
Human Capital and Vulnerability Among Young Gig Workers in Indonesia

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Abstract

The rapid expansion of digital technology, intensified by the COVID-19 pandemic, has increased the number of gig workers in Indonesia, particularly youth aged 15–29. Although the gig economy offers flexible earning opportunities, concerns persist regarding income insecurity. This study investigates the determinants of income vulnerability among young gig workers using logistic regression applied to the 2023 National Labor Force Survey (SAKERNAS). Vulnerability is defined as earnings below the provincial minimum wage (UMP), the binary dependent variable is coded as 1 = non-vulnerable ($\text{income} \geq \text{UMP}$) and 0 = vulnerable ($\text{income} < \text{UMP}$). Results show that higher educational attainment is associated with lower vulnerability in urban areas, but no significant effect is found in rural settings. Participation in training programs does not significantly reduce vulnerability across all models. These findings indicate that structural and institutional conditions mediate the returns to human capital within platform-based labor markets. Urban–rural disparities suggest that returns to education depend on market characteristics such as platform penetration, digital infrastructure, and demand density. The limited effect of training highlights misalignment between current interventions and the skills needed for higher-value tasks. Policy efforts should combine targeted upskilling, improved relevance of vocational training, and investments in rural digital infrastructure, alongside broader reforms related to minimum income standards, algorithmic transparency, and portable social protection. Overall, this study underscores the limited role of human capital in mitigating precarity and highlights the importance of structural interventions in platform labor markets.

Keywords: GIG workers; young workers; human capital; job vulnerability; logistic regression.

1. Introduction

The growth of digitalization and technology has transformed the labor market structures in the world. One of these transformations is the rise of the gig economy that is characterized by flexible work arrangements that are typically based on short-term or task-oriented (Behl et al., 2021). Gig economy in Indonesia is rapidly growing, but its impact remains debated (Putri et al., 2023). As gig workers are typically classified as partners rather than employees, they have limited access to labor protections and social security, positioning them in structurally disadvantaged relationships with platforms (Wood et al., 2019; Graham & Anwar, 2019; Montgomery & Baglioni, 2021).

Digital transformation has led to the growth of the gig economy, and thus the number of gig workers (Pratomo, 2024). Although gig work provides flexible income opportunities, it is also associated with income instability, weak bargaining power, and dependence on platform-determined pricing (Heeks, 2021). The vulnerability of this segment became more apparent during the COVID-19 pandemic, when many gig workers experienced declines in demand, income loss, and insufficient social protection (Aggarwal & Ehrbeck, 2020; Rachmawati & De Ruyter, 2021; Pratomo et al., 2024). Several studies have shown that flexibility in gig work is often illusory, as workers may need to extend working hours far beyond standard norms to secure adequate earnings (Maftuchan, Djamhari, & Thaariq, 2018).

The gig worker trend is also felt by young people. Young workers work in the gig sector not only out of compulsion, but also because of the flexibility and financial opportunities it offers (Hed & Rosli, 2025). However, the lack of social protection and regulations raises questions about whether the gig economy expands financial inclusion or increases labor vulnerability (Behrendt et al., 2019). This is because gig workers are often classified as self-employed, thus companies are not required to provide social protection (ILO, 2025). Furthermore, gig workers face high income uncertainty and relatively low wage levels, increasing their economic vulnerability (Zoepf et al., 2018; Berg et al., 2018).

To date, there is no standard or binding definition of gig workers, and their presence varies across countries due to levels of informality and precarious employment (Hunt et al., 2019), including in Indonesia. However, previous studies have estimated the number of gig workers in Indonesia. One such study, Permana & Izzati (2023), estimated the number of gig workers in Indonesia in 2019 at 430,000 to 2.3 million, or approximately 0.3 to 1.7 percent of the total Indonesian workforce, based on data from the National Labor Force Survey (SAKERNAS). This number continues to increase with the rise of online platforms and consumer demand for services from gig workers (El Hajal, 2020; Van Doorn, 2023). A study by the Universitas Indonesia's LPEM (2025), found that many workers are shifting to the informal digital sector or gig economy due to pressure on formal employment, whether due to the global economic slowdown, corporate restructuring, or automation. Formal workers who lose their jobs, particularly in the manufacturing and service sectors, tend to become gig workers (LPEM, 2025). This choice of becoming a gig worker is certainly not without consequences. Those who become gig workers tend to experience decreased income and work very long hours (LPEM, 2025).

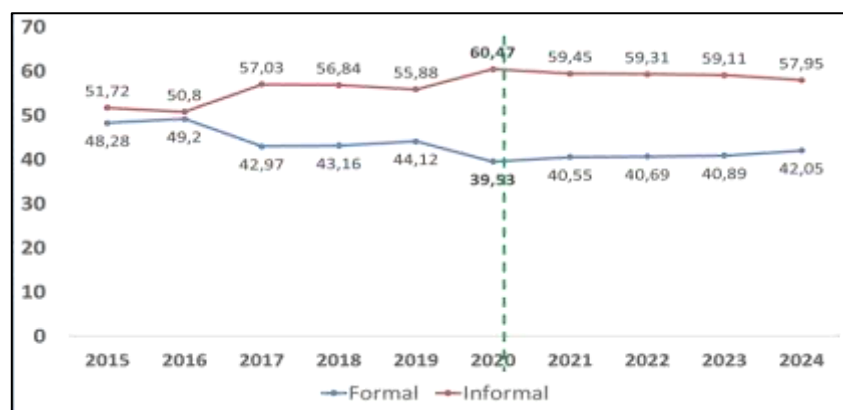


Figure 1. Proportion of formal and informal workers in Indonesia 2015-2024

Source: SAKERNAS 2015-2024

Gig economy has increasingly blurred the boundaries between formal and informal employment in Indonesia. Permana & Izzati (2023) classify gig workers into the informal sector because of the characteristics. Looking at trends in formal and informal workers in figure 1, since the onset of Covid-19 pandemic in Indonesia in 2020, the gap between the proportion of formal and informal workers has widened (BPS, 2024a). This trend aligns with the expansion of digital platform-based work, where individuals increasingly engage in gig activities as alternative income sources (LPPEM, 2025). However, economic returns from such work remain low. Pratomo et al. (2024) reports that the median monthly income of gig workers in 2022 was approximately IDR 2 million, below the provincial minimum wage (UMP) in most regions. According to BPS data (2024b), the average wage of digital freelance workers, which is included in the gig workers, is mostly lower than most UMPs in Indonesia, underscoring persistent income vulnerability within the sector.

According to BPS data, based on the 2023 Sakernas results, the proportion of gig workers in Indonesia in 2023 was dominated by millennials (44.21 percent), Generation X (30.86 percent), and Generation Z (20.13 percent). This indicates that the gig sector is increasingly becoming the primary choice for young workers to earn income amidst limited formal employment opportunities. However, welfare outcomes young gig workers (Gen Z) have the lowest average income, at around IDR 1.93 million per month, compared to older generations. This indicates the vulnerability experienced by young gig workers.

The vulnerabilities experienced by gig workers are divided into three, occupational vulnerabilities, precarity and platform-based vulnerabilities (Bajwa, 2018). The occupational vulnerabilities in gig work depend on the type of job performed. These include health and safety risks such as likelihood of traffic accidents of drivers or couriers. The precarity of gig work is not solely driven by technology or platforms, but by a work system that removes formal employment relationships and provides no basic protection (Bajwa, 2018). This condition affects workers' physical, mental, and economic well-being, particularly in countries with weak social protection systems like Indonesia. Workers face economic and social pressures such as having to supply their own tools and equipment, limited access to training and career advancement, low pay, a lack of job and income security, and wage discrimination against specific groups, especially women (Tran, 2017; Benach et al., 2007). The platform-based vulnerabilities are influenced by how platform businesses are structured. This includes factors such as worker classification, control over pricing and task organization, social isolation, repetitive micro-tasks, and stress resulting from constant monitoring. Globally, an important issue in this context is the ongoing debate over whether gig workers are being misclassified as independent contractors instead of employees (Tran, 2017). In this research, the vulnerabilities are limited to the inability to earn the regional minimum wage (UMP).

Human capital refers to an individual's unique skills and ability to contribute to the labor market (Wicaksono et al., 2024). Educational attainment and work experience play a crucial role in accumulating human capital (Borjas, 2016). Workers with high levels of skills and human capital tend to be more productive and earn higher incomes than those with low skills (Becker, 1994). Investing in human capital expects a higher rate of return in the future through its rate of return (Borjas, 2016). In the labor market, asymmetric information exists between employers and job seekers, leading job

seekers to believe that higher levels of education mean higher productivity (Borjas, 2016; J. Mincer, 1991). The Mincer income function model is often used to estimate the rate of return on education. According to Mincer (1974), individuals will determine their level of education based on the present value of the highest income. In addition to education, over time, individuals can accumulate human capital through training (Becker, 1994).

Existing studies highlight that youth participation in the gig economy presents both opportunities and challenges, particularly in relation to employment outcomes and educational relevance. A study by Radic et al. (2022), based on a survey of 199 graduates of vocational higher education and universities in Serbia, indicates that gig work has increasingly served as an alternative for unemployed youth or those unable to secure adequate earnings in traditional employment. However, despite the sector's rapid expansion, higher education institutions have been slow to adjust their curricula, resulting in graduates who are insufficiently equipped for emerging forms of work. These findings highlight the need for curriculum reform, entrepreneurship skill development, and clearer regulatory frameworks surrounding gig work.

Meanwhile, study from Zheng, Zhan and Xu (2024) in China, using 2020 survey data on Chinese platform delivery workers and combining quantitative analysis with case studies, the study finds that platform provided training is associated with lower earnings, whereas learning-by-doing shows a positive correlation with income. They also find that individuals who are more dependent on platform work earn more than those with moderate reliance, under equivalent levels of training or learning-by-doing. These results suggest that formal, platform-driven training may not effectively enhance workers' earning capacity, whereas experiential learning may offer more substantial productivity benefits.

In the Indonesian context, previous studies have identified significant vulnerabilities among informal and gig workers in Indonesia. Damanik and Zebua (2025) analyzed informal workers in North Sumatra and found that low education, limited access to microcredit, lack of luxury asset ownership, shorter working hours, and marital status significantly increased the likelihood of vulnerability. Workers in urban areas have better access to formal sector jobs and are less vulnerable, while those in rural areas rely heavily on the informal sector with limited opportunities for economic advancement. Meanwhile, Pratomo et al. (2024) show that despite the flexibility offered by gig work and its increasing uptake among young (Gen-Z) and urban workers, the sector remains characterized by income volatility, excessive working hours, ambiguous employment relationships, and limited social protection, rendering gig workers highly vulnerable within the labor market. Notably, their analysis finds that participation in government-supported training programs (Kartu Prakerja) is associated with lower earnings among gig workers, suggesting potential mismatches between training content and labor market needs. Taken together, these studies indicate that structural factors, such as education, training, access to credit, and asset ownership, play a decisive role in shaping income vulnerability among gig and informal workers in Indonesia.

In the context of young workers (15-29 years old), the challenges faced by gig workers are a significant concern because young workers are in the early stages of skill development and human capital accumulation through completed education, training, and work experience (ILO, 2021). If gig

economy jobs do not provide decent wage and training, human capital accumulation can be obstructed. This can create a “scarring effect” in the labor market and hold up the future well-being of these young gig workers (Quarina et al., 2023).

Therefore, this research contributes to the research gap by identifying the quality of young gig workers' human capital, related to their education and training, and their vulnerability. Previous studies have focused on general aspects of gig work without considering the dimensions of age and the workers' human capital. Furthermore, no research has specifically examined the relationship between young gig workers' human capital and their vulnerability, particularly from an income perspective. This is a period during which human capital development and accumulation are increasingly formed, determining long-term employment and productivity. Furthermore, given that the risk of young workers becoming gig workers is a combination of individual and regional factors, these factors serve as control variables.

Based on the problems outlined above, this study aims to analyze the influence of human capital on the vulnerability of young gig workers in Indonesia. This will help identify whether human capital variables, such as education and training, can enable young gig workers to earn a decent wage. Furthermore, it will formulate policy recommendations that are expected to serve as a basis for the government and stakeholders in designing effective policies for young gig workers.

2. Research method

2.1. Research Scope

This study examines the relationship between human capital and the economic vulnerability of young gig workers in Indonesia. Therefore, the unit of analysis is the working population aged 15–29, following on the ILO's youth age classification. Examining young workers is important because this group represents a critical transition between education and the workforce, determining career trajectory, income stability, and long-term well-being. According to the ILO (2021), young workers (aged 15–29) often face vulnerability traps in the labor market, such as high unemployment, informal employment, and low social security. These conditions make them more vulnerable to economic uncertainty, especially in an era of changing labor market structures due to digitalization and flexible work. Furthermore, young workers are the most dynamic group in responding to the rise of the gig economy and digital platform-based work (Pratomo et al., 2024; Natalia & Putranto, 2023).

In this study, gig workers are classified according to the ILO (2025), prior empirical classifications, and the definitional constraints of the Sakernas (BPS) microdata. According to the ILO (2025), gig workers are usually self-employed or independent contractors, rather than stable employer–employee relationships, and they have to find their own clients and projects through online platforms and applications. Instead of receiving a fixed salary, gig workers are paid after completing a series of tasks or an entire project (ILO, 2025).

Meanwhile, according to Permana and Izzati (2023), gig workers are categorized as those who are self-employed in the service sector, following the definition that what is traded in the gig economy is

labor services, not products. Therefore, from the classification of KBLI (Klasifikasi Baku Lapangan Usaha Indonesia), gig workers can be categorized into some workers in the service sector, including KBLI codes 8 (transportation and warehousing), 10 (information and communication), 11 (financial and insurance services), 12 (real estate), 13 (corporate services), 15 (education services), 16 (health services), and 17 (other services). By combining the definition from the ILO (2025) and research by Permana & Izzati (2023), in this study, a person is categorized as a young gig worker if, after being identified as a worker aged 15-29 years old who uses the internet in their work and who is not bound by a contract, has the status of self-employed (1) or non-agriculture freelancer (6) in the service sector, namely Transportation and Warehousing (8), Information and Communication (10), financial and insurance services (11), real estate (12), corporate services (13), Education Services (15), health service (16) and other services (17) (ILO, 2016; Permana & Izzati, 2023).

2.2. Data and Variables

This research uses cross-sectional data from National Labor Survey (SAKERNAS) conducted in August 2023 that published by the Central Statistics Agency (BPS) and Provincial Minimum Wage (UMP) data from the Ministry of Manpower Indonesia. This study uses SAKERNAS data because it provides a snapshot of current employment conditions, such as the number of workers, the employed population, employment status, worker age, average wages/income, and other indicators from the district to national levels. Furthermore, SAKERNAS data can also be used to determine the estimated monthly income of gig workers (Damayanti, 2023).

The variables in this study consist of dependent and independent variables. The dependent variable in this study is economic vulnerability, which is classified into two categories: vulnerable and non-vulnerable. Meanwhile, the variables of interest include human capital (education and training) that can influence economic vulnerability, including control variables of age, gender, marital status, resident classification status, and number of working hours. In addition, this study also examines the differences between young gig workers in urban and rural areas. The following are the operational definitions of the research variables used in Table 1.

Table 1. Description of Variables

Variables (1)	Symbol (2)	Category (3)
Dependent Variables		
<i>Vulnerability</i>	Vulnerability (Y)	1 = non-vulnerable ($\geq$ UMP) 0 = vulnerable ($<$ UMP)*
Variable of Interest		
<i>Education</i>	Educ (X ₁)	1 = Lower Secondary 2 = Upper Secondary 3 = Vocational secondary 4 = Diploma 5 = University 0 = Primary education or below*
<i>Training</i>	Training (X ₂)	1 = Training

Variables (1)	Symbol (2)	Category (3)
0 = No training*		
Control Variables		
<i>Gender</i>	Gender (X ₃)	1 = Male 0 = Female*
<i>Age</i>	Age (X ₄)	Numeric
<i>Resident Classification</i>	Residence (X ₅)	1 = Urban 0 = Rural*
<i>Marital Status</i>	Marital (X ₆)	1 = Married 2 = Divorced/Widowed 0 = Singles*
<i>Working Hours</i>	Hours (X ₈)	Numeric
Description: *reference category		

2.3. Analysis Methods

The analysis methods used in this study include descriptive and inferential methods. A descriptive analysis was conducted to examine the general picture of young gig workers and the differences in economic vulnerability of young gig workers in Indonesia. Descriptive analysis in this study will present cross-tabulations of the dependent and independent variables. The inferential statistical analysis used in this study is binary logistic regression to analyze the relationship between human capital (education and training) and vulnerability indicators in terms of income. Several studies define vulnerability in gig work through low and unstable earnings (Bajwa et al., 2018; Pratomo et al., 2024). In this study, young gig workers are categorized as non-vulnerable (Y=1) if their monthly income is more than Provincial Wage Minimum (income $\geq$ UMP). In the Indonesian context, the provincial minimum wage (UMP) represents a statutory wage floor designed to ensure minimum living standards (Rani et al., 2013). The logistic regression model is more commonly used given the interpretation of the β coefficients as log-odds and the interpretation of e^{β} as an odds ratio (Bangdiwala, 2018; Wooldridge, 2019). Binary logistic regression was applied in this study because the dependent variable is dichotomic, with values of 1 (non-vulnerable) and 0 (vulnerable), making it unsuitable for estimation using ordinary least squares (OLS) (Wooldridge, 2019). Unlike linear regression, which may produce predicted values outside the 0–1 range and violate key assumptions such as homoscedasticity and normality of errors, the logistic model transforms the probability of an event occurring into a log-odds function that is linearly related to the explanatory variables (Bangdiwala, 2018; Wooldridge, 2019). This enables the estimation of the likelihood of an outcome with values constrained between 0 and 1. The binary logit model proposed in this study is as follows:

$$\ln \left(\frac{\text{prob}(Y = 1|x)}{\text{prob}(Y = 0|x)} \right)_i = \theta_0 + \theta_1 X_{1i} + \theta_2 X_{2i} + \theta_3 X_{3i} + \theta_4 X_{4i} + \theta_5 X_{5i} + \theta_6 X_{6i} + \theta_7 X_{7i} + \theta_8 X_{8i} \quad (1)$$

where,

$$\ln \left(\frac{\text{prob}(Y = 1|x)}{\text{prob}(Y = 0|x)} \right)_i : \text{logit probability of dependent variable } Y=1 \text{ for individual } i=1,2..n$$

θ_0 : threshold

$\theta_{1i} - \theta_{8i}$: regression coefficient for the independent variables $X_{1i} - X_{8i}$

The next step of the obtained model is to test the significance of the model and parameters, both simultaneously and partially. The simultaneous assessment applies to the Likelihood Ratio Test (LRT) to determine whether the model contributes meaningful explanatory power, while the Wald test is used to examine the significance of each predictor separately (Wooldridge, 2019). In logistic regression, model parameters are interpreted using the odds ratio, commonly denoted as θ . To obtain the odds ratio, the estimated logistic regression coefficients for each explanatory variable included in the model are exponentiated. In addition, this research explores variations across residence, rural versus urban, to determine how differing regional environments influence the vulnerability levels of young gig workers.

3. Results and Discussion

3.1. Overview of Characteristics of Young Gig Workers

Based on the sample size of young gig workers used in this analysis, the total sample size was 2,740 young gig workers, consisting of 2,033 men and 707 women, as shown in Table 2. The majority of young gig workers are classified as economically vulnerable, with 75.11 percent categorized as vulnerable and 24.89 percent categorized as non-vulnerable. This means that three out of four young gig workers earn below the minimum wage (UMP).

Looking at education patterns, there is a decreasing trend in the percentage of young gig workers' vulnerability as education increases. Workers with the lowest level of education (elementary school or less) are the most vulnerable group to exploitation, with 80.68 percent of them being paid below the UMP. This figure decreases with increasing education, with only 63.49 percent of university graduates earning below the UMP. This demonstrates that formal education not only improves skills but also strengthens workers' bargaining power and access to legally compliant employment.

Table 2. Frequency and Percentage Distribution of Income Vulnerability by Socioeconomic and Demographic Characteristics

Variables	Income Vulnerability		Total
	Vulnerable	Non-Vulnerable	
(1)	(2)	(3)	(4)
Education			
Primary or Lower	238 (80.68)	57 (19.32)	295
Lower Secondary	325 (80.45)	79 (19.55)	404
Upper Secondary	719 (75.84)	229 (24.26)	948
Vocational Upper Secondary	542 (74.97)	181 (25.03)	723
Diploma	34 (61.82)	21 (38.18)	55
University	200 (63.49)	115 (36.51)	315
Training			
Yes	640 (73.39)	232 (26.61)	872

Variables	Income Vulnerability		Total	
(1)	No	Vulnerable (2)	Non-Vulnerable (3)	(4)
Gender	No	1,418 (75.91)	450 (24.09)	1,868
	Male	1,467 (72.16)	566 (27.84)	2,033
	Female	591 (83.59)	116 (16.41)	707
Residence	Urban	1,257 (72.03)	488 (27.97)	1,745
	Rural	801 (80.50)	194 (19.50)	995
	Marital Status			
	Married	609 (68.27)	283 (31.73)	892
	Divorced/Widowed	42 (72.41)	16 (27.59)	58
	Single	1,407 (78.60)	383 (21.40)	1,790
Working Hours	Full Employment	985 (67.42)	476 (32.58)	1,461
	Under Employment	1,073 (83.89)	206 (16.11)	1,279
	Total	2,058 (75.11)	682 (24.89)	2,740

Source: SAKERNAS 2023

Policymakers should be concerned about the limited impact of training. Although workers who have received training have a slightly lower wage rate below the minimum wage than young gig workers who have not received training, this very small difference (2.52 percent) indicates that training alone is insufficient to address the root of the problem if it is not accompanied by increased formal qualifications.

Based on gender, young female gig workers have a higher proportion of income vulnerability than men. 83.59 percent of young female gig workers are classified as vulnerable, compared to 72.03 percent of men. Meanwhile, geographic factors such as residential classification indicate that workers in rural areas (80.50 percent) have a higher level of vulnerability than those in urban areas (72.03 percent). This shows that limited access to formal employment opportunities in rural areas makes many workers dependent on the informal sector (Damanik & Zebua, 2025).

Marital status also shows a significant pattern, where unmarried workers (in the 'others' category) have a higher level of vulnerability (78.41 percent) than those who are married (68.27 percent), which may be related to factors of economic stability and access to social support. Furthermore, marital status also shows quite clear differences. Married workers have a lower vulnerability rate (68.27 percent) compared to those with other statuses (78.41 percent). This may reflect the tendency of married workers to seek more income to meet household needs.

Finally, patterns based on working hours indicate that part-time workers tend to be more vulnerable. The vulnerability rate among part-time workers reached 83.89 percent, significantly higher than that of full employment workers, which was 67.42 percent. This difference aligns with the characteristics of part-time work, which tends to lack social protection and income stability.

Overall, workers who are more vulnerable are those with low education, women, living in rural areas, being unmarried, and underemployment. Meanwhile, higher education, men, living in urban

areas, marriage, and full employment tend to be associated with lower levels of vulnerability. These findings reinforce the importance of improving the quality of human resources, especially education and access to formal employment in reducing labor vulnerability.

3.2. Determinants of Vulnerability of Young Gig Workers

This section discusses inferential analysis to examine the relationship between human capital and the vulnerability of young gig workers. The odds ratio results for each variable are shown in Table 3 using the heteroskedasticity-robust standard errors, representing the full model and the regional variation between urban and rural areas.

Table 3. Logistic Regression Results with Odds Ratio and p-value

Independent Variable	Full Model		Urban Model		Rural Model	
	Exp(β)	p-value	Exp(β)	p-value	Exp(β)	p-value
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Education						
Lower Secondary	1.104	0.626	1.289	0.363	0.887	0.691
Upper Secondary	1.387*	0.066	1.478	0.114	1.282	0.339
Vocational Upper Secondary	1.409*	0.070	1.406	0.184	1.617*	0.096
Diploma	2.810*	0.002	3.581*	0.001	1.297	0.779
	**		**			
University	2.927*	0.000	3.179*	0.000	2.410*	0.020
	**		**		*	
Training (Yes)	1.098	0.384	1.163	0.225	0.954	0.830
Gender (Male)	2.067*	0.000	1.818*	0.000	2.865*	0.000
	**		**		**	
Age	1.096*	0.000	1.084*	0.000	1.130*	0.000
	**		**		**	
Residence (Urban)	1.470*	0.000				
	**					
Marital Status						
Married	1.470*	0.001	1.354*	0.028	1.693*	0.007
	**		*		**	
Divorced/Widowed	1.543	0.197	1.200	0.669	2.621*	0.095
Working Hours	1.020*	0.000	1.019*	0.000	1.025*	0.000
	**		**		**	
_Cons	0.039*	0.000	0.008*	0.000	0.001*	0.000
	**		**		**	
Obs	2740		1745		995	

Independent Variable (1)	Full Model		Urban Model		Rural Model	
	Exp(β) (2)	p-value (3)	Exp(β) (4)	p-value (5)	Exp(β) (6)	p-value (7)
Pseudo R2	0.095		0.080		0.119	
LRT χ^2	272.176***		155.102***		96.843***	

Standard errors in parentheses

* $p < .1$, ** $p < .05$, *** $p < .01$

Simultaneously, the binary logistic regression model showed statistically significant results in both the full model and the separate urban-rural modeling. In the full model, the LRT χ^2 value was 272.176 with a p-value of less than 1 percent, indicating that at least one independent variable in the full model influenced the vulnerability of young gig workers in 2023. Similarly, in the separate urban and rural modeling, both had LRT χ^2 (155.10 and 96.84) with a p-value of less than one percent, indicating that at least one independent variable in the rural and urban models influenced the vulnerability of young gig workers in 2023.

Partial parameter testing is used to evaluate how each independent variable affects the likelihood of vulnerability among young gig workers in Indonesia in 2023. This procedure is carried out using the Wald test. The Wald test outcomes and the corresponding odds ratios for all independent variables are summarized in Table 3. The partial test for full model results shows that education, especially upper secondary, vocational secondary education, diploma and university; gender; age; residence; marital status; and working hours significantly affect the vulnerability of young gig workers. Interestingly happened that training as a component of human capital was not significant in influencing the vulnerability of young gig workers in full model and urban-rural models.

Partial tests of the education variable reveal an interesting pattern. Compared to workers with primary education or lower, higher education levels increase the odds of being non-vulnerable. In the full model, young gig workers with a diploma are 2.810 times more likely not to be economically vulnerable compared to primary education or below, while young gig workers with a university education are 2.927 times more likely not to be economically vulnerable compared to primary education or below. This finding is consistent in urban areas, with even stronger effects (OR diploma = 3.581, OR university = 3.179), indicating that educational capital is more effectively converted into a decent income in cities. However, in rural areas, the effect of tertiary education (diploma and university) weakens and is insignificant in diploma category. The young gig workers with a university education are 2.410 times more likely not to be economically vulnerable compared to primary education or below in rural areas. This is in accordance with the human capital theory that the higher the education, the higher the income, making young gig workers less vulnerable (Becker, 1994).

An interesting thing happened with the training variable. As a component of human capital, training does not have a significant effect on any of the three models (p-value > 0.1), indicating that the training received is not yet effective enough and does not significantly increase the odds of young gig workers to be non-vulnerable. The gender variable shows a strong and significant effect. Young male gig workers were significantly more likely to be non-vulnerable than females, both overall (OR = 2.067, $p < 0.01$), and in urban (OR = 1.817) and rural (OR = 2.865) areas. This could be attributed

to women cannot stay online for long periods of time because they have to divide their time between domestic work and their work in gig economy (Hunt et al., 2019).

Age also positively influenced the likelihood of young gig workers being non-vulnerable (OR = 1.100), suggesting that as age increases within the young worker group, the likelihood of earning income $\geq$ the minimum wage increases, possibly due to accumulated experience and learning by doing (Zheng et al., 2024). Increasing age explains the increase in work experience able to increase income so the workers will be non-vulnerable (Mincer, 1974).

Married young gig workers were also more likely to be non-vulnerable (OR = 1.430 in the full model, OR=1.354 in urban model, OR=1.693) in all three models, reflecting potentially higher economic motivation or additional opportunities through social networks. Odds ratio in full model shows that married young gig workers tend 1.430 times more likely not to be economically vulnerable compared to single. Married workers are often regarded as the main financial providers in the household, which may enhance their motivation and effort, ultimately leading to higher earnings (Blau et al., 2017). The variable working hours increased the likelihood of being non-vulnerable (OR around 1.020), although the effect was small but significant in all three models.

The variable residence classification showed that workers in urban areas were more likely to be non-vulnerable than rural workers (OR = 1.470). Given the more dynamic urban economic structure and the abundance of higher-paying gig job opportunities, these findings are understandable. However, when the models are separated, the effects of the determinants differ: education is stronger in urban areas, while gender, age and working hours are more influential in rural areas. Meanwhile, marital status is significant in urban areas but not in rural areas.

Overall, these findings suggest that human capital, particularly education, is an important determinant in reducing income vulnerability in the gig sector. However, training has not been shown to be effective, requiring improvements in its quality and relevance. Furthermore, demographic factors (gender, age, marital status) and location also contribute significantly. These findings underscore the importance of policies that encourage skills development, better access to jobs in rural areas, and income protection for gig workers.

4. Conclusion and Recommendations

This study highlights that income vulnerability remains prevalent among young gig workers in Indonesia, with three out of four earning below the provincial minimum wage (UMP). Inferential analysis findings show that human capital, particularly formal education, plays a strong and consistent role in reducing income vulnerability among young gig workers. Higher education levels substantially increase the likelihood of being non-vulnerable, with effects more pronounced in urban areas where labor markets give better rate of return educational qualifications. Conversely, job training programs do not affect a significant impact on young gig workers to be non-vulnerable in all three models.

Demographic and social factors also shape vulnerability outcomes. Male gig workers, older youth, married workers, urban residents, and higher working hours workers are significantly more likely to

be non-vulnerable, indicating that structural and socioeconomic conditions outside individual skill endowments also matter. Rural areas exhibit weaker returns to education, highlighting geographical inequality in labor opportunities. Taking together, these findings confirm that human capital alone is insufficient; contextual factors and labor market segmentation continue to influence income outcomes among young gig workers.

Policies aimed at reducing income vulnerability among young gig workers should prioritize expanding access to and outcomes from formal education, particularly in rural areas where educational attainment does not guarantee adequate income. Furthermore, vocational education should be tailored to market needs, particularly in the gig economy. Improving the quality, relevance, and linkage of training programs to the gig economy industry is necessary to ensure they support increased employability and wages within the gig economy. Programs that integrate digital skills, platform literacy, financial literacy, and entrepreneurship can deliver benefits more aligned with the market.

Future research could expand this analysis by including additional dimensions of human capital quality, such as field of study, digital skills, and type of training received (general or specific training), to better understand why training does not show a significant effect. Furthermore, distinguishing between location-based gig work (e.g., ride-hailing, delivery) and web-based gig work (e.g., freelance creative services) may reveal heterogeneous effects, as income structures and career trajectories differ across gig segments. Longitudinal data are also needed to capture dynamic income mobility and transitions into and out of vulnerability over time, as cross-sectional data limits causal inference. Finally, future research could examine how regional policies, digital infrastructure, and local labor market conditions influence returns to human capital in rural areas, where education provides lower rates of return.

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