IEJ Indonesian Economic Journal

P-ISSN 0854-1507 | E-ISSN 2721-222x
Available at https://jurnal.isei.or.id

Job loss, informality, and the scarring effect in central java's labor market

Sucihatiningsih Dian Wisika Prajanti [a], Euis Soliha[a], Tri Purwani[b], Dhea Rizky Amelia [a*], Tania Wicaksana[a], Agni Alam Awirya[c], Febyolla Putri Aninditya[c], Kinanthi Sukma Wening[c]

[a]Faculty of Business and Economics, Universitas Negeri Semarang, Indonesia
[b]A Department of Management, Universitas Abdi Karya Indonesia, Indonesia
[c]Regional Representative Office in Central Java, Central Bank of Indonesia, Indonesia

*Corresponding author: dhearizkyamelia@mail.unnes.ac.id

Abstract

Purpose — This study examines job loss risk, post-layoff transitions, and employment quality after industrial shocks in Central Java's labor-intensive sectors.
Method — Using August 2024 Sakernas microdata, the study applies probit and Heckman selection models to analyze job loss, formal–informal transitions, earnings, minimum wage compliance, and excessive working hours.
Findings — Manufacturing workers face a higher job loss risk, while service workers are relatively protected. Industrial shocks increase movement into informal employment, where workers are more likely to earn below the minimum wage and work excessive hours. Education and union membership reduce vulnerability.
Implications — Policies should strengthen formal job absorption, industry-based training, wage protection, enforcement of working time, and regional coordination.
Originality — The study offers regional evidence from Indonesia on how labor-intensive industrial shocks create spatial and sectoral spillovers and long-term labor market scarring.
Keywords: Layoffs; labor market vulnerability; informal sector; formal sector; wages
JEL Classification: J64; O17; R11

Recommended Citation
Prajanti, S. D. W., Soliha, E., Purwani, T., Amelia, D. R., Wicaksana, T., Awirya, A. A., Aninditya, F. P., Wening, K. S. (2026). Job Loss, Informality, and the Scarring Effect in Central Java's Labor Market. *Jurnal Ekonomi Indonesia.* 15(1) 2026, 075-093. DOI: https://doi.org/10.52813/jei.v15i1.793

Introduction

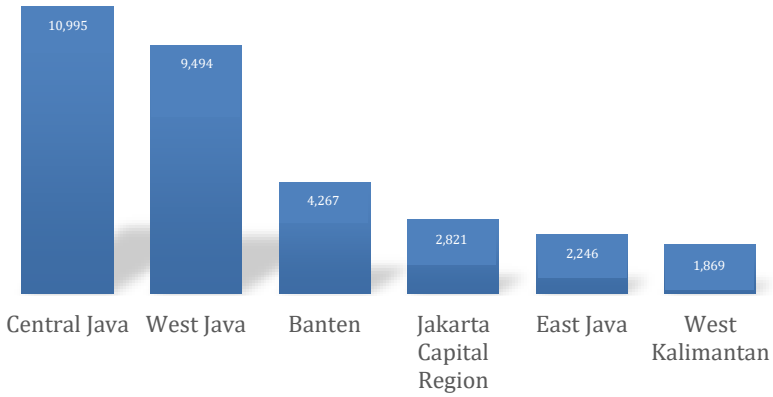
Mass layoffs represent not only short-term disruptions in employment but also long-term structural shocks that generate persistent scarring effects in the labor market. Beyond immediate job loss, displaced workers often experience prolonged declines in earnings, reduced access to formal employment, and deterioration in job quality upon re-entry. These scarring effects are particularly pronounced in labor-intensive industries, where workers face higher risks of informality, skill downgrading, and unstable working conditions following economic shocks.

Submitted: 22 September 2025 – Revised: 18 April 2026 – Accepted: 30 April 2026

Available at: https://jurnal.isei.or.id/index.php/isei

Employment dynamics in Central Java Province reflect these challenges. Data from the Ministry of Manpower in June 2025 recorded 42,385 workers affected by layoffs (*PHK*), representing an increase of 32.19 percent compared to the same period in 2024. Central Java Province recorded the highest number of affected workers nationwide, at 10,995, followed by West Java Province and Banten. These findings indicate significant pressure on labor market resilience, particularly in the labor-intensive industrial sector, which has long served as the backbone of employment absorption in the region.

Figure 1. The Six Provinces with the Highest Number of Layoffs (*PHK*) in Indonesia (number of workers)



Source: Ministry of Manpower (2025)

Beyond the magnitude of the employment shock, Central Java's structural characteristics further reinforce its relevance as an analytical setting. The province is characterized by a high concentration of labor-intensive industries, particularly in textiles and garment manufacturing, which play a pivotal role in employment absorption but are inherently vulnerable to fluctuations in external demand and cost pressures. In such sectors, layoffs are often used as short-term adjustment mechanisms, yet they tend to generate persistent labor market disruptions and long-term scarring effects, as widely documented in the literature (e.g., David Autor et al., 2013; Till von Wachter, 2020). Moreover, the province's dense production networks and extensive inter-regional linkages increase the likelihood that shocks propagate across sectors through input-output connections (Daron Acemoglu et al., 2012) and generate spatial spillovers across local labor markets (Enrico Moretti, 2010).

As a result, labor market dynamics in Central Java extend beyond localized adjustments and provide a representative lens for understanding broader patterns of vulnerability and recovery in industrial regions. Shocks in the labor market often trigger domino effects in regional economies, either directly or through sectoral and spatial spillovers (Gathmann, Helm and Schönberg, 2020; Vermeulen and Braakmann, 2023; vom Berge and Schmillen, 2023; Blank and Maghzian, 2024; Fratesi *et al.*, 2025). The initial impacts, which are local in nature, frequently extend to surrounding areas through input–output linkages, commuter mobility, and interconnected supply chains. The industrial structure in Central Java, particularly within the garment and textile manufacturing sector, provides a relevant example:

when anchor firms face pressure, the consequences are not confined to a single regency/municipality but may also spill over into neighboring districts and related sectors such as trade services, transportation, and accommodation.

This underscores the urgency of understanding workers' vulnerability to job loss and the quality of employment available in the post-recovery period, not only in Central Java but also across the broader labor market. Recent studies consistently demonstrate that mass layoffs have long-lasting consequences for workers and regional economies. Beyond the immediate job loss, they generate persistent declines in earnings, reduce future income prospects, and amplify inequality across labor markets (Lachowska, Mas and Woodbury, 2020; Illing, Schmieder and Trenkle, 2024; Fallick *et al.*, 2025; Moore and Scott-Clayton, 2025). These findings highlight that labor market shocks should be viewed not only as short-term disruptions but also as structural challenges that shape long-term labor market outcomes.

From a structural perspective, these effects are closely linked to processes of labor reallocation following economic shocks. Displaced workers do not re-enter the labor market under equal conditions but instead face segmented pathways of adjustment. According to Labour Market Segmentation Theory by Doeringer and Piore, the labor market is divided into formal and informal sectors, with the latter characterized by lower wages and weaker protection. In the aftermath of mass layoffs, barriers to re-entry into formal employment often push displaced workers into informal jobs, reinforcing long-term vulnerability. This reallocation process is further shaped by sectoral and spatial spillovers, whereby shocks in core industries transmit to supporting sectors and neighboring regions, altering both the availability and quality of employment opportunities.

At the same time, Human Capital Theory (Becker, 2002) emphasizes the role of education and skills in mediating these outcomes. Workers with higher levels of human capital are more resilient to job loss and better able to access quality employment upon re-entry. Conversely, workers with lower skill levels are more likely to become trapped in informal employment, thereby intensifying the scarring effect. Taken together, these theoretical perspectives provide a more comprehensive analytical basis for understanding how industrial shocks translate into job loss, labor reallocation, and ultimately differences in employment outcomes across worker characteristics such as age, gender, education, marital status, and union membership.

The research gap in this study is emphasized in two main aspects. First, national micro-level labour force studies remain limited in evaluating the impact of localized shocks on the risk of job loss and the quality of employment during the recovery phase. While international literature has documented the long-term consequences of mass layoffs on earnings, mobility, and worker vulnerability (Fallon and Lucas, 2002; Bosch and Maloney, 2010; Huttunen, Møen and Salvanes, 2011; Autor, Dorn and Hanson, 2013; Kabeer, 2021), systematic empirical evidence from Indonesia remains scarce.

Second, although international studies have begun to examine the sectoral and spatial spillover mechanisms of mass layoffs (Greenstone, Hornbeck and Moretti, 2010; Martin, 2010; Enrico, 2011), similar analyses in the Indonesian context are still highly limited. Most labour market research in Indonesia has focused on employment uncertainty (Mba, Nwosu and Orji, 2021), the impact of globalization on labour-intensive industries (Manning, 2020), and the vulnerability of informal workers (Taufiq and Dartanto, 2020), but has not explicitly assessed how shocks in labour-intensive industries such as the manufacturing sector in Central Java generate ripple effects on neighbouring districts and related service sectors.

Accordingly, this study seeks to address these gaps by examining three key dimensions of labor market dynamics. First, it assesses labor market vulnerability by analyzing the risk of job loss based on key worker characteristics, including education, wage levels, gender, age, marital status, and union membership. These variables are grounded in Labor Market Segmentation Theory, Human Capital Theory, and Efficiency Wage Theory. Second, it evaluates the labor market recovery process by examining workers' transitions between formal and informal employment following job loss. Third, it investigates post-recovery job conditions, measured in terms of income, compliance with minimum wage regulations, and excessive working hours.

Using data from the August 2024 Sakernas survey, this study employs a quantitative approach, using probit regression models to estimate the probability of job loss and labor market transitions, and Heckman selection models to analyze post-recovery job quality, while addressing potential sample selection bias. Through this approach, the study contributes methodologically by integrating probit and Heckman models, empirically by providing regional evidence on labor market vulnerability and spillover effects, and from a policy perspective by offering insights to strengthen labor protection and improve employment outcomes in the aftermath of industrial shocks.

Methodology

This study employs a quantitative approach, using *SAKERNAS* August 2024 as the primary data source. *SAKERNAS* is a specialized survey designed to capture general labor market conditions across different periods of enumeration. It is conducted nationwide in Indonesia, covering approximately 307,880 households across 30,788 census blocks in all provinces, both urban and rural, and produces estimates at the regency/municipality level.

The analysis of labor market vulnerability in this study focuses on three main objectives: the risk of job loss, labor market transition processes, and post-recovery job conditions. The unit of analysis consists of individuals aged 18–64 who are part of the labor force and reside in Central Java, as identified by the variables KODE_PROV and r23c for main employment during the previous week. The restricted sample of job loss is defined as individuals who previously held employment or a business activity but ceased working in that job within the past year.

The probit model is used to estimate the probability of binary labor market outcomes, while the Heckman selection model is employed to correct for potential selection bias arising from the non-random observation of post-recovery job quality, which is available only for individuals who successfully re-enter employment.

The first research objective is to assess labor market vulnerability in Central Java in the context of mass layoffs in labor-intensive industries, with particular reference to the case of PT Sritex. While the large-scale layoffs peaked in March 2025, the downsizing process had already begun in 2024, indicating that the shock unfolded gradually rather than as a single discrete event. Therefore, the August 2024 Sakernas data are used to capture early labor market adjustments and emerging vulnerabilities associated with the initial phase of the layoffs.

Within this framework, the risk of job loss is estimated using a probit regression model. The dependent variable (JobLoss) is a binary indicator that equals 1 if an individual previously held a job or business (r45b) and ceased working in that job within the past year (r46b).

The latent variable specification is defined as:

$$J_i^* = \alpha + \beta' sector_i + \emptyset' Shock_i + \delta' X_i + \varepsilon \qquad \varepsilon_i \sim N(0,1)_i \tag{1}$$

The observed outcome is given by:

$$Job\_Loss_i \begin{cases} 1, if\ J_i^* > 0 \\ 0, otherwise \end{cases} \qquad Pr(Job\_Loss_i = 1|\cdot) = \Phi(+\beta' sector_i + \emptyset' Shock_i + \delta' X_i)$$

with Φ denoting the cumulative distribution function of the standard normal. Equation (1) represents the baseline specification for estimating job loss risk, hereafter referred to as Model 1, which will be discussed in the Results section.

Shock Variables. The key explanatory variables in this study are the shock variables, which capture different forms of exposure to mass layoffs in Central Java: (1) Shock Sritex (Epicenter Shock): A dummy equal to 1 for workers located in Sukoharjo Regency and employed in the manufacturing sector. This measures direct exposure to the epicenter of layoffs at PT Sritex, (2) Shock Neighbor (Spatial Shock): A dummy equal to 1 for workers in regencies neighboring Sukoharjo (Boyolali, Klaten, Wonogiri, Karanganyar, and Surakarta City). This captures geographical spillovers due to proximity to the epicenter, such as relocation of orders or commuting flows, (3) Shock Spillover (Sectoral Linkages Shock): A dummy equal to 1 for workers employed in supporting sectors (trade, transportation, and accommodation) in surrounding regencies. These variable captures input–output linkages whereby shocks in the core industry transmit to related sectors.

These shock variables are incorporated into the estimation alongside sectoral dummies and individual characteristics. $X_i$is defined as a vector of explanatory variables capturing individual and job-related characteristics, including gender, marital status, educational attainment, urban or rural residence, union membership, employment sector, and wage group. These variables are treated as explanatory variables as they represent key determinants of job loss risk based on the theoretical framework discussed earlier. At this stage, the sample includes all individuals who were previously employed, regardless of whether they left their jobs voluntarily or involuntarily.

Following the analysis of job loss (Model 1), this study proceeds to evaluate the recovery process in the labor market. Two recovery indicators are employed: (1) whether individuals transition into formal employment, and (2) whether they transition into informal employment. For this analysis, probit regression is applied using the following specifications:

$$Transition\_formal_i^* = \alpha + \beta' sector_i + \emptyset' Shock_i + \delta' X_i + \varepsilon_i$$
$$Transition\_informal_i^* = \alpha + \beta' sector_i + \emptyset' Shock_i + \delta' X_i + \varepsilon_i$$
$$Transition\_formal_i \begin{cases} 1, Transition\_formal_i^* > 0 \\ 0, otherwise \end{cases},$$
$$Transition\_informal_i \begin{cases} 1, Transition\_informal_i^* > 0 \\ 0, otherwise \end{cases}$$

The corresponding probabilities are given by:

$$Pr(Transition_{formal,i} = 1) = \Phi(\beta' sector_i + \theta' Shock_i + \delta' X_i)$$
$$Pr(Transition_{informal,i} = 1) = \Phi(\beta' sector_i + \theta' Shock_i + \delta' X_i)$$

where Φ denotes the cumulative distribution function of the standard normal. These specifications are hereafter referred to as Model 2 and will be discussed in the Results section. Transition_Formal is a dummy variable that equals 1 if an individual who lost a job can r-enter employment in the formal sector. Transition_Informal is a dummy variable that equals 1 if an individual who lost a job can re-enter employment in the informal sector. The explanatory variables employed in this stage are the same as those in Model 1. The observations are restricted to individuals who experienced job loss, defined as those who (a) previously held a job or business (r45b), (b) ceased working in that job within the past year (r46b), and (c) are currently employed in their main job.

We evaluate three indicators of job quality for individuals who have returned to employment after experiencing job loss: (i) the log of real monthly earnings, (ii) a dummy variable indicating whether earnings are ≥ the provincial minimum wage (*UMR*), and (iii) a dummy variable indicating excessive working hours (>48 hours per week). Since these outcomes are only observed for workers who have re-entered employment, we correct for potential sample selection bias using the Heckman model (for continuous outcomes) and the Heckprobit model (for binary outcomes).

$$Work_i^* = Z_I' \gamma + \mu_i$$
$$Work_i = 1\{Work_i^* > 0$$

Where Z_i contains the selection covariates, including age and its squared term, education, marital status, gender, urban residence, union membership, employment sector, and the shock variable. Age and its squared term are included to capture potential non-linear effects of age on employment outcomes, allowing for an inverted U shaped relationship. The outcome equation for earnings is specified as:

$$ln(Earnings_i) = \alpha + \beta' sector_i + \emptyset' Shock_i + \delta' X_i + \varepsilon \qquad \varepsilon_i \sim N(0,1)_i$$

Estimated conditional on $(Work_i = 1)$, $\begin{pmatrix} \mu_i \\ \varepsilon_i \end{pmatrix} \sim N \begin{pmatrix} 0 \\ 0 \end{pmatrix}, \begin{pmatrix} 1 & \rho\sigma \\ \rho\sigma & \sigma^2 \end{pmatrix}$

A correlation coefficient $\rho \neq 0$ indicates the presence of selection bias, which is corrected using the Heckman procedure (either Maximum Likelihood or two-step estimation). For binary outcomes, we employ a probit framework with selection, specified as:

$$UMR_i^* = \alpha + \beta' sector_i + \emptyset' Shock_i + \delta' X_i + \varepsilon_i$$
$$Overwork_i^* = \alpha + \beta' sector_i + \emptyset' Shock_i + \delta' X_i + \varepsilon_i$$
$$UMR_i = 1\{UMR_i^* > 0\}, overwork_i = 1\{overwork_i^* > 0\}$$

These specifications are hereafter referred to as Model 3 and will be discussed in the Results section. To ensure the reliability and validity of the empirical findings, several diagnostic and robustness checks are conducted.

Multicollinearity is assessed using the Variance Inflation Factor (VIF), with all values below the commonly accepted threshold, indicating no severe collinearity issues. Robustness is further examined through alternative model specifications within the probit framework, as well as variations in the Heckman selection model, where the selection term remains statistically significant.

Sensitivity analyses using alternative definitions of key variables, along with subsample analyses across different worker groups, are also performed to test the consistency of the results. In addition, alternative measures of exposure are employed to validate spatial and sectoral spillover effects. Across all specifications, the findings remain qualitatively consistent, indicating that the results are robust and not driven by model specification, sample selection, or variable definition.

Results and Discussion

This section presents the empirical findings of the study and discusses their implications in light of the theoretical framework outlined earlier. The analysis is structured into three parts, corresponding to the main research objectives: (i) labor market vulnerability measured through job loss risk (Model 1), (ii) post-layoff labor market transitions (Model 2), and (iii) post-recovery job quality (Model 3). This structure allows for a comprehensive examination of how industrial shocks affect not only the probability of job loss but also the pathways of recovery and the quality of employment outcomes. Table 1 reports the marginal effects from Model 1, corresponding to Equation (1) in the Methodology section, which estimates labor market vulnerability through the measurement of job loss among workers in Central Java Province.

Table 1. Marginal Effect Job Loss Model

Variables	Model Job Loss (1)
Agricultural Sector (Ref)	
Manufacturing Sector	0.011*
	(0.006)
Finance Sector	-0.014
	(0.015)
Services Sector	-0.026***
	(0.005)
Other Services Sector	-0.011
	(0.008)
Shock Sritex	-0.010
	(0.019)
Shock Neighbor	-0.043***
	(0.008)
Shock Spillover	0.042***
	(0.010)

Variables	Model Job Loss (1)
Training and certification	0.006
	(0.005)
age	-0.009***
	(0.001)
age2	6.47e-05***
	(8.26e-06)
Labor Union Member	-0.052***
	(0.007)
<=Primary school (SD/MI) (Ref)	
Junior Secondary (SMP/MTs)	-0.026***
	(0.004)
Senior Secondary (SMA/K/MA)	-0.016***
	(0.005)
Diploma I/II/III	-0.000
	(0.014)
>= Diploma IV / Bachelor's Degree	-0.015*
	(0.009)
Male	0.041***
	(0.004)
Married	-0.031***
	(0.004)
Urban	-0.005
	(0.004)
<=500.000 (Ref)	
>500.000-1.000.000	-0.163***
	(0.010)
>1.000.000-2.000.000	-0.177***
	(0.009)
>2.000.000-5.000.000	-0.193***
	(0.009)
>5.000.000-10.000.000	-0.213***
	(0.011)
>10.000.000	-0.208***
	(0.015)
Observations	23,167

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Source: Processed by Author

The estimation results in Table 1 show that the risk of job loss in Central Java following shocks in labor-intensive industries is strongly influenced by sectoral, spatial, and individual characteristics. From a sectoral perspective, workers in services face a lower probability of job loss than those in agriculture, whereas manufacturing workers exhibit a higher degree of vulnerability. This finding suggests that the service sector enjoys relatively greater flexibility and diversification, while manufacturing, particularly garments and textiles, remains the epicenter of vulnerability due to its high exposure to global demand fluctuations and shifts in trade policy. This sectoral disparity also reflects differences in labor market stability across sectors, consistent with segmented labor market structures.

The results for the shock variable illustrate how industrial shocks operate in Central Java's labor market. The analysis shows that the shock at the epicenter (Sritex) has no significant effect on the probability of job loss. This suggests that the impact of shocks is not statistically concentrated at the point of origin but instead spreads more broadly to surrounding regions and sectors through spillover mechanisms.

By contrast, workers residing in neighboring regencies and municipalities are observed to have a significantly lower likelihood of job loss. This pattern may reflect a substitution or relocation effect, whereby when the production center comes under pressure, part of the economic activity and employment opportunities shift to surrounding areas. In this sense, neighboring regions benefit from a form of protective effect as industrial activities relocate or expand beyond the epicenter.

Unlike this geographical pattern, sectoral spillover effects move in the opposite direction. Workers in sectors directly linked to the affected industries, such as trade, transportation, and accommodation, face a higher risk of job loss. This is consistent with the literature on input-output linkages, which emphasizes that shocks to anchor firms cascade to supporting sectors, thereby increasing vulnerability beyond the core industry (Acemoglu *et al.*, 2012). Overall, these findings highlight that the impact of shocks is multidimensional rather than singular. Geographically, neighboring regencies appear relatively more protected, but sectorally, workers connected through supply chains are more exposed. This dynamic is particularly important for Central Java, whose economy is heavily reliant on labor intensive industries. Thus, mitigation strategies cannot focus solely on core firms or epicenter regions but must also encompass supporting sectors and surrounding areas to sustain employment absorption in the aftermath of shocks.

At the individual level, worker characteristics, treated as explanatory variables, also play a critical role in explaining vulnerability. Secondary and tertiary education consistently reduce the risk of job loss, supporting the argument of Human Capital Theory (Becker, 1964) that skill accumulation provides protection in the labor market. Union membership is shown to protect workers by reducing the probability of job loss, reflecting the important role of collective institutions in maintaining job security. Meanwhile, the risk of job loss follows an inverted U-shaped curve with respect to age, where young workers are vulnerable due to limited experience and older workers face challenges in adaptation. Interestingly, men have a higher risk than women, possibly due to the dominance of male workers in the affected labor-intensive sectors. Marital status serves as a protective factor: married workers are more likely to be retained by firms and have a lower probability of job loss than unmarried workers.

From a wage perspective, the analysis shows a consistent pattern: higher-wage groups face lower risks of job loss. Low-wage workers (≤Rp500,000) are the most vulnerable, while higher-wage workers are relatively more protected. This pattern also supports Labor Market Segmentation Theory, which suggests that workers in the lower segment of the labor market are more exposed to instability and displacement risks. This finding is consistent with Efficiency Wage Theory (Shapiro and Stiglitz, 1984), which suggests that firms tend to retain higher-wage workers because of their productivity and the costs of replacing them. Taken together, these results confirm that vulnerability to job loss is highly segmented by sector, region, and individual characteristics. Table 2 presents the marginal effects from Model 2 (as specified in the Methodology section), which examines labor market transitions between workers who re-enter the formal sector and those who move into the informal sector after experiencing job loss.

The results in Table 2 reveal distinct patterns of transition between workers who re-enter the formal sector and those who move into the informal sector after experiencing job loss. From a sectoral perspective, workers previously employed in manufacturing, services, and other service activities are less likely to return to formal employment but more likely to shift to informal employment.

This is consistent with the characteristics of labor-intensive industries in Central Java, where shocks create constraints on formal sector absorption but allow transitions into informal employment, which is easier to access but associated with lower job quality.

Table 2. *Marginal Effects Job Transition Model*

Variables	Formal Transition	Informal Transition
Agricultural Sector (Ref)		
Manufacturing Sector	-0.152***	0.114***
	(0.035)	(0.033)
Finance Sector	-0.084	0.162
	(0.117)	(0.114)
Services Sector	-0.090**	0.086**
	(0.040)	(0.036)
Other Services Sector	-0.277***	0.205***
	(0.052)	(0.065)
shock_sritex	-0.225	1.489***
	(0.163)	(0.563)
shock_neighbor	-0.022	-0.165
	(0.069)	(0.127)
shock_spillover	0.020	0.806***
	(0.082)	(0.180)
Training and certification	-0.247***	0.232***
	(0.079)	(0.075)
age	0.0246***	-0.013**
	(0.006)	(0.006)
age2	-0.000***	8.53e-05
	(6.30e-05)	(7.05e-05)
<=Primary school (SD/MI) (Ref)		
Junior Secondary (SMP/MTs)	-0.047	0.056
	(0.0370)	(0.035)
Senior Secondary (SMA/K/MA)	-0.127***	0.094***
	(0.0350)	(0.035)
Diploma I/II/III	-0.087	0.039
	(0.0930)	(0.087)
>= Diploma IV / Bachelor's Degree	-0.297***	0.169**
	(0.052)	(0.070)
Male	0.126***	-0.196***
	(0.028)	(0.028)
Married	0.094***	-0.050
	(0.030)	(0.032)
Urban	-0.085***	0.068**
	(0.027)	(0.027)
<=500.000 (Ref)		
>500.000-1.000.000	0.298***	0.371***
	(0.042)	(0.0370)

Variables	Formal Transition	Informal Transition
>1.000.000-2.000.000	0.206***	0.479***
	(0.033)	(0.0280)
>2.000.000-5.000.000	0.039	0.655***
	(0.030)	(0.023)
>5.000.000-10.000.000	0.208*	0.482***
	(0.108)	(0.105)
>10.000.000	-0.164	0.871***
	(0.122)	(0.108)
Observations	1,957	1,957

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.
Source: Processed by Author

The results in Table 2 reveal distinct patterns of transition between workers who re-enter the formal sector and those who move into the informal sector after experiencing job loss. From a sectoral perspective, workers previously employed in manufacturing, services, and other service activities are less likely to return to formal employment but more likely to shift to informal employment. This is consistent with the characteristics of labor-intensive industries in Central Java, where shocks create constraints on formal sector absorption but allow transitions into informal employment, which is easier to access but associated with lower job quality.

The shock variables provide a striking contrast. The Sritex shock is not significant for transitions into formal employment, yet it strongly increases the likelihood of workers moving into informal employment. In other words, the epicenter of the shock no longer functions as a source of formal job absorption but instead pushes displaced workers into the informal market. Similarly, spillover shocks follow the same pattern: although insignificant for formal transitions, they significantly increase the probability of entering informal employment. These results confirm a displacement effect, where supporting sectors are unable to absorb labor into formal pathways and instead intensify flows into informality. By contrast, shocks in neighboring regions are insignificant, indicating that the protective effects identified in Model 1 do not necessarily draw workers back into formal jobs, but neither do they strongly channel them into informal work (Bosch and Maloney, 2010). This pattern provides strong empirical support for Labor Market Segmentation Theory, which posits that barriers to entry in the formal sector constrain re-employment opportunities, thereby channeling displaced workers into the informal segment of the labor market.

Individual characteristics, treated as observed explanatory variables in the model, also play an important role in shaping transition outcomes. Workers with higher education (senior secondary through university) are less likely to return to formal employment but more likely to enter informal jobs, pointing to evidence of skill downgrading. This suggests that even educated workers, under labor market pressure, may be forced to accept informal jobs of lower quality than their qualifications. Training and certification also exhibit a paradoxical pattern: they reduce the probability of transitioning into the formal sector but increase the likelihood of entering the informal sector.

This may reflect the short-term practical nature of training programs, which are more easily accommodated in informal settings than in the formal sector, where employment structures tend to be more rigid (ILO, 2011; World Bank, 2013; Peter

Cookey, 2017; McKenzie, 2017; Kluve et al., 2019). Demographic factors further reinforce these dynamics. Male workers are more likely to re-enter formal jobs, while women are more frequently pushed into informal employment, reflecting persistent gender segregation in the labor market. Younger workers have a greater chance of returning to formal employment, whereas older workers are more likely to enter informal employment. Marital status serves as a protective factor, with married workers more likely to remain in formal employment. At the same time, living in urban areas reduces the probability of formal transition but raises the probability of entering informal jobs, consistent with the large share of the urban informal economy.

From the wage perspective, workers from higher previous wage groups are more likely to transition into informal rather than formal jobs. This pattern indicates that even those with prior experience in higher-wage positions are forced by labor market shocks to adjust to informal work, highlighting the scarring effect of mass layoffs on post-recovery job quality. Overall, the results from Model 2 suggest that post-job-loss transitions in Central Java are dominated by movements into the informal sector rather than by recovery into formal employment. This highlights the limited absorptive capacity of the formal sector and reinforces the structural segmentation of the labor market following industrial shocks.

Taken together, the findings from Model 2 suggest that post-job-loss transitions in Central Java predominantly flow into the informal sector, particularly among workers directly or indirectly affected by industrial shocks. This underscores the weak capacity of the formal sector to reabsorb displaced workers and highlights the substantial challenge of maintaining job quality in the face of volatility in labor-intensive industries. Table 3 presents the results from Model 3 (as specified in the Methodology section), which evaluates job quality among workers who have re-entered employment after experiencing job loss, using a Heckman selection framework to account for potential selection bias.

Table 3. *Marginal Effects Wage Model*

VARIABLES	Formal			Informal		
	Heckman: ln(Earnings) | Two-step	Heckprobit: Above UMR	Heckprobit: overwork	Heckman: ln(Earnings) | Two-step	Heckprobit: Above UMR	Heckprobit: overwork
Agricultural Sector (Ref)						
Manufacturing Sector	0.421***	0.422***	0.413***	-0.449***	-0.391***	-0.437***
	(0.089)	(0.089)	(0.089)	(0.076)	(0.076)	(0.074)
Finance Sector	0.857***	0.883***	0.889***	-0.202	-0.227	-0.289
	(0.211)	(0.212)	(0.219)	(0.286)	(0.290)	(0.288)
Services Sector	0.628***	0.629***	0.605***	0.020	0.158**	0.134*
	(0.093)	(0.095)	(0.092)	(0.081)	(0.076)	(0.076)
Other Services Sector	0.344***	0.347***	0.341***	-0.325***	-0.333***	-0.334***
	(0.116)	(0.116)	(0.117)	(0.107)	(0.106)	(0.109)

VARIABLES	Formal			Informal		
	Heckman: ln(Earnings) | Two-step	Heckprobit: Above UMR	Heckprobit: overwork	Heckman: ln(Earnings) | Two-step	Heckprobit: Above UMR	Heckprobit: overwork
shock_sritex	-0.062	-0.021	-0.067	-0.361*	-0.194	-0.187
	(0.198)	(0.208)	(0.198)	(0.191)	(0.225)	(0.232)
shock_neighbor	0.206	0.229*	0.225*	0.218*	0.289**	0.290**
	(0.127)	(0.128)	(0.127)	(0.121)	(0.132)	(0.132)
shock_spillover	0.114	0.100	0.104	-0.038	0.002	0.020
	(0.162)	(0.164)	(0.163)	(0.154)	(0.170)	(0.174)
Training and certification	0.043	0.036	0.036	0.005	-0.037	-0.023
	(0.066)	(0.066)	(0.067)	(0.067)	(0.067)	(0.070)
age	0.093***	0.093***	0.092***	0.109***	0.106***	0.109***
	(0.010)	(0.010)	(0.010)	(0.010)	(0.009)	(0.009)
age2	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***	-0.001***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
<=Primary school (SD/MI) (Ref) Junior Secondary (SMP/MTs)	0.333***	0.335***	0.337***	0.253***	0.256***	0.281***
	(0.080)	(0.080)	(0.080)	(0.072)	(0.078)	(0.079)
Senior Secondary (SMA/K/MA)	0.269***	0.262***	0.272***	0.009	-0.069	-0.043
	(0.070)	(0.071)	(0.070)	(0.063)	(0.063)	(0.065)
Diploma I/II/III	0.376**	0.375**	0.388**	0.118	-0.029	-0.083
	(0.173)	(0.174)	(0.173)	(0.234)	(0.194)	(0.192)
>= Diploma IV / Bachelor's Degree	0.295***	0.261**	0.263**	-0.163	-0.271**	-0.346***
	(0.106)	(0.105)	(0.104)	(0.116)	(0.114)	(0.111)
gender	0.004	0.021	-0.003	0.004	-0.111**	-0.027
	(0.050)	(0.056)	(0.052)	(0.054)	(0.051)	(0.050)
Male	0.481***	0.471***	0.481***	0.511***	0.659***	0.610***
	(0.055)	(0.055)	(0.056)	(0.050)	(0.050)	(0.052)
Married	0.108*	0.110**	0.117**	-0.069	-0.109**	-0.109*
	(0.056)	(0.056)	(0.056)	(0.054)	(0.054)	(0.057)
Constant	-1.419***	-1.411***	-1.365***	-1.382***	-1.111***	-1.172***
	(0.224)	(0.225)	(0.225)	(0.235)	(0.214)	(0.209)
Observations	10,610	10,614	10,614	15,772	15,772	15,772

Robust standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1
Source: Processed by Author

The results of Model 3 provide insights into job quality in the post recovery period following labor market shocks. Overall, workers who return to employment face significant variation in earnings, the probability of earning at or above the provincial minimum wage, and the risk of excessive working hours. First, in the earnings model (log of real wages), the findings show that manufacturing, financial services, and modern services are positively associated with real income among formal workers. In contrast, for informal workers, manufacturing is negatively associated, underscoring that those pushed into informal manufacturing jobs experience a deterioration in earnings quality. This divergence suggests that sectoral effects on earnings depend critically on whether workers re-enter the formal or informal segment of the labor market.

Education consistently plays a positive role: higher levels of education are strongly linked to higher real earnings. This is consistent with Human Capital Theory (Becker, 1964), which posits that investment in human capital through education enhances productivity and directly translates into higher wages. In addition, union membership is positively associated with earnings, reflecting unions' role of unions in protecting wage bargaining (Bryson, Forth and Laroche, 2011; Card, Lemieux and Riddell, 2017; Psacharopoulos and Patrinos, 2018). The Sritex shock in the informal sector is significantly negative, suggesting a scarring effect: workers affected by the core shock not only lose their jobs but also earn lower wages upon reemployment. This indicates that the impact of the shock persists beyond displacement, affecting subsequent income trajectories. The displacement worker literature emphasizes that job loss due to external shocks can result in long-term earnings losses (Jacobson, LaLonde and Sullivan, 1993).

Second, in the model of the probability of receiving wages ≥ the minimum wage, clear sectoral differentiation emerges. Workers in manufacturing and modern services are more likely of earn at or above the minimum standard, while those pushed into the informal sector are less likely. Training exhibits an ambiguous effect: although it may improve the likelihood of remaining in the labor market, it does not necessarily guarantee decent wages. This underscores the need to adjust training programs to better align with the requirements of the formal sector. Third, in the overwork model (>48 hours per week), the results show that the risk of excessive working hours is higher among male workers, low-wage earners, and those re-entering the informal sector. This is consistent with findings from developing countries (Bosch and Maloney, 2010), which show that informality not only reduces wage quality but also increases disproportionate workloads, as workers tend to extend working hours to compensate for lower earnings.

Interestingly, the shock variables display mixed patterns. The Sritex shock is not significant for real earnings or for minimum wage compliance, yet it is correlated with a greater likelihood of entering informal employment, which is often characterized by low pay and long hours. Spillover shocks similarly suggest an increased probability of workers entering jobs of lower quality (underpayment or overwork), indicating that inter-sectoral spillovers are more negative than protective. By contrast, shocks in neighboring regions sometimes serve a mitigating role: spatial proximity to the epicenter does not necessarily reduce job quality and, in some models, is even associated with a higher probability of retaining more decent work. Taken together, the results of Model 3 underscore that post-recovery job quality remains fragile in Central Java. Education and union membership emerge as key protective factors, while structural characteristics such as sectoral exposure and employment type continue to shape outcomes.

Overall, the findings provide strong evidence of scarring effects, in which labor market shocks not only increase the probability of job loss (Model 1) and shift workers into informal employment (Model 2) but also lead to a persistent deterioration in job quality after re-employment.

The policy implications of Model 3 underscore that post-layoff recovery should be assessed not only by the number of workers who regain employment but also by the quality of the jobs they obtain. As Model 2 indicates that transitions are more likely to occur into informal employment rather than formal employment, short-term and practical training programs may inadvertently channel workers into the informal sector. This calls for a reorientation of training design toward competency-based models and industry-recognized certification, so that programs genuinely facilitate pathways back to formal employment. A triple-helix collaboration among government, businesses, and universities is critical to ensuring that training curricula align with the requirements of the formal labor market. This finding is consistent with the literature highlighting the limitations of short-term vocational training in creating formal transitions, while integration with industry standards has proven more effective (McKenzie, 2017; Kluve *et al.*, 2019).

In addition, the minimum wage policy requires strengthening, particularly in the informal sector, since Model 3 indicates that informal workers are more vulnerable to underpayment. Labor law enforcement must be broadened so that minimum wage standards reach workers pushed out of the formal sector. However, implementation reach is limited. Incentive programs such as wage subsidies could also be considered to safeguard the purchasing power of vulnerable workers in the aftermath of layoffs. Empirical evidence from developing countries suggests that minimum wage protection can mitigate inequality and shield low-wage workers from the pressures of flexible labor markets (Bosch and Maloney, 2010).

The heightened risk of excessive working hours, especially among male workers in manufacturing, also indicates the need for stricter enforcement of working time regulations, as shown in Model 3. Labor-intensive firms often rely on overtime to meet production targets, yet this practice undermines job quality and poses health risks for workers. Research on working time in developing countries shows that both informal and formal workers are vulnerable to excessive workloads as a strategy to offset insufficient earnings (Donovan, Lu, and Schoellman, 2018; Liu, Chen, and Gan, 2019; Zhou, Zhang, and Li, 2024). Accordingly, labor market policies should encourage firms to raise productivity through technological and managerial innovation rather than by extending working hours.

Long-term scarring effects also warrant close attention. Model 3 shows that workers at the shock epicenter not only experience immediate income losses after layoffs but also continue to face lower job quality upon reemployment. This is consistent with Sullivan (1993), who found that displaced workers in industrial restructuring suffered significant long-term income losses. Policy interventions such as wage insurance, temporary compensation, and reemployment services, including job matching, career counseling, and industry-based retraining, are therefore needed to minimize long-term damage. In addition, the results suggest that age and gender differences play a role in shaping post recovery outcomes, implying that targeted interventions may be necessary for specific worker groups. The spatial dimension is equally important for policy design. As Model 1 shows differences in job loss risk across regions and Model 3 indicates relatively better job quality in neighboring areas, this highlights the importance of cross-regional labor strategies.

A regional cluster approach could help distribute the risks of layoffs and strengthen labor market resilience more evenly across Central Java. This aligns with Acemoglu *et al.* (2012), who show that sectoral and spatial linkages can either amplify or dampen the effects of shocks, depending on the structure of production networks and the distribution of economic activities. Overall, post-layoff policy must emphasize not only employment quantity but also job quality, fair wages, humane working hours, and sustainable productivity. An integrated strategy that combines skills enhancement, wage protection, enforcement of working time, mitigation of scarring effects, and cross-regional coordination can support the achievement of the ILO Decent Work Agenda and SDG 8 on decent work and sustainable economic growth.

Conclusion

This study demonstrates that labor market shocks in Central Java generate multidimensional vulnerabilities. First, the risk of job loss is segmented by sector, space, and individual characteristics. Manufacturing workers are the most exposed, service workers are relatively more protected, and agricultural workers face intermediate risks. Spatially, neighboring regions benefit from a protective substitution effect, while sectoral linkages through supply chains transmit vulnerability to supporting industries. At the individual level, education, union membership, marital status, and higher wage groups serve as protective factors, while men, younger and older workers, and the low-paid are more vulnerable.

Second, post-layoff transitions predominantly channel displaced workers into informal employment. The epicenter (shock_sritex) and sectoral spillovers strongly increase the likelihood of moving into informal rather than formal employment, underscoring the formal sector's weak absorptive capacity of the formal sector. Even educated and trained workers experience skill downgrading, while demographic factors such as gender, age, and urban residence further reinforce segmented pathways.

Third, job quality in the recovery phase remains fragile. Workers pushed into informality are more likely to earn below minimum wage and to experience excessive working hours, confirming a scarring effect that extends beyond job loss into the degradation of employment conditions. Conversely, education and union membership consistently improve earnings and wage compliance, underscoring their role as structural protections.

Overall, the findings emphasize that industrial shocks in labor-intensive regions such as Central Java cannot be addressed by focusing only on epicenter firms. Effective policy responses must account for sectoral and spatial spillovers, strengthen formal sector absorptive capacity, and enhance worker protections through education, training alignment, wage regulation, and collective institutions.

However, this study is subject to several limitations. The use of cross-sectional data from SAKERNAS limits the ability to capture dynamic and long-term scarring effects following job loss, as the analysis is based on a single observation period. Future research would benefit from the use of longitudinal data or panel datasets to better track employment trajectories over time, as well as in-depth case studies to capture firm-level adjustments and worker experiences. In addition, further exploration of emerging labor market dynamics, such as digital platform employment and regional labor networks, would provide valuable insights into how workers adapt to structural changes.

AI declaration
The authors declare that artificial intelligence (AI) tools were used solely to assist in language refinement, grammar checking, and improving the clarity of writing. The use of AI did not influence the research design, data collection, data analysis, interpretation of results, or the development of conclusions. All intellectual contributions, including conceptualization, methodology, analysis, and final content, remain the full responsibility of the authors.

Conflict Interest
The authors declare that there are no conflicts of interest regarding the publication of this paper. The research was conducted independently without any financial, commercial, or personal relationships that could be construed as a potential conflict of interest.

References

[1] Acemoglu, D. *et al.* (2012) 'The network origins of aggregate fluctuations', *Econometrica*. Wiley Online Library, 80(5), pp. 1977–2016.
[2] Adam, A. and Moutos, T. (2024) 'Do public-sector employment reductions promote the informal economy?', *Journal of Institutional Economics*. Cambridge University Press, 20, p. e42.
[3] Autor, D. H., Dorn, D. and Hanson, G. H. (2013) 'The China syndrome: Local labor market effects of import competition in the United States', *American economic review*. American Economic Association, 103(6), pp. 2121–2168.
[4] Becker, G. S. (2002) 'Human capital', *The concise encyclopedia of economics*. Liberty Fund Indianapolis, IN, 2, pp. 1–12.
[5] vom Berge, P. and Schmillen, A. (2023) 'Effects of mass layoffs on local employment—evidence from geo-referenced data', *Journal of Economic Geography*. Oxford University Press, 23(3), pp. 509–539.
[6] Blank, M. and Maghzian, O. (2024) *The labor market spillovers of job destruction*. Stanford Institute for Economic Policy Research (SIEPR).
[7] Bosch, M. and Maloney, W. F. (2010) 'Comparative analysis of labor market dynamics using Markov processes: An application to informality', *Labour Economics*. Elsevier, 17(4), pp. 621–631.
[8] Bryson, A., Forth, J. and Laroche, P. (2011) 'Evolution or revolution? The impact of unions on workplace performance in Britain and France', *European Journal of Industrial Relations*. Sage Publications Sage UK: London, England, 17(2), pp. 171–187.
[9] Card, D., Lemieux, T. and Riddell, W. C. (2017) 'Unions and wage inequality', in *What do unions do?* Routledge, pp. 114–159.
[10] Donovan, K., Lu, J. and Schoellman, T. (2018) 'Labor market flows and development', in *2018 Meeting Papers, Society for Economic Dynamics*.
[11] Enrico, M. (2011) 'Local labor markets', in *Handbook of labor economics*. Elsevier, pp. 1237–1313.
[12] Fallick, B. *et al.* (2025) 'Job displacement and earnings losses: The role of joblessness', *American Economic Journal: Macroeconomics*. American Economic Association 2014 Broadway, Suite 305, Nashville, TN 37203-2425, 17(2), pp. 177–205.

[13] Fallon, P. R. and Lucas, R. E. B. (2002) 'The impact of financial crises on labor markets, household incomes, and poverty: A review of evidence', *The World Bank Research Observer*. Oxford University Press, 17(1), pp. 21–45.
[14] Fratesi, U. *et al.* (2025) 'Spillovers and small spatial scale analyses: contributions from spatial economics', *Spatial Economic Analysis*. Taylor & Francis, pp. 1–7.
[15] Gathmann, C., Helm, I. and Schönberg, U. (2020) 'Erratum: Spillover Effects of Mass Layoffs (Journal of the European Economic Association (2020) 18: 1 (540', *Journal of the European Economic Association*.
[16] Gomes, D. B. P., Iachan, F. S. and Santos, C. (2020) 'Labor earnings dynamics in a developing economy with a large informal sector', *Journal of Economic Dynamics and Control*. Elsevier, 113, p. 103854.
[17] Greenstone, M., Hornbeck, R. and Moretti, E. (2010) 'Identifying agglomeration spillovers: Evidence from winners and losers of large plant openings', *Journal of political economy*. The University of Chicago Press, 118(3), pp. 536–598.
[18] Gupta, N. and Narayanan, K. (2024) 'Transition from Formal to Informal Sector in India: Implications for Earnings and Household Well-Being'.
[19] Huttunen, K., Møen, J. and Salvanes, K. G. (2011) 'How destructive is creative destruction? Effects of job loss on job mobility, withdrawal and income', *Journal of the European Economic Association*. Oxford University Press, 9(5), pp. 840–870.
[20] Illing, H., Schmieder, J. and Trenkle, S. (2024) 'The gender gap in earnings losses after job displacement', *Journal of the European Economic Association*. Oxford University Press, 22(5), pp. 2108–2147.
[21] Jacobson, L. S., LaLonde, R. J. and Sullivan, D. G. (1993) 'Earnings losses of displaced workers', *The American economic review*. JSTOR, pp. 685–709.
[22] Kabeer, N. (2021) 'Gender equality, inclusive growth, and labour markets', in *Women's economic empowerment*. Routledge, pp. 13–48.
[23] Kluve, J. *et al.* (2019) 'Do youth employment programs improve labor market outcomes? A quantitative review', *World Development*. Elsevier, 114, pp. 237–253.
[24] Lachowska, M., Mas, A. and Woodbury, S. A. (2020) 'Sources of displaced workers' long-term earnings losses', *American Economic Review*. American Economic Association 2014 Broadway, Suite 305, Nashville, TN 37203, 110(10), pp. 3231–3266.
[25] Liu, B., Chen, H. and Gan, X. (2019) 'How much is too much? The influence of work hours on social development: An empirical analysis for OECD countries', *International journal of environmental research and public health*. MDPI, 16(24), p. 4914.
[26] Manning, C. (no date) 'Globalization and Labour Markets in Boom and Crisis'.
[27] Martin, R. (2010) 'Roepke lecture in economic geography—rethinking regional path dependence: beyond lock-in to evolution', *Economic geography*. Taylor & Francis, 86(1), pp. 1–27.
[28] Mba, P. N., Nwosu, E. O. and Orji, A. (2021) 'Effects of exposure to risks on household vulnerability in developing countries: a new evidence from urban and rural areas of Nigeria', *Sage Open*. SAGE Publications Sage CA: Los Angeles, CA, 11(1), p. 21582440211002216.
[29] McKenzie, D. (2017) 'How effective are active labor market policies in developing countries? a critical review of recent evidence', *The World Bank Research Observer*. Oxford University Press, 32(2), pp. 127–154.

[30] Moore, B. and Scott-Clayton, J. (2025) 'The Firm's Role in Displaced Workers' Earnings Losses', *ILR Review*. SAGE Publications Sage CA: Los Angeles, CA, 78(3), pp. 517–542.
[31] Psacharopoulos, G. and Patrinos, H. A. (2018) 'Returns to investment in education: a decennial review of the global literature', *Education Economics*. Taylor & Francis, 26(5), pp. 445–458.
[32] Shapiro, C. and Stiglitz, J. E. (1984) 'Equilibrium unemployment as a worker discipline device', *The American economic review*. JSTOR, 74(3), pp. 433–444.
[33] Taufiq, N. and Dartanto, T. (2020) 'Education, Informal Turnover and Poverty Dynamics in Indonesia.', *International Journal of Economics & Management*, 14(1).
[34] Vermeulen, W. and Braakmann, N. (2023) 'How do mass lay-offs affect regional economies?' OECD.
[35] Yulianingrum, V. *et al.* (2022) 'Batik fashion trends and national identity', *Philosophica: Jurnal Bahasa, Sastra, dan Budaya*, 5(2), pp. 46–58.
[36] Zhou, D., Zhang, Q. and Li, J. (2024) 'Impact of informal employment on individuals' psychological well-being: microevidence from China', *International Journal of Mental Health Systems*. Springer, 18(1), p. 29.