*Daengku: Journal of Humanities and Social Sciences Innovation* *ISSN: 2775-6165 (online)*
*Vol. 6 No. 5 (2026)*
https://doi.org/10.35877/454RI.daengku5306

# When Does Growth Create Jobs? Business-Cycle Asymmetry and Demographic Capacity in ASEAN-5

Andi Naila Quin Azisah Alisyahbana[a] , Madris[b] & Amanus Khalifah Fil'ardy Yunus[b]

[a]*Doctoral Program in Economics, Universitas Hasanuddin, Indonesia*
[b]*Faculty of Economics and Business, Universitas Hasanuddin, Indonesia*

**Abstract**

When does economic growth create jobs, and does its employment association differ across phases of the business cycle? This study tests business-cycle asymmetry in the growth–employment relationship for ASEAN-5—Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam—over 2010–2023. Employment absorption is measured by the employment-to-population ratio (EPR) for persons aged 15 years and above. The specification relates EPR to its own lag, real GDP growth, demographic capacity, the Human Development Index, a positive-output-gap regime indicator, a Growth × Regime interaction, macroeconomic controls, and country and year effects, estimated by a bias-corrected least-squares dummy-variable estimator with bootstrap inference. Employment absorption is strongly persistent. The short-run growth association is positive and significant under both non-positive-output-gap and positive-output-gap conditions, but the difference between the two slopes is not statistically distinguishable from zero; business-cycle slope asymmetry is therefore not detected. Demographic capacity is positive but statistically inconclusive at the 5 per cent level, and human development is statistically insignificant. Importantly, the contemporaneous growth association loses precision when 2020–2021 are excluded and changes sign and becomes insignificant when growth and the macroeconomic controls are lagged, showing material pandemic and timing sensitivity. The estimates are dynamic conditional associations, not identified causal effects: EPR measures the employed share of the working-age population rather than the number of jobs created, and long-run multipliers are not forecasts of job creation.

*Keywords:* employment absorption; employment-to-population ratio; economic growth;business-cycle asymmetry; demographic capacity; dynamic panel; ASEAN-5

Received: 11 August 2026 Revised: 4 October 2026 Published: 31 October 2026

## 1. Introduction

Whether economic growth is translated into broader employment remains one of the most consequential questions in macroeconomic and labour-market policy. The conventional point of departure is Okun's law, which links fluctuations in aggregate output to movements in labour-market outcomes and thereby provides an empirical bridge between the goods market and the labour market. A large body of evidence confirms that this relationship is economically meaningful, but it is not governed by a single coefficient that applies uniformly across countries, periods, or institutional settings. Cross-country estimates vary with national labour-market characteristics, levels of development, and the nature of macroeconomic shocks, while time-varying analyses show that the output–labour-market relationship can change as economies evolve (Ball et al., 2017; Ball et al., 2019; Bartolucci et al., 2018; Furceri et al., 2020). The recent scholarly synthesis by Boďa (2025) similarly shows that contemporary research has moved beyond a one-size-fits-all interpretation towards heterogeneity, nonlinearity, regional variation, and methodological scrutiny. Consequently, a high rate of gross domestic product growth cannot, by itself, be treated as sufficient evidence that an economy is generating employment on a commensurate scale.

Within Southeast Asia, Widarjono (2020) reports asymmetric Okun-type relationships for Malaysia, the Philippines, and Singapore, while district-level evidence from Indonesia shows that the estimated growth–unemployment relationship depends on endogeneity treatment and regional industrial structure (Aginta et al., 2025). More recent evidence for ASEAN-10 finds that Okun's law is weaker and less regular than in advanced Western economies and that

* Corresponding author.
*E-mail address*: nailaquinn@gmail.com

Daengku: Journal of Humanities and Social Sciences Innovation is licensed under an Attribution-NonCommercial-ShareAlike 4.0 International (CC BY-NC-SA 4.0)

its validity differs substantially across member states; Malaysia and Thailand display more consistent results than several other ASEAN economies (Bod'a et al., 2026). These findings suggest that the employment content of growth in ASEAN cannot be inferred from regional expansion alone and must instead be examined in relation to country heterogeneity and cyclical conditions.To provide descriptive motivation for the empirical analysis, Figure 1 presents the evolution of real GDP growth and the employment-to-population ratio across ASEAN-5 during 2010–2023.

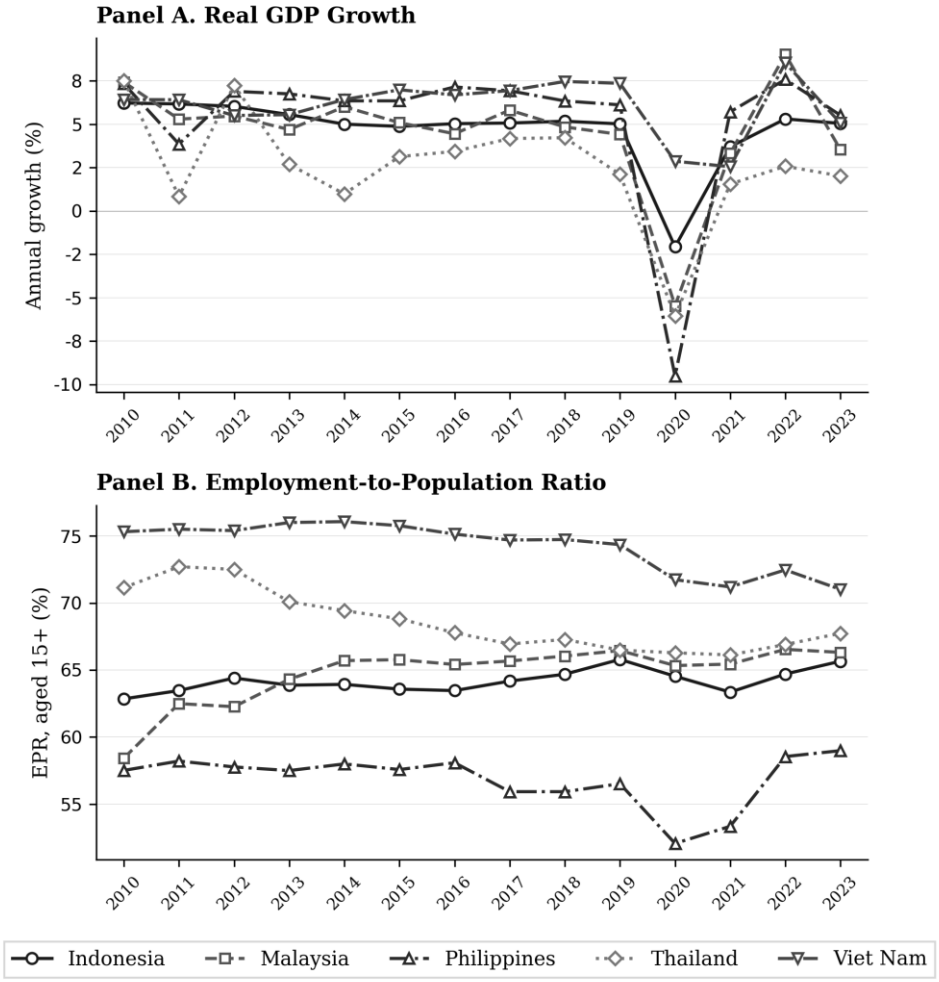



**Figure 1.** Economic Growth and Employment Absorption in ASEAN-5, 2010–2023

*Note: Panel A presents annual real GDP growth, while Panel B presents the employment-to-population ratio for persons aged 15 years and above. The figure is descriptive and should not be interpreted as evidence of causal relationships. Source: Authors' calculations based on World Development Indicators data.*

The descriptive patterns reveal that real GDP growth was considerably more volatile than the employment-to-population ratio across all five economies. Similar output expansions were not consistently accompanied by proportionate changes in EPR, and cross-country employment responses to comparable growth episodes differed markedly. The divergence is particularly visible around the 2020 pandemic contraction, where output collapsed sharply in every country while employment absorption displayed more muted and varied responses, and around the subsequent recovery, where the speed of EPR adjustment differed across economies. These patterns provide preliminary motivation for examining employment persistence and business-cycle asymmetry within a dynamic panel framework.

Most of the Okun's-law literature evaluates labour-market adjustment through the unemployment rate. Although unemployment is an important indicator of labour-market distress, its denominator is restricted to the labour force and can therefore change when individuals enter or leave active participation. This feature is especially important in economies where informal work, self-employment, discouragement, and demographic differences shape observed labour-market responses. Studies that disaggregate unemployment by age and gender, or distinguish self-employment

from dependent employment, demonstrate that aggregate unemployment can conceal substantial differences in how worker groups and forms of employment respond to output fluctuations (Dunsch, 2017; Porras-Arena & Martín-Román, 2019; An et al., 2022). The present study therefore uses the employment-to-population ratio for persons aged 15 years and above as a proxy for employment absorption.The title's question, "When Does Growth Create Jobs?", is operationalised as whether real GDP growth coincides with a larger employed share of the working-age population. EPR is a proxy for employment absorption, not a count of new jobs or a measure of job quality, informality, or hours worked; the estimates consequently cannot establish causal job creation.

A further limitation of a simple linear growth–employment specification is the assumption that labour markets react identically in expansions and periods of slack. Firms may adjust employment slowly because hiring, training, and separation are costly; they may initially respond to stronger demand through overtime, capacity utilisation, productivity changes, or labour hoarding rather than immediate changes in headcount. Conversely, during weak demand or recovery from a downturn, output changes may be associated with different employment responses because spare capacity, uncertainty, and delayed recruitment alter the timing of adjustment. Empirical research supports this possibility. Tang and Bethencourt (2017) document asymmetric short- and long-run unemployment–output trade-offs in the Eurozone; Nebot et al. (2019) identify nonlinearities and multiple regimes without imposing a single threshold in advance; and Boďa and Považanová (2021) find that Okun coefficients differ across output and unemployment phases in OECD economies. Evidence also indicates that the relationship can change across business cycles and that delayed labour-market responses are empirically relevant (Novák & Darmo, 2019; Obst, 2022). These results justify testing the growth–employment relationship separately under boom and slack conditions rather than assuming a constant marginal association throughout the cycle.

The employment consequences of growth also depend on the economy's demographic capacity. A rising share of the working-age population can create a favourable demographic window by reducing the relative dependency burden and expanding the potential supply of labour. However, standard dependency ratios are only simplified indicators: actual economic dependency also reflects labour-force participation, health, productivity, and institutional arrangements (Chomik et al., 2016). The demographic dividend is therefore an opportunity rather than an automatic outcome. Evidence for Asia indicates that demographic change can support economic convergence, but the gains depend on the ability of economies to productively employ their working-age population (Ha & Lee, 2016). Baerlocher et al. (2019) show that the direct accounting effect of age structure is limited once human capital is considered and that the education-related second demographic dividend is more important for growth. Han and Lee (2020) likewise demonstrate that the expansion and upgrading of the workforce contributed materially to Korea's economic performance, while changes in employment rates among women and older workers alter the balance between labour quantity and human capital. Demographic dynamics have also been shown to affect the cyclical sensitivity of labour-market outcomes (Erdoğan Coşar & Yavuz, 2021; An et al., 2022). Accordingly, a lower dependency burden should be interpreted as demographic capacity that can facilitate employment absorption, but only when productive opportunities and human capabilities are sufficiently developed.

Human development is therefore not merely an additional control but a structural condition that influences whether demographic opportunity and economic expansion translate into employment. Education, health, and material living standards shape employability, adaptability, and the capacity of workers to participate in sectors created by structural transformation. The evidence reviewed above indicates that human capital can convert demographic change into a more substantive development dividend (Baerlocher et al., 2019; Han & Lee, 2020). Labour quality also conditions the employment effects of foreign investment across Asia-Pacific economies, implying that capital inflows do not generate uniform employment gains in the absence of an appropriately skilled workforce (Nguyen et al., 2024). Firm-level evidence from Indonesian manufacturing similarly shows that foreign direct investment affects labour demand differently across skill groups (Matsuura & Saito, 2023). For the same reason, gross fixed capital formation, foreign direct investment, and government consumption cannot be assumed to have unambiguously positive employment effects: their consequences depend on whether expenditure and investment are labour-intensive, capital-intensive, skill-biased, or concentrated in sectors with limited domestic employment linkages. Evidence based on disaggregated expenditure components confirms that the composition of output and demand matters for labour-market outcomes (Hashmi et al., 2021). These considerations motivate the joint inclusion of demographic capacity, human development, and selected macroeconomic controls in the empirical framework.

Despite substantial progress in the literature, several gaps remain when the existing evidence is considered against the employment challenge of ASEAN-5. First, the dominant Okun's-law framework continues to operationalise labour-market adjustment through unemployment, leaving the employment-to-population ratio comparatively underused as a direct measure of employment absorption. Second, the ASEAN studies reviewed in this article document heterogeneity

and asymmetry, but they have not jointly integrated employment persistence, business-cycle regimes, demographic capacity, and human development within a single dynamic ASEAN-5 specification (Widarjono, 2020; Boďa et al., 2026). Third, the reviewed research on demographics and human capital establishes that a favourable age structure is conditional on education, participation, and productive opportunities, yet these structural factors are not jointly incorporated into the same models used to examine regime-dependent growth–employment associations (Baerlocher et al., 2019; Han & Lee, 2020; An et al., 2022). Fourth, regional evidence from Indonesia and cross-country reviews cautions that endogeneity, structural heterogeneity, and model specification can materially alter the estimated relationship (Aginta et al., 2025; Boďa, 2025).These gaps motivate an explicit test of business-cycle asymmetry in the growth–employment relationship while accounting for employment persistence, demographic capacity, and human development.

Recent ASEAN-wide evidence sharpens the study's incremental contribution. Huruta et al. (2026) analyse ten ASEAN economies over 2000–2024 using unemployment as the labour-market outcome and Panel Structural Equation Modeling, while Boďa et al. (2026) also evaluate an unemployment-based ASEAN framework. The present study is deliberately narrower in country coverage but different in empirical object and design: it models the employment-to-population ratio rather than unemployment, treats employment persistence explicitly, conditions the growth slope on the output-gap regime, incorporates demographic capacity and human development, and uses LSDVC to address dynamic fixed-effects bias in a very small cross-section.The contribution is therefore a dynamic test of when growth is associated with greater employment absorption, including whether the growth–EPR slope differs across cyclical states; it does not estimate the causal number of jobs created.

This study addresses those gaps by analysing a dynamic macro-panel of Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam over 2010–2023. Employment absorption is proxied by the employment-to-population ratio for persons aged 15 years and above. The model includes its one-year lag to capture labour-market persistence, real GDP growth as the principal explanatory variable, demographic capacity defined as one hundred minus the age dependency ratio and the Human Development Index as structural predictors. Business-cycle conditions are identified through an output-gap dummy that distinguishes boom years from slack years, and an interaction between economic growth and the boom dummy tests whether the short-run growth–employment association differs across regimes. Gross fixed capital formation, net foreign direct investment inflows, and government final consumption are included as macroeconomic controls, together with country and year fixed effects. Because the panel contains only five countries and a moderate time dimension, the principal specification is estimated using the bias-corrected least-squares dummy-variable estimator. The estimated coefficients are interpreted as dynamic conditional associations rather than as identified causal effects.

The study makes four contributions. First, it shifts the empirical focus from unemployment to the employment-to-population ratio, thereby examining the extent to which growth is associated with broader labour mobilisation. Second, it treats the business cycle as a source of possible slope heterogeneity by distinguishing the growth association under non-positive-output-gap conditions from the corresponding association under positive-output-gap conditions rather than imposing a single average relationship. Third, it integrates demographic capacity and human development into a dynamic employment framework, recognising that a large working-age population becomes economically valuable only when human capabilities and productive opportunities permit its absorption. Fourth, it applies a small-sample dynamic-panel strategy that explicitly accounts for employment persistence and reports short-run associations while treating cumulative long-run multipliers as secondary reduced-form quantities.The question "When Does Growth Create Jobs?" is examined empirically through the growth–EPR association and a formal test of asymmetry across output-gap regimes; the EPR outcome does not directly quantify newly created jobs.

Accordingly, the study pursues three related objectives: to estimate the dynamic association between economic growth and employment absorption after accounting for persistence and macroeconomic controls;to test business-cycle asymmetry by comparing the growth–EPR slopes under positive- and non-positive-output-gap conditions; and to evaluate how demographic capacity and human development are related to employment absorption within the same framework. By answering these questions, the analysis seeks to provide a more policy-relevant understanding of the employment content of growth in ASEAN-5 without attributing causal effects to the estimated coefficients.

## 2. Literature Review

### *2.1. Economic Growth and Employment Absorption*

The empirical regularity linking fluctuations in aggregate output to movements in labour-market outcomes is conventionally associated with Okun's law. Although the relationship was originally formulated for the United States, a large body of subsequent research has examined its validity across countries, time periods, and institutional settings. Ball et al. (2017) show that the relationship has remained economically meaningful over fifty years of data, though its magnitude varies across advanced economies. Ball et al. (2019) extend the analysis to a cross-country setting and find that the output–unemployment trade-off differs substantially with national labour-market characteristics: countries with more flexible labour markets tend to exhibit larger Okun coefficients, while those with rigid institutional arrangements display smaller responses. The comprehensive survey by Boďa (2025) similarly concludes that a quarter century of scholarly literature has moved the field beyond a single-coefficient interpretation towards heterogeneity, nonlinearity, and methodological scrutiny.

The evidence for developing and emerging economies is more mixed. Bartolucci et al. (2018) compare GDP dynamics and unemployment changes across developed and developing countries and find that the output–unemployment relationship is generally weaker in the developing world, where structural features such as informality, self-employment, and limited social protection shape labour-market adjustment. Ben-Salha and Mrabet (2019) examine North African economies and find evidence of "jobless growth," where output expands without proportionate employment gains. Within ASEAN, Widarjono (2020) reports asymmetric Okun-type relationships for Malaysia, the Philippines, and Singapore, while Boďa et al. (2026) study all ten ASEAN economies and find that Okun's law, when found to be statistically significant, is weaker and less regular than in advanced Western economies. These findings imply that the employment content of growth in ASEAN cannot be presumed from output expansion alone.

Most of the literature evaluates the output–labour-market relationship through the unemployment rate. However, unemployment rates in developing economies can be misleading because their denominator is restricted to the labour force and can therefore change when individuals enter or leave active participation. Studies that disaggregate unemployment by age, gender, or employment type show that aggregate unemployment can conceal substantial heterogeneity in how worker groups respond to output fluctuations (Dunsch, 2017; Porras-Arena & Martín-Román, 2019; Butkus & Seputiene, 2019; An et al., 2022). The present study uses the employment-to-population ratio as a more direct measure of labour utilisation, capturing the share of the working-age population that is actually employed regardless of whether non-employed individuals classify themselves as unemployed or out of the labour force.

On this basis, the first hypothesis predicts that economic growth is positively associated with employment absorption when the output gap is non-positive:

**Hypothesis 1.** Economic growth is positively associated with the employment-to-population ratio under non-positive-output-gap conditions ($\beta_1 > 0$).

### *2.2. Employment Persistence*

Employment outcomes exhibit substantial inertia. The employment-to-population ratio in any given year is strongly conditioned by the ratio observed in the preceding year because labour-market adjustment is neither instantaneous nor costless. Firms face hiring costs, training investments, and contractual obligations that make rapid expansion or contraction of headcount inefficient; workers face search frictions, occupational specificity, and geographic immobility that delay transitions between employment and non-employment. These adjustment costs generate persistence in aggregate employment that survives after controlling for contemporaneous macroeconomic conditions. In the dynamic panel literature, this persistence is captured by including the lagged dependent variable as a regressor, so that the autoregressive coefficient $\rho$ measures the proportion of last period's employment-to-population ratio that carries forward into the current period.

The importance of accounting for employment persistence in output–labour-market models has been emphasised in several strands of the literature. Obst (2022) estimates a dynamic version of Okun's law for the EU15 and finds that delays in the unemployment–output nexus are empirically significant: the contemporaneous relationship between output and unemployment understates the full adjustment because a portion of the response materialises with a lag. Novák and Darmo (2019) similarly show that the Okun relationship changes over the business cycle in EU countries, with lagged effects playing a substantive role in the post-financial-crisis period. Ball et al. (2017) note that including lagged unemployment in the Okun specification improves fit across a wide range of advanced economies, consistent with the view that labour markets do not clear within a single period.

In the ASEAN-5 context, persistence is also plausible because labour-market adjustment occurs through a combination of formal and informal employment arrangements, participation responses, sectoral reallocation, and gradual demographic change. These mechanisms can cushion the immediate employment effect of a downturn and delay the restoration of employment during recovery. Evidence that Okun-type relationships vary across ASEAN economies and across regional labour markets is consistent with the view that adjustment speeds need not be uniform across countries or episodes (Widarjono, 2020; Aginta et al., 2025; Boďa et al., 2026). The implication is not that a single institutional feature determines persistence, but that the observed EPR can embody accumulated adjustment from earlier macroeconomic conditions. A static specification may therefore attribute part of this inherited adjustment to contemporaneous regressors unless the lagged employment outcome is explicitly represented.

The inclusion of lagged EPR in the specification is therefore not merely a technical convenience but a substantive modelling choice that reflects the institutional and structural characteristics of the labour markets under study. The second hypothesis predicts that employment persistence is positive and economically meaningful:

**Hypothesis 2.** The employment-to-population ratio exhibits positive persistence: current EPR is positively associated with its own one-period lag ($\rho > 0$).

*2.3. Demographic Capacity and Employment Absorption*

The demographic structure of an economy determines the size of the potential labour pool and the dependency burden borne by the working-age population. A declining age dependency ratio expands the share of the population that is of working age, creating a demographic window that can support higher employment and output if the economy generates sufficient productive opportunities. This mechanism is the foundation of the first demographic dividend, which predicts that demographic transition raises per capita income by shifting the age composition in favour of producers relative to dependents (Ha & Lee, 2016). However, the dividend is conditional: a large working-age population creates economic opportunity only when labour-market institutions, human capital, and productive demand are adequate to absorb the additional labour supply.

Empirical evidence supports both the relevance and the conditionality of demographic dynamics. Baerlocher et al. (2019) study Brazilian regions and find that the direct accounting effect of the working-age population share on growth is modest once human capital is controlled for; the education-related second demographic dividend is quantitatively more important. Ha and Lee (2016) show that demographic change can support economic convergence in Asia, but the gains depend on the ability of economies to productively employ their working-age population. Han and Lee (2020) demonstrate that workforce expansion and upgrading contributed materially to Korea's economic performance, while changes in employment rates among women and older workers alter the balance between labour quantity and human capital. Chomik et al. (2016) further caution that standard dependency ratios are only simplified indicators because actual economic dependency also reflects labour-force participation, health, productivity, and institutional arrangements.

Demographic dynamics have also been shown to affect the cyclical sensitivity of labour-market outcomes. Erdoğan Coşar and Yavuz (2021) find that demographic composition affects the Okun coefficient in Turkey, and An et al. (2022) report that the cyclical sensitivity of unemployment varies across economy groups and demographic categories. These findings suggest that demographic structure is not merely a background condition but an active determinant of how employment responds to macroeconomic fluctuations.

In the present study, demographic capacity is constructed as one hundred minus the age dependency ratio, so that higher values correspond to a lower dependency burden and a more favourable demographic configuration for employment absorption. On this basis, the third hypothesis predicts:

**Hypothesis 3.** Demographic capacity is positively associated with the employment-to-population ratio ($\beta_2 > 0$).

*2.4. Human Development and Employment Absorption*

Human development is not merely an additional control but a structural condition that influences whether demographic opportunity and economic expansion translate into employment. Education, health, and material living standards shape employability, adaptability, and the capacity of workers to participate in sectors created by structural transformation. The evidence reviewed above indicates that human capital can convert demographic change into a more substantive development dividend (Baerlocher et al., 2019; Han & Lee, 2020). Countries with higher levels of human development are better positioned to absorb demographic surpluses into productive employment because their workers are more employable across a wider range of economic activities.

Labour quality also conditions the employment effects of investment and trade. Nguyen et al. (2024) study 29 Asia-Pacific economies and find that foreign direct investment positively affects employment, but that the interaction between FDI and labour quality moderates this relationship: at higher levels of labour quality, the positive employment effect of FDI is attenuated because multinational firms are attracted by relatively lower labour costs. This finding implies that the employment consequences of capital inflows depend on the human-capital characteristics of the host economy. Matsuura and Saito (2023) provide firm-level evidence from Indonesian manufacturing showing that FDI affects labour demand differently across skill groups, further supporting the idea that human capital mediates the employment effects of macroeconomic drivers.

The role of human development in the present framework is therefore to capture the extent to which the workforce possesses the health, education, and material conditions necessary to be absorbed into employment. Higher human development is expected to facilitate employment absorption both directly, by expanding the pool of employable individuals, and indirectly, by enabling the economy to benefit more fully from demographic opportunity and output growth.

At the macro level, HDI should be interpreted as a broad capability environment rather than as a direct measure of occupational skill. This distinction is important because employment absorption depends not only on the number of working-age individuals but also on whether health, education, and material conditions enable them to enter and remain in productive work. The demographic evidence indicates that a favourable age structure yields larger development gains when human capital improves alongside it (Baerlocher et al., 2019; Han & Lee, 2020). At the same time, evidence on FDI and labour demand shows that the employment consequences of economic expansion can vary with workforce quality and skill composition (Matsuura & Saito, 2023; Nguyen et al., 2024). Human development is therefore modelled here as a direct structural predictor of EPR, not as a statistical mediator. Its role is to capture the broader capability conditions under which demographic opportunity and macroeconomic expansion can be translated into employment. Human capability formation also extends beyond formal education to informal learning within families and communities. Manggau and Prusdianto (2026) illustrate this dimension through the Bugis Iyabelale tradition, which transmits values such as honesty, perseverance, industriousness, and courage during early childhood. Although this evidence does not directly establish labour-market effects, it highlights developmental dimensions beyond conventional measures of human capital.

Educational innovation represents an important dimension of human capability formation beyond conventional indicators of educational attainment. Swandi et al. (2025) demonstrate that a STEM hybrid research-based learning model significantly improved undergraduate students' scientific reasoning, highlighting the potential of innovative pedagogical approaches to strengthen cognitive capabilities. While these findings do not directly measure employment outcomes, they provide educational evidence relevant to the broader conceptual discussion of human capital development and workforce preparedness. Ismail et al. (2026) found that deep learning and scientific argumentation significantly strengthen innovation readiness, highlighting the importance of cognitive and educational capabilities. These findings complement the broader perspective of human development as a foundation for workforce adaptability and employment potential.

**Hypothesis 4.** Human development is positively associated with the employment-to-population ratio ($\beta_5 > 0$).

*2.5. Business-Cycle Conditions and Employment Absorption*

Business-cycle conditions represent a distinct channel through which macroeconomic fluctuations are associated with employment outcomes. Beyond the association with output growth itself, the position of actual output relative to estimated potential may be related to the level of employment absorption. In this study, a positive output gap denotes output above the estimated trend and a non-positive output gap denotes output at or below the estimated trend. These categories are not treated as synonyms for positive/negative GDP growth, “expansion,” or “downturn.” The direct regime term is therefore interpreted only as a conditional level difference within this output-gap classification.

A central limitation of a symmetric specification is the assumption that labour markets respond identically to output changes under positive-output-gap and non-positive-output-gap conditions. Firms may adjust employment slowly because hiring, training, and separation are costly; they may initially respond to stronger demand through overtime, capacity utilisation, productivity changes, or labour hoarding rather than immediate changes in headcount. Conversely, when output is at or below estimated potential, spare capacity, uncertainty, and delayed recruitment can alter the timing of adjustment.

Empirical research documents substantial heterogeneity in labour-market responses across cyclical phases. Tang and Bethencourt (2017) document asymmetric short- and long-run unemployment–output trade-offs in the Eurozone,

showing that expansions and contractions generate unequal labour-market responses. Boďa and Považanová (2021) find that Okun coefficients differ across output and unemployment phases in OECD economies. Time-varying evidence further indicates that the relationship can shift across business cycles (Aguiar-Conraria et al., 2020; Novák & Darmo, 2019; Obst, 2022). Within ASEAN, Widarjono (2020) reports that the asymmetric relationship holds for selected economies, and Boďa et al. (2026) find that where the output–labour-market relationship is statistically significant in ASEAN, it varies substantially across countries and over time. These findings establish that the phase of the business cycle is an empirically relevant conditioning variable for the growth–employment nexus.

The direct regime effect must nevertheless be distinguished from the slope asymmetry examined in the next subsection. A positive output gap can coincide with tighter labour demand and a higher EPR, but it can also coincide with productivity-led expansion, capacity constraints, changes in participation, or sectoral shifts that limit additional hiring. Conversely, slack periods may contain recoveries in which employment improves even while the output gap remains non-positive. The asymmetric and time-varying evidence in the Okun literature therefore supports treating the regime as empirically relevant without imposing a universal sign on its level effect (Tang & Bethencourt, 2017; Boďa & Považanová, 2021; Boďa et al., 2026). Accordingly, the direct association between the boom regime and EPR is theoretically ambiguous, and no directional hypothesis is specified for $\beta_3$.

### *2.6. Testing Business-Cycle Asymmetry in the Growth–Employment Relationship*

The distinction between the direct effect of business-cycle conditions on EPR levels and their moderating role on the growth–EPR slope is analytically important. The direct effect, captured by the boom dummy in the specification, allows the intercept of the employment equation to shift between regimes. The moderating role, captured by the interaction between economic growth and the boom dummy, tests whether the growth–employment slope differs between positive- and non-positive-output-gap regimes.A non-zero interaction coefficient would indicate that identical output expansions produce different employment responses depending on the cyclical state of the economy.

The theoretical mechanisms that give rise to this moderation are well established. Under positive-output-gap conditions, output growth may be associated with a weaker employment response when firms are already operating near capacity and additional output is achieved through productivity gains, overtime, or capital deepening rather than new hiring. Under non-positive-output-gap conditions, by contrast, output growth may draw idle or underemployed labour into employment because spare capacity creates a larger margin for labour absorption.This reasoning motivates a formal test of business-cycle asymmetry, without assuming in advance that the growth–employment association differs across regimes or that either state must exhibit the larger slope.

Nebot et al. (2019) identify nonlinearities and multiple regimes in the Okun relationship without imposing a single threshold in advance, consistent with the view that the growth–employment slope is state-dependent. Boďa and Považanová (2023) demonstrate that the credibility of Okun coefficients depends on the version and specification used, and that failing to account for regime differences can distort inference. Regional and sub-national analyses confirm that the asymmetry is not merely an artefact of cross-country pooling but can be observed within economies as well (Maza, 2022; Zanin, 2018; Aginta et al., 2025). The structural characteristics of ASEAN-5 economies including large informal sectors, elastic labour supply at the extensive margin, and demographic heterogeneity suggest that the moderation is likely to be present in the growth–EPR relationship.

The fifth hypothesis therefore tests whether the short-run growth–employment association differs across output-gap states:

Hypothesis 5. The short-run association between economic growth and the employment-to-population ratio differs between positive-output-gap and non-positive-output-gap conditions ($\beta_4 \neq 0$).

### *2.7. Macroeconomic Control Variables*

The empirical specification includes three macroeconomic controls gross fixed capital formation, net foreign direct investment inflows, and government final consumption that are included to condition the growth–employment relationship on observable macroeconomic channels rather than to test specific hypotheses about their effects. The expected signs of these variables are left unrestricted because the applied literature reports mixed results.

Gross fixed capital formation represents domestic investment in productive capacity and can influence employment through both scale and substitution channels. When investment expands production, infrastructure, or complementary productive assets, firms may require additional labour and the employment-to-population ratio can rise. Yet the same increase in capital formation may embody automation, capital deepening, or projects with limited labour intensity, weakening or even reversing the short-run employment association. This ambiguity is especially relevant in structurally

diverse economies because the labour content of investment depends on the sectors receiving capital and on the technologies embodied in new assets. The control is therefore included to distinguish the employment association of aggregate growth from variation associated with domestic capital accumulation rather than to impose a uniformly positive coefficient.

Foreign direct investment has similarly competing employment channels. New foreign operations can create direct jobs and stimulate labour demand through domestic suppliers, but foreign entry can also alter competitive conditions, production technology, and the skill composition of labour demand. Nguyen et al. (2024) report a positive baseline relationship between FDI and employment across Asia-Pacific economies while showing that labour quality changes that relationship, underscoring that capital inflows do not have a mechanically uniform employment effect. Firm-level evidence from Indonesian manufacturing likewise indicates that FDI affects labour demand differently across skill categories (Matsuura & Saito, 2023). In the present macro-panel, IHS-transformed net FDI is consequently used as a conditioning variable whose sign is allowed to emerge from the data rather than being treated as a core theoretical prediction.

Government final consumption captures another component of aggregate demand that may be associated with labour absorption through direct public employment, procurement, and demand for domestically produced goods and services. However, the size and direction of this association depend on the composition and transmission of spending. Expenditure concentrated in labour-intensive services can support employment more directly than spending with weak domestic linkages, while persistent public demand can also coexist with crowding-out pressures or productivity changes in the private sector. Evidence using disaggregated expenditure components shows that different components of output and demand need not carry identical labour-market implications (Hashmi et al., 2021). For this reason, government consumption is included as a macroeconomic control with an unrestricted expected sign.

Taken together, GFCF, FDI, and government consumption are not treated as competing explanations for the study's central hypotheses. Their purpose is to condition the estimated associations of growth, demographic capacity, human development, and the business-cycle interaction on observable macroeconomic channels that may co-move with both output and employment. Entering the controls individually and jointly, as specified in the Methodology, also helps reveal whether the core coefficients are sensitive to common trends in investment, foreign capital, or public demand. Because the underlying literature points to sector-, technology-, skill-, and composition-dependent effects, no directional hypotheses are formulated for these controls and their expected signs remain unrestricted.

**Table 1.** Synthesis of Selected Empirical Studies on Output, Employment, and Structural Determinants

| Study | Country / Sample | Labour-Market Outcome | Key Explanatory Factor | Method | Main Finding | Gap Relevant to Present Study |
|---|---|---|---|---|---|---|
| Ball et al. (2017) | G20 / advanced | Unemployment | GDP | OLS, 2SLS | Okun's law holds at 50; coefficient varies across economies | Unemployment-based; no EPR, no boom/slack moderation |
| Ball et al. (2019) | 71 countries | Unemployment | GDP, LM institutions | Panel | Cross-country heterogeneity driven by labour-market flexibility | Symmetric specification; no demographic or human-development predictors |
| Boďa & Považanová (2021) | OECD | Unemployment | Output gap | 2SLS, time-varying | Okun coefficients differ across output and unemployment phases | OECD focus; unemployment-based; no ASEAN evidence |
| Boďa et al. (2026) | ASEAN-10 | Unemployment | GDP, digitalisation | Hierarchical 2SLS | Okun's law weaker and less regular than in advanced economies | Unemployment-based; no EPR, persistence, or structural predictors |

| Study | Country / Sample | Labour-Market Outcome | Key Explanatory Factor | Method | Main Finding | Gap Relevant to Present Study |
|---|---|---|---|---|---|---|
| Widarjono (2020) | ASEAN-3 | Unemployment | GDP | NARDL | Asymmetric relationship in Malaysia, Philippines, Singapore | Three countries only; unemployment-based; no demographic controls |
| Baerlocher et al. (2019) | Brazilian regions | GDP per capita | Demographic variables | Panel IV | Education-related dividend exceeds pure demographic accounting effect | Regional; growth-focused DV; no employment absorption measure |
| Ha & Lee (2016) | Asia | GDP convergence | Demographic dividend | Panel | Demographic dividend supports convergence; conditional on absorption | Growth-focused; no direct employment outcome or cyclical conditioning |
| An et al. (2022) | Cross-country | Unemployment by group | GDP | Panel | Cyclical sensitivity varies by development level and demographics | Unemployment-based; no EPR or boom/slack interaction |
| Nguyen et al. (2024) | 29 Asia-Pacific | Employment ratio | FDI, labour quality | System GMM | FDI positive on employment; labour quality moderates | FDI-focused; no growth–EPR asymmetry or demographic capacity |
| Obst (2022) | EU15 | Unemployment | GDP | Dynamic panel | Delays in unemployment–output nexus are empirically significant | EU focus; unemployment-based; no structural predictors |
| Nebot et al. (2019) | Multiple | Unemployment | Output | Smooth transition | Nonlinearity in Okun's law without imposing a threshold | Unemployment-based; no employment absorption or demographic channels |
| Erdoğan Coşar & Yavuz (2021) | Turkey | Unemployment | GDP, demographics | Time-varying | Demographic composition affects Okun coefficient | Single country; unemployment-based; no EPR or business-cycle moderation |

*Note: The table summarises selected empirical studies relevant to the five hypotheses of the present study. The final column identifies the gap in each study that the present framework addresses. All entries are drawn from the reference list; no external sources have been added.*

### *2.8. Conceptual and Empirical Framework*

The literature reviewed in this section establishes five analytical pillars that motivate the empirical specification. First, the output–employment relationship is empirically meaningful but heterogeneous across countries, periods, and institutional settings, and the employment-to-population ratio provides a direct measure of labour absorption (H1). Second, employment outcomes exhibit positive persistence, requiring a dynamic specification that accounts for lagged EPR (H2). Third, demographic capacity creates a structural opportunity for employment absorption but does not guarantee its realisation (H3). Fourth, human development describes capability conditions relevant to employment absorption (H4). Fifth, business-cycle conditions may moderate the growth–employment association, which is tested as a difference between positive-output-gap and non-positive-output-gap slopes rather than assumed in advance (H5).

These five pillars are integrated in a dynamic specification in which the employment-to-population ratio depends on its own lag, economic growth, demographic capacity, human development, a business-cycle regime indicator, a growth–regime interaction, and three macroeconomic controls, estimated with country and year fixed effects. The conceptual and empirical framework is presented in Figure 2.

The framework therefore separates three conceptually different forms of conditioning. The lagged EPR term captures dynamic persistence. The Boom indicator is a shorthand for a positive output gap and captures a conditional intercept difference, while the Growth × Boom interaction tests whether the marginal association between growth and EPR differs from the corresponding association when the output gap is non-positive. Demographic capacity and human development enter as structural predictors, whereas GFCF, FDI, and government consumption are macroeconomic controls. Country effects absorb time-invariant national characteristics and year effects absorb shocks shared across ASEAN-5. This architecture preserves coefficient interpretability without treating HDI as a mediator or imposing a directional sign on the regime indicator.

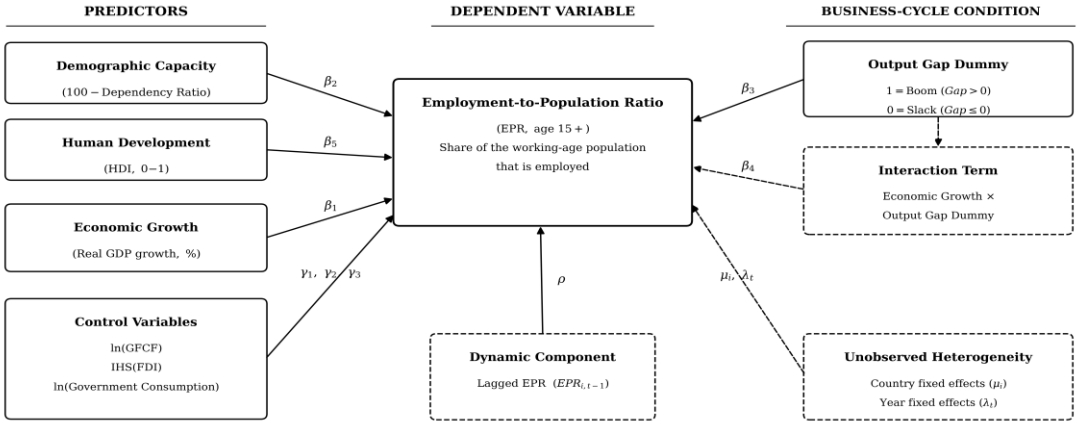



**Figure 2.** Conceptual and Empirical Framework

*Note: Solid arrows represent direct and dynamic associations, while dashed arrows represent the moderating and fixed-effect paths. The framework corresponds to equation (8) in the Methodology. Source: Authors' conceptualisation (2026).*

**Table 2.** Summary of Hypotheses

| Hypothesis | Statement | Relationship | Parameter | Expected Sign |
|---|---|---|---|---|
| H1 | Economic growth is positively associated with EPR under non-positive-output-gap conditions | Growth → EPR | $\beta_1$ | + |
| H2 | Current EPR is positively associated with its own one-period lag | Lagged EPR → EPR | $\rho$ | + |
| H3 | Demographic capacity is positively associated with EPR | DemoCap → EPR | $\beta_2$ | + |
| H4 | Human development is positively associated with EPR | HDI → EPR | $\beta_5$ | + |
| H5 | The growth–EPR association differs between positive-output-gap and non-positive-output-gap conditions | Growth × Boom → EPR | $\beta_4$ | $\neq 0$ |

*Note: The parameter column refers to equation (8). H1 and H5 jointly define the regime-specific marginal associations: ME_non-positive gap = $\beta_1$ and ME_positive gap = $\beta_1 + \beta_4$. "Boom" and "Slack" are retained only as compact model labels for positive and non-positive output gaps, respectively.*

## 3. Methods

### *3.1. Research Design and Country Sample*

The study adopts a quantitative explanatory design based on a dynamic macro-panel of five ASEAN economies Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam observed at annual frequency. The country-year is the

unit of analysis. These five economies constitute an internally coherent grouping in which employment outcomes, output dynamics, demographic transitions, and human-development trajectories can be compared under broadly similar regional trade and production linkages while retaining sufficient heterogeneity in economic structure, dependency burden, and cyclical experience to identify the relationships of interest. The regional focus is consistent with evidence that the output–labour-market relationship in Southeast Asia is heterogeneous and asymmetric across cyclical regimes (Widarjono, 2020; Boďa et al., 2026).

The primary observation window is 2010–2023. With five countries observed over fourteen years, the raw balanced panel contains seventy country-year observations. The introduction of a one-year within-country lag of the employment-to-population ratio, required by the dynamic specification, removes the first year of each country from the effective estimation sample, leaving a maximum of sixty-five country-year observations covering 2011–2023 for the principal dynamic model. Country fixed effects absorb time-invariant heterogeneity in institutions, geography, sectoral composition, and long-standing labour-market arrangements; year fixed effects absorb macroeconomic shocks common to the five economies within a given year, including global financial conditions, commodity-price cycles, and the pandemic disruption of 2020 and 2021. Because macroeconomic aggregates can respond simultaneously at annual frequency, the estimated coefficients are interpreted throughout as dynamic conditional associations rather than as identified causal effects.

### *3.2. Data Sources and Sample Construction*

Annual country-level indicators were compiled from the World Development Indicators (WDI) database of the World Bank, from ILOSTAT labour-force statistics disseminated through WDI, and from the Human Development Reports of the United Nations Development Programme (UNDP). The employment-to-population ratio for persons aged fifteen years and above is taken from the WDI series Employment-to-population ratio, 15+, total, national estimate (%) (WDI indicator SL.EMP.TOTL.SP.NE.ZS) and is applied consistently across the five economies from a single source definition; the analysis does not combine an alternative modelled labour-force series with a national-survey series within the same panel. Real GDP, the age dependency ratio, gross fixed capital formation, net foreign direct investment inflows, and government final consumption are obtained from WDI. Human Development Index values are drawn from the UNDP series in its published 0–1 scale. The last consistent HDI observation used in the analysis corresponds to 2023, which delimits the upper bound of the estimation window.

The five country series were merged by ISO3 country identifier and calendar year, ordered chronologically within country, checked for duplicate country-year identifiers and missing values, and verified for panel balance before the one-period lag of the dependent variable was constructed. The resulting panel is strongly balanced. The national-estimate EPR series is retained because it provides observed country survey estimates from a common WDI/ILOSTAT dissemination source and is complete in the synchronised panel. This choice favours within-country temporal continuity over maximum cross-country harmonisation. Country fixed effects absorb persistent level differences, but they cannot remove within-country breaks caused by survey redesigns or revisions; the source workbook does not encode survey-break metadata, so such revisions cannot be ruled out. Unconditional cross-country EPR rankings are therefore not used substantively, and the internationally modelled ILO EPR series remains an important robustness benchmark for future replication.

### *3.3. Variable Definition and Measurement*

Employment absorption is proxied by the employment-to-population ratio (EPR) for persons aged fifteen years and above, expressed as a percentage. EPR is used as a proxy: it measures the share of the working-age population that is employed and therefore captures the extent to which labour is drawn into employment more directly than an unemployment rate, whose denominator is limited to the labour force and whose interpretation is sensitive to participation dynamics. EPR is not intended as a metric of the absolute number of jobs created and is not interpreted as an indicator of job quality, informality, or working time.

Economic growth is measured as the annual percentage change in real gross domestic product and is the principal explanatory variable. Demographic capacity is constructed as one hundred minus the age dependency ratio; the transformation is monotone and reverse-orders the original indicator so that higher values correspond to a lower dependency burden and to a demographic configuration more supportive of labour mobilisation. Demographic capacity is therefore an analytical index of demographic opportunity, not an assertion of an automatic demographic dividend: whether a favourable age structure translates into higher employment absorption depends on the accompanying stock of human capital and on the productive opportunities available in the economy (Baerlocher et al., 2019; Ha & Lee,

2016; Han & Lee, 2020). Human development is represented by the Human Development Index on its original 0–1 scale, capturing joint achievements in health, education, and material living standards.

Three macroeconomic controls are included. Gross fixed capital formation and government final consumption expenditure are measured in constant 2015 US dollars and enter through the natural logarithm. Net foreign direct investment inflows are reported by WDI in balance-of-payments current US dollars and include a negative disinvestment observation; the inverse hyperbolic sine (IHS) is therefore used because it is defined at zero and for negative values. The price bases of the three controls are not directly comparable, so their coefficient magnitudes are not compared with one another and FDI is treated only as a signed conditioning variable. A mechanically deflated FDI series is not imposed because a single price deflator for cross-border financial flows would be conceptually ambiguous; this scale difference is retained as a measurement limitation rather than interpreted substantively.

$$DemoCap_{it} = 100 - DependencyRatio_{it} \tag{1}$$

$$LnGFCF_{it} = \ln(GFCF_{it}) \tag{2}$$

$$IHSFDI_{it} = \operatorname{asinh}(FDI_{it}) = \ln\left[FDI_{it} + \sqrt{FDI_{it}^2 + 1}\right] \tag{3}$$

$$LnGovCons_{it} = \ln(GovCons_{it}) \tag{4}$$

In equations (1)–(4), the subscripts i and t index country and year, respectively. GFCF and government consumption enter in constant-price US-dollar magnitudes so that the log transformation compresses scale while retaining a proportional interpretation; FDI enters as a signed IHS-transformed current-US-dollar flow. Table 3 summarises the operational definition and role of each variable and states the expected sign for variables for which theory provides a directional prediction.

### *3.4. Measurement of Business-Cycle Conditions*

Business-cycle conditions are captured by the output gap, defined as the percentage deviation of actual real GDP from estimated potential output. The HP filter is applied to the logarithm of real GDP; the estimated log-trend is exponentiated to obtain potential GDP in levels and the gap is computed as the percentage deviation of actual from potential GDP. The principal smoothing parameter is $\lambda = 100$. Operationally, the filter is estimated over 2010–2024 for each country and the main dynamic estimation uses 2011–2023. Thus, the 2024 observation contributes to the right-hand endpoint of the ex-post historical cycle estimate even though it is outside the main outcome window. The resulting regime indicator should therefore be interpreted as an ex-post classification, not as a real-time policy signal available to decision makers in 2023. To reduce reliance on this short two-sided HP window, robustness checks include $\lambda = 6.25$, a continuous gap specification, and an auxiliary country-specific linear-trend regime estimated on log real GDP over 2010–2023, which does not use the 2024 observation.

$$\begin{aligned} Y_{it}^{\text{pot}} &= \exp(\tau_{it}) \\ Gap_{it} &= 100\left(\frac{Y_{it} - Y_{it}^{\text{pot}}}{Y_{it}^{\text{pot}}}\right) \end{aligned} \tag{5}$$

A positive output gap identifies observations in which realised output exceeds the estimated trend; a non-positive gap identifies observations at or below the estimated trend. The Boom dummy is retained as shorthand for the positive-gap state and interacts with economic growth. In the interaction model, $\beta_3$ is the conditional intercept difference between positive-gap and non-positive-gap observations when Growth = 0 and the remaining regressors are held fixed; it is not an average "boom penalty" or an unconditional regime effect. The interaction coefficient $\beta_4$ tests whether the short-run growth slope differs across the two output-gap states.

$$Boom_{it} = \begin{cases} 1, & \text{if } Gap_{it} > 0, \\ 0, & \text{if } Gap_{it} \le 0. \end{cases} \tag{6}$$

$$GrowthBoom_{it} = Growth_{it} \times Boom_{it} \tag{7}$$

### *3.5. Empirical Model Specification*

The empirical model combines employment persistence, a direct growth term, two structural predictors of employment capacity, a business-cycle regime indicator, a growth–regime interaction, and three macroeconomic controls. The preferred dynamic specification takes the form:

$$EPR_{it} = \alpha + \rho EPR_{i,t-1} + \beta_1 Growth_{it} + \beta_2 DemoCap_{it} + \beta_3 Boom_{it} + \beta_4 (Growth_{it} \times Boom_{it}) + \beta_5 HDI_{it} + \gamma_1 LnGFCF_{it} + \gamma_2 IHSFDI_{it} + \gamma_3 LnGovCons_{it} + \mu_i + \lambda_t + \varepsilon_{it} \quad (8)$$

**Table 3**. Data sources, operational definitions, and measurement of variables

| Variable | Symbol | Operational definition and units | Source | Role in model | Expected sign |
|---|---|---|---|---|---|
| Employment-to-population ratio | EPR | Employed persons aged 15+ as a percentage of the population aged 15+ | WDI / ILOSTAT (SL.EMP.TOTL.SP.NE.ZS) | Dependent variable | |
| Lagged employment-to-population ratio | EPR(i,t−1) | One-year within-country lag of EPR | Constructed | Dynamic term | Positive |
| Economic growth | Growth | Annual percentage change in real GDP | WDI real GDP (NY.GDP.MKTP.KD; annual % change) | Main explanatory | Expected positive under non-positive output gap |
| Demographic capacity | DemoCap | 100 − age dependency ratio | WDI SP.POP.DPND (constructed as 100 − ratio) | Structural predictor | Expected positive |
| Human development | HDI | Human Development Index on 0–1 scale | UNDP Human Development Report 2025 | Structural predictor | Expected positive |
| Business-cycle regime | Boom | 1 if output gap > 0, 0 otherwise | Constructed from WDI NY.GDP.MKTP.KD | Direct regime effect | Theoretically ambiguous / unrestricted |
| Growth × Boom interaction | Growth × Boom | Product of economic growth and the boom dummy | Constructed | Moderator | Unrestricted; non-zero indicates regime asymmetry |
| Capital formation | LnGFCF | Natural log of GFCF in constant 2015 US$ | WDI NE.GDI.FTOT.KD | Control | ± |
| Foreign direct investment | IHSFDI | IHS of net FDI inflows in current US$ | WDI BX.KLT.DINV.CD.WD | Control | ± |
| Government consumption | LnGovCons | Natural log of government final consumption in constant 2015 US$ | WDI NE.CON.GOVT.KD | Control | ± |

*Note. EPR is used as a proxy for employment absorption; the ratio does not measure the number of jobs created, job quality, informality, or working time. Demographic capacity is an analytical index of demographic opportunity, not a mechanical demographic dividend. The three macroeconomic variables at the bottom of the table are controls; their expected signs are unrestricted because the underlying literature reports mixed effects.*

In equation (8), i denotes country and t denotes year; $\alpha$ is the common intercept; $\mu_i$ denotes unobserved country-specific effects; $\lambda_t$ denotes common year effects; and $\varepsilon_{it}$ is the idiosyncratic disturbance. The persistence parameter $\rho$ captures the conditional association between current EPR and its one-period lag. The slope $\beta_1$ measures the short-run growth association when the output gap is non-positive (Boom = 0); $\beta_2$ measures the association with demographic capacity; $\beta_3$ is the positive-gap versus non-positive-gap intercept difference specifically at Growth = 0; $\beta_4$ is the difference between the two growth slopes; $\beta_5$ measures the association with human development; and $\gamma_1$, $\gamma_2$, and $\gamma_3$ refer to the three

macroeconomic controls. A two-way fixed-effects analogue of equation (8), obtained by excluding the lag of EPR, is estimated as a static benchmark and reported alongside the dynamic estimates.

*3.6. Interpretation of Moderating and Long-Run Effects*

Because economic growth appears both on its own and inside a product with the positive-gap dummy, the coefficient on growth alone does not represent the total short-run association in every regime. When the output gap is non-positive (Boom = 0), the short-run association is $\beta_1$; when the output gap is positive (Boom = 1), it is $\beta_1 + \beta_4$. Thus $\beta_4$ is the difference between the two slopes and is not itself the positive-gap growth association. Likewise, $\beta_3$ refers only to the conditional intercept difference at Growth = 0 unless growth is mean-centred.

$$ME_{slack} = \beta_1 \tag{9}$$

$$ME_{boom} = \beta_1 + \beta_4 \tag{10}$$

$$ME_{boom} - ME_{slack} = \beta_4 \tag{11}$$

The statistical significance of the positive-gap slope is assessed by a linear-combination test of $H_0$: $\beta_1 + \beta_4 = 0$, reported alongside tests on the individual coefficients. Marginal associations with two-sided ninety-five per cent confidence intervals are reported graphically. Provided the persistence coefficient satisfies $|\rho| < 1$, reduced-form cumulative long-run multipliers can be calculated from the dynamic parameters as:

$$LR_{slack} = \frac{\beta_1}{1 - \rho} \tag{12}$$

$$LR_{boom} = \frac{\beta_1 + \beta_4}{1 - \rho} \tag{13}$$

Bootstrap confidence intervals are reported for these long-run objects. They are treated as secondary stylised dynamic multipliers because their precision depends strongly on $\rho$ and because a permanent one-percentage-point increase in an annual GDP growth rate is not an observed policy intervention. They should not be read as forecasts of jobs generated by permanently higher growth.

*3.7. Estimation Strategy*

The dynamic specification is estimated by a bias-corrected least-squares dummy-variable estimator (LSDVC). The choice of LSDVC responds to two features of the panel that make alternative dynamic estimators unattractive in the present setting. First, in a fixed-effects model that contains a lagged dependent variable, the within transformation induces a mechanical correlation between the transformed lag and the transformed disturbance; the resulting dynamic-panel bias is decreasing in the length of the time dimension but remains non-trivial at moderate T and is not eliminated by conventional standard-error corrections (Nickell, 1981). Second, difference-GMM and system-GMM estimators are designed for panels in which the cross-sectional dimension is large relative to the time dimension (Arellano & Bond, 1991; Blundell & Bond, 1998). With only five cross-sectional units, GMM instrument counts grow rapidly and become disproportionate to N; the finite-sample properties of the two-step estimator can be unreliable, and the standard specification tests the Hansen–Sargan overidentification test and the Arellano–Bond serial-correlation test have very low power at such a small N and can produce misleading acceptances rather than informative diagnostics. LSDVC circumvents both problems by correcting the least-squares dummy-variable estimator analytically for the persistence-induced bias, without introducing an instrument set whose validity depends on a large cross-section; its favourable small-sample behaviour in dynamic panels with a small number of individuals has been established in the methodological literature (Kiviet, 1995; Judson & Owen, 1999; Bun & Kiviet, 2003; Bruno, 2005a, 2005b).

The implementation follows Bruno's bias-corrected estimator through Stata's user-written xtlsdvc routine (Stata Journal module st0091; Bruno, 2005a, 2005b). The correction is initialised with the one-step Arellano–Bond estimator, uses the third-order bias approximation, and reports bootstrap standard errors and confidence intervals based on 1,000 replications; country and year effects are included in every principal specification. The archived estimation output does not preserve the Stata release number or a fixed bootstrap random-number seed, so exact bitwise replication of bootstrap

draws cannot be claimed; this limitation is disclosed explicitly while the estimator, initialisation, correction order, transformations, sample construction, and replication count are documented. Two substantive limitations remain. First, N = 5 is extremely small, so finite-sample precision is assessed through robustness and influence diagnostics. Second, LSDVC addresses persistence-induced fixed-effects bias but not all sources of endogeneity. Accordingly, coefficients are interpreted as dynamic conditional associations rather than causal effects, and lagged-regressor checks are used only to assess timing sensitivity.

Hansen–Sargan and Arellano–Bond tests are not reported as primary validity criteria because LSDVC is not an instrumental-variables estimator and does not rely on an overidentified moment structure; the robustness and credibility assessment is instead the sequence of nested specifications introduced in the next section together with the robustness variants described in Section 3.9.

### *3.8. Sequential Model Development*

The dynamic specification is built up sequentially rather than introducing every regressor at once. Sequential estimation makes the central growth–regime relationship transparent and shows how the coefficients respond as slow-moving structural predictors and trending controls are added. Table 4 summarises the sequence of models estimated. Model 8 is the principal complete model corresponding to the conceptual framework; Model 4 is the minimum interaction specification required to test the asymmetry proposition; and Models 5 to 7 add the macroeconomic controls one at a time. The final block reports robustness variants that alter cycle measurement, sample composition, or regressor timing.

### *3.9. Diagnostic and Robustness Checks*

Several checks assess whether the main findings depend on a particular sample definition, business-cycle measure, variable timing, or model composition. First, the binary HP-filter regime is replaced by the continuous output gap and its interaction with growth. Second, the HP filter is recalculated with $\lambda = 6.25$. Third, 2020 and 2021 are excluded to assess the influence of the pandemic contraction and rebound. Fourth, growth and the three macroeconomic controls are lagged by one year to reduce contemporaneous feedback concerns and assess timing sensitivity. Fifth, the original dependency ratio replaces the reverse-coded demographic-capacity index. Sixth, the three macroeconomic controls are entered individually and jointly. Seventh, alternative LSDVC correction orders are compared. Because both contemporaneous Growth and the HP-filter regime are transformations of the real-GDP series, two additional diagnostics address generated-regressor dependence: a country-specific linear-trend regime estimated from log real GDP over 2010–2023, and a one-year-lagged HP regime interacted with current growth. Finally, because N = 5, each country is omitted in turn in an auxiliary dynamic two-way-fixed-effects analogue of equation (8) to reveal country leverage on $\rho$, the non-positive-gap growth slope, the interaction, and the implied positive-gap slope. These auxiliary screens diagnose fragility; the principal hypothesis tests remain based on the LSDVC specification.

Inference in the principal LSDVC specifications is anchored in the linear-combination test on the positive-gap slope ($H_0$: $\beta_1 + \beta_4 = 0$) and in 1,000-replication bootstrap standard errors and confidence intervals. Robustness assessment focuses on signs, magnitudes, confidence intervals, and stability across specifications rather than on significance stars alone. The persistence parameter is inspected for $|\rho| < 1$. Pairwise correlations and two-way-FE-residualised variance-inflation factors screen for multicollinearity. Hansen–Sargan and Arellano–Bond tests are not used as primary validity criteria because LSDVC is not an overidentified instrumental-variables estimator. The auxiliary dynamic-FE checks are interpreted only as influence and regime-definition diagnostics.

### *3.10. Statistical Inference and Ethical Considerations*

Statistical inference is based on two-sided 95 per cent bootstrap confidence intervals from 1,000 replications for the principal LSDVC model. Conventional 1, 5, and 10 per cent thresholds are shown for transparency, but substantive interpretation gives priority to point-estimate magnitude, confidence-interval width, regime-specific linear combinations, and stability across robustness checks. The implementation uses Stata's xtlsdvc routine with one-step Arellano–Bond initialisation and the third-order bias correction; the archived output does not retain the Stata release or a fixed random seed, which is reported as a reproducibility limitation rather than silently reconstructed.

All data are aggregate, publicly available country-year statistics and involve no human participants, personal identifiers, or confidential records; ethics-committee approval and informed consent are therefore not applicable. For replication, the country set is Indonesia (IDN), Malaysia (MYS), the Philippines (PHL), Thailand (THA), and Viet Nam (VNM). The principal WDI/ILOSTAT series are employment-to-population ratio, 15+, total, national estimate (SL.EMP.TOTL.SP.NE.ZS); age dependency ratio (SP.POP.DPND); real GDP in constant 2015 US dollars for the output-gap construction (NY.GDP.MKTP.KD); gross fixed capital formation in constant 2015 US dollars

(NE.GDI.FTOT.KD); foreign direct investment, net inflows, BoP current US dollars (BX.KLT.DINV.CD.WD); and general government final consumption expenditure in constant 2015 US dollars (NE.CON.GOVT.KD). HDI is taken from the UNDP Human Development Report 2025 composite-indices time-series release. The HP trend is estimated over 2010–2024 and the principal dynamic sample covers 2011–2023 after construction of the within-country EPR lag. The analysis-ready data and transformation logic document EPR lags, DemoCap = 100 − dependency ratio, IHS(FDI), the output gap, regime indicators, and regime-specific marginal associations; the cleaned dataset and estimation code should accompany the article as supplementary replication material where journal policy permits.

**Table 4.** Sequential dynamic specifications and robustness variants

| Block | Model | Specification | Analytical purpose |
|---|---|---|---|
| Static benchmark | M0 | Two-way fixed-effects analogue of (8) without the lag of EPR | Provide a transparent static benchmark and a reference point for the persistence-corrected dynamic estimates. |
| Sequential build | M1 | Lagged EPR + Growth + country and year effects | Establish employment persistence and the baseline dynamic association with growth. |
| | M2 | M1 + DemoCap + HDI | Introduce structural employment capacity. |
| | M3 | M2 + Boom | Estimate the direct business-cycle level effect. |
| | M4 | M3 + Growth × Boom | Minimum interaction specification for the central asymmetry proposition; not the final theoretical model. |
| | M5 | M4 + LnGFCF | Control-variable sensitivity: domestic capital formation. |
| | M6 | M4 + IHSFDI | Control-variable sensitivity: foreign investment. |
| | M7 | M4 + LnGovCons | Control-variable sensitivity: public-sector demand. |
| | M8 | M4 + all three controls | Principal complete model corresponding exactly to the conceptual framework. |
| Robustness | R1 | Replace Boom with continuous output gap; use Growth × Gap as moderator | Test whether the asymmetric growth association survives a continuous cycle metric. |
| | R2 | Exclude 2020–2021 | Test whether pandemic-related labour-market disruption dominates the identification. |
| | R3 | One-period lag of Growth and of the three controls | Reduce contemporaneous feedback concerns and assess the timing sensitivity of the estimates. |
| | R4 | Original dependency ratio in place of DemoCap | Confirm that the reverse-coded index is not driving the results. |
| | R5 | Alternative initialisation and bias-correction order for LSDVC | Test sensitivity of the bias correction where methodologically justified. |

*Note. M4 is the minimum interaction specification required to test the central asymmetry proposition. M8 is the principal complete model corresponding exactly to the conceptual framework. R1–R5 constitute the LSDVC robustness set discussed in Section 3.9. Additional country-influence, linear-trend-regime, and lagged-regime diagnostics are reported as auxiliary dynamic two-way-fixed-effects screens and are not used as substitutes for the principal LSDVC inference.*

## 4. Result and Discussion

### *4.1. Results*

#### *4.1.1. Descriptive Statistics and Preliminary Analysis*

The analytical dataset is the synchronised ASEAN-5 panel covering Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam. The raw 2010–2023 panel contains 70 country-year observations. After constructing the one-period lag of the employment-to-population ratio, the effective dynamic sample contains 65 observations covering 2011–2023, or five countries observed over thirteen years. The panel is strongly balanced, with no duplicate country-year identifiers and no missing values in the variables entering the principal specification.

Across the dynamic sample, mean EPR is 65.77 per cent and mean annual real GDP growth is 4.46 per cent. The output gap averages close to zero and ranges from −6.60 to 7.55 per cent. Thirty of the 65 observations have a positive output gap and 35 have a non-positive output gap, so both output-gap states are represented. The IHS transformation preserves the negative FDI observation that a conventional logarithm would discard. Table 5 reports the variable distributions and Table 6 reports sample composition by country and output-gap state. Country averages describe sample structure only; substantive inference rests on within-country variation conditional on country and year effects.

**Table 5.** Descriptive Statistics

| Variable | N | Mean | SD | Minimum | Median | Maximum |
|---|---|---|---|---|---|---|
| EPR (%) | 65 | 65.767 | 5.954 | 52.052 | 65.700 | 76.076 |
| Lagged EPR (%) | 65 | 65.699 | 6.177 | 52.052 | 65.670 | 76.076 |
| Economic growth (%) | 65 | 4.458 | 3.230 | −9.518 | 5.092 | 9.032 |
| Demographic capacity | 65 | 52.542 | 6.045 | 37.094 | 53.042 | 60.506 |
| HDI | 65 | 0.743 | 0.046 | 0.674 | 0.729 | 0.819 |
| Output gap (%) | 65 | 0.083 | 2.657 | −6.604 | −0.194 | 7.548 |
| Boom dummy | 65 | 0.462 | 0.502 | 0.000 | 0.000 | 1.000 |
| Growth × Boom | 65 | 2.475 | 2.860 | 0.000 | 0.000 | 7.465 |
| LnGFCF | 65 | 25.404 | 0.567 | 24.506 | 25.277 | 26.640 |
| IHSFDI | 65 | 23.065 | 5.816 | −22.874 | 23.779 | 24.640 |
| LnGovCons | 65 | 24.611 | 0.451 | 23.712 | 24.609 | 25.315 |

*Note. Statistics are calculated from the 65-observation effective dynamic sample (2011–2023).*

Two preliminary diagnostics precede estimation. First, the principal business-cycle classification was re-audited directly from the synchronised workbook. Applying the HP filter to log real GDP over 2010–2024 with $\lambda = 100$, exponentiating the trend, and computing actual minus potential output as a percentage reproduces the workbook series to numerical precision. Because 2024 is used at the right-hand endpoint, this is explicitly an ex-post historical classification. An auxiliary country-specific linear-trend regime estimated only over 2010–2023 is therefore used later to assess whether substantive conclusions depend on the short two-sided HP window.

Second, multicollinearity and identifying variation were evaluated after residualising regressors on country and year indicators. The largest residualised VIF is 6.39 for Growth × Boom and 5.61 for the regime dummy; all remaining values are below four (Table 7). After the same two-way-FE residualisation, the standard deviation of demographic capacity is 1.902 index points and that of HDI is only 0.0072, compared with raw standard deviations of 6.045 and 0.046, respectively. The limited residual variation—especially for HDI—helps explain why slow-moving structural coefficients are estimated imprecisely and cautions against interpreting statistical insignificance as substantive irrelevance.

#### *4.1.2. Baseline and Dynamic Panel Estimation Results*

Table 8 reports the static two-way fixed-effects benchmark (M0) alongside the complete dynamic LSDVC specification (M8). The static benchmark is not used for the principal hypothesis tests because it omits lagged EPR; its role is to

show how the coefficient pattern changes once employment persistence and the small-sample dynamic-panel correction are incorporated. Table 9 presents the full bootstrap inference for the principal model.

The central dynamic result is the persistence parameter, estimated at $\rho = 0.7710$ with a bootstrap standard error of 0.1053. The coefficient is statistically significant at the 1 per cent level, and its 95 per cent percentile bootstrap interval [0.5195, 0.9416] lies entirely below unity; all 1,000 bootstrap draws satisfy the stability condition. Employment absorption in ASEAN-5 is therefore strongly persistent yet dynamically stable within the estimated model.

**Table 6.** Sample Composition by Country and Business-Cycle Regime

| Country | N | Boom | Slack | Mean EPR (%) | Mean Growth (%) |
|---|---|---|---|---|---|
| Indonesia | 13 | 7 | 6 | 64.275 | 4.610 |
| Malaysia | 13 | 6 | 7 | 65.210 | 4.347 |
| Philippines | 13 | 5 | 8 | 56.795 | 5.080 |
| Thailand | 13 | 6 | 7 | 68.393 | 2.226 |
| Viet Nam | 13 | 6 | 7 | 74.165 | 6.027 |

*Note. Positive-gap (Boom) = output gap > 0; non-positive-gap (Slack) = output gap ≤ 0. These labels describe output relative to estimated potential and are not synonyms for positive/negative GDP growth.*

**Table 7.** Two-Way-FE-Residualised Variance-Inflation Factors

| **Variable** | **VIF** |
|---|---|
| Lagged EPR | 1.56 |
| Economic growth | 1.19 |
| Demographic capacity | 3.64 |
| HDI | 2.31 |
| Boom dummy | 5.61 |
| Growth × Boom | 6.39 |
| LnGFCF | 2.25 |
| IHSFDI | 1.18 |
| LnGovCons | 3.62 |

*Note. VIFs are computed after residualising each substantive regressor on country and year indicators.*

Conditional on lagged EPR, structural predictors, macroeconomic controls, and country and year effects, the short-run growth coefficient when the output gap is non-positive is $\beta_1 = 0.2424$ ($p = 0.003$). A one-percentage-point increase in annual real GDP growth is therefore associated with about a 0.242-percentage-point higher EPR in that state, conditional on the model. Demographic capacity is positive ($\beta_2 = 0.2045$) but statistically inconclusive at the 5 per cent level ($p = 0.081$; 95% bootstrap CI [−0.0129, 0.4397]); it is treated as suggestive rather than confirmatory evidence. HDI is positive but very imprecisely estimated and statistically insignificant. None of the three macroeconomic controls is individually significant. The regime coefficient is $\beta_3 = -1.9930$ ($p = 0.019$), but in the interaction model this is only the conditional positive-gap versus non-positive-gap intercept difference at Growth = 0, not an average EPR penalty associated with positive-gap years.

*4.1.3. Business-Cycle Asymmetry and Marginal Effects*

The interaction specification implies that the short-run growth–EPR association equals $\beta_1$ when the output gap is non-positive and $\beta_1 + \beta_4$ when the output gap is positive. The estimated non-positive-gap slope is 0.2424 ($p = 0.003$) and the implied positive-gap slope is 0.4869 ($p = 0.005$). Both conditional associations are individually positive and statistically significant at the 1 per cent level.

The difference between the two slopes is $\beta_4 = 0.2445$, with bootstrap $p = 0.116$ and a 95 per cent percentile interval of [−0.0493, 0.5619]. Because the interval includes zero, business-cycle slope asymmetry is not statistically detected in the principal model. This does not establish symmetry: with N = 5 and an imprecise interaction, failure to reject $\beta_4 = 0$

is not positive evidence that the slopes are equal. Figure 3 displays the two conditional associations and their bootstrap intervals.

**Table 8.** Static Two-Way Fixed-Effects Benchmark and Principal Dynamic LSDVC Model

| Variable | M0: Two-way FE | M8: LSDVC3 |
|---|---|---|
| Economic growth ($\beta_1$) | 0.2350* | 0.2424*** |
| | (0.1313) | (0.0816) |
| Demographic capacity ($\beta_2$) | 0.5299*** | 0.2045* |
| | (0.1636) | (0.1170) |
| Boom dummy ($\beta_3$) | −2.2194 | −1.9930** |
| | (1.3515) | (0.8493) |
| Growth × Boom ($\beta_4$) | 0.4003* | 0.2445 |
| | (0.2402) | (0.1555) |
| Human Development Index ($\beta_5$) | −21.6831 | 12.9545 |
| | (35.7290) | (23.3024) |
| LnGFCF ($\gamma_1$) | 0.8986 | −0.0132 |
| | (2.5165) | (1.6010) |
| IHSFDI ($\gamma_2$) | 0.0216 | −0.0300 |
| | (0.0364) | (0.0236) |
| LnGovCons ($\gamma_3$) | −9.2081** | −1.7074 |
| | (3.8786) | (2.6503) |
| Lagged EPR ($\rho$) | | 0.7710*** |
| | | (0.1053) |
| Country fixed effects | Yes | Yes |
| Year fixed effects | Yes | Yes |
| Observations | 65 | 65 |

*Note. Standard errors in parentheses. M0 reports conventional two-way fixed-effects standard errors; M8 reports 1,000-replication parametric bootstrap standard errors. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.*

**Table 9.** Principal LSDVC3 Estimates with Bootstrap Inference

| Variable | Estimate | Boot. SE | z | p-value | 95% Percentile Bootstrap CI |
|---|---|---|---|---|---|
| Lagged EPR ($\rho$) | 0.7710 | 0.1053 | 7.32 | <0.001 | [0.5195, 0.9416] |
| Economic growth ($\beta_1$) | 0.2424 | 0.0816 | 2.97 | 0.003 | [0.0853, 0.4000] |
| Demographic capacity ($\beta_2$) | 0.2045 | 0.1170 | 1.75 | 0.081 | [−0.0129, 0.4397] |
| Boom dummy ($\beta_3$) | −1.9930 | 0.8493 | −2.35 | 0.019 | [−3.5380, −0.3134] |
| Growth × Boom ($\beta_4$) | 0.2445 | 0.1555 | 1.57 | 0.116 | [−0.0493, 0.5619] |
| Human Development Index ($\beta_5$) | 12.9545 | 23.3024 | 0.56 | 0.578 | [−31.8232, 57.5103] |
| LnGFCF ($\gamma_1$) | −0.0132 | 1.6010 | −0.01 | 0.993 | [−3.3606, 2.9829] |
| IHSFDI ($\gamma_2$) | −0.0300 | 0.0236 | −1.27 | 0.205 | [−0.0759, 0.0156] |
| LnGovCons ($\gamma_3$) | −1.7074 | 2.6503 | −0.64 | 0.519 | [−6.9641, 3.7895] |

*Note. LSDVC3 is initialised with the one-step Arellano–Bond estimator and uses the third-order bias approximation. Bootstrap inference is based on 1,000 parametric replications. Country and year effects are included but not displayed.*

Because $|\rho| < 1$, reduced-form long-run multipliers can be calculated by dividing the short-run associations by one minus ρ. The implied values are 1.0587 for the non-positive-gap state and 2.1265 for the positive-gap state, but their percentile bootstrap intervals are very wide as ρ approaches unity in some draws. These quantities are therefore retained only as secondary stylised dynamic implications and are not interpreted as forecasts of permanent job creation.

**Table 10.** Regime-Specific Marginal and Long-Run Associations

| Effect | Estimate | Boot. SE | p-value | 95% Percentile Bootstrap CI |
|---|---|---|---|---|
| Short-run: non-positive output gap ($\beta_1$) | 0.2424 | 0.0816 | 0.003 | [0.0853, 0.4000] |
| Short-run: positive output gap ($\beta_1 + \beta_4$) | 0.4869 | 0.1750 | 0.005 | [0.1557, 0.8189] |
| Positive-gap − non-positive-gap difference ($\beta_4$) | 0.2445 | 0.1555 | 0.116 | [−0.0493, 0.5619] |
| Long-run: non-positive output gap | 1.0587 | | | [0.2493, 5.0872] |
| Long-run: positive output gap | 2.1265 | | | [0.5335, 8.2150] |

*Note. Short-run non-positive-gap association = $\beta_1$; short-run positive-gap association = $\beta_1 + \beta_4$; the slope difference = $\beta_4$. Long-run quantities divide the corresponding short-run association by $(1 - \rho)$. Their wide empirical bootstrap intervals make them secondary reduced-form quantities rather than job-creation forecasts.*

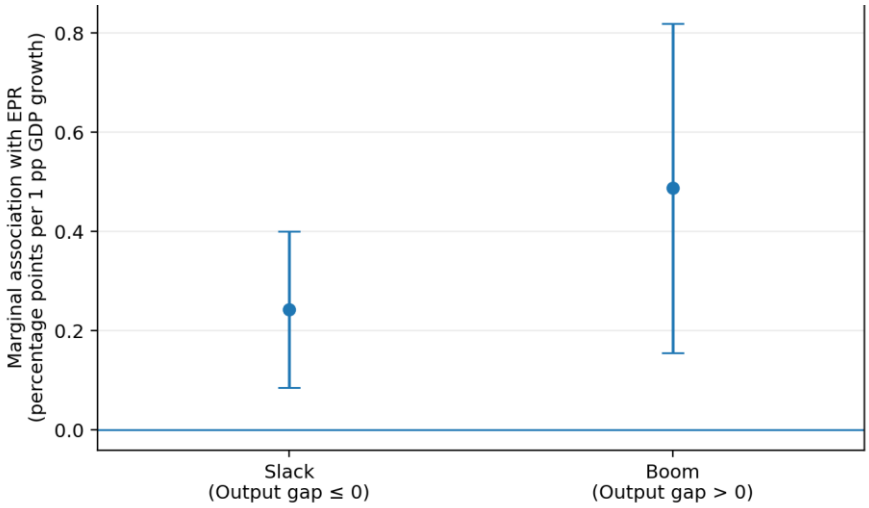



**Figure 3.** Regime-Specific Short-Run Growth–Employment Associations

*Note. Points are estimated marginal associations; vertical bars are 95 per cent percentile bootstrap confidence intervals based on 1,000 replications.*

Table 11 summarises the five hypothesis tests in the principal specification. H1 and H2 are supported at the 1 per cent level. H3 is positive but statistically inconclusive at the 5 per cent level because its 95 per cent bootstrap interval includes zero. H4 is not supported, and H5 is not supported because the slope-difference interaction is not statistically distinguishable from zero; accordingly, asymmetry is not detected rather than symmetry being established.

*4.1.4. Robustness and Additional Checks*

The sequential specifications assess whether the central coefficients depend on a particular combination of structural predictors or macroeconomic controls. Across M1–M8 the growth coefficient remains positive in every model, ranging from 0.1738 in M1 to 0.2562 in M3 and settling at 0.2424 in the complete specification, while employment persistence remains high, with ρ between 0.7366 and 0.8175 (Table 12). Once the interaction is introduced in M4, the Growth × Boom coefficient remains positive across M4–M8, ranging from 0.2125 to 0.2988. The stability of its sign does not override the bootstrap inference from the complete model: the final interaction estimate remains statistically indistinguishable from zero. The sequential pattern therefore supports coefficient-sign stability but not a claim of statistically established business-cycle asymmetry.

**Table 11.** Hypothesis Evaluation

| Hypothesis | Parameter | Estimate | p-value | Tested Sign | Decision |
|---|---|---|---|---|---|
| H1 | $\beta_1$ | 0.2424 | 0.003 | > 0 | Supported |
| H2 | $\rho$ | 0.7710 | <0.001 | > 0 | Supported |
| H3 | $\beta_2$ | 0.2045 | 0.081 | > 0 | Suggestive; statistically inconclusive at 5% |
| H4 | $\beta_5$ | 12.9545 | 0.578 | > 0 | Not supported |
| H5 | $\beta_4$ | 0.2445 | 0.116 | ≠ 0 | Not supported; asymmetry not detected |

*Note. H3 is interpreted as suggestive, not confirmatory, because p = 0.081 and the 95% bootstrap interval includes zero. H5 tests the difference between the two output-gap-state slopes; failure to reject $\beta_4 = 0$ means asymmetry was not detected, not that equality of slopes was proven.*

**Table 12.** Sequential LSDVC3 Point Estimates

| Model | ρ | Growth | DemoCap | HDI | Boom | Growth × Boom | Controls Added | N |
|---|---|---|---|---|---|---|---|---|
| M1 | 0.8175 | 0.1738 | | | | | None | 65 |
| M2 | 0.7570 | 0.1918 | 0.1170 | −3.1674 | | | None | 65 |
| M3 | 0.7721 | 0.2562 | 0.1112 | −7.3688 | −0.9044 | | None | 65 |
| M4 | 0.7679 | 0.2471 | 0.1362 | 4.5492 | −2.2762 | 0.2626 | None | 65 |
| M5 | 0.7669 | 0.2498 | 0.1561 | 12.6985 | −2.3401 | 0.2988 | LnGFCF | 65 |
| M6 | 0.7888 | 0.2443 | 0.1383 | 4.4157 | −1.9479 | 0.2125 | IHSFDI | 65 |
| M7 | 0.7366 | 0.2428 | 0.2310 | 15.2799 | −2.2609 | 0.2949 | LnGovCons | 65 |
| M8 | 0.7710 | 0.2424 | 0.2045 | 12.9545 | −1.9930 | 0.2445 | All three | 65 |

*Note. All models include country and year effects and use third-order LSDVC with Arellano–Bond initialisation. M8 is the principal complete specification.*

The robustness checks yield a mixed but informative pattern (Table 13). The contemporaneous positive growth association survives the continuous-output-gap specification and the alternative HP smoothing parameter $\lambda = 6.25$. In neither HP-based variant is the corresponding interaction statistically distinguishable from zero. These checks support stability to alternative HP parameterisation, but they do not by themselves establish robustness to sample timing, country influence, or a non-HP cycle definition.

The pandemic-exclusion check removes 2020 and 2021 and applies the dynamic selection rule, leaving 50 usable country-year observations. The growth coefficient remains positive but becomes highly imprecise, showing that the pandemic contraction and rebound contribute materially to identification in this five-country sample. The timing check is more demanding: when growth and all three macroeconomic controls are lagged one year, the growth coefficient changes sign and is statistically insignificant, as is the lagged interaction. The headline positive coefficient is therefore a contemporaneous conditional association that is sensitive to timing; it should not be described as generally robust without this qualification.

Replacing demographic capacity with the original dependency ratio mechanically reverses the sign of the demographic coefficient while leaving the remaining estimates unchanged to numerical precision, confirming that the reverse coding does not drive the substantive results. Finally, first-, second-, and third-order bias corrections produce very similar values for the persistence, growth, regime, and interaction coefficients (Table 14), indicating that the coefficient pattern is not an artefact of the selected approximation order. The alternative Anderson–Hsiao first stage is not used for substantive inference because it proved numerically unstable in this highly parameterised specification.

**Table 13.** Robustness of the Core Dynamic Associations

| Specification | N | ρ | Growth | p | Interaction | p | Key Implication |
|---|---|---|---|---|---|---|---|
| M8 Main | 65 | 0.7710 | 0.2424 | 0.003 | 0.2445 | 0.116 | Positive non-positive-gap growth slope; interaction not significant |
| R1 Continuous output gap | 65 | 0.7269 | 0.2672 | 0.023 | −0.0179 | 0.288 | Growth remains positive; continuous-gap interaction not significant |
| Alt. HP λ = 6.25 | 65 | 0.7921 | 0.2235 | 0.014 | −0.0133 | 0.935 | Growth remains positive; HP-regime interaction not significant |
| R2 Exclude 2020–2021 | 50 | 0.9082 | 0.1647 | 0.772 | 0.1827 | 0.755 | Positive sign but very wide uncertainty without 2020–2021 |
| R3 Lag growth + controls | 60 | 0.8331 | −0.1076 | 0.257 | −0.0646 | 0.712 | Lagged growth and interaction not significant; timing-sensitive |
| R4 Dependency-ratio coding | 65 | 0.7710 | 0.2424 | 0.003 | 0.2445 | 0.116 | Core growth and regime estimates unchanged |

*Note. R1 interaction = Growth × continuous output gap. The λ = 6.25 row uses the alternative boom classification generated by the same filter procedure. R2 uses the dynamic selection induced by deleting 2020–2021. R3 uses one-period-lagged growth and lagged controls, with the interaction defined as lagged growth × current boom. Bootstrap inference uses 1,000 replications.*

**Table 14.** Sensitivity to LSDVC Bias-Correction Order

| Correction Order | ρ | Growth | DemoCap | Boom | Growth × Boom |
|---|---|---|---|---|---|
| LSDVC1 | 0.7461 | 0.2393 | 0.2160 | −1.9870 | 0.2458 |
| LSDVC2 | 0.7516 | 0.2404 | 0.2122 | −1.9855 | 0.2461 |
| LSDVC3 (main) | 0.7710 | 0.2424 | 0.2045 | −1.9930 | 0.2445 |

*Note. The small movement in the core coefficients across first-, second-, and third-order corrections indicates that the coefficient pattern of the principal model is not an artefact of the selected approximation order.*

Two additional regime diagnostics address cycle-definition and generated-regressor concerns. A country-specific linear trend fitted to log real GDP over 2010–2023 classifies 31 observations above trend and agrees with the principal HP sign in 62 of 65 observations; in the auxiliary dynamic-FE analogue, the below-trend growth slope is 0.2135 (p = 0.015), the Growth × above-trend interaction is 0.3557 (p = 0.030), and the implied above-trend slope is 0.5692 (p = 0.002). Thus asymmetry inference is sensitive to the cycle definition/estimator and the principal HP-LSDVC null should not be generalized as proof of symmetry. Using the one-year-lagged HP regime, the current-growth slope after a non-positive prior-year gap is 0.0554 (p = 0.669), the interaction is 0.1650 (p = 0.255), and the implied slope after a positive prior-year gap is 0.2204 (p = 0.027). This lagged-regime screen reduces contemporaneous mechanical dependence between Growth and the regime indicator and reinforces the timing-sensitivity conclusion.

**Table 15.** Auxiliary Leave-One-Country-Out Dynamic Two-Way-FE Influence Screen

| Omitted country | N | ρ | Growth: non-positive gap | Growth × regime | Growth: positive gap |
|---|---|---|---|---|---|
| Indonesia | 52 | 0.6980 | 0.2572 (p = 0.012) | 0.2585 (p = 0.128) | 0.5157 (p = 0.011) |
| Malaysia | 52 | 0.7495 | 0.2958 (p = 0.003) | 0.1810 (p = 0.291) | 0.4767 (p = 0.019) |
| Philippines | 52 | 0.5535 | 0.0647 (p = 0.474) | 0.3249 (p = 0.013) | 0.3896 (p = 0.011) |

| Omitted country | N | ρ | Growth: non-positive gap | Growth × regime | Growth: positive gap |
|---|---|---|---|---|---|
| Thailand | 52 | 0.4827 | 0.3200 (p < 0.001) | 0.4882 (p = 0.028) | 0.8082 (p = 0.003) |
| Viet Nam | 52 | 0.6212 | 0.2440 (p = 0.053) | 0.3122 (p = 0.222) | 0.5562 (p = 0.032) |

*Note. This is an auxiliary dynamic two-way-fixed-effects analogue of equation (8), used only as a country-leverage diagnostic; primary hypothesis inference remains based on LSDVC. The sign of the non-positive-gap growth slope remains positive in all five omissions, but inference is not stable: omitting the Philippines reduces it to 0.0647 (p = 0.474), and omitting Viet Nam yields p = 0.053. The interaction becomes significant in some omissions, reinforcing that N = 5 does not permit a strong claim about slope equality or asymmetry.*

Taken together, the estimates show high employment persistence and a positive contemporaneous growth association in both output-gap states, but with important limits. The principal interaction does not statistically detect slope asymmetry; demographic capacity is suggestive but inconclusive at the 5 per cent level; and HDI is imprecisely estimated. The positive contemporaneous growth coefficient survives alternative HP formulations but loses precision without 2020–2021 and is not invariant to lagged timing. Auxiliary country-omission and alternative-regime screens further show that inference is sensitive to individual-country leverage and regime definition. These results therefore support a cautious associational interpretation rather than a causal or symmetry claim.

### *4.2. Discussion*

#### *4.2.1. Growth, Employment Persistence, and Labour Absorption*

The most stable feature of the estimated model is the persistence of employment absorption. A persistence parameter of 0.7710 implies that roughly three-quarters of the previous year's employment-to-population ratio carries into the current year once contemporaneous macroeconomic conditions, structural predictors, and country and year effects are held constant. Substantively, this means that the level of labour absorption an ASEAN-5 economy achieves in any given year is inherited to a considerable degree from the labour-market conditions it entered the year with, rather than being determined afresh by that year's macroeconomic performance. The mechanisms proposed in Section 2.2 offer a coherent account: hiring and training investments, separation costs, search frictions, and the gradual pace at which employment structures reorganise all slow the adjustment of aggregate employment, so that shocks propagate over several periods rather than dissipating within one.

This result extends rather than contradicts the existing Okun-type literature. Obst (2022) shows for the EU15 that delays in the unemployment–output nexus are empirically significant and that contemporaneous specifications understate full adjustment, while Novák and Darmo (2019) document that lagged effects matter over the business cycle. The present estimates indicate that the same logic holds when the labour-market outcome is measured as employment absorption rather than unemployment, and in a developing-economy setting where structural transformation is ongoing. The finding also carries a methodological implication consistent with Section 3.7: a static specification that omits the lagged dependent variable would attribute inherited employment conditions to contemporaneous regressors, and the marked difference between the static benchmark and the dynamic model in Table 8 illustrates precisely this risk.

Against this persistent background, the contemporaneous growth association remains economically meaningful but conditional. When the output gap is non-positive, a one-percentage-point increase in real GDP growth is associated with approximately a 0.24-percentage-point higher EPR in the principal model. This magnitude is modest but not negligible in a panel where EPR varies within a comparatively narrow band. It is consistent with evidence that output–labour-market relationships tend to be weaker in developing economies than in advanced ones (Bartolucci et al., 2018), while avoiding the stronger claim that output growth mechanically "creates" a corresponding number of jobs.

The timing and pandemic sensitivity of this association is central to its interpretation. Excluding 2020–2021 sharply reduces precision, and lagging growth and the macroeconomic controls changes the growth coefficient's sign and removes statistical significance. The auxiliary lagged-regime screen also weakens the non-positive-gap contemporaneous slope. These patterns indicate that the headline estimate is partly identified by large within-year macroeconomic movements and should be understood as a conditional contemporaneous association under the model's exogeneity assumptions, not as an identified causal effect or an invariant dynamic response.

*4.2.2. Demographic Capacity and Human Development*

Demographic capacity enters with the anticipated positive sign but its 95 per cent bootstrap interval includes zero and p = 0.081. The appropriate interpretation is therefore suggestive evidence that remains statistically inconclusive at the 5 per cent level, not support for a confirmed effect. This is consistent with the distinction between demographic opportunity and realised employment absorption: a lower dependency burden enlarges the share of the population that could work but does not itself generate productive opportunities. Chomik et al. (2016) and Baerlocher et al. (2019) similarly caution against treating age structure as an automatic dividend.

The limited identifying variation in these slow-moving variables is quantitatively important. After removing country and year effects, demographic capacity has a residual standard deviation of 1.902 index points and HDI only 0.0072. Thus much of their raw cross-country and common time variation is absorbed before the coefficients are identified. The pooled ASEAN-5 slope also imposes a common association across countries at different demographic stages. These features help explain imprecision and mean that weak significance should not be read as evidence that demographic structure is unimportant.

Human development is positive but statistically insignificant in the complete model. This result is not evidence that human development is unimportant. HDI is a slow-moving composite, its two-way-FE residual variation is very small, and its channels may operate over horizons longer than annual EPR movements. Moreover, EPR measures employment quantity rather than job quality, productivity, or earnings, dimensions on which human development may matter more directly. The finding therefore indicates limited identifying precision for an annual five-country panel rather than a substantive null effect.

*4.2.3. Business-Cycle Asymmetry and the Question "When Does Growth Create Jobs?"*

The question "When Does Growth Create Jobs?" and the proposed business-cycle asymmetry require three distinct empirical statements. First, when the output gap is non-positive, the growth–EPR slope is positive and significant ($\beta_1$ = 0.2424, p = 0.003). Second, when the output gap is positive, the implied slope $\beta_1 + \beta_4$ is also positive and significant (0.4869, p = 0.005). Third, the difference between those slopes is $\beta_4$ = 0.2445 and is not statistically distinguishable from zero (p = 0.116; 95% bootstrap CI includes zero).

The statistically exact conclusion is therefore that positive contemporaneous growth associations are detected in both output-gap states, whereas business-cycle slope asymmetry is not detected in the principal LSDVC model. This is not evidence that the two slopes are proven equal. The interaction is estimated imprecisely in a small panel, and auxiliary cycle-definition and country-influence screens show that inference can change under alternative constructions. The manuscript therefore treats H5 as unsupported without converting a failure to reject into a symmetry claim.

This outcome invites a more careful reading of the wider asymmetry literature than a simple confirmation or rejection. Evidence of nonlinear and regime-dependent Okun relationships is well documented for the Eurozone and OECD economies (Tang & Bethencourt, 2017; Nebot et al., 2019; Boďa & Považanová, 2021), and Widarjono (2020) reports asymmetric relationships for selected ASEAN economies using unemployment as the outcome. The present results neither replicate nor refute those findings; they suggest a boundary condition. When labour absorption is measured by EPR rather than unemployment, and when persistence is explicitly modelled, the employment content of growth in ASEAN-5 appears more uniform across cyclical states than regime-switching accounts would predict. Boďa et al. (2026) similarly find that the output–labour-market relationship in ASEAN is weaker and less regular than in advanced Western economies, which is consistent with a setting in which sharp regime distinctions are harder to detect.

Several features of ASEAN-5 labour markets make this plausible. Large informal and self-employment margins allow labour to be absorbed and released more continuously than formal-sector hiring alone would permit, which can smooth the employment response to output across cyclical states rather than concentrating it in one. The statistical properties of the design also matter: with 65 observations, a binary regime split, and a country-and-year fixed-effects structure, the interaction term is estimated from limited residual variation, and the residualised variance-inflation factors in Table 7 confirm that the interaction carries the highest collinearity in the model. An insignificant interaction in these circumstances indicates that regime asymmetry cannot be reliably detected here, not that it is absent.

The answer to "When Does Growth Create Jobs?" is conditional and associational rather than causal, because the model examines EPR rather than directly observed job creation. In the principal model, higher contemporaneous growth is associated with a higher EPR under both non-positive-output-gap and positive-output-gap conditions, from a strongly persistent employment base. The negative regime coefficient adds no general "positive-gap penalty": because Growth

is not centred, $\beta_3$ is only the conditional intercept difference at Growth = 0. Its sign should therefore not be interpreted as evidence that operating above estimated potential lowers employment absorption on average.

*4.2.4. Theoretical Contribution and Macroeconomic Implications*

The study contributes to the literature in three connected ways. It shifts the empirical focus from unemployment to employment absorption, addressing a measurement concern that is particularly acute in economies where participation margins are elastic and informality is widespread; the evidence that EPR is highly persistent and positively associated with growth in both regimes shows that this reorientation yields substantive rather than merely definitional differences. It embeds the growth–employment relationship in a dynamic framework in which persistence is treated as an economically meaningful feature rather than a statistical nuisance. And it subjects business-cycle asymmetry to a formal test rather than assuming it, producing the disciplined finding that a numerically larger boom-period association need not constitute statistical evidence of regime difference.

The macroeconomic controls behave in a manner consistent with their assigned role. None of gross fixed capital formation, foreign direct investment, or government consumption is individually significant in the complete dynamic specification, and their inclusion leaves the central coefficients essentially unchanged across the sequential models. This pattern is consistent with the theoretically ambiguous employment consequences discussed in Section 2.7, where investment can either complement or substitute for labour and public expenditure can either support or crowd out private activity. Their function here is to condition the principal relationships on observable macroeconomic variation, and the stability of the growth and persistence estimates across specifications indicates that they perform that function without displacing the substantive findings.

For policy, the implications remain associational rather than causal. Strong employment persistence indicates that low or high labour absorption tends to carry forward, while the positive contemporaneous growth association is observed in both output-gap states in the principal model. However, the imprecise slope difference, country influence, pandemic sensitivity, and timing sensitivity do not support regime-specific causal prescriptions. Likewise, favourable demographic structure and higher capability indicators should not be assumed to translate automatically into higher employment within annual horizons. The broader policy-relevant message is therefore to evaluate growth by its observed employment content while recognising that the present estimates do not identify the effect of a particular intervention.

## 5. Conclusion and Implications

This study addressed the question “When Does Growth Create Jobs?” by testing the conditional association between growth and employment absorption, including business-cycle asymmetry, in ASEAN-5. It estimated a dynamic panel model of the employment-to-population ratio for Indonesia, Malaysia, the Philippines, Thailand, and Viet Nam over 2010–2023 using a bias-corrected least-squares dummy-variable estimator and explicitly tested whether the conditional growth–EPR slope differs between positive-output-gap and non-positive-output-gap states. The design identifies dynamic conditional associations rather than causal effects, and EPR measures the share of the working-age population employed rather than the absolute number of jobs created.

The principal findings are that employment absorption is strongly persistent and dynamically stable, and that contemporaneous growth is positively associated with EPR in both output-gap states. Demographic capacity has the expected positive sign but is statistically inconclusive at the 5 per cent level because its 95 per cent bootstrap interval includes zero. HDI is positive but statistically insignificant, a result that must be read alongside its very limited residual within-panel variation. The macroeconomic controls are individually insignificant and do not materially displace the principal coefficients.

The asymmetry conclusion is deliberately narrow. The non-positive-gap slope is positive and significant; the implied positive-gap slope is also positive and significant; but the difference between the two is not statistically distinguishable from zero in the principal LSDVC model. Business-cycle slope asymmetry is therefore not detected, but symmetry is not proven. Auxiliary diagnostics further show that country omission and alternative regime definitions can alter inference, which reinforces the need to avoid categorical statements about equality of the two slopes.

The positive contemporaneous growth association is also sensitive to timing and pandemic observations. Its precision deteriorates when 2020–2021 are excluded, and lagged growth and controls yield an insignificant coefficient with a different sign. Accordingly, the empirical message is not that growth mechanically generates employment, but that

contemporaneous growth and employment absorption move together positively in the principal specification from a highly persistent employment base. The long-run multipliers remain secondary stylised reduced-form quantities and are not forecasts of permanent job creation.

The study has several limitations. N = 5 constrains precision and makes pooled estimates sensitive to individual-country leverage. The national-estimate EPR series may contain survey-specific revisions that fixed effects cannot remove; the modelled ILO series is a useful future robustness benchmark. The principal HP regime is an ex-post classification estimated over 2010–2024, so the 2024 observation contributes future information relative to the 2023 endpoint; alternative linear-trend and lagged-regime screens show that regime inference is not invariant to measurement. Growth and the HP regime also originate from the same GDP series, creating generated-regressor dependence. FDI is a signed current-dollar flow whereas GFCF and government consumption are real-dollar stocks/flows, so the controls are not compared in magnitude. Finally, the timing sensitivity and strict-exogeneity assumption preclude causal interpretation. Future work should use longer or higher-frequency panels, alternative harmonised EPR measures, external or real-time output-gap measures, sectoral or subnational data, and heterogeneous-country specifications.

## References

Aginta, H., Mendez, C., & Someya, M. (2025). Regional Okun's law and endogeneity: Evidence from Indonesian districts. *Applied Economics Letters*, *32*(3), 329–336. https://doi.org/10.1080/13504851.2023.2267814

Aguiar-Conraria, L., Martins, M. M. F., & Soares, M. J. (2020). Okun's law across time and frequencies. *Journal of Economic Dynamics and Control*, *116*, 103897. https://doi.org/10.1016/j.jedc.2020.103897

An, Z., Ball, L., Jalles, J. T., & Loungani, P. (2019). Do IMF forecasts respect Okun's law? Evidence for advanced and developing economies. *International Journal of Forecasting*, *35*(3), 1131–1142. https://doi.org/10.1016/j.ijforecast.2019.03.001

An, Z., Bluedorn, J., & Ciminelli, G. (2022). Okun's law, development, and demographics: Differences in the cyclical sensitivities of unemployment across economy and worker groups. *Applied Economics*, *54*(36), 4227–4239. https://doi.org/10.1080/00036846.2022.2027333

Arellano, M., & Bond, S. (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, *58*(2), 277–297. https://doi.org/10.2307/2297968

Baerlocher, D., Parente, S. L., & Rios-Neto, E. (2019). Economic effects of demographic dividend in Brazilian regions. *The Journal of the Economics of Ageing*, *14*, 100198. https://doi.org/10.1016/j.jeoa.2019.100198

Ball, L., Furceri, D., Leigh, D., & Loungani, P. (2019). Does one law fit all? Cross-country evidence on Okun's law. *Open Economies Review*, *30*(5), 841–874. https://doi.org/10.1007/s11079-019-09549-3

Ball, L., Leigh, D., & Loungani, P. (2017). Okun's law: Fit at 50? *Journal of Money, Credit and Banking*, *49*(7), 1413–1441. https://doi.org/10.1111/jmcb.12420

Bartolucci, F., Choudhry, M. T., Marelli, E., & Signorelli, M. (2018). GDP dynamics and unemployment changes in developed and developing countries. *Applied Economics*, *50*(31), 3338–3356. https://doi.org/10.1080/00036846.2017.1420894

Benos, N., & Stavrakoudis, A. (2022). Okun's law: Copula-based evidence from G7 countries. *The Quarterly Review of Economics and Finance*, *84*, 478–491. https://doi.org/10.1016/j.qref.2020.10.004

Ben-Salha, O., & Mrabet, Z. (2019). Is economic growth really jobless? Empirical evidence from North Africa. *Comparative Economic Studies*, *61*(4), 598–624. https://doi.org/10.1057/s41294-018-00082-9

Blundell, R., & Bond, S. (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, *87*(1), 115–143. https://doi.org/10.1016/S0304-4076(98)00009-8

Boďa, M. (2025). A quarter century of Okun's law in scholarly literature. *Journal of the Knowledge Economy*, *16*(6), 17784–17839. https://doi.org/10.1007/s13132-024-02425-7

Boďa, M., & Považanová, M. (2019). Okun's law in the Visegrád Group countries. *Europe-Asia Studies*, *71*(4), 608–647. https://doi.org/10.1080/09668136.2019.1598936

Boďa, M., & Považanová, M. (2020). Formal and statistical aspects of estimating Okun's law at a regional level. *Papers in Regional Science*, *99*(4), 1113–1136. https://doi.org/10.1111/pirs.12511

Boďa, M., & Považanová, M. (2021). Output-unemployment asymmetry in Okun coefficients for OECD countries. *Economic Analysis and Policy*, *69*, 307–323. https://doi.org/10.1016/j.eap.2020.12.004

Boďa, M., & Považanová, M. (2023). How credible are Okun coefficients? The gap version of Okun's law for G7 economies. *Economic Change and Restructuring*, *56*(3), 1467–1514. https://doi.org/10.1007/s10644-022-09438-9

Boďa, M., Považanová, M., & Vitálišová, K. (2026). Digital Okun's law: A case study of ASEAN-10 economies. *Technology in Society*, *87*, 103304. https://doi.org/10.1016/j.techsoc.2026.103304

Bruno, G. S. F. (2005a). Approximating the bias of the LSDV estimator for dynamic unbalanced panel data models. *Economics Letters*, *87*(3), 361–366. https://doi.org/10.1016/j.econlet.2005.01.005

Bruno, G. S. F. (2005b). Estimation and inference in dynamic unbalanced panel-data models with a small number of individuals. *The Stata Journal*, *5*(4), 473–500. https://doi.org/10.1177/1536867X0500500401

Bun, M. J. G., & Kiviet, J. F. (2003). On the diminishing returns of higher-order terms in asymptotic expansions of bias. *Economics Letters*, *79*(2), 145–152. https://doi.org/10.1016/S0165-1765(02)00299-9

Butkus, M., & Seputiene, J. (2019). The output gap and youth unemployment: An analysis based on Okun's law. *Economies*, *7*(4), 108. https://doi.org/10.3390/economies7040108

Chomik, R., McDonald, P., & Piggott, J. (2016). Population ageing in Asia and the Pacific: Dependency metrics for policy. *The Journal of the Economics of Ageing*, *8*, 5–18. https://doi.org/10.1016/j.jeoa.2016.05.002

Dixon, R., Lim, G. C., & van Ours, J. C. (2017). Revisiting the Okun relationship. *Applied Economics*, *49*(28), 2749–2765. https://doi.org/10.1080/00036846.2016.1245846

Dunsch, S. (2017). Age- and gender-specific unemployment and Okun's law in CEE countries. *Eastern European Economics*, *55*(4), 377–393. https://doi.org/10.1080/00128775.2017.1338962

Economou, A., & Psarianos, I. N. (2016). Revisiting Okun's law in European Union countries. *Journal of Economic Studies*, *43*(2), 275–287. https://doi.org/10.1108/JES-05-2013-0063

Erdoğan Coşar, E., & Yavuz, A. A. (2021). Okun's law under the demographic dynamics of the Turkish labor market. *Central Bank Review*, *21*(2), 59–69. https://doi.org/10.1016/j.cbrev.2021.03.002

Fontanari, C., Palumbo, A., & Salvatori, C. (2020). Potential output in theory and practice: A revision and update of Okun's original method. *Structural Change and Economic Dynamics*, *54*, 247–266. https://doi.org/10.1016/j.strueco.2020.04.008

Furceri, D., Jalles, J. T., & Loungani, P. (2020). On the determinants of Okun's law: New evidence from time-varying estimates. *Comparative Economic Studies*, *62*(4), 661–700. https://doi.org/10.1057/s41294-019-00111-1

Ha, J., & Lee, S.-H. (2016). Demographic dividend and Asia's economic convergence towards the US. *The Journal of the Economics of Ageing*, *8*, 28–41. https://doi.org/10.1016/j.jeoa.2016.03.006

Han, J.-S., & Lee, J.-W. (2020). Demographic change, human capital, and economic growth in Korea. *Japan and the World Economy*, *53*, 100984. https://doi.org/10.1016/j.japwor.2019.100984

Hashmi, S. M., Khushik, A. G., Gilal, M. A., & Yongliang, Z. (2021). The impact of GDP and its expenditure components on unemployment within BRICS countries: Evidence of Okun's law from aggregate and disaggregated approaches. *SAGE Open*, *11*(2), 1–11. https://doi.org/10.1177/21582440211023423

Hoffmann, F., & Lemieux, T. (2016). Unemployment in the Great Recession: A comparison of Germany, Canada, and the United States. *Journal of Labor Economics*, *34*(S1), S95–S139. https://doi.org/10.1086/682424

Huruta, A. D., Perangin Angin, S. A. F. B., Anggereni, B. F., Ritma, R., Wijayanti, S., Prasetyo, B. A., Atahau, A. D. R., & Robiyanto. (2026). Okun's Law in ASEAN countries: A Panel Structural Equation Modeling approach to growth–unemployment dynamics. *Cogent Economics & Finance*, *14*(1), 2728286. https://doi.org/10.1080/23322039.2026.2728286

Ibragimov, M., & Ibragimov, R. (2017). Unemployment and output dynamics in CIS countries: Okun's law revisited. *Applied Economics*, *49*(34), 3453–3479. https://doi.org/10.1080/00036846.2016.1262519

Ismail, I., Bin Jamaluddin, A., Muis, A., Citra Pratiwi, A., Palennari, M., & Adnan, A. (2026). Cultivating innovation readiness in biology education: The mediating roles of plant attitudes and scientific argumentation in deep learning and cognitive flexibility. *Qubahan Academic Journal, 6*(2), 157–176. https://doi.org/10.48161/qaj.v6n2a2429

İsmihan, M. (2016). A useful framework for linking labor and goods markets: Okun's law and its stability revisited. *Review of Keynesian Economics*, *4*(2), 175–192. https://doi.org/10.4337/roke.2016.02.03

Judson, R. A., & Owen, A. L. (1999). Estimating dynamic panel data models: A guide for macroeconomists. *Economics Letters*, *65*(1), 9–15. https://doi.org/10.1016/S0165-1765(99)00130-5

Kiviet, J. F. (1995). On bias, inconsistency, and efficiency of various estimators in dynamic panel data models. *Journal of Econometrics*, *68*(1), 53–78. https://doi.org/10.1016/0304-4076(94)01643-E

Manggau, A., & Prusdianto, P. (2026). Singing values: The multidimensional roles of the Bugis lullaby ritual Iyabelale in family life. *Early Childhood Education Journal*, *54*, 3977–3985. https://doi.org/10.1007/s10643-026-02143-6

Matsuura, T., & Saito, H. (2023). Foreign direct investment and labor demand by skill in Indonesian manufacturing firms. *Review of World Economics*, *159*(4), 921–941. https://doi.org/10.1007/s10290-022-00485-y

Maza, A. (2022). Regional differences in Okun's law and explanatory factors: Some insights from Europe. *International Regional Science Review*, *45*(5), 555–580. https://doi.org/10.1177/01600176221082309

Nebot, C., Beyaert, A., & García-Solanes, J. (2019). New insights into the nonlinearity of Okun's law. *Economic Modelling*, *82*, 202–210. https://doi.org/10.1016/j.econmod.2019.01.005

Nguyen, H. T., Le, A. N. N., Le, H. V., & Duong, K. D. (2024). Foreign direct investment and employments in Asia Pacific nations: The moderating role of labor quality. *Heliyon*, *10*(9), e30133. https://doi.org/10.1016/j.heliyon.2024.e30133

Nickell, S. (1981). Biases in dynamic models with fixed effects. *Econometrica*, *49*(6), 1417–1426. https://doi.org/10.2307/1911408

Novák, M., & Darmo, Ľ. (2019). Okun's law over the business cycle: Does it change in the EU countries after the financial crisis? *Prague Economic Papers*, *28*(2), 235–254. https://doi.org/10.18267/j.pep.694

Obst, T. (2022). Dynamic version of Okun's law in the EU15 countries The role of delays in the unemployment-output nexus. *Scottish Journal of Political Economy*, *69*(2), 225–241. https://doi.org/10.1111/sjpe.12305

Porras-Arena, M. S., & Martín-Román, Á. L. (2019). Self-employment and Okun's law. *Economic Modelling*, *77*, 253–265. https://doi.org/10.1016/j.econmod.2018.09.006

Swandi, A., Sujiono, E. H., Khaeruddin, & Sinring, A. (2025). Development of STEM hybrid research-based learning model to improve scientific reasoning of undergraduate students. *Eurasia Journal of Mathematics, Science and Technology Education*, *21*(11), Article em2725. https://doi.org/10.29333/ejmste/17287

Tang, B., & Bethencourt, C. (2017). Asymmetric unemployment-output tradeoff in the Eurozone. *Journal of Policy Modeling*, *39*(3), 461–481. https://doi.org/10.1016/j.jpolmod.2017.01.003

Widarjono, A. (2020). Asymmetric Okun's law in an emerging market: ASEAN-3 case. *Economics & Sociology*, *13*(3), 203–217. https://doi.org/10.14254/2071-789X.2020/13-3/12

Zanin, L. (2018). The pyramid of Okun's coefficient for Italy. *Empirica*, *45*(1), 17–28. https://doi.org/10.1007/s10663-016-9343-5