

The Effect Of Regional Minimum Wage, Educational Attainment And Industrial Investment On Labor Absorption In The Manufacturing Sector

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Abstract.

This study aims to comprehensively analyze the effect of Regional Minimum Wage (UMR), educational attainment, and industrial investment on labor absorption in Indonesia's manufacturing sector. Structural transformation positions the manufacturing sector as a strategic pillar in formal employment creation and the reallocation of surplus labor. Employing a quantitative approach with balanced panel data covering 34 provinces in Indonesia from 2017 to 2024 (272 observations), the econometric model is estimated using the Fixed Effect Model (FEM) with Driscoll-Kraay robust standard errors to resolve groupwise heteroskedasticity, serial autocorrelation, and cross-sectional spatial dependence. The empirical results reveal that: (1) Regional Minimum Wage exerts a statistically significant negative effect on manufacturing labor absorption ($\beta = -0.218$, $p < 0.05$), validating neoclassical theory regarding wage rigidity that incentivizes capital-for-labor substitution in labor-intensive industries; (2) Educational attainment, proxied by mean years of schooling, has a positive and significant effect on labor absorption ($\beta = 0.145$, $p < 0.01$), substantiating that human capital quality is essential for adapting to modern technology; and (3) Industrial investment (DDI and FDI) significantly fosters labor absorption ($\beta = 0.092$, $p < 0.05$), although its elasticity is moderate due to capital-deepening trends. These findings recommend productivity-indexed minimum wage formulas, accelerated vocational link-and-match curricula, and targeted fiscal incentives to prevent premature deindustrialization.

Keywords: Regional Minimum Wage, Educational Attainment, Industrial Investment, Labor Absorption, Manufacturing Sector.

I. INTRODUCTION

The manufacturing sector has historically been recognized as the primary engine of economic modernization, productivity enhancement, and structural transformation in developing nations [1, 2]. Through its extensive forward and backward linkages, industrialization not only stimulates Gross Domestic Product (GDP) expansion, but also serves as an indispensable mechanism for absorbing surplus labor transitioning from low-productivity subsistence agriculture into formal industrial employment with superior earnings [3, 4]. In Indonesia, the manufacturing sector consistently contributes approximately 18% to 20% to the national GDP and forms the backbone of formal employment generation. Nevertheless, over the past decade, numerous developing economies, including Indonesia, have encountered the risk of premature deindustrialization, wherein the share of industrial employment stagnates or contracts before achieving advanced economic maturity [5, 6].

The capacity of the manufacturing industry to absorb labor is fundamentally governed by the dynamic interaction among labor wage regulations, the quality of human capital stock, and the trajectory of physical capital accumulation [7]. From a labor market perspective, Regional Minimum Wage (UMR) policy—along with Provincial and District Minimum Wage (UMP/UMK) regulations—represents one of the most widely debated governmental interventions in labor economics literature [8, 9]. On one hand, statutory minimum wage increments aim to preserve workers' purchasing power, alleviate income inequality, and enhance internal firm efficiency through the efficiency wage mechanism [10, 11]. On the other hand, neoclassical labor demand theory posits that establishing minimum wage floors above the marginal revenue product of labor increases marginal production costs [12, 13]. In labor-intensive subsectors such as textiles, apparel, footwear, and furniture operating with narrow profit margins and fierce global competition, rapid real wage increases compel enterprises to downsize payrolls, freeze entry-level hiring, relocate facilities to lower-wage jurisdictions, or accelerate labor-saving automation [14, 15].

Beyond wage dynamics, the quality of human resources plays an increasingly pivotal role in determining modern industrial absorptive capacity [16]. Grounded in Human Capital Theory, formal education and vocational skill development enhance cognitive faculties, intrinsic worker productivity, and technological adaptability [17, 18]. The industrial paradigm shift toward intelligent automation, computerized numerical control (CNC) machinery, and digitalized manufacturing (Industry 4.0) has substantially altered the composition of labor demand [19]. The capital-skill complementarity hypothesis asserts that modern capital infrastructure requires educated, technically proficient labor as a complement, while routine unskilled labor faces high substitution risks [20, 21]. In Indonesia, labor market friction is exacerbated by a persistent skill mismatch between educational institutional outputs and industrial competencies, making mean years of schooling a fundamental determinant of workforce absorption in high-value-added manufacturing [22, 23].

A third vital determinant is industrial investment flows, encompassing both Domestic Direct Investment (DDI) and Foreign Direct Investment (FDI) [24, 25]. According to the Harrod-Domar and Solow growth models, gross fixed capital formation expands physical factory capacity, establishes new production lines, and generates derived demand for labor through the output expansion effect [26, 27]. Furthermore, FDI frequently facilitates technological spillovers and managerial expertise that accelerate industrial expansion in host economies [28, 29]. Nonetheless, recent capital inflows into the manufacturing sector have become increasingly capital- and technology-intensive, particularly in mineral downstreaming (hilirisasi), basic chemicals, and electric vehicle battery supply chains [30, 31]. This capital-deepening phenomenon tends to attenuate the employment elasticity per unit of investment compared to historical labor-intensive industrialization phases [32, 33].

While previous empirical studies have investigated the determinants of employment absorption, most literature in Indonesia examines minimum wages, education, or investment in isolation without evaluating their simultaneous interaction within a comprehensive longitudinal panel framework [34, 35]. Moreover, empirical estimations frequently overlook provincial spatial heterogeneity and econometric issues such as heteroskedasticity and cross-sectional dependence. This study addresses these gaps by evaluating the joint effect of Regional Minimum Wage, educational attainment, and industrial investment on manufacturing labor absorption across 34 Indonesian provinces from 2017 to 2024 using a Fixed Effect Model (FEM) with Driscoll-Kraay robust standard errors. The findings are expected to provide empirical foundations for designing productivity-indexed wage policies, vocational revitalization, and targeted investment incentive frameworks.

II. METHODS

This study employs an explanatory quantitative approach utilizing balanced longitudinal secondary data (panel data) across 34 Indonesian provinces over the period 2017 to 2024 ($N = 34$, $T = 8$, total balanced observations $N \times T = 272$). Data were retrieved from official statistical databases of Statistics Indonesia (Badan Pusat Statistik - BPS), specifically the Medium and Large Manufacturing Survey (Survei IBS), National Labor Force Survey (Sakernas), National Socioeconomic Survey (Susenas), and investment realization reports from the Ministry of Investment / BKPM [34].

The operational definitions of variables are as follows: (1) Manufacturing Labor Absorption (LAB), measured by total formal workers absorbed in medium and large manufacturing establishments, log-transformed as $\ln(\text{LAB})$; (2) Regional Minimum Wage (UMR), measured by the real provincial minimum wage deflated by the provincial CPI with base year 2018 ($\ln(\text{UMR})$); (3) Educational Attainment (EDU), proxied by Mean Years of Schooling of the working-age population aged 15 and above (in years); (4) Industrial Investment (INV), measured by total realized FDI and DDI in the secondary manufacturing sector in million IDR ($\ln(\text{INV})$); and (5) Manufacturing Economic Growth (GRW), measured by the real annual growth rate of provincial manufacturing GRDP (%) as a macroeconomic control variable.

The econometric model of labor demand is derived from a Cobb-Douglas production function and specified in log-linear form as follows [11, 35]:

$$\ln(LAB)_{it} = \beta_0 + \beta_1 \ln(UMR)_{it} + \beta_2 EDU_{it} + \beta_3 \ln(INV)_{it} + \beta_4 GRW_{it} + \mu_i + \varepsilon_{it} \quad (1)$$

where i denotes the cross-sectional provincial units ($i = 1, 2, \dots, 34$), t represents the annual time series ($t = 2017, \dots, 2024$), β_0 is the constant term, β_1 through β_4 denote elasticity coefficients, μ_i captures unobserved province-specific individual fixed effects (geographical advantages, natural endowments, and institutional quality), and ε_{it} represents the idiosyncratic error term. The econometric procedure involves model selection tests (Chow and Hausman tests), classical assumption testing (Modified Wald heteroskedasticity and Wooldridge serial autocorrelation tests), and final parameter estimation via the Fixed Effect Model (FEM) with Driscoll-Kraay robust standard errors [10].

III. RESULT AND DISCUSSION

Descriptive statistics across the 272 panel observations demonstrate substantial spatial heterogeneity across the Indonesian archipelago. The absorbed manufacturing workforce averaged 284,520 persons, ranging from 12,450 persons in emerging eastern provinces to over 2.18 million workers in heavily industrialized clusters on Java Island (West Java, East Java, and Central Java). National educational attainment averaged 8.94 years of schooling (equivalent to junior secondary education), while the real monthly regional minimum wage averaged IDR 2,645,800.

Table 1. Panel Regression Estimation Results for Labor Absorption (Dependent Variable: $\ln(LAB)$)

Independent Variables	Pooled OLS (CEM)	Random Effect (REM)	Fixed Effect (FEM - Robust)
$\ln(UMR)$	-0.382*** (0.081)	-0.245** (0.098)	-0.218** (0.089)
EDU	0.094*** (0.021)	0.112*** (0.029)	0.145*** (0.034)
$\ln(INV)$	0.158*** (0.032)	0.104*** (0.028)	0.092** (0.036)
GRW (Control)	0.018* (0.009)	0.024** (0.010)	0.021** (0.008)
Constant	5.412*** (0.842)	6.219*** (0.912)	6.840*** (1.045)
R-squared (Within)	0.612	0.584	0.678
F-statistic	45.82***	38.91***	54.12***
Chow Test (p-value)	—	—	0.0000 (FEM Preferred)
Hausman Test (p-value)	—	—	0.0018 (FEM Preferred)

Note: Standard errors are in parentheses. *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Source: Processed Data (2026).

Based on the formal specification tests presented in Table 1, both the Chow Test ($p = 0.0000$) and the Hausman Test ($p = 0.0018$) reject their respective null hypotheses at the 1% significance level, confirming that the Fixed Effect Model (FEM) is the statistically consistent and preferred estimator. Diagnostic checks indicated groupwise heteroskedasticity and serial autocorrelation, which were effectively corrected using Driscoll-Kraay robust standard errors.

Effect of Regional Minimum Wage (UMR): The parameter estimate for $\ln(UMR)$ is negative and statistically significant at the 5% level ($\beta_1 = -0.218$, $p = 0.017$). This indicates that, ceteris paribus, a 10% increase in real minimum wage leads to a 2.18% contraction in manufacturing labor absorption. This finding is consistent with neoclassical labor demand theory and previous empirical literature [8, 12, 14]. In Indonesia's industrial landscape, which remains concentrated in export-oriented labor-intensive subsectors, wages constitute a substantial proportion of operational overhead. When statutory wage increments outpace labor productivity gains, manufacturers respond by rationalizing workforce size, reducing overtime, curbing contractual recruitment, or relocating plants to jurisdictions with lower wage floors [15, 35].

Effect of Educational Attainment: The educational attainment variable (EDU) exhibits a positive and highly significant coefficient at the 1% level ($\beta_2 = 0.145$, $p = 0.000$). This indicates that each additional year of mean schooling increases manufacturing labor absorption by approximately 14.5%. This empirical result reinforces Human Capital Theory and the capital-skill complementarity hypothesis [17, 20]. Modern manufacturing operations require workers endowed with technical literacy, analytical reasoning, and operational adaptability to work alongside computerized production systems and quality-control frameworks. Regions with higher educational attainment foster industrial expansion by reducing corporate onboarding and training costs [22, 23].

Effect of Industrial Investment: The coefficient of realized industrial investment $\ln(INV)$ is positive and statistically significant at the 5% level ($\beta_3 = 0.092$, $p = 0.012$). This confirms that a 10% increase in realized manufacturing investment generates a 0.92% expansion in labor demand. While this supports capital accumulation theory [24, 26], the elasticity magnitude is relatively moderate. This reflects a structural shift wherein recent FDI and DDI inflows have been predominantly allocated toward capital-intensive and automated industries (such as metal smelters and chemical processing) [30, 32]. Consequently, capital investments yield substantial output gains but with moderate direct headcount additions compared to traditional light industries.

IV. CONCLUSION

This study concludes that labor absorption in the manufacturing sector across 34 Indonesian provinces from 2017 to 2024 is simultaneously determined by minimum wage policies, human capital stock, and industrial investment. Regional Minimum Wage exhibits a statistically significant negative elasticity ($\beta = -0.218$), whereas educational attainment ($\beta = 0.145$) and industrial investment ($\beta = 0.092$) demonstrate significant positive elasticities. The policy implications derived from these findings are: (1) Wage determination councils and local governments should adhere to objective, productivity-indexed minimum wage formulas aligned with regional inflation and Total Factor Productivity (TFP) growth to safeguard labor-intensive clusters; (2) Government authorities should accelerate the link-and-match modernization of vocational institutions (SMK and polytechnics) to bridge industrial skill deficits; and (3) Investment authorities should structure fiscal incentives (e.g., super tax deductions) tied directly to domestic job creation quotas and workforce training programs.

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