From Crisis to Recovery: Understanding the Impact of COVID-19 on Indonesian Employment Dynamics

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Abstract

This research analyzes the impact of the economic disruption caused by the COVID-19 pandemic on Indonesia's labor market by utilizing data from SAKERNAS, or the National Labor Force Survey, for 2020 and 2021. A logistic regression model is used to analyze the impact of sociodemographic factors, job-related variables, and the Kartu Prakerja (a pre-employment program focused on training and skill development) on unemployment, labor force participation, and reduced working hours caused by the economic disruption of COVID-19. The findings underscore the enduring repercussions of the pandemic on employment landscapes, with pronounced impacts observed among older workers, married individuals, less educated workers, and urban residents. The manufacturing and service sectors experienced more significant implications than agriculture, revealing sector-specific challenges. Kartu Prakerja influenced working hour reductions in 2021, showing the effects of evolving government intervention. Increased Internet use was linked to reduced working hours, signaling the need for accelerated digital skill programs for jobs dependent on Internet use.

Keywords

Decent work; employment; internet access; skill development; social protection

Introduction

The economic turmoil caused by the COVID-19 pandemic has impacted countries globally, including Indonesia. In 2020, COVID-19 was declared a global pandemic by the World Health Organization (WHO) after spreading worldwide from China. Countries implemented mobility restrictions to contain the virus, reducing global traffic for goods and people. This impacted various sectors, such as trade, industry, tourism, and transportation. The labor market was impacted severely. The International Labor Organization (ILO) (2020) reported a decline in global labor force participation to 58.7%, a 1.1% increase in open unemployment, and an 8.3% decrease in income (ILO, 2020). The same trend was observed in Indonesia, where the open unemployment rate increased by 1.84%, informal labor by 4.59%, and underemployment and part-time work by 3.77% and 3.42%, respectively. Additionally, wages decreased by 5.18% (BPS-Statistics Indonesia, 2020). A 2020 survey on the impact of the lockdown restrictions caused by the COVID-19 pandemic on businesses revealed that 2.52% of respondents were laid off, and 40% experienced reduced income. The sectors most affected were accommodation, food and beverage (92.47%), other services (90.9%), and transportation and warehousing (90.34%).

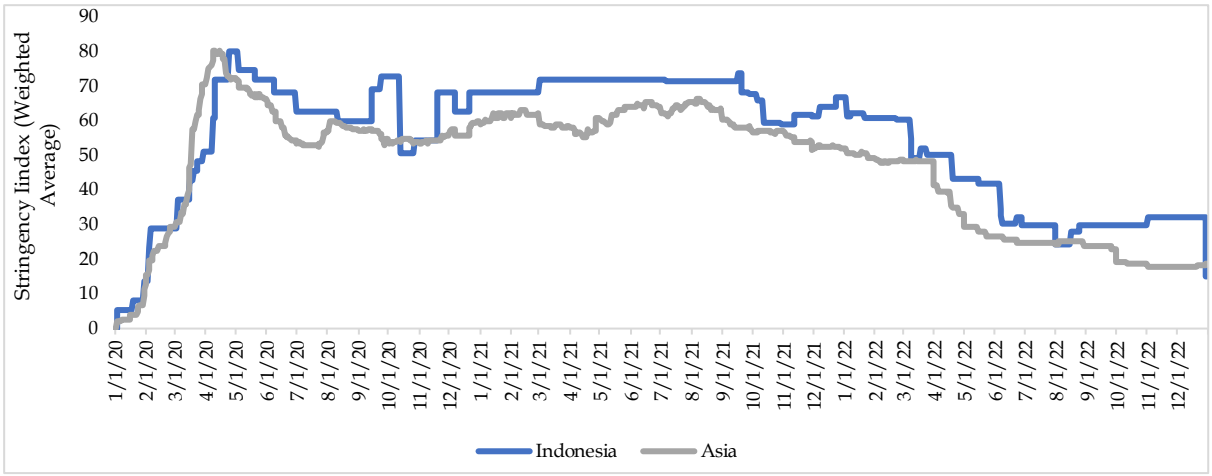
In developed countries, empirical research revealed that the short-time work (STW) scheme offered in Germany mitigated the risk among its workers compared to the United States and the United Kingdom. In contrast, informal workers in developing countries with weak employment contracts are more susceptible to job loss (Narula, 2020). Remote work was not feasible for most workers on temporary contracts. They were the hardest hit by the lockdown restrictions caused by the pandemic, followed by women with low levels of education (Adams-Prassl et al., 2020; Deléchat & Medina, 2021). In the United Kingdom and the United States, the most vulnerable groups were young workers, individuals with limited education, minority groups, and those unable to Work From Home (WFH). Similar results have been reported in South Africa (Jain et al., 2020; Ranchhod & Daniels, 2021), Russia (Kartseva & Kuznetsova, 2020), and India (Kapoor, 2020). In the United States, retail, recreation, and hospitality jobs declined, and there was a U-shaped relationship between age variables and job loss probability (Bartik et al., 2020). Similar results were reported by Allcott et al. (2020), Alon et al. (2020), Chetty et al. (2020), Cortes and Forsythe (2023), Goolsbee and Syverson (2021), Coven and Gupta (2020), Forsythe et al. (2020), Kurmann et al. (2020), Lin and Meissner (2020), McNabb et al. (2023), and Mongey et al. (2021). The lesson learned from the pandemic is that companies must retrain their workforce to remain resilient in a crisis. Skills and roles must be adapted to post-pandemic work methods.

In Indonesia, the COVID-19 pandemic began in March 2020, prompting the government to implement policies such as Large-Scale Social Restrictions (PSBB) to curb the spread of the virus (Khoirunurrofik et al., 2022). The reduction in economic activities during the PSBB has led to an economic downturn. In the second quarter of 2020, Indonesia's economy contracted by 5.32% year-on-year, which persisted in the third quarter. This has negatively impacted the labor market, with many workers furloughed and laid off (Putra et al., 2023). As a result, the unemployment rate increased from 5.23% in 2019 to 7.07% in 2020.

During the pandemic, many workers shifted to informal activities, as evidenced by the dominance of informal employment (60.47%), and to sectors with low productivity, such as agriculture. The BPS-Statistics Indonesia (2020) indicated that 29.12 million people (14.28%) of the working-age population were impacted by the lockdown restrictions caused by COVID-

19, including 2.56 million unemployed individuals, 0.76 million Non-in Labour Force, 1.77 million losing jobs due to the pandemic, and 24.03 million individuals experiencing reduced working hours.

Figure 1: Stringency Index (Weighted Average) Indonesia and Average Asian Peers



Note: Asian countries represented by Japan, Malaysia, Philippines, Singapore, South Korea, Thailand, and Vietnam; 0 to 100 with 100 = strictest

Figure 1 shows the stringency index, measuring the strictness of COVID-19 responses (e.g., school and workplace closures, travel bans) on a scale from 0 to 100. From early 2020 through 2022, Indonesia's stringency index generally remained higher than the average of the Asian countries, indicating stricter COVID-19 measures for a longer duration. Both indices peaked around the first half of 2020, reflecting the initial global response to the pandemic, and gradually decreased over time as restrictions were eased. The figure compares Indonesia and the average of Asian countries like Japan, Malaysia, the Philippines, Singapore, South Korea, Thailand, and Vietnam.

The impact of the economic disruption caused by the COVID-19 pandemic on employment can be viewed from several perspectives. Workers must adapt to changing circumstances (Pitoyo et al., 2021), and companies must learn how to help these workers adopt new roles and responsibilities. These dynamics are not only about remote work arrangements using technology or the importance of digitization but also about how policymakers can retrain and upskill the workforce to create new business models in the post-pandemic era (Sutarto et al., 2022). According to Dartanto et al. (2023), in Indonesia in 2020, about 65% of workers affected by layoffs during the pandemic had found employment again in the informal sector. The COVID-19 containment measures have had a lasting impact on the job market, with fewer opportunities in the formal sector. The formal workers who experienced job termination began selling goods or opening food stalls. Unfortunately, the increasing number of sellers was met with low purchasing power, which has yet to recover from the pandemic's effects (Elhan-Kayalar et al., 2022). This high supply but low demand has worsened the economic situation.

Initiated in 2020 during the COVID-19 pandemic, the Kartu Prakerja (Pre-employment card) program aimed to enhance workforce skills to improve employability, productivity, and entrepreneurship. This governmental response to the economic crisis targets job seekers, terminated workers, and individuals needing upskilling, including informal workers and micro-business owners (Pratomo et al., 2023). The Kartu Prakerja program has the potential

to help workers affected by the economic disruption caused by the COVID-19 pandemic acquire new skills for future employment (Rosyadi et al., 2022) and increase participation in the labor market (Al Ayyubi et al., 2023).

The COVID-19 lockdown measures impacted Indonesian workers and businesses in various ways. Studies show that female workers were particularly vulnerable (Dewi et al., 2023; Junaidi, 2023; Ridhwan et al., 2023). However, the pandemic spurred growth in the digital economy, primarily e-commerce, due to mobility restrictions and advancements in e-payment platforms (Kilay et al., 2022). Businesses expanded their digital presence, supported by government efforts in digital transformation and initiatives to enhance digital literacy and financial inclusion (Affandi et al., 2024). Increased Internet penetration and logistics improvements further accelerated e-commerce development (Trinugroho et al., 2022), helping to mitigate the economic decline. This growth supported the labor market by increasing informal sector working hours and reducing formal sector working hours for women (Ridhwan et al., 2023).

This study primarily analyzes changes in unemployment, non-labor force participation, and reduced working hours as significant impacts due to the economic downturn caused by the COVID-19 pandemic. Additionally, the research examines the social demographic and employment factors that support resilience against the pandemic's impact. The study utilizes the 2020 and 2021 National Labor Force Surveys [Survei Angkatan Kerja Nasional] (SAKERNAS), employing logistic regression to assess changes in unemployment, labor force non-participation, and reduced working hours due to the economic decline caused by the COVID-19 pandemic. Variables such as age, gender, marital status, residence area, and education are considered in the models. To analyze reduced working hours, job characteristics (employment sector, tenure, training, and Internet usage) and sociodemographic factors are considered. The analysis also focuses on Kartu Prakerja, a program initiated by the Indonesian government to provide skills training and financial assistance to workers impacted by the economic disruption caused by the COVID-19 pandemic.

The equilibrium business cycle model concept is employed to achieve our objective as it captures economic fluctuations due to shocks/disturbances to productivity (Schoder, 2020). When labor supply variables are incorporated, the model demonstrates how employment and working hours respond to these shocks (Brinca et al., 2021). Fluctuations in employment significantly influence real Gross Domestic Product (GDP), increasing during economic expansions and decreasing during contractions (Barro, 2008). Understanding labor markets' resilience and recovery factors from shocks, such as the COVID-19 pandemic, is crucial for formulating effective policy responses. The analysis encompasses the effects on employment, sectoral shifts, disparities across different demographic groups, and other factors essential for developing more adaptable and inclusive economies.

Our study contributes to the literature on economic fluctuations and labor dynamics by exploring the impact of shocks such as the economic disruption caused by the COVID-19 pandemic. We investigate the recovery trajectories, the structural changes in the labor market, and the differential impacts across demographic groups, industries, and regions. Additionally, we evaluate the effectiveness of policy interventions like employment support programs. Our study also delves into the interplay between technological advancements, labor market dynamics, and resilience to shocks. Finally, we address future challenges to labor market stability, such as remote work and gig employment.

The structure of this research is as follows. Section 2 outlines the literature review related to the impact of the lockdown restrictions caused by the COVID-19 pandemic on employment. Section 3 presents the data description and methodology. Section 4 outlines the results and discussion. Lastly, Section 5 provides conclusions and policy recommendations.

Literature review

Theoretical and empirical background

Economic fluctuations are assumed to result from shocks within an economy. A variable of this shock is technology, denoted by A, which is part of the production function $Y = A \cdot F(K, L)$. An increase in A enhances productivity, enabling more output Y with given capital and labor inputs K and L, while a decrease makes the economy less productive. The equilibrium business cycle model postulates that shocks cause economic fluctuations (Barro, 2008), affecting real GDP and macro variables like labor input L, measured by employment or working hours (Schoder, 2020).

Incorporating labor supply (Ls) into the production function captures the procyclical nature of labor input. Ls represents the labor households that are willing to supply at a given wage, fluctuating with economic conditions. Ls typically increases during economic booms due to higher labor force participation and decreases during recessions as participation rates fall. Therefore, Ls interacts with L, where actual labor input (L) is determined by the equilibrium between labor supply (Ls) and labor demand (Ld). This equilibrium reflects short-term employment variations driven by changes in technology (A) and aligns with observed variations in real GDP.

Therefore, the production function can be expanded to:

$$Y = A \cdot F(K, Ld(Ls))$$

Ld is influenced by Ls and wage rates, with changes in Ls directly affecting L and thus Y. Conversely, during downturns such as the COVID-19 pandemic, economic activity falls, akin to a recession, with shocks like reduced demand, supply chain issues, and labor market challenges decreasing both Ls and Ld, leading to a drop in L and subsequently Y, exacerbating the recession. By integrating this model with our study, we gain insights into labor market dynamics during the pandemic, characterized by lower participation and higher unemployment, demonstrating the theoretical framework's applicability in examining the economic effects of lockdown restrictions on labor markets.

Working hour losses are a term ILO (2020) used to describe the number of working hours lost owing to the confinement regulations caused by the COVID-19 pandemic. Globally, working-hour losses in 2020 amounted to 8.8% or 255 million full-time jobs. Furthermore, working hour losses are detailed by the ILO into several components: 1) employment loss (114 million), which is further divided into shifts to unemployment (33 million) and shifts to inactivity (81 million), 2) working hour reduction, and 3) labor income losses (3.7 trillion USD).

Numerous studies, such as by Adams-Prassl et al. (2020), have examined the pandemic's effects on labor dynamics and found differing impacts across the United States, the United

Kingdom, and Germany. The crisis affects workers differently, with non-permanent contract holders and those unable to WFH being more susceptible. Female workers with lower levels of education face notably higher risks. This research investigates the crisis' impact on working hours, income, and job loss. Adams-Prassl et al. (2020), noted that those unable to WFH in the United Kingdom and the United States are the most affected. Meanwhile, Bell and Blanchflower (2020) reported that young, less-educated workers and minority groups are also particularly vulnerable.

Bartik et al. (2020) observed a decline in hourly paid jobs in the United States, especially in the retail, recreation, and hospitality sectors. In the United States, studies such as those by Allcott et al. (2020), Chetty et al. (2020), Forsythe et al. (2020), Goolsbee and Syverson (2021), Kurmann et al. (2020), and Lin and Meissner (2020), also highlighted more significant employment effects due to social distancing in accommodation, entertainment, retail, and non-essential sectors compared to other industries. Similarly, Bartik et al. (2020) observed a U-shaped age pattern, indicating higher job loss for workers aged 65+ (14% increase) and 16–25 (8% increase) compared to those aged 26–37. Job retention rates differed by 11% between workers with and without a high school diploma. Black, Asian, and Hispanic workers were 4.8%, 5.4%, and 1.7% more likely to leave their jobs than white workers, respectively, in line with Cortes and Forsythe (2023) and Coven and Gupta (2020) in the United States. Married individuals had lower job loss rates, while women had higher rates. Similarly, in the United States, Alon et al. (2020) found that women experienced disproportionately negative impacts on employment compared to men, similar to less-educated, lower-income, and lower-asset workers, as noted by Mongey et al. (2021).

With a workforce exceeding 125 million in Indonesia, the COVID-19 pandemic has slowed economic growth due to government policies like PSBB. A survey by the Ministry of Manpower of the Republic of Indonesia (2022) found that 88% of companies were affected. The impacts varied from small businesses facing bankruptcy to large companies enacting layoffs (Rosyadi et al., 2022; Siregar et al., 2021; Temenggung et al., 2021). The PSBB also mandated remote work, but not all sectors, particularly those requiring blue-collar workers, can operate remotely. The government launched the 'Kartu Prakerja' program to provide online skills training and incentives to mitigate the impacts of the economic turmoil caused by the COVID-19 pandemic (Nguyen et al., 2023).

However, the 'Kartu Prakerja' program faces challenges, such as weak verification processes during registration, unclear completion indicators, and the tendency for people to use it for social assistance rather than skill improvement (Al Ayyubi et al., 2023). The program has positively impacted its participants (Nguyen et al., 2023), resulting in a 172% increase in training certificates for job searches, an 18% higher likelihood of finding new employment, an additional 122,500 IDR (7.50 USD) monthly income compared to non-participants and a 32% income increase for the previously unemployed and 33% for women relative to non-participants (Program Management Office of the Pre-Employment Card Program, 2021). Despite the challenges and shortcomings, the program has benefitted the participants.

Ridhwan et al. (2023) reported a decline in the labor force participation rate from 69–70% in February 2018 to 64.61% in 2021, due to the lockdown restrictions caused by the COVID-19 pandemic. The unemployment rate increased from 4.51% to 6.79% during this time. Ridhwan et al. (2023) also noted a shift in the economic structure, with an increasing number of workers in the informal sector, where women slightly outnumber men. Although e-commerce has created job opportunities for both genders in the informal sector (Kusumawardhani et al., 2023), it has not had the same impact on the formal sector. The pandemic and e-commerce

growth have led to disparities in working hours between men and women, with COVID-19 increasing working hours for both genders in the informal sector but reducing them in the formal sector.

Furthermore, the pandemic's effect on Indonesia's labor market, as Dartanto et al. (2023) reported, caused a lasting 'scarring effect' with diminished job opportunities in both formal and informal sectors. In 2020, about 65% of those who lost jobs due to the pandemic turned to informal employment, indicating a shift from formal to informal work (Pitoyo et al., 2021). Dartanto et al. (2023) found an increase in informal sector jobs due to the lockdown restrictions caused by the pandemic. However, the link between problem-solving skills and re-employment was negative and significant in 2020 but insignificant in 2021. Conversely, social skills were vital for re-employment, with a 60% increase in urban and a 52% increase in rural areas. For the 25–40 age group, social skills were significant for re-employment in 2020 but not in 2021, while the 15–24 age group showed a significant correlation. Digital literacy also positively and significantly impacted returning to work, although the effects varied by age group.

Dewi et al. (2023) found that the economic disruption caused by the COVID-19 pandemic disproportionately affected female workers in Indonesia's tourism sector, with cultural factors exacerbating their vulnerability. Work-family enrichment negatively impacted women's job satisfaction and intention to leave, while job satisfaction positively influenced their intent to stay. Job satisfaction also mediated the relationship between work-family enrichment and women's intent to leave. Junaidi (2023) observed that the pandemic increased household chores for women, reducing their economic contributions and income, evidenced by a decline in purchasing power for essentials. Putra et al. (2023) noted that the pandemic's income and job losses impacted male workers more severely, particularly younger males with lower levels of education, although the effect varied by region.

Jain et al. (2020) observed a 40% job reduction after one month of lockdown in South Africa, with the most severe impact affecting women, individuals with lower levels of education, manual and informal workers, and people living in poverty. Those still employed saw no income change, but there was a 5% income drop among those moving to paid leave. Ranchhod and Daniels (2020) noted that women, African/Black individuals, youth, and groups with lower levels of education were most vulnerable. In Russia, Kartseva and Kuznetsova (2020) reported that younger workers, those with lower education, and residents in regional centers faced the highest risk of income decline due to the pandemic, potentially impacting the wealth of about 40% of households.

Bartik et al. (2020) identified an increasing labor market disparity during the pandemic, with less-educated workers in agriculture, manufacturing, construction, trade, hotels, and restaurants most affected by lockdowns. Conversely, higher-educated individuals in remote-compatible sectors retained their jobs. Rimkute and Sugiharti (2022) observed varying impacts of job types on married women's labor market participation in Indonesia, influenced by socioeconomic factors and household technology. Digital skills positively affected women's participation in white-collar jobs but negatively impacted their involvement in blue-collar and agricultural work. Lack of household technology resulted in more inactive homemakers in the labor market.

The COVID-19 pandemic's movement restrictions significantly impacted the young workforce. Al Ayyubi et al. (2023) found that Indonesia's pre-employment card program boosted labor market participation, especially in the informal sector, but did not substantially

affect income. In India, women were seven times more likely to lose their jobs during the lockdown than men and eleven times more likely to remain unemployed post-lockdown (Abraham et al., 2022). Young workers and daily wage earners were also vulnerable, with education protecting male workers but making highly educated female workers more susceptible to job loss.

Chatterjee and Dev (2023) analyzed the effects of the lockdown restrictions caused by the COVID-19 pandemic on the Indian labor market using panel data to create a Labor Flow Diagram and Transition Matrix, tracking transitions between employment statuses and types of employment. The results indicated varied impacts among different groups, with uneven recovery influenced by education levels. An event study analysis showed men were more likely to secure full-time employment, a likelihood that increased with education. During the pandemic, this likelihood decreased for most groups but increased for those without education, regardless of gender. Post-restrictions, the probability remained high for men but returned to pre-pandemic levels for women.

In Indonesia, challenges come from the high rates of informal employment, low-skilled workforce, extensive labor market, and limited transitions. Sugiharti et al. (2022) reported that 56.34% of Indonesian workers are in informal activities, 30.58% in formal employment, with only 6.84% moving from informal to formal and 6.24% vice versa. Informal workers often resist transitioning to formal employment; however, work experience and certified training, especially in manufacturing, can facilitate this shift. The labor market disruption due to COVID-19 has been analyzed in terms of job loss, under-employment, re-employment, and transitions between employment, unemployment, and non-participation (Albanesi & Kim, 2021; Carrillo-Tudela et al., 2023; Fiaschi & Tealdi, 2023; Miranti et al., 2022).

Considering the previous studies outlined above, this study explores Indonesia's labor market complexities during the COVID-19 pandemic, considering workers' socioeconomic characteristics and government interventions.

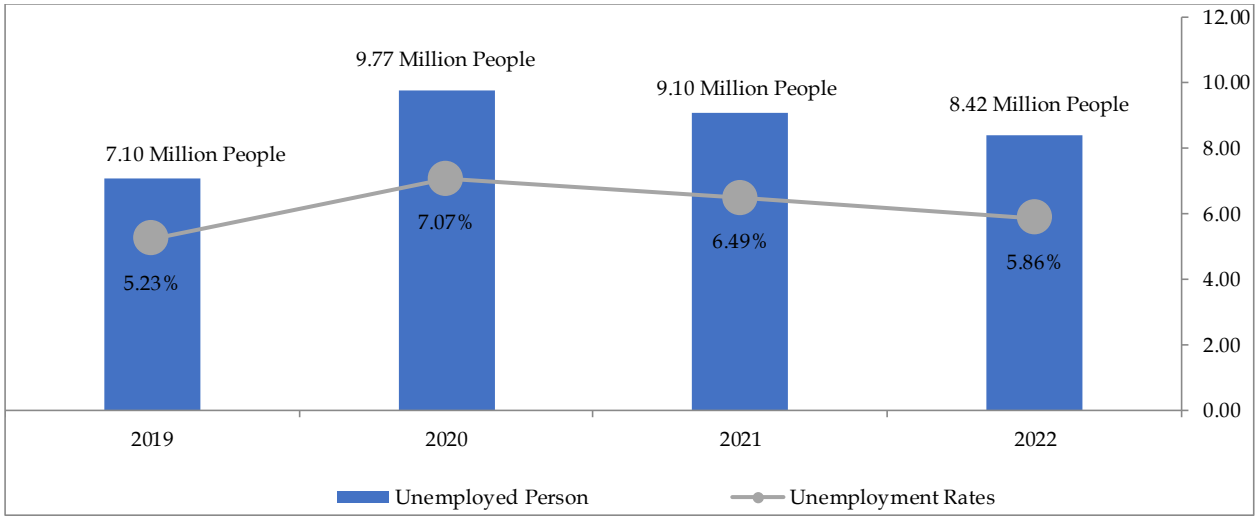
The labor market conditions in Indonesia

This section provides a descriptive analysis of labor market conditions in Indonesia, comparing indicators across three periods: pre-COVID-19 (2019), during the pandemic (2020–2021), and the endemic stage (2022). The goal is to assess the pandemic's impact on employment by reviewing various indicators. The pandemic has significantly affected employment, resulting in high unemployment, increased informal employment, higher under-employment, and declining average incomes. Young workers with limited experience face significant challenges. As such, the government has implemented programs like social assistance distribution to mitigate long-term effects. One of the programs, Kartu Prakerja, supported workers and Micro, Small, and Medium Enterprises (MSMEs) during the pandemic. The second part of the analysis describes the characteristics of the observation units.

Indonesia has faced three significant economic shocks affecting employment conditions: 1963, 1998, and 2020/2021. The 1963 shock was caused by hyperinflation and political instability, resulting in 119% inflation and a 2.24% GDP contraction. The 1998 shock stemmed from the Asian financial crisis, pushing unemployment to 5.7% (5.4 million unemployed) and causing a 13.13% GDP contraction and 77.63% inflation. The strict and prolonged lockdown restrictions during the COVID-19 pandemic in 2020 caused significant economic disruption,

resulting in fluctuating macroeconomic conditions, including a 2.07% GDP contraction in 2020 and a 3.65% growth in 2021. This volatility impacted the labor market, with unemployment rising from 5.23% in 2019 to 7.07% in 2020. Moreover, in 2021, the unemployment rate improved slightly to 6.49% but fell again in 2022 to 5.86% (Figure 2). This trend mirrors the global pattern: the unemployment rate was 5.5% in 2019, increased to 6.6% in 2020, and dropped to 6.2% by 2021 (World Bank Group, 2025). Despite reductions in unemployment numbers and rates in 2022 compared to the pandemic peak, they remained higher than pre-pandemic levels in 2019.

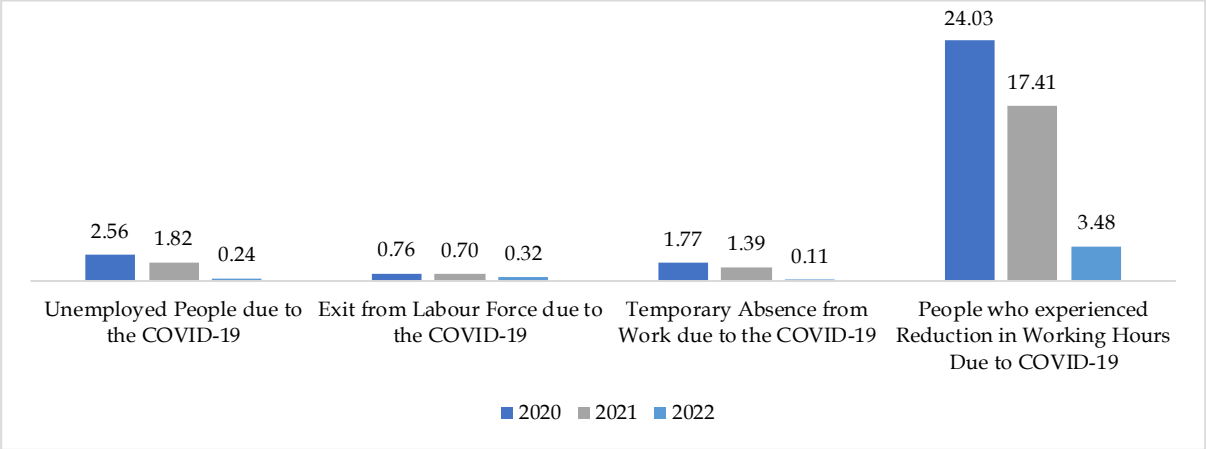
Figure 2: The Unemployment Rate and Unemployed People in Indonesia 2019–2022



Note: Data from BPS-Statistics Indonesia processed by the authors.

Unemployment remains a primary concern, and strategies such as reducing working hours or business operations must be considered. Additionally, those who quit their jobs and cannot find new employment, becoming inactive in the labor force, must be accounted for. The ILO recommends measuring temporary layoffs in labor force surveys to capture the lockdown impact of the COVID-19 pandemic. According to BPS-Statistics Indonesia, the number of individuals affected by the lockdown restrictions dropped from 29.12 million in 2020 to 21.32 million in 2021 and further to 4.15 million in 2022 (Figure 3). Most affected individuals (82–84%) experienced reduced working hours, while 6–9% faced job losses due to the economic disruption from the COVID-19 pandemic. Only 3–8% transitioned to inactive status, and 3–7% experienced temporary unemployment due to the economic disruption caused by COVID-19 (Figure 3).

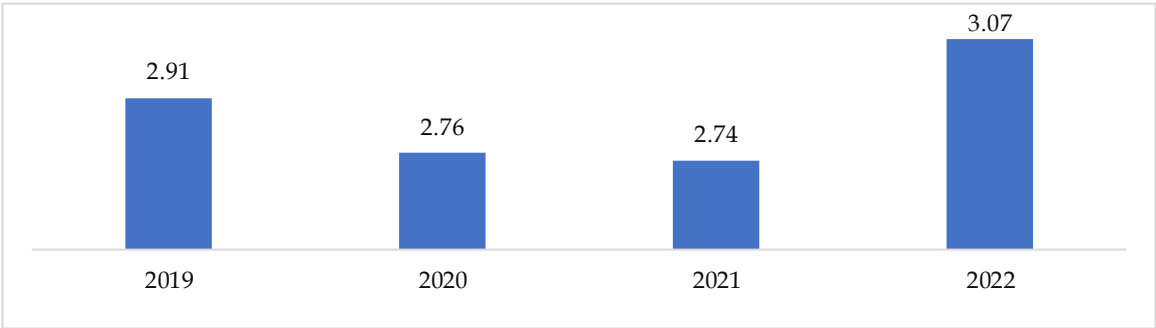
Figure 3: Population Affected by COVID-19, 2020–2022 (Millions of Individuals)



Note: Data from BPS-Statistics Indonesia processed by the authors.

During the COVID-19 pandemic, labor input composition is more susceptible to environmental changes than fixed capital stock (Cahuc et al., 2004). Companies adjusted costs by reducing staff, modifying working hours, cutting allowances and bonuses, hiring temporary workers, cross-training employees, implementing remote work, renegotiating salaries, and other efficiency measures. The average labor wage in Indonesia dropped from 2.91 million IDR in 2019 to 2.76 million in 2020 and 2.74 million in 2021 (Figure 4). It rebounded in 2022, rising by approximately 12.22% to 3.07 million IDR.

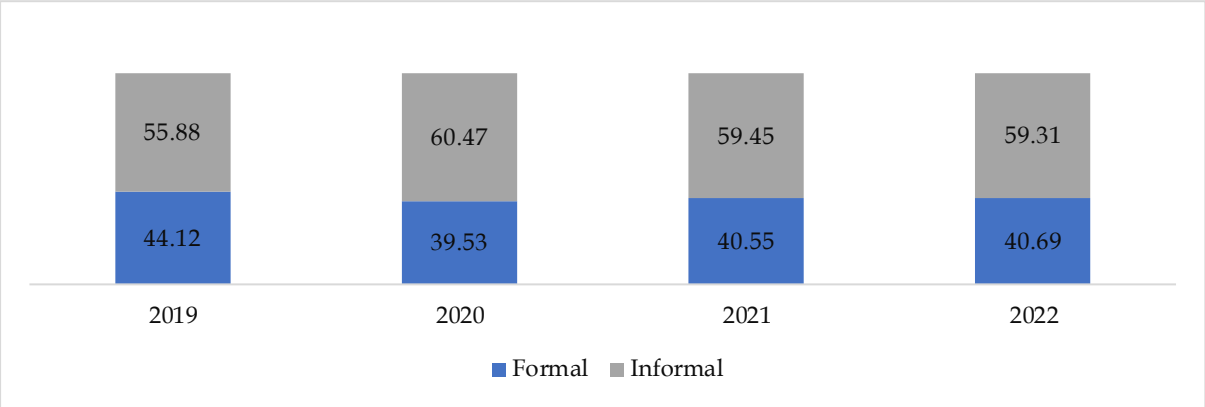
Figure 4: Average Labor Wage Trends 2019–2022 (Million IDR)



Note: Data from BPS-Statistics Indonesia processed by the authors; 1 USD = 16,275 IDR.

In 2020, 62% of the global workforce, or 2 billion out of 3.3 billion people, were in the informal sector. The pandemic affected nearly 1.6 billion individuals (Lee et al., 2020). In Indonesia, informal sector participation rose from 55.88% in 2019 to 60.47% in 2020, slightly decreasing to 60.35% in 2021 (Figure 5). Informal work often serves as a last resort for those facing job termination. It can supplement household income and be a crucial buffer during economic crises. In 2022, the informal workforce was expected to remain dominant, with a slight decrease of 0.14%.

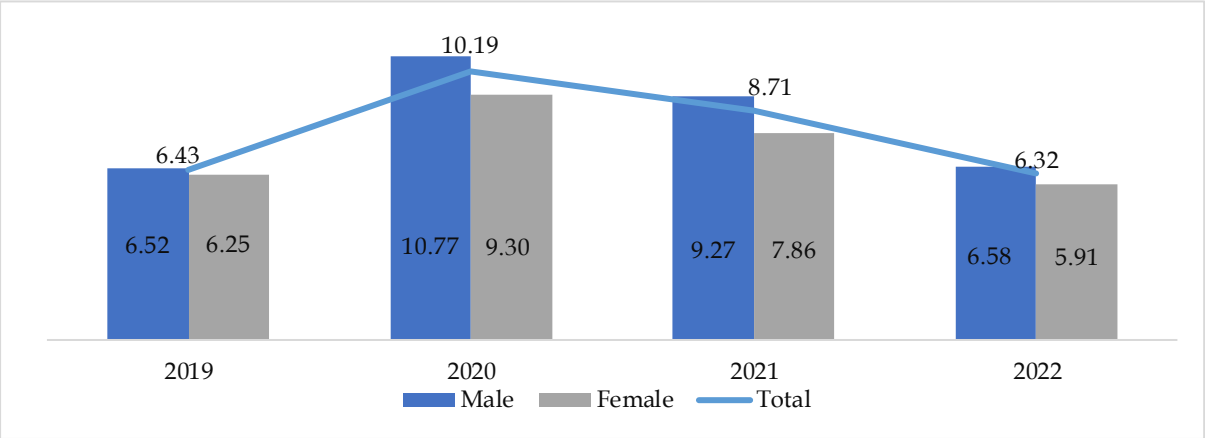
Figure 5: Changes in Employment Status in Formal and Informal Activities, 2019–2022 (Percentage)



Note: Data from BPS-Statistics Indonesia processed by the authors.

Underemployment refers to individuals working fewer than 35 hours per week seeking more work. In August 2022, the underemployment rate was 6.32%, meaning about six out of 100 employed individuals were underemployed (see Figure 6). This rate has returned to and even improved upon pre-COVID-19 levels. During 2020–2021, underemployment was higher due to social distancing and restricted operational hours, which reduced working hours while individuals still sought more work. From 2019 to 2022, the underemployment rate for males was consistently higher than for females, with a significant gap emerging between 2020–2021.

Figure 6: The Rate of Underemployment by Gender, 2019–2022 (Percentage)



Note: Data from BPS-Statistics Indonesia processed by the authors.

Data and methodology

This study leverages data from the August 2020 and 2021 National Labor Force Survey [Survei Angkatan Kerja Nasional] (SAKERNAS) conducted by BPS-Statistics Indonesia. The SAKERNAS is a survey conducted to collect employment indicators. The SAKERNAS is held twice yearly, in February and August, with different estimation levels. The February SAKERNAS has a sample size of approximately 75,000 households with estimates up to the provincial level, while the August SAKERNAS covers around 300,000 households with forecasts up to the district level. All individuals in the sampled households are recorded. The

August SAKERNAS is recommended for annual figures due to its larger sample size. In addition to general employment information, the 2020–2021 SAKERNAS also collected information regarding COVID-19's impact on the labor market. Variables related to the pandemic's impact were adapted from ILO recommendations for labor force survey data collection during the pandemic.

The study's analytical unit is the working-age population, defined as individuals aged 15 and above, categorized by employment status: unemployed, not in the labor force, and employed but with reduced working hours. The observations from the individual sample for 2020 and 2021 are as follows: 30,067 and 20,739 unemployed individuals, 251,547 and 180,435 not in the labor force individuals, and 119,452 and 67,345 employed individuals with reduced working hours. Since this study aims to explore relationships and patterns within the SAKERNAS sample, the data presented are based on individual-level observations processed without applying weights. In contrast, national-level figures, such as those in Table 2, are weighted by BPS-Statistics Indonesia to provide representative population estimates.

A logistic regression analysis was performed for 2020 and 2021. Equation (1) examines the factors influencing changes in unemployment, labor force participation, and reduced working hours due to the economic disruption caused by COVID-19. Unemployment related to COVID-19 is defined as individuals who were previously employed but became unemployed because of economic disruptions due to the pandemic. Not in the labor force due to the economic disruption refers to employed individuals who left the workforce triggered by the economic disruption. A reduction in working hours due to COVID-19 is defined as employed individuals experiencing decreased working hours compared to usual, resulting from the economic disruption caused by the pandemic. The impact due to the economic disruption caused by the COVID-19 pandemic is estimated using Equation (1):

$$Ln\left(\frac{p_{ni}}{1-p_{ni}}\right) = \beta_{ni0} + x_{nij}{}'\beta_{nij} + \varepsilon_{ni} \qquad (1)$$

Where n is set to 1 when assessing the influence of the COVID-19 pandemic on shifts in unemployment, 2 when evaluating its impact on changes in those not part of the labor force, and 3 when estimating its effect on changes in the number of working hours. The value of j ranges from one to k, where k represents the number of explanatory variables employed in each logistic regression model.

P_{1i} represents unemployment due to the impact of COVID-19, while 1-P1i represents unemployment recorded in SAKERNAS, not caused by the economic disruption caused by the COVID-19 pandemic. P_{2i} represents the notation for not being in the labor force due to the impact of COVID-19, while 1-P2i represents others not in the labor force, as recorded in SAKERNAS, not caused by the economic turmoil caused by COVID-19. P_{3i} represents workers experiencing a reduction in working hours due to the economic impact of COVID-19, while 1-P3i represents reductions in working hours due to other reasons recorded in SAKERNAS not caused by COVID-19. Additionally, ε_i represents the error in each model. In Models P_{1i} and P_{2i}, the explanatory variables used were sociodemographic variables, namely, age, gender, marital status, area of residence, and level of education. In Model P_{3i}, the explanatory variables used were sociodemographic variables and job characteristics: employment sector, tenure, training attended, Internet usage at work, and participation in the Kartu Prakerja program. To analyze the results, we used odds ratios and presented robust standard errors.

Logistic regression analysis is a robust tool for examining labor crises and evaluating government intervention programs, particularly highlighted during the COVID-19 pandemic. Its capability for modeling binary outcomes enables detailed analysis of labor market indicators like unemployment status and participation in support initiatives (Esquivias et al., 2021). The interpretability of logistic regression through log-odds ratios clarifies the impact of factors such as demographics, employment sector, and intervention program participation on outcomes like job retention or transition into formal employment (Sugiharti et al., 2022). Additionally, its flexibility with multiple predictors allows for an extensive exploration of the relations between socioeconomic factors and labor market dynamics (Esquivias et al., 2020). With robustness against multicollinearity and minimal assumptions, logistic regression offers a reliable framework for assessing the effectiveness of government interventions during labor crises, aiding policymakers in crafting informed and targeted economic recovery strategies.

Result and discussion

Table 1 presents a descriptive analysis of the study's observational units. In 2020, there were 401,066 units, decreasing to 268,519 in 2021. Males constituted approximately 58–59%, while females comprised 41–42%. Over half of the units resided in rural areas in 2020, but by 2021, the majority were in urban areas. About 75–76% were married. The study assessed participation in courses and training, with only 15–19% receiving training and certification in 2020–2021. It also reviewed involvement in the Kartu Prakerja/Pre-employment Card Program, designed to assist workers facing job termination due to the pandemic. Enrollment was below 1% in 2020, rising to 1.47% in 2021, likely due to the program's launch in April 2020, which limited initial awareness. Most individuals had intermediate education (high school level), over 50%, followed by high-level education at nearly 30%, and low-level education (primary) at 17–19%.

Our observation unit includes those employed but with reduced working hours due to the COVID-19 economic impact. We examine their Internet use for their primary job. In 2020, 35.47% used the Internet for their job, rising to 38.76% in 2021. Pandemic policies restricting public activities disrupted work mechanisms, shifting them to technology-based solutions. WFH and remote work arrangements have made the Internet essential. Those with reduced working hours due to lockdowns were in the services sector at 54%, followed by agriculture at 24–26% and manufacturing at around 21%.

Table 1: Observation Units According to Demographic Characteristics, Training, and Education

Characteristic		2020 (%)				2021 (%)			
		Total	**(1)**	**(2)**	**(3)**	**Total**	**(1)**	**(2)**	**(3)**
Gender	Female	59.77	36.87	71.43	41.03	61.52	38.09	71.51	41.95
	Male	40.23	63.13	28.57	58.97	38.48	61.91	28.49	58.05
Residence	Rural	51.70	41.46	53.05	51.44	49.44	37.89	50.65	49.76
	Urban	48.30	58.54	46.95	48.56	50.56	62.11	49.35	50.24
Marital Status	Single	42.19	61.89	48.39	24.22	44.26	64.12	50.20	22.24
	Married	57.81	38.11	51.61	75.78	55.74	35.88	49.80	77.76

Characteristic		2020 (%)				2021 (%)			
		Total	(1)	(2)	(3)	Total	(1)	(2)	(3)
Training/ Course Certification	Did not participate	88.25	83.72	92.30	80.86	91.68	89.19	94.33	85.36
	Participated	11.75	16.28	7.70	19.14	8.32	10.81	5.67	14.64
Enrolled in the Kartu Prakerja program/Pre-Employment Card	No	99.79	99.08	99.92	99.70	99.03	97.24	99.42	98.53
	Yes	0.21	0.92	0.08	0.30	0.97	2.76	0.58	1.47
Education	Low	60.82	36.50	68.05	51.76	62.35	39.85	67.77	54.74
	Intermediate	29.39	49.84	26.86	29.56	29.19	49.37	27.15	28.42
	High	9.79	13.66	5.09	18.68	8.47	10.78	5.07	16.84
Using the Internet in the Main Job	No	64.53			64.53	61.24			61.24
	Yes	35.47			35.47	38.76			38.76
Sector in the Main Job	Agriculture	24.49			24.49	26.42			26.42
	Manufacture	21.23			21.23	21.41			21.41
	Services	54.28			54.28	52.17			52.17
Total Observations		401,066	30,067	251,547	119,452	268,519	20,739	180,435	67,345

Note: SAKERNAS 2020–2021 processed by the authors; (1) Unemployment (%); (2) Not in Labor Force (%); (3) Working Hours Reduction (%)

The paper presents six models examining the economic effects of COVID-19 on unemployment, labor force non-participation, and reduced working hours in 2020 and 2021, comparing the first and second years of the pandemic. In 2021, there was some economic improvement over 2020. Logistic regression results reveal that several explanatory variables had differing probabilities between 2020 and 2021, indicating varied impacts. The Wald Test (full model) suggests that at least one variable significantly influences the model, with p-values below 1% for all models.

Economic disruption effects on unemployment

As seen in Table 2, the regression results show significant factors influencing unemployment due to COVID-19's economic disruption across 2020 and 2021. Age had a positive and significant effect on unemployment likelihood in 2020 (dy/dx = 0.0019), meaning each additional five years increased the probability of unemployment by about 1%. However, by 2021, this effect decreased (dy/dx = 0.0003), suggesting adaptations in hiring practices, with businesses possibly shifting to younger employees to cut labor costs (Fazlurrahman & Setyowati, 2023). Many older workers left the labor force altogether due to limited job prospects or health concerns (ILO, 2020).

Women were disproportionately affected. In 2020, men were 1.57% less likely than women to be unemployed due to the pandemic's economic impact (dy/dx = -0.0157). By 2021, this effect reversed, with men's unemployment increasing significantly (dy/dx = 0.0844), likely due to male-dominated industries experiencing more significant disruptions (Malahayati et al., 2021). Many women responded by turning to online work to support family finances,

illustrating a shift in economic roles during the pandemic (Dewi et al., 2023; Jain et al., 2020; Junaidi, 2023; Ridhwan et al., 2023).

Married individuals consistently faced higher unemployment risks, with increases of 6.96% in 2020 and 7.41% in 2021 compared to unmarried individuals (dy/dx = 0.0696, 0.0741). This may be due to caregiving responsibilities limiting their adaptability to changing work conditions (Sutarto et al., 2022). Disruptions in childcare services and schooling arrangements disproportionately affected married individuals, forcing many to prioritize family over job searching. Urban residency also affected unemployment, with urban residents 8.12% more likely to be unemployed in 2020, though this decreased to 3.83% in 2021 (dy/dx = 0.0812, 0.0383). This reflects the impact of stricter restrictions on urban service sectors in 2020, with some recovery by 2021.

Educational attainment also influenced unemployment. Individuals with lower education were 6.38% more likely to face unemployment in 2020 (dy/dx = 0.0638), though this weakened to 2.1% in 2021 (dy/dx = 0.021), likely as hiring adapted to favor skilled roles, in line with Putra et al. (2023). The economic downturn significantly impacted labor-intensive sectors, which employ lower-educated workers. The findings align with Mongey et al. (2021), who noted greater vulnerability to job loss among less-educated and lower-income workers in the United States due to the economic downturn. Intermediate education was also positively associated with unemployment in both years, with a higher effect in 2020 (dy/dx = 0.068) than in 2021 (dy/dx = 0.0408).

Table 2: Marginal Effects of Logistic Regression Estimation on COVID-19's Economic Disruption

Variable	Year 2020			Year 2021		
	Unemployment	Non-Labor Force	Reduction in Working Hours	Unemployment	Non-Labor Force	Reduction in Working Hours
	dy/dx (Delta-method SE)	*dy/dx (Delta-method SE)*	*dy/dx (Delta-method SE)*	*dy/dx (Delta-method SE)*	*dy/dx (Delta-method SE)*	*dy/dx (Delta-method SE)*
Age	0.0019*** (0.0002)	$2.2x10^{-5}$** ($9.61x10^{-6}$)	0.0001*** (-11.29)	0.0003 (0.0002)	0** (0)	-0.0011*** (0.0001)
Male	-0.0157*** (0.005)	0.0025*** (0.0005)	0.0024*** (4.48)	0.0844*** (0.0058)	0.0056*** (0.0007)	0.0085*** (0.0031)
Married	0.0696*** (0.0064)	0.0065*** (0.0005)	0.0028*** (8.86)	0.0741*** (0.0081)	0.0069*** (0.0006)	0.0276*** (0.0038)
Urban	0.0812*** (0.0048)	0.0049*** (0.0004)	0.0026*** (32.6)	0.0383*** (0.0056)	0.0055*** (0.0005)	0.1009*** (0.0035)
Low education	0.0638*** (0.0071)	-0.0057*** (0.001)	0.0047*** (-23.31)	0.021** (0.0091)	-0.0044*** (0.001)	-0.131*** (0.0064)
Intermediate education	0.068*** (0.0067)	-0.001 (0.001)	0.0044*** (-16.76)	0.0408*** (0.009)	0.002* (0.0011)	-0.0899*** (0.006)
Manufacturing Sector			0.0044*** (74.33)			0.3634*** (0.0058)
Service Sector			0.0042*** (96.92)			0.4536*** (0.0055)
Length of Employment			0.0001 (0.59)			0.0006*** (0.0002)
Enrolled Training			0.0039** (2.13)			0.0011 (0.0056)
Using the Internet			0.0032*** (26.59)			0.1137*** (0.0043)
Kartu Prakerja			0.0254 (0.13)			-0.0455*** (0.0147)
Number of observations (N)	30,067	251,547	119,452	20,739	180,435	67,345
Wald $\chi 2$	871.05	797.28	25,817.46	383.55	599.15	16,941.66
(prob.> $\chi 2$)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)

*Note: *, **, and *** denote the level of statistical significance of the coefficients, < .10, < .05, and < .01, respectively; The values in parentheses next to the coefficients represent their standard errors.*

Economic disruption effects on labor force non-participation

COVID-19 restrictions significantly influenced labor force non-participation, with age, gender, marital status, and urban residency showing the most notable effects. Age was associated with a slight increase in non-participation in 2020, possibly due to health concerns or caregiving responsibilities during the pandemic. Men showed a rising likelihood of exiting the labor force, increasing from 0.25% in 2020 (dy/dx = 0.0025) to 0.56% in 2021 (dy/dx = 0.0056), possibly due to job losses in male-dominated sectors or increased family responsibilities. Conversely, women's labor force participation rose in 2021 as many took on online work to support family incomes (Dunn et al., 2021).

Married individuals were more likely to leave the labor force, with non-participation likelihoods of 0.65% in 2020 and 0.69% in 2021 (dy/dx = 0.0065, 0.0069), likely due to added caregiving duties. Urban residency also impacted non-participation, increasing likelihood by 0.49% in 2020 and 0.55% in 2021 (dy/dx = 0.0049, 0.0055). The greater reliance on in-person jobs in urban areas and stricter lockdowns affected urban economic activity significantly. This impact left many urban workers unable to secure alternative sources of income, highlighting the higher vulnerability of urban economies to pandemic restrictions, as Putra et al. (2023) reported. Lower-educated workers were less likely to leave the labor force, while intermediate-educated workers showed higher non-participation in 2021, possibly due to challenges in transitioning to remote roles, in line with the findings of Adams-Prassl et al. (2020) and Deléchat and Medina (2021).

Economic disruption effects on reduced working hours

Reduced working hours were another significant outcome of the COVID-19 economic disruption, particularly in urban areas and specific employment sectors. In 2020, older workers were slightly more likely to have reduced hours (dy/dx = 0.0001). Still, by 2021, younger workers were more affected (dy/dx = -0.0011), possibly due to their representation in sectors that shifted to remote work (Eichhorst et al., 2020; International Labour Organization [ILO], 2021). Male workers experienced more significant reductions in both years (2020: dy/dx = 0.0024; 2021: dy/dx = 0.0085), likely due to male-dominated industries facing persistent pandemic restrictions. This finding aligns with the literature on labor during downturns (Doepke & Tertilt, 2016), where men are often more affected. However, in some countries (i.e., the United States), women experienced more significant reductions in working hours due to COVID-19 (Alon et al., 2020).

Married individuals faced intensified reductions in working hours, increasing from 0.28% in 2020 to 2.76% in 2021 (dy/dx = 0.0028, 0.0276). This may reflect the dual burden of work and caregiving during the pandemic. Urban residents also faced substantial impacts on working hours, with urban residency increasing hour reductions from 0.26% in 2020 (dy/dx = 0.0026) to 10.09% in 2021 (dy/dx = 0.1009), likely due to the economic disruption of urban service sectors. Workers with lower or intermediate education levels were less affected by hour reductions than higher-educated workers, as skilled, remote-eligible jobs were more prone to pandemic-related hour cuts. Moreover, workers with longer employment tenure faced more significant reductions in working hours, aligning with Cortes and Forsythe (2023), who found that the COVID-19 pandemic accelerated retirement for long-tenured workers in countries like the United States.

Workers in manufacturing and service sectors in 2021 were particularly impacted, with a 36.34% increase in reduced hours for manufacturing (dy/dx = 0.3634) and a 45.36% increase for service workers (dy/dx = 0.4536), underscoring the pandemic vulnerability of these in-person sectors. In Indonesia and the United States, studies such as those by Allcott et al. (2020), Bartik et al. (2020), Chetty et al. (2020), Dewi et al. (2023), Goolsbee and Syverson (2021), and Forsythe et al. (2020) also noted more significant adverse economic effects of COVID-19 on service sector employment.

Internet use notably affected reduced working hours, particularly in 2021 (dy/dx = 0.1137), as remote jobs became more susceptible to workload reductions. A possible explanation for reduced working hours among internet-using workers is the mismatch between job requirements for digital skills and workers' actual abilities. As jobs become more digital in Indonesia, workers lacking these skills face reduced hours. This aligns with Dartanto et al. (2023), who emphasize the need for digital literacy in post-pandemic reemployment and call for government support to bridge skill gaps.

Changes in the employment landscape (2020–2021)

In 2020, the economic effects of COVID-19 increased non-labor force participation and reduced working hours, especially among older individuals, urban residents, and men. Men exited the workforce at higher rates, while married individuals experienced more reductions in working hours, likely due to increased caregiving responsibilities. Urban areas with service-driven economies saw more people leave the labor force and face hour reductions as lockdowns impacted in-person jobs, in line with Bartik et al. (2020).

In 2021, the employment landscape shifted. Unemployment rose among men, and younger workers saw more hour reductions, in line with Putra et al. (2023), reflecting the changing demands of remote work. Non-labor force participation remained elevated for married individuals and urban residents but showed some decrease. Education also played a role; workers with lower education were less likely to leave the labor force, while those with intermediate education faced more significant challenges adapting. The Kartu Prakerja program in 2021 helped participants retain their working hours, contributing positively to job stability. These trends illustrate how COVID-19's impact evolved, affecting different demographics and regions.

Conclusion and policy implications

The empirical analysis sheds light on the diverse impacts of COVID-19's economic disruption on Indonesia's labor market dynamics and the effectiveness of the Kartu Prakerja program. The descriptive analysis of labor market indicators across different periods reveals a lingering scarring effect of the economic turmoil caused by COVID-19 on employment, characterized by persistently high unemployment rates, increased informal employment, rising under-employment, and declining average income. Furthermore, the intense vulnerability of some groups of workers in the job market (i.e., older people, urban workers, and lower education workers) indicates the long-term repercussions of the pandemic on Indonesia's workforce.

To address the negative consequences of the economic disruption caused by the COVID-19 pandemic, the government has introduced several programs, including the Kartu Prakerja

initiative. Despite these efforts, certain groups, such as older, less educated, and urban individuals, are disproportionately affected by unemployment, reduced working hours, and non-labor force participation. Married workers may face additional challenges due to family responsibilities and financial strain. These disparities indicate a widening gap in employment opportunities and access to stable employment based on educational attainment. This can result in social exclusion for individuals with limited education. Therefore, educational attainment is crucial in enhancing employability and economic resilience. Higher education typically leads to improved skills and qualifications, making individuals more competitive in the job market and better equipped to handle economic changes.

Urban workers were more likely to leave the labor force due to lockdown restrictions from COVID-19 compared to rural workers, highlighting the need for targeted policy interventions to address the unique challenges urban workers face. While the manufacturing and service sectors experienced significant reductions in working hours, workers in the agricultural industry faced fewer impacts. Variables such as Internet usage at work and length of employment also exhibited consistent patterns of effects, with individuals with a higher length of employment after 2021 experiencing an increase in the odds of lower working hours. This suggests a shift in workplace dynamics as the pandemic progressed, potentially indicating a greater reliance on experienced employees to navigate evolving challenges or adaptations in work arrangements that favor longer-tenured workers. Although individuals engaged in training experienced significant reductions in working hours during the initial stages of the pandemic in 2020, this association waned as the situation evolved in 2021. This shift suggests potential adjustments in workforce strategies or policy interventions over time, reflecting the adaptability of labor market dynamics in response to changing circumstances. Notably, the Kartu Prakerja program's effect on reducing working hours was more pronounced in 2021, indicating a potential shift in program effectiveness over time.

Future research should delve deeper into the role of digitalization in shaping labor-market outcomes during economic crises. Industries or occupations heavily reliant on digital technologies may exhibit distinct vulnerabilities to disruptions, as evidenced by the higher susceptibility to reduced working hours observed in this study. Understanding the mechanisms through which digitalization influences labor market dynamics, such as the prevalence of remote work arrangements and the impact of automation on job security, is crucial for informing targeted policy interventions and workforce strategies to mitigate adverse effects during economic uncertainty.

The results highlight the significance of ongoing surveillance and tailored policy measures to tackle the enduring obstacles confronting Indonesia's labor market after the COVID-19 pandemic. Recognizing the complex factors involved and adjusting interventions accordingly will empower policymakers to provide more effective assistance to workers and foster inclusive economic growth.

Ethical statement

The dataset used in this research is from the National Labor Force Survey (SAKERNAS), conducted twice a year in February and August by BPS-Statistics Indonesia. Access to this dataset was obtained through approval from BPS-Statistics Indonesia via their specialized data service procedure. This study's second and third authors are internal employees of BPS-

Statistics Indonesia involved in data collection for SAKERNAS, allowing us to use this internal dataset with appropriate authorization from their superiors.

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