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Health Shocks, Workforce Resilience, and Economic Productivity: Longitudinal Evidence from East Java

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Abstract

This study investigates the relationship between health status, health shocks, and labor force participation in East Java using panel data from the Indonesia Family Life Survey (IFLS) waves 3, 4, and 5. Employing fixed-effects and random-effects logistic regression models, the results show that good self-reported health significantly increases the probability of labor force participation, affirming the economic value of health as human capital. However, health shocks—captured as changes in health condition between waves—do not significantly predict labor market disengagement, indicating possible measurement limitations or labor supply rigidity. The analysis further reveals that the positive effect of good health is substantially weaker for women, suggesting gendered constraints in labor returns to health. Educational attainment consistently predicts labor force participation, reinforcing the complementary role of formal education in economic resilience. These findings contribute to the growing empirical literature on the health–labor nexus in emerging regional economies.

Keywords: *labor force participation, health shocks, gender disparity, East Java*

Abstrak

Penelitian ini mengkaji hubungan antara status kesehatan, guncangan kesehatan, dan partisipasi angkatan kerja di Jawa Timur dengan menggunakan data panel dari Indonesia Family Life Survey (IFLS) gelombang 3, 4, dan 5. Dengan menerapkan model regresi logistik efek tetap dan efek acak, hasil analisis menunjukkan bahwa kesehatan yang dilaporkan baik secara signifikan meningkatkan probabilitas partisipasi dalam angkatan kerja, menegaskan nilai ekonomi kesehatan sebagai modal manusia. Namun, guncangan kesehatan—yang diukur sebagai perubahan kondisi kesehatan antar gelombang—tidak secara signifikan memprediksi pelepasan dari pasar tenaga kerja, yang dapat menunjukkan keterbatasan pengukuran atau kekakuan dalam pasokan tenaga kerja. Analisis lebih lanjut mengungkapkan bahwa efek positif kesehatan yang baik jauh lebih lemah pada perempuan, mengindikasikan adanya hambatan gender dalam

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pengembalian tenaga kerja terhadap kondisi kesehatan. Tingkat pendidikan secara konsisten mempengaruhi partisipasi angkatan kerja, memperkuat peran komplementer pendidikan formal dalam ketahanan ekonomi. Temuan ini memberikan kontribusi terhadap literatur empiris yang berkembang mengenai keterkaitan antara kesehatan dan tenaga kerja di ekonomi regional yang sedang tumbuh.

***Kata Kunci** : partisipasi angkatan kerja, guncangan kesehatan, kesenjangan gender, Jawa Timur*

INTRODUCTION

East Java, one of Indonesia's most populous and economically vital provinces, faces significant challenges in boosting productivity and economic resilience. Among these challenges is the health vulnerability of its workforce, particularly amid demographic aging, rising prevalence of chronic illnesses, and uneven access to healthcare services across regions. In an era marked by global economic volatility, maintaining a healthy and productive working-age population is not only a public health imperative but also an economic necessity.

Indonesia's labor market has exhibited signs of stagnation in labor force participation, especially among women and older adults. Data from Statistics Indonesia (BPS) indicate that East Java's labor force participation rate has plateaued in recent years, with marked disparities across districts and demographic groups (BPS, 2024). Concurrently, non-communicable diseases (NCDs) and functional health limitations have emerged as leading barriers to sustained workforce engagement.

The relationship between health and productivity is well-established. Strauss & Thomas (1998) argue that better health enhances labor supply by increasing both hours worked and labor force participation. Similarly, Currie & Madrian (1999) highlight the causal link between adverse health events and labor market withdrawal, particularly when health shocks are sudden and severe. In the Indonesian context, Gertler & Gruber (2002) demonstrate that households experiencing health shocks often suffer significant income losses due to reduced labor supply.

Despite these insights, there remains a notable gap in empirical research examining how changes in health status over time influence labor force participation at the subnational level, such as in East Java. Most existing studies rely on cross-sectional data, which fail to account for unobserved individual heterogeneity. Moreover, the gendered and spatial dimensions of health-related labor market exit remain underexplored.

This study seeks to address existing gaps by leveraging longitudinal data from the Indonesia Family Life Survey (IFLS) waves 3 (2000), 4 (2007), and 5 (2014), with a specific focus on East Java. By constructing a 14-year panel dataset, the

research estimates the impact of health shocks—characterized as declines in self-reported health status—on the probability of sustained labor force participation, employing fixed effects modeling to control for time-invariant individual characteristics. The study aims to evaluate how health status and health shocks influence labor force participation, to determine the extent to which chronic illness and changes in self-reported health contribute to workforce attrition, and to assess whether these effects vary across gender, age groups, or urban-rural residency. Central to the inquiry are questions regarding whether health deterioration diminishes labor force engagement in East Java, how acute changes in health status affect employment trajectories over time, and whether the consequences of health disparities on labor participation are more significant among women or older workers. Addressing these issues, the study contributes to policy discussions aimed at enhancing human capital development and economic resilience in East Java through integrated health and labor market interventions.

METODE PENELITIAN

This study utilizes panel data from the Indonesia Family Life Survey (IFLS), specifically waves 3, 4, and 5, conducted in 2000, 2007, and 2014, respectively. The IFLS, a comprehensive longitudinal survey developed by the RAND Corporation in collaboration with SurveyMETER, covers approximately 83% of Indonesia's population. For this analysis, the sample is restricted to respondents residing in East Java to align with the study's regional focus. The IFLS provides extensive data on individual labor force status, self-assessed health, demographic characteristics, and household variables—key components for examining the relationship between health and labor force participation (Strauss & Thomas, 1998).

The analytical sample includes working-age individuals (aged 15–64) observed in at least two consecutive waves (either waves 3 and 4, or waves 4 and 5) with complete information on employment and health indicators. To ensure representativeness, appropriate sample weights are applied.

The dependent variable in this study is labor force participation (LFP), operationalized as a binary indicator coded 1 if respondents reported working or actively seeking employment during the reference week, and 0 otherwise. This definition aligns with standard labor market measures commonly employed in micro-econometric analyses (Blundell et al., 2004).

The primary independent variables capture health dynamics. Self-reported general health is measured on a five-point Likert scale ranging from very healthy to very unhealthy. For robustness, a binary classification distinguishes good/very good health from fair or poorer health. Health shocks are operationalized as changes in health status between survey waves, with deterioration coded as 1, consistent with prior studies on health and labor market outcomes (Bound et al., 1999; Cai & Kalb, 2006).

Control variables include age (continuous, in years), gender (binary: male = 1, female = 0), educational attainment (categorized into elementary, junior secondary, senior secondary, and university levels), marital status (binary: married or not), household economic status proxied by a wealth index derived from principal component analysis of assets and amenities (Filmer & Pritchett, 2001), and urban versus rural residence based on IFLS household location data. Together, these variables provide a comprehensive framework to isolate the effects of health and health shocks on labor market participation within a socio-demographic context.

To identify the causal impact of health shocks on labor force participation, the study employs a fixed effects binary logistic regression model:

$$LFP_{it} = \beta_0 + \beta_1 \Delta HealthStatus_{it} + \beta_2 HealthStatus_{it} + \beta_3 X_{it} + \gamma_i + \delta_t + \varepsilon_{it} \quad (1)$$

In the empirical specification, the dependent variable is the individual's labor force participation status at time t, denoted as LFP_{it} which equals 1 if the respondent is either working or actively seeking employment, and 0 otherwise. The principal explanatory variable of interest is the health shock variable, $\Delta HealthStatus_{it}$ which captures intertemporal changes in self-reported health status across survey waves and serves as a proxy for sudden deterioration or improvement in health. The current level of health at time represented by $HealthStatus_{it}$, is derived from the respondent's self-assessment of general health, operationalized either on a Likert scale or as a binary indicator. The model also includes a vector of time-varying individual and household characteristics X_{it}, encompassing age, gender, educational attainment, marital status, urban residence, and a household wealth index, which are standard controls in labor supply and health economics literature. Unobserved individual heterogeneity is captured by γ_i, which controls for all time-invariant factors such as innate ability, preferences, or genetic predispositions. Period-specific macroeconomic and policy shocks that affect all individuals similarly are accounted for using survey wave fixed effects δ_t. The term ε_{it} represents the idiosyncratic error component.

Using individual fixed effects helps mitigate bias from time-invariant unobserved characteristics such as ability, preferences, and family background. The fixed-effects logistic estimator is appropriate for binary dependent variables in panel settings, and ensures consistency under standard assumptions (Chamberlain, 1980; Wooldridge, 2010).

This specification is particularly well-suited for longitudinal data and research objectives, as it separates health dynamics by including both the level and change in health status, enabling us to capture differential impacts of chronic health conditions and acute health shocks on labor participation, a distinction emphasized in recent empirical studies (Beckmannshagen & Koenig, 2025; Di

Meo & Eryilmaz, 2025). Moreover, individual fixed effects mitigate potential bias from unobserved, time-invariant factors such as innate ability or long-term health endowments (Blundell et al., 2004; Holt, 2010), and wave fixed effects control for macroeconomic or policy changes affecting all individuals within a given survey wave.

To explore heterogeneous effects and enhance policy relevance, the model is extended to include an interaction term between health status and gender:

$$LFP_{it} = \beta_0 + \beta_1 \Delta HealthStatus_{it} + \beta_2 HealthStatus_{it} + \beta_3 HealthStatus_{it} \times Gender_i + \beta_4 HealthStatus_{it} \times Female_i + \beta_5 HealthStatus_{it} \times Location_{it} + \beta_6 X_{it} + \gamma_i + \delta_t + \varepsilon_{it} \quad (2)$$

This interaction allows us to test whether the labor market impact of health shocks differs by gender, reflecting evidence from labor supply and health economics literature that women and men may respond differently to health adversities (Di Meo & Eryilmaz, 2025).

Given the binary nature of LFPit, estimation is conducted using fixed-effects logistic regression (conditional logit), which appropriately handles panel data with binary outcomes and controls for individual fixed effects, focusing on within-individual variation over time (Blundell et al., 2004).

HASIL DAN PEMBAHASAN

Table 1. Descriptive Statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
Labor force participation	8088	.77	.421	0	1
Health status	8091	.864	.342	0	1
Health shock	8091	-1	0	-1	-1
Age	8091	36.258	12.354	15	64
Gender	8091	1.899	.995	1	3
Education	8070	2.017	1.17	0	4
Marital Status	8091	.757	.429	0	1
Location	8091	1.381	.486	1	2

Source: Author's own calculation based on IFLS data using Stata 18.

Table 1 presents descriptive statistics for the main variables used in the analysis. On average, 76.99% of individuals participated in the labor force, indicating relatively high engagement among working-age respondents in East Java. Meanwhile, 86.44% of respondents reported being in good health, reflecting a predominantly healthy sample. The variable representing categorized health shocks was constant across observations and thus omitted from the regression due

to perfect collinearity—suggesting either a data coding issue or lack of variation across time and individuals.

The average age of respondents is 36.26 years, with a range of 15 to 64, consistent with the working-age population. The gender variable, while included in the data, was dropped in the fixed-effects model due to zero within-individual variation, implying that gender remained unchanged across waves. Educational attainment (mean = 2.02) suggests that, on average, respondents completed junior or senior high school. Approximately 75.7% of the sample were married, and 62% resided in urban areas.

Our study estimates the causal effect of individual health status on labor force participation (LFP) in East Java using IFLS panel data (Waves 3–5). Two econometric specifications—conditional fixed-effects logistic regression and random-effects logistic regression—were estimated to address unobserved heterogeneity and identify the most consistent estimator for inference. The Hausman specification test was subsequently employed to guide model selection. All models included demographic and socioeconomic controls, with year dummies added in the random-effects model to capture macroeconomic shifts over time.

The analysis is grounded in the theoretical expectation that good health enhances individuals' physical and cognitive capacity to participate in labor markets (Cai & Kalb, 2006; Strauss & Thomas, 1998), while poor health or health shocks may deter labor market engagement through increased opportunity costs or reduced work capacity (Currie & Madrian, 1999; Dano, 2005). Education, age, gender, and marital status were also controlled for, given their established influence on labor participation (Alatas & Newhouse, 2010; Becker, 2009).

Table 2. The effect of Health on Labor Force Participation

	(FE)	(RE)
VARIABLES	labor force participation	labor force participation
good/poor (health status)	0.5694	0.4560***
	(0.3683)	(0.1165)
(health shock) comparing last year	-0.2815	0.0231
	(0.3448)	(0.1380)
Age	0.0021	0.0250***
	(0.0099)	(0.0032)
Gender		-1.1281***
		(0.0489)
Education	0.9992***	0.1138***

	(0.2362)	(0.0361)
Marital status	0.2010	0.1633*
	(0.2274)	(0.0841)
Location	-0.1299	-0.0287
	(0.2556)	(0.0819)
lnsig2u		-0.1851
		(0.2494)
Constant		3.2171***
		(0.2667)
Observations	1,348	8,067
Number of panelid	581	5,214

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Regression output using Stata 18.

The conditional fixed-effects logistic regression, which accounts for all time-invariant individual factors, produced nuanced results as shown in Table 2. The coefficient for self-reported good health (health status) was positive (0.569), indicating a positive association between better health and labor force participation, although this effect was not statistically significant. This lack of precision likely results from substantial sample reduction in the fixed-effects model—only 1,348 observations from 581 individuals remained due to limited within-individual variation, as cases with uniform outcomes were excluded. Consequently, reduced statistical power limits robust inference. Nonetheless, the positive direction aligns with prior research linking improved health to increased labor supply (Case & Paxson, 2011; Thomas et al., 2006). Conversely, education was a strong and statistically significant predictor of labor participation at 0.999, consistent with human capital theory (Becker, 1962) and findings in Indonesia (Alatas & Newhouse, 2010; Suryadarma & Yamauchi, 2013). The odds ratio suggests individuals with higher education are more than twice as likely to be labor force participants, controlling for other variables. Other covariates such as age, marital status, and urban versus rural residence showed no significant effects in the fixed-effects model. The non-significant age coefficient may reflect limited within-individual variation over the study period, while gender was excluded due to lack of within-person change, a common issue in short-panel fixed-effects analyses (Wooldridge, 2010). Health shocks also lacked statistical significance at 0.282 though its negative sign aligns with theoretical expectations.

In contrast, the random-effects logistic regression, which incorporates both within- and between-individual variation with a larger sample (8,067 observations from 5,214 individuals), yielded more precise and statistically significant results (Table 2). The coefficient for health_bin was positive and highly significant, confirming that self-reported good health substantially increases the likelihood of

labor force participation. The corresponding odds ratio indicates a 58% higher probability of participation among healthy individuals, corroborating literature on the economic impacts of poor health (Cai & Kalb, 2006; Thomas et al., 2006). Age demonstrated a positive and significant effect at 0.025, suggesting a nonlinear association possibly linked to rising economic responsibilities with age. Gender was significant and negatively associated with labor force, reflecting lower female labor participation consistent with previous studies in Indonesia (Dhanani & Islam, 2004; Suryadarma & Yamauchi, 2013). Education remained a significant predictor, which is 0.114, but with reduced magnitude relative to the fixed-effects model, reflecting between-individual comparisons. Marital status was marginally significant, and indicate a potential positive influence on labor participation, likely related to household income strategies. Health shocks did not significantly affect labor force participation, possibly due to measurement error or transient shocks without lasting labor market withdrawal. The Hausman test rejected the null hypothesis of equal coefficients ($\chi^2(6) = 23.67$, $p = 0.0006$), indicating fixed-effects estimation provides more consistent results. Despite the greater efficiency and sample size of the random-effects model, correlated unobserved heterogeneity justifies reliance on fixed-effects estimates for causal inference (Greene, 2012; Wooldridge, 2010).

Our study delves deeper into the conditional effects of health status on LFP, specifically focusing on the gender-based heterogeneity. Understanding how the effect of health status varies between males and females is critical to designing inclusive labor market and health policies in developing economies such as Indonesia, where the gender gap in labor market access remains persistent (Emcet Oktay Tas et al., 2024). The empirical investigation employs both fixed-effects and random-effects logistic regression models to rigorously assess the interaction between health status and gender. This approach is in line with recent empirical labor economics literature emphasizing the importance of examining conditional effects to uncover hidden disparities (Currie & Madrian, 1999; de Ree & Alessie, 2011).

Table 3. Results with Interaction Term Using Random-Effect Model

VARIABLES Labor Force Participation	(1)	(2)	(3)
(health status) good/poor	1.3418***	0.9645***	0.3638
	(0.2561)	(0.1731)	(0.2984)
Gender	-0.8084***		-1.1286***
	(0.0936)		(0.0489)
Health status x gender	-0.3773***		
	(0.0989)		
(Health shock) compare last year	0.0282	0.0282	0.0234

	(0.1360)	(0.1360)	(0.1381)
Age	0.0251***	0.0251***	0.0250***
	(0.0032)	(0.0032)	(0.0032)
Education	0.1120***	0.1120***	0.1141***
	(0.0361)	(0.0361)	(0.0361)
Marital status	0.1714**	0.1714**	0.1630*
	(0.0841)	(0.0841)	(0.0841)
Location (urban/rural)	-0.0248	-0.0248	-0.0842
	(0.0818)	(0.0818)	(0.1843)
lnsig2u	-0.2014	-0.2014	-0.1832
	(0.2514)	(0.2514)	(0.2492)
female gender		-1.6168***	
		(0.1872)	
Health status x female		-0.7545***	
		(0.1978)	
Health status x location			0.0658
			(0.1960)
Constant	2.4570***	1.6486***	3.2958***
	(0.3236)	(0.2688)	(0.3559)
Observations	8,067	8,067	8,067
Number of panelid	5,214	5,214	5,214

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Regression output using Stata 18.

Table 3 presents interaction effects derived from the random-effects logistic regression. The coefficient for the primary health variable (health status) is positive and statistically significant at 0.964, indicating that individuals reporting good health have a markedly higher likelihood of labor force participation. Critically, the interaction term health status × female is negative and significant at 0.755, suggesting that the positive impact of good health on labor participation is considerably attenuated for women relative to men.

Specifically, the marginal effect of good health on female labor force participation is 0.209 (0.964 – 0.755), substantially lower than the effect observed for males (0.964). This indicates that although improved health promotes labor market involvement for both genders, the effect size for women is markedly reduced. These results provide robust evidence of persistent gender-based labor market constraints in Indonesia, which remain even among healthier individuals.

This interaction aligns with existing literature on gender disparities in labor markets within developing countries. For example, Jayachandran (2021) documents that despite better health and education, women's labor market participation is limited by social norms, domestic obligations, and discrimination. Correspondingly, Strauss & Thomas (1998) argue that health improvements translate more effectively into labor market gains for men due to structural gender-specific barriers.

Table 4. Results with Interaction Term Using Fixed-Effect Model

VARIABLES Labor Force Participation	(1)	(2)	(3)
(Health status) good/poor	1.3714**	1.2104**	0.4932
	(0.6311)	(0.5151)	(0.6518)
Gender	-		-
Health status x gender	-0.1610		
	(0.1828)		
(Health shock) compare last year	-0.4519	-0.4519	-0.4480
	(0.3992)	(0.3992)	(0.3998)
Age	-0.0631	-0.0631	-0.0592
	(0.0803)	(0.0803)	(0.0803)
Education	0.8440***	0.8440***	0.8275***
	(0.2457)	(0.2457)	(0.2447)
Marital status	0.1809	0.1809	0.2039
	(0.2519)	(0.2519)	(0.2527)
Location (urban/rural)	0.2363	0.2363	-0.0446
	(0.2836)	(0.2836)	(0.3934)
female gender		-	
Health status x female		-0.3219	
		(0.3655)	
Health status x location			0.3372
			(0.3411)
Observations	1,348	1,348	1,348
Number of panelid	581	581	581

Standard errors in parentheses

*** p<0.01, ** p<0.05, * p<0.1

Source: Regression output using Stata 18.

The fixed-effects logistic regression inherently omits the main effect of gender due to its time-invariant characteristic, and the interaction between health status and gender is not statistically significant within this model. This nonsignificance likely stems from the limited sample size (n = 1,348) and the short panel duration (three waves), which reduce statistical power and hinder detection of differential effects. Conversely, the random-effects model, estimated on a substantially larger sample (n = 8,067), offers enhanced power and generates more reliable estimates of gender-based heterogeneity. The consistent direction of the interaction coefficients across both approaches strengthens confidence in the robustness of these findings, despite the fixed-effects model's inherent constraints.

These outcomes underscore the necessity for gender-responsive labor and health policies. Although health improvements broadly stimulate labor supply, their advantages are unevenly distributed between men and women. Therefore, policies aimed at increasing female labor force participation must extend beyond health interventions to tackle systemic gender barriers, such as access to childcare, flexible employment arrangements, and targeted active labor market programs. Moreover, this evidence concurs with broader research on the gender-health-labor relationship in developing contexts (Banerjee et al., 2015), indicating that unaddressed disparities risk sustaining the dual burden on women and impeding inclusive economic development, particularly in regions like East Java from which the panel data are derived.

CONCLUSION AND RECOMMENDATION

This study presents robust empirical evidence on the intricate relationship between health status, gender, and labor force participation in East Java, utilizing panel data from IFLS waves 3 to 5. Applying fixed-effects and random-effects logistic regression models, the analysis demonstrates that good health substantially increases the probability of labor market participation. However, health shocks, defined as abrupt health declines, show weak and imprecisely estimated effects. Notably, gender significantly moderates the health–labor link: although better health generally promotes labor force involvement, this positive effect is markedly reduced for women, highlighting enduring structural barriers that limit women's economic participation despite relatively good physical health.

Aligned with theoretical frameworks connecting health to economic productivity (Cai & Kalb, 2006; Strauss & Thomas, 1998), individuals reporting good or very good health exhibit significantly higher odds of labor participation, with the random-effects model indicating roughly a 58% increase. Yet, this advantage is strongly gendered; men display a more pronounced labor market response to good health, while women's response diminishes by over half, as evidenced by a significant negative interaction term. Contrary to expectations, health deterioration between survey waves does not significantly predict labor force withdrawal, potentially due to measurement constraints or informal sector

buffering and limited social protection. Education remains a consistent, powerful predictor of labor participation across models. These findings emphasize the complex roles of health, gender, and education in labor outcomes and underscore the need for refined health shock measurement and enhanced social safety nets.

To mitigate these disparities and strengthen economic resilience amid demographic changes and increasing non-communicable diseases, the following policy recommendations are proposed:

1. Integrate preventive health and workforce initiatives through collaboration between East Java's health and labor authorities, focusing on health promotion, chronic disease screening, and ergonomic workplace adaptations, especially targeting older and vulnerable workers.
2. Provide targeted support for older and rural workers by expanding mobile health services, job-matching platforms, and community-based retraining, in alignment with SDGs 8 and 10 to foster inclusive labor markets.
3. Enhance health insurance coverage and chronic care access by ensuring comprehensive BPJS Kesehatan enrollment, expanding chronic care benefits, and strengthening health data systems to monitor individual health trajectories, thereby improving labor continuity.Implement gender-responsive employment and health policies addressing systemic impediments, including wage subsidies for women, affordable childcare, flexible work arrangements, enforcement of anti-discrimination laws, and promotion of equal pay, consistent with SDG 5.
4. Align strategies with East Java's Regional Medium-Term Development Plan (RPJMD) and regional SDGs by integrating health indicators into labor planning and advancing localization of SDG 3, SDG 8, and SDG 10 targets.

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