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**Inclusive Growth and Employment Challenges in ASEAN-10:
A Panel Quantile Regression**

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Abstract: The study examines the determinants of unemployment in the ten ASEAN member countries during 2014–2023, focusing on economic performance and labour market inclusiveness. Four explanatory variables are considered: output per worker growth, working poverty, youth not in employment, education or training (NEET), and female vulnerable employment. Given the limitations of conventional mean-based estimation, panel quantile regression (PQR) is employed to examine how these factors influence unemployment across different points of its distribution, accounting for cross-country heterogeneity. The findings indicate that output per worker growth is negatively and statistically significantly associated with changes in unemployment at the 60th and 70th quantiles, while the estimates at the 80th and 90th quantiles are not statistically significant. The results therefore suggest that the productivity–unemployment relationship varies across the conditional distribution of changes in unemployment. Working poverty and female vulnerable employment exhibit heterogeneous effects across quantiles, reflecting differences in labour market structures and informality. The effect of NEET is generally weak and inconsistent. Overall, the findings highlight the importance of enhancing productivity, reducing labour market vulnerability, and promoting inclusive employment opportunities for sustainable labour market outcomes in ASEAN.

Keywords: Unemployment, ASEAN, Panel quantile regression, Productivity growth, Inclusive employment

Introduction

In the last three decades, there has been a rapid transformation of the economies of Association of Southeast Asian Nations (ASEAN) countries characterized by structural change, industrialization, regional economic integration and sustained economic growth. However, labour markets of the 10 ASEAN member states are heterogeneous in terms of

quality, productivity and inclusiveness. For example, persistent labour informality, working poverty and high youth NEET (not in education, employment, or training) rates are challenges for some ASEAN countries, while others such as Singapore, Malaysia and Vietnam enjoy low unemployment and relatively high productivity (ASEAN Secretariat, 2020; International Labour Organization [ILO], 2024). Structural issues and uneven economic growth remain recurring issues across the member states of ASEAN.

Economic theory and literature show an inverse relationship between output growth and unemployment in the form of Okun's Law (Okun, 1962). When the economy grows it requires more labor by firms which leads to lower level of unemployment rate as growth increases demand for labor. In ASEAN labor markets, it is really important to understand how economic growth affects employment. This is because ASEAN is changing in its structural industries and technological use. The unemployment elasticity of output per worker is highly relevant for measuring the link between productivity growth and employment creation (Barnichon, 2010). This information is important for the development of policies aimed at more inclusive and sustainable employment creation in the region.

Beyond output growth, working poverty and youth exclusion, measured by the share of young people who are not in employment, education or training (NEET), are also important indicators of labour market vulnerability. A high incidence of working poverty suggests that having a job does not necessarily provide a reliable route out of poverty, particularly in economies where informal and low-productivity activities remain widespread. Similarly, a high rate of NEET implies difficulties in the transition from school to work, limited employment opportunities, and the risk of long-term adverse effects on future employability and earnings (ILO, n.d.-a).

However, the extent to which working poverty and youth exclusion are associated with unemployment, particularly when considered alongside productivity growth, remains an empirical question for the ASEAN-10 economies. Examining these dimensions together may help clarify whether unemployment dynamics are associated not only with economic performance but also with the vulnerability and accessibility of employment opportunities.

Besides, gender-based differences in employment quality also another concerned. There is inequality between men and women in labor market. The kind of work that women often do, like family work and self-employment without any contracts or protection shows that there are big inequalities in the labor market. Female vulnerable employment, which often includes unpaid family work and self-employment without formal contracts or adequate social protection, reflects deeper structural inequalities within labour markets. Previous study indicates that countries with a larger share of women in vulnerable forms of employment tend to exhibit greater labour market segmentation and lower resilience during economic shocks (Bue, 2022). Considering this factor alongside productivity growth, working poverty, and youth exclusion gives a better idea of the forces shaping unemployment across the ASEAN-10 economies.

An important unresolved issue is whether these four dimensions—output per worker growth, working poverty, youth NEET, and female vulnerable employment—are associated

with unemployment in similar or different ways when examined jointly across ASEAN-10. An integrated analysis is useful because these factors represent distinct but potentially interconnected aspects of economic performance and labour market vulnerability.

Inclusive Growth provides a broader conceptual perspective for understanding the relationship between economic performance and labour market outcomes. Economic growth alone does not necessarily ensure that the benefits of economic development are widely shared, particularly when productivity improvements are not accompanied by sufficient employment opportunities, adequate earnings, and access to secure work. From this perspective, unemployment represents one important dimension of labour market inclusion, while working poverty, youth exclusion, and female vulnerable employment highlight additional challenges concerning the quality and accessibility of employment opportunities.

In the context of ASEAN-10, these dimensions are particularly relevant given the heterogeneity of economic structures, productivity performance, and labour market conditions across member states. An economy may experience relatively low unemployment while continuing to face substantial working poverty or vulnerable employment. Therefore, examining unemployment alongside indicators of labour market vulnerability provides a more nuanced understanding of the employment-related challenges associated with Inclusive Growth. Nevertheless, these indicators represent selected dimensions of labour market inclusion rather than a comprehensive measure of Inclusive Growth itself.

A further gap concerns the possibility that the relationships vary according to the level of unemployment. Conventional fixed-effects and random-effects panel models generally summarize conditional mean relationships and may not reveal how associations differ across the conditional unemployment distribution.

Accordingly, this study examines the relationships between output per worker growth, working poverty, youth not in employment, education, or training (NEET), female vulnerable employment, and unemployment across the ASEAN-10 economies from 2014 to 2023. The usual methods, like fixed-effects or random-effects models (conventional mean-based panel estimators) only look at the relationships between variable focusing on average relationships. They may fail to capture how explanatory variables affect countries with different levels of unemployment. By employing panel quantile regression, the study investigates whether these relationships vary across different points of the unemployment distribution.

The empirical novelty of this study lies in examining productivity growth, working poverty, youth NEET, and female vulnerable employment jointly within a panel quantile framework for the ASEAN-10 economies over 2014–2023. This approach enables the study to assess whether the estimated associations between these factors and unemployment differ across lower, middle, and upper quantiles of the conditional unemployment distribution, thereby identifying patterns that may be obscured by conventional mean-based panel estimates.

Theoretically, this study extends the empirical application of Okun's Law by considering productivity growth alongside selected dimensions of labour market vulnerability within an Inclusive Growth perspective. Rather than treating unemployment as an isolated outcome of economic performance, it examines how productivity and the quality and accessibility of

employment opportunities are associated with unemployment across its conditional distribution. From a policy perspective, the findings may help identify whether the relationships differ across lower- and higher-unemployment settings, providing evidence to inform more differentiated policy responses concerning productivity enhancement, poverty among workers, youth labour market integration, and women's employment vulnerability. These contributions are intended to inform discussions of Inclusive Growth without treating the selected labour market indicators as a comprehensive measure of it.

Literature Review

Theoretical Framework

This study uses new economic ideas to explain what causes unemployment and how the job market works in ASEAN countries. The model brings together thoughts from Okun's Law Keynesian employment theory, structural labour market theory, human capital theory, and the Inclusive Growth approach. All these views show the interaction between macroeconomic performance, productivity, labour market institutions, and social vulnerability.

The analysis is based on Okun's Law (Okun, 1962) which suggests an inverse relationship between output growth and unemployment. Generally, higher economic or productivity growth leads to demand for workers and helps reduce unemployment. Within the ASEAN, output per worker growth (LP) is used to show this connection as it shows that improvements in labor productivity may due to technology, investment and efficiency gains. When productivity increases in economies that are not fully use all their resources, firms can produce more by hiring more people, which helps lower unemployment rate (Barnichon, 2010; Butkus et al., 2024). On the hand, weak productivity growth limits the economy's capacity to absorb labour. This will lead to high likelihood of persistent unemployment and underemployment.

While Okun's Law emphasises cyclical demand conditions, structural theories of unemployment delve on labour market imperfections, skills mismatches, and institutional rigidities. In the current study, working poverty (WP) and female vulnerable employment (VE) are used as indicators of deeper structural weaknesses that affect the quality and inclusiveness of employment.

A high number of people living in working poverty implies that many people remain in low-productivity jobs and informal works. This indicates there are not enough formal jobs being created and limited mechanisms of income sharing (ILO, 2018). Women are vulnerable in employment as there is not equal access to secure and decent jobs. This fact matches with the dual labour market theory, which differentiat between two types of jobs, protected formal job and insecure informal jobs. (Doeringer & Piore 1971; Bue, 2022). In these situations the official unemployment numbers might seem low because many people are working in these informal activities. But poverty, job insecurity and insufficient social support still exist. This leads to hidden unemployment and weak labor welfare.

The inclusion of youth who are not in employment, education or training (YP) is based on human capital theory (Becker, 1964). This theory sees education and skills as the factors that affect employability of persons and how productive they are. A higher NEET rate reflects

there is under investment for young people to develop their skills and high barriers for labor market entry among young people (ILO, 2019; Raifu, 2023). This view also consistent with employment theory by Keynes. It argues that low level of aggregate demand for goods and services as well as limited productive opportunities can reduce the chances of employment among youngsters. Staying away from education and work for a time may lead to structural unemployment and weak long-term earning prospects.

The Inclusive Growth paradigm expands the framework analysis to the idea that link between economic growth to job creation and sustainable employment. Growth is not just about producing more but also about making sure people have a good life and access to decent work (Ali & Son, 2007; ILO, 2022). Within this framework, the inability of economic growth to be shared broadly across society may imply high unemployment, working poverty, and vulnerable employment. Thus, high productivity growth with low unemployment and labor market vulnerability is a good sign of Inclusive Growth. On the other hand, if many young people are not working or studying (high NEET) and many people are working but still poor (high working poverty), it means the economy is growing in a way that does not include everyone. Inclusive Growth is about making sure the economy works for everyone, not a few people.

Theoretical Mechanisms Linking Labour Productivity, Working Poverty, Female Vulnerable Employment, Youth NEET, and Unemployment

The relationships between labour productivity, working poverty, female vulnerable employment, youth NEET, and unemployment can be explained through the interaction of macroeconomic demand, labour market segmentation, human capital accumulation, and employment inclusion. These theoretical perspectives suggest that unemployment is shaped not only by the pace of economic growth but also by the capacity of an economy to translate productivity improvements into accessible, adequately remunerated, and secure employment opportunities.

From the perspective of Okun's Law (Okun, 1962), stronger economic activity is generally associated with lower unemployment because expanding output increases firms' demand for labour. Keynesian employment theory complements this argument by emphasizing the importance of aggregate demand in determining production and employment. In the present study, output per worker growth represents changes in labour productivity and economic efficiency. Productivity improvements can support employment creation when they stimulate output expansion and generate additional labour demand. However, productivity growth may not reduce unemployment when efficiency gains arise primarily from automation, capital deepening, or labour-saving technological change without sufficient expansion in production. The relationship between productivity and unemployment is therefore conditional on the composition of growth, the sectoral structure of the economy, and the extent to which additional output generates employment (Barnichon, 2010; Foroni & Furlanetto, 2022).

Working poverty provides a complementary perspective by distinguishing the availability of employment from its economic adequacy. Structural and dual labour market theories suggest that labour markets may be segmented between relatively secure formal employment and less protected informal or low-productivity activities (Doeringer & Piore, 1971). A high incidence of working poverty may indicate that employment opportunities are concentrated

in activities that generate insufficient earnings or provide limited economic security (ILO, 2018). Such conditions may coexist with unemployment when productive job creation is weak. Conversely, individuals who cannot obtain formal employment may enter low-paid or informal work, reducing measured unemployment without resolving the underlying problems of underemployment and economic vulnerability. Consequently, the relationship between working poverty and unemployment may be positive, negative, or ambiguous depending on the extent to which working poverty reflects weak labour demand or the absorption of workers into low-quality employment.

Female vulnerable employment reflects another structural dimension of labour market performance. Women concentrated in own-account work or contributing family employment may face limited contractual protection, inadequate social security, and restricted access to secure and productive jobs. These conditions can reflect gender-related barriers and labour market segmentation, as well as insufficient formal employment opportunities. Female vulnerable employment may therefore be associated with unemployment when structural barriers prevent women from accessing available jobs or when economic shocks disproportionately affect insecure employment. However, vulnerable work may also act as an informal buffer when formal opportunities are limited, allowing women to remain economically active rather than openly unemployed. The relationship with measured unemployment is consequently not necessarily positive and should be interpreted in the context of gendered employment structures and differences in labour market participation (Bue, 2022; Tobin, 2023).

Human capital theory provides the principal explanation for the relationship between youth NEET and unemployment (Becker, 1964). Education, training, and work experience contribute to skills development and employability, while prolonged disengagement from employment, education, and training may limit opportunities to accumulate human capital and weaken future employment prospects. A high NEET rate may therefore signal difficulties in school-to-work transitions, skills mismatches, and barriers to labour market entry (ILO, 2019; Raifu, 2023). Nevertheless, youth exclusion cannot be attributed solely to individual skill deficits. Consistent with Keynesian employment theory, insufficient aggregate demand and limited creation of entry-level jobs can prevent young people from obtaining employment even when they possess relevant qualifications. Moreover, because the NEET population includes both unemployed young people and those outside the labour force, its relationship with the overall unemployment rate depends on the composition of the NEET population and prevailing labour market conditions.

These mechanisms are interconnected. Productivity growth may create employment when output expansion generates sufficient labour demand, but its benefits may be unevenly distributed when new opportunities require skills that disadvantaged workers do not possess or when growth is concentrated in sectors with limited labour absorption. In such circumstances, unemployment may persist alongside working poverty, female vulnerable employment, and youth NEET. Conversely, improvements in productive capacity accompanied by accessible formal employment, skills development, and more secure working conditions may support reductions in unemployment and labour market vulnerability. This interpretation is consistent with the Inclusive Growth perspective, which emphasizes that economic progress should be assessed alongside the distribution of opportunities and access to decent work (Ali & Son, 2007; ILO, 2022).

Taken together, these theoretical arguments suggest that the relationships between the explanatory variables and unemployment may differ across economic and labour market conditions. The employment effects of productivity growth may depend on the strength of labour demand, while the relationships involving working poverty, female vulnerable employment, and youth NEET may depend on the prevalence of informal employment, gender-related barriers, and obstacles to skills accumulation and labour market entry. This provides a theoretical justification for employing panel quantile regression to examine whether the estimated associations differ across the conditional unemployment distribution in ASEAN-10. The approach allows the analysis to move beyond average relationships, while the interpretation of the results remains associational unless additional identification strategies support causal conclusions.

The Inclusive Growth perspective complements Okun's Law, structural labour market theory, and human capital theory by emphasising that economic progress should be considered alongside the accessibility and quality of employment opportunities. As discussed by Ali and Son (2007), Inclusive Growth concerns the extent to which the benefits of economic development reach different segments of society. Within the present study, this perspective provides the overarching conceptual basis for examining how productivity performance and labour market vulnerabilities are associated with unemployment in ASEAN-10.

Four explanatory variables represent selected dimensions of this relationship. Output per worker growth captures changes in labour productivity and economic efficiency, while working poverty reflects the extent to which employment may fail to provide adequate economic security. The youth NEET rate represents the exclusion of young people from employment, education, and training, whereas female vulnerable employment captures gender-related disadvantages in employment conditions. Together, these indicators provide complementary information on productivity performance, employment access, and employment vulnerability.

Unemployment is the principal empirical outcome through which these relationships are examined. The panel quantile regression framework enables the analysis to investigate whether the associations between the explanatory variables and unemployment differ across the conditional unemployment distribution. This is relevant to understanding the potentially different labour market challenges faced by ASEAN economies.

Importantly, the framework does not treat unemployment as a comprehensive proxy for Inclusive Growth. Rather, it uses unemployment to examine one important dimension of labour market performance, interpreted alongside indicators of employment vulnerability and exclusion. Consequently, the study's contribution lies in providing evidence on labour market conditions relevant to Inclusive Growth, rather than directly measuring or establishing the overall inclusiveness of economic growth.

Past Studies

Research on the determinants of unemployment in ASEAN and other developing regions increasingly delve on the interaction between productivity growth, labour market quality, and demographic pressures, especially youth disengagement. Three broad themes are generally discussed: the role of output and productivity growth, the importance of labour market

quality and gendered vulnerability, and the influence of youth NEET dynamics in which these themes are relevant to current policy debates in ASEAN (ILO, 2018; ILO, 2022).

The link between output growth and unemployment remains a big concern in the literature. As in Okun's proposition, stronger output and productivity growth are generally associated with lower unemployment, even though the size of effect might vary across countries, sectors, and patterns of economic growth (Barnichon, 2010; Foroni & Furlanetto, 2022). In ASEAN, labour market outcomes have not been uniformed although export-oriented manufacturing and service industries have contributed significantly to productivity improvements. Some countries have experienced substantial job creation alongside productivity growth, whereas others have seen productivity increases without many new jobs being created (ASEAN Secretariat, 2020; ILO, 2022). This suggests that the employment effects of productivity growth may differ across countries and across different unemployment conditions.

The literature also highlights the importance of employment quality. Working poverty and vulnerable employment indicate that employment does not necessarily guarantee economic security or stable integration into formal labour markets. The evidence shows that working poverty and vulnerable employment remain widespread across the Asia-Pacific region, affecting labour market resilience and increasing unemployment volatility during economic stress (ILO, 2018; ILO, 2022). Economies with large informal sectors often show distinctive unemployment patterns, including weaker automatic stabilisers and greater exposure to cyclical shocks (ILO, 2022). Women are disproportionately concentrated in vulnerable forms of employment, and making them more exposed to economic disruptions and weaker labour market outcomes (Tobin, 2023). Gender disparities and female vulnerable employment therefore captures institutional and distributional dimensions of labour market performance that are often overlooked by aggregate employment indicators.

The next concern is youth exclusion, commonly measured by the share of young people who are not in employment, education, or training (NEET). High NEET rates are both a result of and a determinant of persistent unemployment. They often reflect skills mismatches, limited employment opportunities, and barriers to labour market entry, while also increasing the risk of long-term labour market detachment and lower lifetime earnings (ILO, 2019; ILO, 2024). Young people were among the groups most affected by the COVID-19 crisis in ASEAN. The elevated NEET rates contributed to rising unemployment and underemployment during the recovery period (ILO, 2022; ILO, 2024). Therefore, NEET provides important structural information that goes beyond short-term cyclical fluctuations.

As of method of analysis, several recent research emphasises the need to account for heterogeneity across unemployment levels and questions the adequacy of conventional mean-based estimators. Traditional panel models focus on average effects and may obscure important differences between low- and high-unemployment contexts. Panel quantile regression (PQR), such as Canay's two-step estimator and the Machado-Santos Silva approach (Canay, 2011; Machado & Santos Silva, 2019), allows researchers to estimate effects across different points of the conditional distribution and to uncover distributional differences in relationships such as the output-unemployment nexus. Studies from other regions suggest that productivity, social vulnerability, and demographic factors may have markedly different effects across unemployment quantiles (Butkus et al., 2024; Raifu, 2023).

This makes PQR particularly appropriate for ASEAN, where substantial cross-country heterogeneity exists.

In similar vein, the literature discusses to the importance of non-linearity and the role of economic shocks. The COVID-19 pandemic demonstrated that unemployment does not respond uniformly to changes in GDP and productivity. The magnitude of the response depends on factors such as social protection systems, labour market formality, and sectoral exposure (ILO, 2022). As a results, policies that combine productivity enhancement with measures to reduce working poverty and improve youth labour market integration are generally considered more effective in achieving sustained reductions in unemployment (ILO, 2022). A quantile-based approach is therefore useful in this regard because it can identify which policy interventions are likely to be most effective under different unemployment conditions.

The evidence from 2015–2024, thus, supports modelling unemployment in ASEAN using output per worker growth, working poverty, NEET, and female vulnerable employment as key explanatory factors. Past studies further indicates that quantile-based panel methods can provide more policy-relevant insights by capturing differences across the unemployment distribution and by accommodating outliers and non-normal error distributions (Canay, 2011; Machado & Santos Silva, 2019). All these points provide a strong justification for estimating panel quantile regression models for the ASEAN-10 over the period 2014–2023 in order to explore more nuanced relationships between productivity, vulnerability, youth exclusion, and unemployment.

Despite the growing body of research, several important gaps remain. Many studies on ASEAN continue to rely on mean-based estimators and pay limited attention to distributional heterogeneity. Comparative analyses that cover all ten ASEAN member countries are relatively scarce, and social and demographic variables such as working poverty, NEET, and female vulnerable employment are often omitted from empirical models. In addition, few studies explicitly examine labour market adjustments in the post-COVID period, and panel quantile regression has not yet been applied systematically to ASEAN unemployment data. This study addresses these gaps by employing a PQR framework for the ASEAN-10 over 2014–2023, thereby providing new evidence on the structural and social determinants of unemployment in the region.

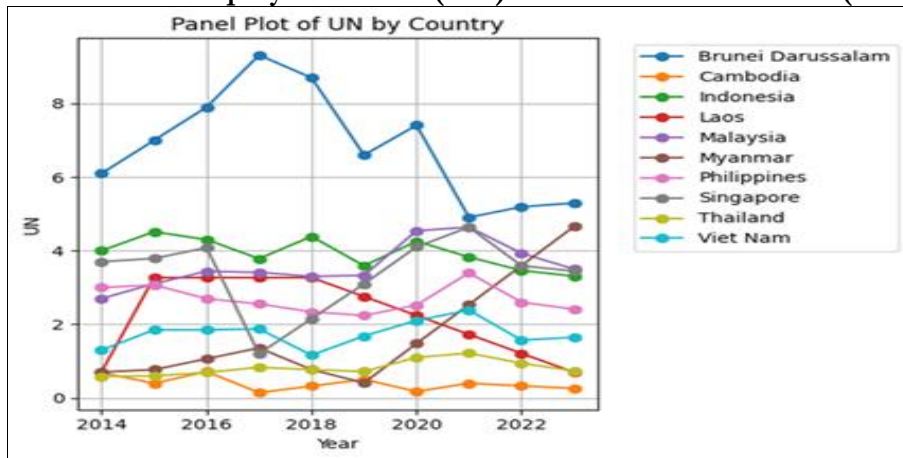
Methods

This study uses a panel quantile regression (PQR) framework to examine the contributing factors of unemployment across the ASEAN-10 countries over the period 2014–2023. The framework reflects the possibility that the impact of the explanatory variables are not constant across all unemployment levels. Using conventional mean-based panel estimators, such as fixed-effects and random-effects models, which focus on the conditional mean of unemployment, may mask important differences between countries with relatively low, moderate, and high unemployment rates (Koenker & Bassett, 1978; Machado & Santos Silva, 2019). Estimating several conditional quantiles, for example at 0.25, 0.50, and 0.75 quantiles, the PQR approach provides a richer understanding on the strength and direction of the relationship differences across different unemployment conditions.

The analysis is based on five key variables that capture labour market performance and structural characteristics in the ASEAN-10 economies from 2014 to 2023 (see Table 1). The dependent variable is the unemployment rate (UN), defined as the annual percentage of the total labour force that is without work but available for and actively seeking employment. Data are obtained from the World Bank's World Development Indicators (WDI) database, which provides similar job market information that can be compared around the world.

At initial stage, we examine the unemployment trends of 10 ASEAN countries within the sample data. As shown in Figure 1, unemployment trajectories differ considerably across ASEAN economies. Some countries maintained persistently low unemployment rates, whereas others experienced marked fluctuations and structural shifts, particularly during the COVID-19 pandemic. The patterns indicate that the relationship between unemployment and its determinants is unlikely to be captured by mean-based estimation techniques that impose homogeneous effects across the conditional distribution. The results reveal substantial cross-country heterogeneity, non-linearity, and asymmetric adjustment patterns during the sample period which suggest that the marginal effects of the explanatory variables are unlikely to be constant across different unemployment regimes. The factors that shape unemployment in countries with persistently low unemployment may differ substantially from those operating in high-unemployment environments.

Figure 1. Plot of Unemployment Rate (UN) of 10 ASEAN Countries (2014-2023)



Source: Authors' illustration

Thus, the use of panel quantile regression is considered well suited to reflect the diverse labour market responses observed across ASEAN countries. The panel quantile estimator is able to account for country-specific heterogeneity and remains robust in the presence of outliers and non-normal error distributions, features that are commonly observed in macroeconomic and labour market datasets covering multiple developing economies (Canay, 2011). To account for this heterogeneity, the study adopts a panel quantile regression framework, which allows the effects of the explanatory variables to be estimated at different points of the unemployment distribution.

This approach provides a more complete picture of unemployment dynamics while also offering greater robustness to outliers and distributional asymmetries, making it particularly well suited to the diverse and structurally heterogeneous economies of the ASEAN-10. Such distributional insights are especially valuable in the ASEAN context. For example, the effects of working poverty or NEET rates may be more pronounced in countries experiencing

persistently high unemployment, whereas productivity growth may have a stronger employment effect in economies with relatively low unemployment. The resulting evidence is expected to support more targeted and evidence-based policy design aimed at promoting inclusive, productive, and resilient employment growth across ASEAN economies.

The first explanatory variable is the annual growth rate of output per worker (LP), sourced from the International Labour Organization (ILO). It captures changes in labour productivity, expressed as GDP per employed person in constant 2021 international dollars adjusted for purchasing power parity (PPP). It reflects improvements in efficiency, technology, and production capacity, and is expected to be negatively associated with unemployment, in line with the productivity–employment relationship implied by Okun’s Law.

The second variable is the working poverty rate (WP), which also sourced from the ILO. The WP represents the proportion of employed individuals living below the international poverty line of US\$2.15 per day (PPP). A high level of working poverty often refers to low-quality, informal, or insecure employment and may therefore be linked to labour underutilisation and greater structural unemployment.

The youth NEET rate (YP), drawn from the World Bank database. It measures the share of young people who are neither employed nor engaged in education or training. This indicator captures labour market exclusion among youth and serves as an important signal of future unemployment risk and weaker long-term labour market integration.

Lastly, female vulnerable employment (VE) is based on ILO modelled estimates. It measures the proportion of women engaged in vulnerable forms of work, including self-employment and unpaid family work. The variable reflects gender disparities in employment conditions. It also provides an indication of the structural quality of labour markets in ASEAN economies, in which high levels of female vulnerable employment often suggest weaker labour market institutions, limited job security, and insufficient social protection.

Table 1. Description of variables

Variable	Variable Name	Definition / Measurement	Expected Relationship with Unemployment	Data Source
UN	Unemployment rate (%)	The annual percentage of the total labor force that is without work but available for and seeking employment.	Dependent variable	World Bank (World Development Indicators)
LP	Output per worker growth (%)	Annual growth rate of output per worker, measured as GDP per employed person (constant 2021 international \$ at PPP). Indicates labor productivity and efficiency.	Negative (higher productivity expected to reduce unemployment)	International Labour Organization (ILO)
WP	Working poverty rate (%)	Percentage of employed persons living below the international poverty line of	Positive (higher working poverty associated with higher unemployment)	International Labour Organization (ILO)

Variable	Variable Name	Definition / Measurement	Expected Relationship with Unemployment	Data Source
YP	Youth NEET rate (%)	US\$2.15 per day (PPP). Reflects prevalence of low-income or informal work.	Positive (higher NEET rate expected to increase unemployment)	World Bank (World Development Indicators)
		Share of youth not in employment, education, or training, as a percentage of the total youth population. Represents youth exclusion from the labor market.		
VE	Female vulnerable employment (%)	Share of women in vulnerable employment (own-account and contributing family workers) as a percentage of total female employment. Reflects job insecurity and informality.	Positive (higher female vulnerability linked to weaker employment resilience)	International Labour Organization (ILO)

Source: Author's summarization

The model specification adopted in this study is with the unemployment rate (%) as the dependent variable and four principal explanatory variables: the annual growth rate of output per worker, the working poverty rate, the share of youth who are not in education, employment, or training (NEET), and female vulnerable employment (measured as a percentage of total female employment). The inclusion of these variables reflects the multidimensional nature of unemployment. Output per worker growth captures changes in productivity and economic efficiency, while working poverty and female vulnerable employment represent the quality and security of employment. The NEET indicator, in turn, reflects the degree of youth labour market exclusion and potential barriers to future labour market integration.

It is important to note that the panel quantile regression in this current study estimates associations between the explanatory variables and the conditional distribution of changes in the unemployment rate, $D(UN)$, as the UN was found to be stationary at first difference. The estimated quantiles are therefore interpreted as distributional positions of unemployment changes, rather than as classifications of countries according to their unemployment levels. The general panel quantile regression model is expressed as follows:

$$Q_{\tau}(\Delta UN_{it} | X_{it}) = \beta_0(\tau) + \beta_1(\tau)LP_{it} + \beta_2(\tau)WP_{it} + \beta_3(\tau)YP_{it} + \beta_4(\tau)VE_{it} + \mu_i + \varepsilon_{it}(\tau) \quad (1)$$

where $Q_{\tau}(\Delta UN_{it} | X_{it})$ denotes the τ th conditional quantile of the annual change of unemployment rate for country i at time t given the vector of explanatory variables X_{it} . The coefficients $\beta_j(\tau)$ represent the marginal effects of each explanatory variable at the τ th quantile, μ_i captures unobserved country-specific effects, and $\varepsilon_{it}(\tau)$ is the error term.

The coefficient of output per worker growth (β_1) is expected to be negative, indicating that higher productivity reduces unemployment. The coefficients for working poverty (β_2), NEET (β_3), and female vulnerable employment (β_4) are expected to be positive, suggesting

that higher levels of labour market vulnerability, youth exclusion, and gender disparity are associated with higher unemployment rates.

The sample period of 2014–2023 encompasses the COVID-19 pandemic and the subsequent economic recovery, during which labour-market conditions across ASEAN economies were affected by substantial macroeconomic disruptions. The empirical specification includes country-specific effects to account for time-invariant heterogeneity across countries. However, it does not separately include year fixed effects to absorb unobserved shocks common to all countries in a given year. Although first-differencing the unemployment rate helps address certain forms of persistence in the dependent variable, it does not necessarily eliminate the influence of common time-specific shocks. Accordingly, the estimated coefficients should be interpreted as conditional associations within the specified model rather than as relationships fully isolated from all common macroeconomic influences. The potential influence of unobserved year-specific shocks is recognised as a limitation when interpreting the results, particularly for the pandemic and recovery period.

Findings

As of descriptive statistics, Table 2 summarises statistics of the variables included in the analysis: unemployment rate (UN), output per worker growth (LP), female vulnerable employment (VE), youth not in employment, education, or training (YP), and working poverty (WP) across the ASEAN-10 countries from 2014 to 2023. The unemployment rate averaged 2.74 per cent, with values ranging from minimum of 0.14 per cent to maximum of 9.32 per cent with a standard deviation of 1.95. The distribution is positively skewed (0.999) and leptokurtic (4.136), which indicates that unemployment rates are generally low across most ASEAN economies, although a small number of economies experience noticeably higher unemployment. The pattern reflects the diversity of labour market structures within the region. More advanced economies, such as Singapore and Malaysia, tend to have relatively tight labour markets, whereas several other ASEAN members continue to face structural and cyclical unemployment challenges.

The variable of output per worker growth (LP), which is an indicator of productivity performance, recorded an average growth rate of 2.33 per cent with substantial variation, ranging from –8.46 per cent to 8.83 per cent, and a standard deviation of 3.60. The negative skewness (–0.702) suggests that periods of productivity decline occur more frequently than episodes of strong productivity growth. This finding is consistent with the uneven and cyclical nature of productivity improvements across ASEAN economies.

Female vulnerable employment (VE) remains relatively high, with an average of 44.64 per cent and values ranging from minimum 5.15 per cent to maximum of 86.15 per cent. A high value of standard deviation (25.13) indicates substantial differences among countries. The distribution is moderately negatively skewed (–0.347) with a kurtosis value of 1.893, suggesting that the data are fairly close to a normal distribution. Generally, these statistics implies to the continued prevalence of insecure and informal forms of women employment in many ASEAN countries, highlighting persistent gender inequalities and underlying structural weaknesses in labour market institutions.

The average share of youth who are not in employment, education, or training (YP) is 14.71 per cent, with values ranging from 3.60 per cent to 28.46 per cent and a standard deviation

of 6.36. The skewness is close to zero (−0.032) and the kurtosis is relatively low (1.914), indicating a fairly symmetrical distribution across ASEAN countries. The statistics suggests that differences in youth exclusion are moderate rather than highly focused in a few economies. Nevertheless, the variable highlights ongoing challenges related to school-to-work transitions, skills matching, and youth employability in several ASEAN member states. The statistics for Working poverty (WP) records an average of 3.97 per cent, but the values vary considerably, ranging from 0 to 30.46 per cent (a standard deviation of 6.24). The distribution is strongly positively skewed (2.177) and highly leptokurtic (7.548), implying that most countries experience relatively low levels of working poverty, while a small number face exceptionally high rates. The statistics suggests that the quality of employment remains uneven across the region, with some economies still characterised by a substantial share of vulnerable and low-income workers.

The descriptive statistics reveal significant differences among ASEAN-10 countries in terms of productivity performance, labour market inclusiveness, and job quality. Although the average unemployment rate is relatively low, the wide variation in productivity growth, vulnerable employment, and working poverty indicates that employment conditions across ASEAN remain uneven. These patterns show labour market dynamics within the ASEAN region and allow the analysis to capture how the effects of productivity and labour market factors may differ across various levels of unemployment.

Table 2. Summary of descriptive statistics

Variables	Min.	Max.	Mean	Std Dev	Skewness	Kurtosis
<i>UN</i>	0.141	9.316	2.735	1.946	0.999	4.136
<i>LP</i>	-8.461	8.834	2.326	3.599	-0.702	3.255
<i>VE</i>	5.15	86.15	44.64	25.130	-0.347	1.893
<i>YP</i>	3.6	28.46	14.708	6.363	-0.032	1.914
<i>WP</i>	0	30.462	3.966	6.244	2.177	7.548

Source: Author's computation

Table 3 displays the results of the panel unit root tests: the Levin–Lin–Chu (LLC), Im–Pesaran–Shin (IPS), and Fisher-type tests (based on both ADF and PP procedures). The tests were conducted to decide the stationarity of variables in the study. It is an important step in panel regression analysis because non-stationary variables can produce spurious relationships and lead to unreliable statistical inference (Baltagi, 2021; Levin, Lin, & Chu, 2002).

The results of the stationary tests show that the unemployment rate (UN) is non-stationary at its level form. All three tests fail to reject the null hypothesis of a unit root, indicating that the series contains a stochastic trend. The variable was transformed into its first difference and tested. The results of test statistics become highly significant at the 1 per cent level across all methods. This confirms that the differenced unemployment series is stationary. The study, therefore, uses the first-differenced form of unemployment, D(UN), in the panel quantile regression analysis to ensure robust estimation and to avoid misleading long-run correlations arising from non-stationarity (Im, Pesaran, & Shin, 2003).

As for the four explanatory variables, the findings show mixed orders of integration. Output per worker growth (LP) is found to be stationary at level based on the LLC, IPS, and Fisher-type tests, indicating that productivity fluctuates around a relatively stable mean over time.

On the other hand, female vulnerable employment (VE) and youth not in employment, education, or training (YP) appear to be weakly stationary under the LLC test. However, this result is not consistently supported by the IPS and Fisher-type tests. This is due to possible cross-sectional heterogeneity across ASEAN countries. Similarly, working poverty (WP) shows stationarity at level under the LLC and Fisher tests, while exhibiting stronger evidence of stationarity after first differencing.

In general, these findings suggest that some labour market indicators are stationary around a trend, whereas others may be influenced by short-term shocks or persistent structural factors that differ across economies. The unit root tests indicate that the unemployment rate is integrated of order one, $I(1)$, while the majority of evidence supports treating the explanatory variables as integrated of order zero, $I(0)$. Accordingly, the current study applies a first-difference transformation only to the unemployment variable in the panel quantile regression analysis, following standard econometric practice for handling non-stationary macroeconomic and labour market data. This helps ensure valid statistical inference and reduces the risk of spurious regression (Koenker & Bassett, 1978; Canay, 2011) which allows the quantile estimates to reflect meaningful relationships between productivity, labour market vulnerability, and unemployment across the ASEAN-10 economies.

Table 3. The stationary test of variables

Method	Levin–Lin–Chu (LLC)		Im–Pesaran–Shin (IPS)		Fisher-Type (ADF or PP)	
Variable	<i>level</i>	<i>1st diff</i>	<i>level</i>	<i>1st diff</i>	<i>level</i>	<i>1st diff</i>
UN	-0.6459 (0.2592)	-3.4228*** (0.000)	0.5676 (0.7148)	-3.0119*** (0.0013)	-0.0794 (0.5317)	6.0767*** (0.000)
LP	-5.3156*** (0.000)	-7.7874*** (0.000)	-1.4078* (0.079)	-2.5024*** (0.0062)	2.6360*** (0.0042)	4.8836*** (0.000)
VE	-4.7614*** (0.000)	-1.7353** (0.0413)	-0.1578 (0.4373)	-1.1404 (0.1271)	0.5928 (0.2767)	1.1001 (0.1356)
YP	-6.9602*** (0.000)	-4.6078*** (0.000)	-1.1931 (0.1164)	-1.5227* (0.0639)	5.7378*** (0.000)	1.7810** (0.0375)
WP	-6.1117*** (0.000)	-8.9069*** (0.000)	n.a	n.a	4.1921*** (0.000)	4.5542*** (0.000)

Note: p-value in parentheses

Source: Author's computation

**Table 4. Traditional mean-based panel estimations
(Fixed Effect and Random Effect models)**

Independent Variable	Dependent Variable: D(UN)	
	(1)	(2)
constant	0.559 (3.368)	0.145 (0.2381)
LP	-0.026 (0.027)	-0.025 (0.023)
VE	-0.003 (0.073)	0.005 (0.004)

Independent Variable	Dependent Variable: D(UN)	
	(1)	(2)
YP	-0.035 (0.033)	-0.016 (0.015)
WP	0.055 (0.057)	-0.011 (0.017)
<i>Number of observations</i>	90	90
<i>Number of groups</i>	10	10
<i>Overall R²</i>	0.0012	0.026
<i>F statistic (prob)/Wald Chi-square (prob)</i>	0.68 (0.6069)	2.27(0.6856)
<i>Type of model</i>	Fixed	Random

Note: 1. Standard errors are in parentheses

2. ***statistically significant at the 1% level; **5% level; *10% level.

Source: Author's computation

Results of the conventional mean-based panel estimations using the Fixed Effects (FE) and Random Effects (RE) model were reported in Table 4. The findings show that none of the explanatory variables, namely output per worker growth (LP), female vulnerable employment (VE), youth not in employment, education, or training (YP), and working poverty (WP), have a statistically significant effect on changes in unemployment (D(UN)), across the ASEAN-10 countries.

The estimated coefficients are generally small and vary in sign between the FE and RE specifications. Moreover, both models show very weak explanatory power. This is reflected in the extremely low R² values of 0.0012 for the FE model and 0.026 for the RE model, as well as the insignificant F-statistic and Wald Chi-square value. These results suggest that when the effects of the explanatory variables are assumed to be the same across all countries and across all levels of unemployment, the selected labour market and productivity indicators do not have a strong or systematic relationship with unemployment. The statistical insignificance of the variables also implies an important limitation of traditional panel estimators, FE and RE models, which focus on the conditional mean of the dependent variable and impose homogeneous effects across all observations. However, in ASEAN, labour markets are highly diverse and the determinants of unemployment may differ considerably between countries with relatively low unemployment and those with higher unemployment.

Having said this, the findings in Table 4 provide a strong justification for employing panel quantile regression (PQR) which allows the effects of the regressors to vary across different quantiles of unemployment. This makes it possible to identify heterogeneous relationships that may be insignificant on average but become important at specific points of the distribution. This PQR approach is perceived to offer a more detailed and policy-relevant understanding of how productivity, labour market vulnerability, and social exclusion influence change in unemployment across the ASEAN-10 economies.

Table 5. Panel quantile regression results

Independent variables	Dependent variable: $D(UN)$								
	10 th quant	20 th quant	30 th quant	40 th quant	50 th quant	60 th quant	70 th quant	80 th quant	90 th quant
LP	0.0054 (3.24E-02)	0.0248 (0.0281)	0.0191* * (0.0083)	0.0032 (0.0202)	0.0157 (0.0148)	- 0.033** (0.0171)	- 0.0371* ** (0.0136)	- 0.157 4 (0.281)	- 0.119 4 (0.452)
VE	0.027*** (0.0039)	-0.0177 (0.0113)	- 0.00403 (0.0037)	- 0.00073 (0.0034)	- 0.0051* * (0.0025)	- 0.0091* ** (0.0026)	- 0.0128* ** (0.0042)	-1.869 (5.792)	0.077 9 (0.212)
YP	0.011 (0.0219)	-0.0219 (0.0278)	- 0.00039 (0.0118)	0.00475 (0.0069)	- 0.0115* (0.0068)	-0.0047 (0.0104)	-0.0215 (0.0141)	- 0.553 8 (1.691)	0.327 9 (0.908)
WP	-0.0523** (2.19E-02)	0.0704* (0.0372)	-0.0242 (0.0223)	-0.0366 (0.0258)	0.0368* * (0.0162)	0.0381* ** (0.0131)	0.021 (0.0142)	0.434 (1.395)	0.533 9 (1.393)
No. of obs	90	90	90	90	90	90	90	90	90
No. of groups	10	10	10	10	10	10	10	10	10
Slopes equality test ($\tau_{0.10,0.20,0.30,0.40,0.50,0.60,0.70,0.80,0.90}$)									
Wald $\chi^2(4)$									
LP, VE, YP, WP	0.083								

Note: 1. Standard errors are in parentheses;

2. ***statistically significant at the 1% level; **5% level; *10% level.

Source: Author's computation

Table 5 presents the panel quantile regression estimates examining the relationships between output per worker growth (LP), female vulnerable employment (VE), youth NEET (YP), working poverty (WP), and changes in unemployment across the ASEAN-10 economies from 2014 to 2023. The dependent variable is the first difference of the unemployment rate, $D(UN)$. Accordingly, the estimated quantiles represent different points of the conditional distribution of changes in unemployment, rather than differences in the levels of unemployment across countries. The coefficients are therefore interpreted as conditional associations between the explanatory variables and changes in unemployment at each estimated quantile.

The results reveal heterogeneous coefficient patterns across the conditional distribution of $D(UN)$. For output per worker growth (LP), the estimated coefficients are positive at the 10th through 50th quantiles and negative at the 60th through 90th quantiles. However, statistical significance is observed only at the 30th, 60th, and 70th quantiles, according to the reported estimates. In particular, the coefficients at the 60th and 70th quantiles are significantly negative, whereas those at the 80th and 90th quantiles, although negative, are not statistically significant. These findings provide evidence of a negative association between productivity growth and changes in unemployment at selected quantiles, particularly the 60th and 70th quantiles, rather than a uniformly significant relationship across the upper quantiles.

The negative and statistically significant coefficients at the 60th and 70th quantiles suggest that higher output per worker growth is associated with lower changes in unemployment in these parts of the conditional distribution, holding the other explanatory variables constant. This pattern is consistent with the possibility that productivity improvements support employment adjustment under certain labour-market conditions. Nevertheless, the absence of statistical significance at the 80th and 90th quantiles means that the negative association cannot be extended to the entire upper tail of the conditional distribution. The results should therefore be interpreted as evidence of a quantile-specific relationship, rather than proof that productivity growth consistently reduces unemployment changes under all conditions. This interpretation is broadly consistent with the productivity–employment relationship discussed in Okun’s Law (Okun, 1962; Barnichon, 2010), while recognising that the strength and statistical significance of the estimated association vary across quantiles.

For female vulnerable employment (VE), the estimates also display variation in sign and statistical significance across quantiles. The coefficient is positive and statistically significant at the 10th quantile, while negative and statistically significant at the 50th, 60th, and 70th quantiles. The remaining estimates should be interpreted according to their reported statistical significance. Because the dependent variable is $D(UN)$, the negative coefficients at the median and upper-middle quantiles indicate an association with lower changes in unemployment, not necessarily lower unemployment levels. One possible interpretation is that vulnerable employment may provide an employment channel when access to formal jobs is limited. However, the regression results alone do not establish this mechanism, and the findings should be understood as conditional associations rather than causal effects.

The coefficients for youth NEET (YP) are generally statistically insignificant across the estimated quantiles, with the exception of the reported weakly significant negative coefficient at the 50th quantile. This indicates that the analysis provides limited evidence of a systematic contemporaneous association between youth NEET and changes in unemployment across most of the conditional distribution. Although youth exclusion remains relevant to longer-term labour-market integration, the present estimates do not establish a consistent relationship between the NEET rate and changes in aggregate unemployment.

Working poverty (WP) also exhibits heterogeneous associations across quantiles. Its coefficient is negative and statistically significant at the 10th quantile, positive and weakly significant at the 20th quantile, and positive and statistically significant at the 50th and 60th quantiles. The coefficients at other quantiles should not be interpreted as statistically meaningful unless supported by their reported significance levels. These results suggest that the association between working poverty and changes in unemployment varies across the conditional distribution. The negative coefficient at the 10th quantile may be consistent with circumstances in which low-paid or informal employment absorbs workers who might otherwise be unemployed, whereas the positive coefficients at selected quantiles may reflect the coexistence of working poverty and increases in unemployment. These explanations are plausible interpretations rather than mechanisms directly identified by the model.

Overall, the panel quantile regression results indicate that the associations between productivity growth, working poverty, female vulnerable employment, youth NEET, and changes in unemployment are not uniform across the conditional distribution. The evidence for productivity growth is particularly concentrated at the 60th and 70th quantiles, where the estimated coefficients are significantly negative; the negative estimates at the 80th and 90th

quantiles are not statistically significant. These findings support a cautious interpretation of distributional heterogeneity without equating upper quantiles of D(UN) with countries experiencing high unemployment levels. From a policy perspective, the results highlight the importance of considering how productivity performance and labour-market vulnerability relate to unemployment adjustment, while recognising that the estimates are conditional associations and do not by themselves establish causal effects.

The model incorporates country-specific fixed effects to control for unobserved differences across the ASEAN-10. The fixed effects account for time-invariant traits unique to each nation, such as institutional frameworks, labour market regulations, and demographic traits, that could bias our results if it failed to be included (Canay, 2011). Under this framework (following Canay, 2011; Koenker, 2004), the inclusion of fixed effects absorbs the constant term or intercept into individual country effects. As a result, the regression output get rid an overall constant because each country's unique intercept is handled via de-meaning or differencing transformations. This enables the quantile estimates to focus strictly on how the regressors alter the distribution of unemployment, rather than its absolute levels.

The Pseudo R^2 statistic commonly found in cross-sectional models was not reported due to similar reasons., The Pseudo R^2 poorly defined once individual effects are removed or when the data is de-meaned in panel quantile models with fixed effects (Koenker, 2004; Machado & Santos Silva, 2019). Because these goodness-of-fit metrics are not directly comparable across quantiles or against mean-based OLS estimators, the analysis focuses only on the sign, size, and statistical significance of the coefficients across quantiles to uncover the distinct relationships among variables.

The slope equality test ($\text{Wald } X^2 = 0.083$) fails to reject the null hypothesis of equal slope coefficients, indicating that from a purely statistical standpoint, the estimated coefficients do not differ drastically across the quantiles. However, even if the slopes show statistical homogeneity, the shifts in sign and magnitude across quantiles still carry vital economic weight. The insignificant of the test value might stem from a relatively small panel size or limited within-country variation. Even so, the quantile-specific estimates successfully map out meaningful real-world variations especially regarding productivity growth and vulnerable employment, validating the use of the PQR framework over blunt mean regressions (Machado & Santos Silva, 2019; Butkus et al., 2024).

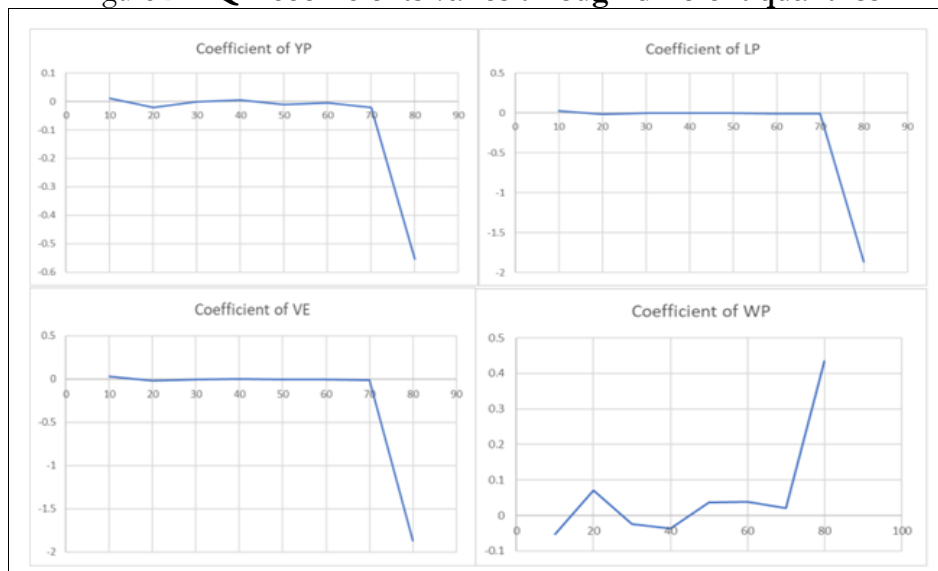
The empirical findings provide insights into selected labour market dimensions relevant to Inclusive Growth in ASEAN-10. The estimated relationships between productivity growth and unemployment suggest that the employment implications of productivity performance warrant attention when designing policies to promote more inclusive economic development. At the same time, the heterogeneous coefficients for working poverty and female vulnerable employment indicate that unemployment figures alone may not adequately reflect the quality and security of employment opportunities.

In particular, a negative association between vulnerable employment and unemployment should not automatically be interpreted as evidence of improved labour market inclusiveness. Although vulnerable or informal activities may provide employment opportunities, they may also be associated with inadequate earnings, limited social protection, and employment insecurity. Similarly, working poverty highlights the possibility that employment does not necessarily translate into adequate economic well-being. The generally weak statistical

relationship between youth NEET and unemployment in the estimated models also suggests that the implications of youth exclusion should not be evaluated solely through contemporaneous aggregate unemployment outcomes.

These findings support a multidimensional policy perspective in which productivity enhancement is complemented by measures to improve employment quality, strengthen social protection, facilitate youth transitions into employment, and reduce gender-related employment disadvantages. However, the results should be interpreted as evidence concerning selected labour market relationships rather than direct evidence that economic growth has become more or less inclusive. Moreover, the reported slope-equality test does not reject the null hypothesis of equal coefficients across quantiles; therefore, the apparent differences in coefficient patterns should be interpreted cautiously.

Figure 2. PQR coefficients varies through different quantiles



Source: Author's illustration

In addition to the estimations, Figure 2 illustrates how the drivers of unemployment shift across different labor market conditions, spanning from the 10th to the 90th quantiles. This visualization highlights how labor productivity growth (LP), working poverty (WP), youth NEET (YP), and female vulnerable employment (VE) impact ASEAN economies distinctively depending on their baseline unemployment levels. The coefficient plot uncovers a non-linear relationship between output per worker growth (LP) and joblessness across the quantiles. The productivity coefficients are negative at the 60th to 90th quantiles, but statistical significance is confined to the 60th and 70th quantiles among these estimates. The negative coefficients at the 80th and 90th quantiles are statistically insignificant. This pattern indicates a quantile-specific association between productivity growth and changes in unemployment. The pattern strongly supports the Okun's Law hypothesis: productivity growth yields the highest employment returns in economies with excess labour supply (Okun, 1962; Barnichon, 2010), and it aligns with findings by Butkus et al. (2024) and Foroni & Furlanetto (2022) that productivity effects intensify at upper quantiles when unemployment is persistently high.

The coefficients of female vulnerable employment (VE) show an inverted trend, with positive at lower quantiles but turning negative at higher ones. As discussed earlier, this suggests that in low-unemployment countries, rising vulnerable employment among women correlates with marginal increases in joblessness, likely reflecting job insecurity and a shift toward part-time work substitution effects. However, in high-unemployment settings, greater female labour participation, though vulnerable, is linked to a decline in unemployment. In these environments, informal and self-employment channels act as safety nets that absorb excess labour when formal opportunities are limited.

The coefficients for working poverty (WP) also display a mixed pattern with negative at the lower quantiles but positive at the middle and upper quantiles. This suggests that in low-unemployment countries, working poverty might reflect a growing informal sector that provides some employment opportunities, which lowers level of unemployment. However, in economies with higher unemployment, working poverty becomes positively associated with joblessness, which signals deeper structural deficiencies in job quality and a failure of the formal sector to absorb workers.

Meanwhile, the youth NEET (YP) coefficients fluctuate mildly and remain statistically weak across most quantiles. This suggests that while youth exclusion exerts limited short-term influence on overall unemployment figures, it represents longer-term structural vulnerabilities. As stated by ILO (2019, 2024), NEET dynamics function better as indicators of youth disengagement risks rather than direct, immediate unemployment pressures.

Overall, the heterogeneous coefficient patterns illustrate that productivity, job quality, and labour vulnerability factors interact differently across ASEAN economies depending on their unemployment levels. These findings highlight the need for differentiated policy strategies. Productivity and skills interventions are most effective in high-unemployment economies, while gender equity and formalization policies are critical in low-unemployment but high-vulnerability contexts.

Conclusion

The present study examines the determinants of unemployment across the ASEAN-10 economies from year 2014 to 2023 using a panel quantile regression framework, focusing on the roles of productivity growth (output per worker), working poverty, youth NEET, and female vulnerable employment. The descriptive analysis revealed substantial heterogeneity among ASEAN labour markets. While average unemployment rates seems low, large disparities exist underneath regarding job quality, productivity growth, and labour market inclusiveness. Stationarity tests were conducted for all data, confirming that the unemployment variable was non-stationary at level but became stationary after first differencing, which fully justified the use of the first difference series in the regression estimation. The results indicate that productivity growth is negatively and significantly associated with changes in unemployment at the 60th and 70th quantiles, but this association is not statistically significant at the 80th and 90th quantiles. These findings highlight heterogeneity in the estimated relationship across the conditional distribution of unemployment changes, without implying that the upper quantiles necessarily represent countries with higher unemployment levels. Working poverty and female vulnerable employment showed highly heterogeneous effects, suggesting that structural labour vulnerabilities have distinct impacts depending on specific labour market contexts. Youth

NEET, although not statistically significant across most quantiles, underlines the importance of addressing education-to-employment transitions to prevent long-term exclusion.

From the perspective of Inclusive Growth, this study provides evidence on selected labour market conditions that are relevant to the relationship between economic performance and employment opportunities across ASEAN-10. The findings indicate that productivity growth, working poverty, female vulnerable employment, and youth NEET capture different aspects of labour market performance, although their estimated relationships with changes in unemployment vary in direction, magnitude, and statistical significance. The results underline the importance of looking beyond aggregate unemployment rates when assessing employment-related challenges in the region. Productivity improvements may contribute to reducing unemployment, while working poverty and vulnerable employment highlight the need to consider whether available jobs provide adequate earnings, security, and social protection. Youth exclusion remains a relevant policy concern even though its estimated relationship with unemployment is generally statistically weak in the present models.

Based on these findings, targeted policy frameworks across ASEAN economies must prioritize four interconnected areas; (1) enhancing Productivity-Led Employment Creation: ASEAN member states should pivot from low-cost labor advantages toward high-value, tech-driven productivity. Policy measures include national upskilling and reskilling initiatives—specifically in digital skills, green technologies, and automation—supported by regional alignment via the ASEAN Qualifications Reference Framework. Tax incentives and matching grants should be directed to micro, small, and medium enterprises (MSMEs) to support technological adoption and capital deepening, ensuring that productivity growth expands high-quality formal job capacity rather than causing labor displacement; (2) mitigating Working Poverty through Formalization and Wage Policies: Addressing working poverty requires structural measures to transition informal workers into formal employment. Governments should establish progressive, evidence-based minimum wage frameworks indexed to inflation and productivity metrics. Furthermore, expanding non-contributory social protection floors—such as universal health coverage, micro-insurance schemes, and portable social security for gig and informal workers—will safeguard vulnerable workers against economic shocks; Facilitating Youth Transitions to Combat High NEET Rates: To reduce youth NEET rates, policies must bridge the gap between education systems and private-sector labor demand. Measures include scaling up Dual Vocational Education and Training (DVET) programs, establishing target-driven apprenticeships in high-growth industries, and implementing proactive career counseling services within secondary and tertiary education. Targeted youth entrepreneurship funds with subsidized credit line access can also assist young jobseekers in entering high-productivity self-employment; (3) reducing Female Employment Vulnerability via Structural and Social Supports: Mitigating female labor vulnerability demands policies that lower barriers to formal workforce participation. Specific measures include state-subsidized affordable childcare facilities, mandated paid parental leave, and flexible working arrangements. Additionally, public programs should offer targeted micro-financing and digital literacy training tailored for women entrepreneurs to facilitate their transition from unpaid contributing family work to formal, revenue-generating businesses; (4) last but not least, given the diverse labour market conditions across ASEAN economies, regional cooperation should be expanded in sharing best practices on employment policies, skills development, and social protection. This can help foster more inclusive and balanced economic growth throughout the region. Policies relevant to Inclusive Growth should combine productivity enhancement with employment creation, labour

market formalisation, skills development, improved school-to-work transitions, and broader social protection. These measures may help strengthen the accessibility and quality of employment opportunities across ASEAN economies.

Having said this, the study does acknowledge several limitations. The analysis is restricted to ASEAN-10 countries over the 2014–2023 period, which limits the examination of long-term structural changes. The use of aggregate national data may also conceal important regional and demographic disparities in unemployment within individual countries. Moreover, although panel quantile regression captures heterogeneity across unemployment levels, it does not fully address causal relationships or feedback effects. Data limitations also prevented the inclusion of variables such as migration flows, informal employment trends, and specific labor market institutions.

Accordingly, future research could extend this analysis by using longer time series and sub-national data to better capture regional and demographic variations. Incorporating institutional factors, including labor regulations, education quality, and digital readiness in the estimation model, may provide deeper insights into unemployment determinants. The adoption of dynamic panel quantile models or causal inference techniques could strengthen causal interpretation, while examining the effects of major shocks, such as the COVID-19 pandemic and rapid technological change, would greatly improve the understanding of labor market resilience in ASEAN. Besides, future research could strengthen the Inclusive Growth conceptual connection by incorporating additional indicators of income distribution, poverty reduction, and the distribution of economic gains across population groups.

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