (55-64) and the labor market outcomes of prime-aged persons (25-54)

	(1) Prime-aged Employment	(2) Prime-aged Unemployment	(3) Prime-aged Hours of work (log)	(4) Prime-aged Hourly wage (log)	(5) Prime-aged Monthly income (log)
Generalized least squares					
Employment rate of old persons	0.665***	-0.069***	0.000	-0.002	-0.002
(55-64)	(0.031)	(0.011)	(0.001)	(0.002)	(0.002)
Lagged independent variable					
Lag of employment rate of old	0.505***	-0.077***	0.001	-0.003*	-0.002
persons (T-2) (55-64)	(0.053)	(0.011)	(0.001)	(0.002)	(0.002)

Source: Author's calculations using Sakernas data

Notes: Province-level control variables included are the log of hourly income of prime-aged persons (for models 1-3), the unemployment rate (for models (3-5), the poverty rate, share of employment in the agriculture sector, share of employment in the industrial sector, share of prime-aged persons, share of population with a primary education or less, log of GRP per capita (constant 2010 IDR), and growth in GRP per capita . Robust standard errors in parentheses. ***p<0.01, **p<0.05, *p<0.1.

6 Summary of findings and conclusion

The findings in this paper show that generally an increase in the employment rate of older persons is significantly associated with an increase in the employment rate of youth and prime-aged persons. More specifically, an increase in the employment rate of older persons by 1 percentage point is associated with an increase in the employment rate of youth by 0.5 percentage points, and an increase in the employment rate of prime-aged persons by 0.7 percentage points. The positive relationship is robust and is found across most specifications tested, that is, across genders, education levels, and sectors. Moreover, positive relationships were also found between the formal employment rates of older and younger persons. When age groups for younger women was augmented – following the assumption that women's employment is more sensitive to stages in their lifecycle – significant positive relationships were found between the employment rate of older women and the employment rate of women in all age groups. In other cases, the coefficient is not statistically significant, suggesting no significant relationship between the employment of older persons and younger persons. Encouragingly, there is no evidence of a significant *negative* relationship between the employment of older persons and younger persons. This means that there is no evidence for the notion that there is a fixed number of jobs in an economy.

When there is a significant negative relationship between the employment of older persons and employment outcomes (other than the employment rate) of younger persons, the magnitude is small. The analysis found some evidence of significant negative relationships between the employment rate of older persons with the hours worked and income earned by younger persons. However, the coefficients are small, with the largest being 2 percent. Specifically, an increase in the employment rate of older men by one percentage point was found to be significantly associated with a decrease the monthly income of male youth by 2 percent. The magnitude of the significant negative coefficients reflecting the relationship between the employment rate of older persons with hours worked and income earned by other groups of workers are much smaller. Thus, while there may be negative relationships, the potential practical impacts are likely small.

There are several possible reasons for the positive relationship between the employment rates of older and younger workers, including that these workers are not substitutes. The productive characteristics of older and younger persons presented in Section 2 illustrate key differences between them. Among the main differences is that younger persons are more highly educated than older persons. Formal education aside, older workers are more likely to have accumulated job-specific and managerial skills, while younger workers may be more adept in technical skills. This provides younger workers with access to different types of jobs compared to older persons. For this same reason, younger workers are also more likely to be formally employed. Other than that, the positive relationship may stem from the fact that a growing economy that provides employment opportunities for older workers has more opportunities for *all* workers. Importantly, the number of jobs in an economy is not fixed and can grow with the economy.

These findings support Indonesia's agenda of increasing the retirement age. The increasing share of older persons, their rising life expectancy, their vulnerability, and the lack of coverage and adequacy of social assistance and social insurance programs create the need for older persons to work longer to support their livelihoods. In the long run, there will also be a need to address the sustainability of the pension system (Holmemo et al. 2020), as well as a decline in GDP growth resulting from a decline in the working age population. Even though the retirement age only affects formally employed workers or those covered by the pension system, it sends an important signal to

the labor market on the productive capacity of older people and the importance of hiring and retaining them.

Increasing educational attainment and rapid technological advancements will increase future employment opportunities that are more compatible with the preferences and abilities of older persons. At present, older workers in Indonesia are more likely to be informally employed in the agriculture sector, which is a sector that typically requires low levels of formal education and intense physical effort. Based on research in the United States, these types of jobs are not "age friendly" (Acemoglu, Mühlbach and Scott 2022). Instead, age friendly jobs should encourage older workers to use their soft skills, should offer the opportunity for flexible working, should offer autonomy and discretion rather than close management and supervision, and provide an environment that is inclusive and supportive (Acemoglu et al. 2022). With increasing educational attainment and the development of skills that complement technology, there is the possibility for older persons of the future to attain jobs that are more compatible with their preferences and abilities.

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Annex 1: Descriptive statistics

Table A1: Descriptive statistics of main variables between provinces over time (2016-2023)

	Mean	Std deviation	Min	Max
All young (15-24)				
Employment rate (%)	39.0	4.9	22.9	52.3
Formal employment rate (%)	24.2	12.8	4.3	63.8
Unemployment rate (%)	14.5	5.2	4.6	30.3
Hours worked last week	37.2	4.1	26.8	48.3
Monthly income (million IDR)	1.8	0.5	0.9	3.8
Hourly wage (ten thousand IDR)	1.1	0.3	0.6	2.0
All prime-aged (25-54)				
Employment rate (%)	76.8	4.3	66.2	88.4
Formal employment rate (%)	27.2	8.4	13.7	49.4
Unemployment rate (%)	2.4	1.1	0.5	7.8
Hours worked last week	40.6	3.0	31.6	50.2
Monthly income (million IDR)	2.5	0.6	1.6	5.1
Hourly wage (ten thousand IDR)	1.6	0.4	0.9	3.1
All old (55-64)				
Employment rate (%)	68.9	6.2	48.6	85.7
Formal employment rate (%)	13.0	5.0	4.5	36.3
Unemployment rate (%)	0.7	0.7	0.0	6.4
Hours worked last week	36.6	3.3	28.8	48.4
Monthly income (million IDR)	2.3	0.6	1.2	4.9
Hourly wage (ten thousand IDR)	1.8	0.6	0.8	5.5
Female, young (15-24)				
Employment rate (%)	30.7	6.3	15.4	50.1
Formal employment rate (%)	28.5	13.3	2.4	65.6
Unemployment rate (%)	16.0	6.2	3.2	39.9
Hours worked last week	35.8	4.8	23.4	51.8
Monthly income (million IDR)	1.6	0.6	0.8	3.7
Hourly wage (ten thousand IDR)	1.0	0.3	0.5	2.2
Female, prime-aged (25-54)				
Employment rate (%)	68.4	5.9	55.0	84.9
Formal employment rate (%)	28.1	8.5	11.7	51.1
Unemployment rate (%)	2.9	1.3	0.5	7.8
Hours worked last week	39.1	3.1	30.4	48.3
Monthly income (million IDR)	2.3	0.6	1.4	4.9
Hourly wage (ten thousand IDR)	1.5	0.3	0.8	3.0

Table A1 (continued): Descriptive statistics of main variables between provinces over time

	Mean	Std deviation	Min	Max
Female, old (55-64)				
Employment rate (%)	54.3	9.5	27.6	81.0
Formal employment rate (%)	10.4	5.0	0.0	41.1
Unemployment rate (%)	0.3	0.6	0.0	7.4
Hours worked last week	33.7	3.7	25.2	51.5
Monthly income (million IDR)	1.9	0.6	0.8	5.7
Hourly wage (ten thousand IDR)	1.7	0.6	0.6	5.7
Male, young (15-24)				
Employment rate (%)	46.9	6.2	30.0	63.8
Formal employment rate (%)	21.8	12.9	5.4	62.9
Unemployment rate (%)	13.7	5.5	3.5	29.4
Hours worked last week	38.1	3.9	28.2	48.0
Monthly income (million IDR)	1.9	0.5	1.0	3.9
Hourly wage (ten thousand IDR)	1.1	0.3	0.6	2.0
Male, prime-aged (25-54)				
Employment rate (%)	82.7	2.9	75.0	91.1
Formal employment rate (%)	29.2	9.2	15.0	53.3
Unemployment rate (%)	2.8	1.3	0.6	8.9
Hours worked last week	41.9	3.0	32.8	52.7
Monthly income (million IDR)	2.6	0.7	1.6	5.3
Hourly wage (ten thousand IDR)	1.6	0.4	0.9	3.1
Male, old (55-64)				
Employment rate (%)	82.8	4.6	66.0	92.4
Employment rate (%)	14.6	6.1	5.8	39.2
Formal employment rate (%)	0.9	0.8	0.0	5.7
Unemployment rate (%)	38.4	3.2	29.9	49.0
Hours worked last week	2.5	0.7	1.5	5.6
Monthly income (million IDR)	1.8	0.6	0.8	5.5

Table A3: Descriptive statistics of control variables between provinces over time

	Mean	Std deviation	Min	Max
Share of employment in the agriculture sector (%)	33.9	13.5	0.4	71.5
Share of employment in the industrial sector (%)	18.7	6.1	4.6	35.2
Share of employment in the services sector (%)	47.4	9.8	23.8	85.2
Share of population with a primary education or less (%)	37.4	8.4	13.8	57.4
Poverty rate (%)	10.7	5.6	3.5	28.5
Share of youth (15-24) (%)	22.9	2.1	17.7	29.1
Share of prime-aged persons (25-54) (%)	59.0	2.5	53.2	70.4
Share of old persons (55-64) (%)	10.7	1.6	6.0	14.5
Share of male youth (15-24) (%)	23.0	2.2	18.4	30.2
Share of prime-aged men (25-54) (%)	59.2	2.4	52.9	71.0
Share of old men (55-64) (%)	10.7	1.5	6.6	14.3
Share of female youth (15-24) (%)	22.7	2.1	17.0	28.6
Share of prime-aged women (25-54) (%)	58.8	2.7	52.3	69.9
Share of old women (55-64) (%)	10.6	1.7	5.3	14.8
GRP per capita (constant 2010 IDR)	43,156	32,319	11,469	192,133
Growth in GRP per capita (%)	2.9	4.4	-25.2	25.6