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Unlocking Prosperity: How Inflation, Unemployment, Capital Formation, and Landlockedness Shape Economic Growth in Asia

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Abstract: *This study explores the impact of inflation, unemployment, gross capital formation, and landlockedness on economic growth in Asian countries. It is based on secondary data collected from World Bank reports of respective countries. The unbalanced panel dataset comprising 38 Asian nations from 1990 to 2023 is utilized. The analysis utilizes 1006 annual data points. Panel Generalized Method of Moments (GMM) is used to examine the impact of inflation, unemployment, capital formation, and the landlocked position of a country on economic growth. The present economic growth is also affected by the previous year's economic growth in Asian countries. Inflation, unemployment, and gross capital formation determine economic growth. Unemployment is also statistically significant to explain economic growth. GDP growth Statistically, it is found that one unit increase in previous years' economic growth and inflation rate results in a 2.306 and 0.1086 unit increase in economic growth, but one unit increase in unemployment results in a 2,3869 unit decrease in economic growth. Likewise, every increase in gross capital formation results in 0.2819 unit increase in economic growth in Asian countries. To stimulate economic growth in Asian countries, policies should prioritize the reduction of unemployment and inflation while promoting surplus capital formation. Furthermore, targeted assistance for landlocked countries may offset their economic disadvantages.*

Keywords: Okun's Law; accumulation; hyperinflation; generalized method of moments; causality

JEL Classification: E31, J64, O16, O18

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Introduction

Economic growth is a complex phenomenon influenced by numerous internal and external factors in a nation's economy (Budathoki et al., 2024). Economic growth is the expansion of financial activities that ensures the increase in actual gross domestic product (Dahal, 2023). Inflation, unemployment, gross capital formation growth rate, and geographical characteristics such as landlockedness significantly shape a country's economic course. Sideways from capital accumulation, unemployment, inflation, and landlockedness, some of the more notable determinants of Asian economic growth are institutional quality, openness to trade, and technological advancement. Good institutions, i.e., regulatory frameworks and governance, guarantee a conducive enterprise formation and investment environment. Technological innovation enhances productivity and long-run growth prospects. Trade openness enhances market competition and access. Apart from fiscal and monetary policies, they also engage with key variables such as inflation and capital formation to propel Asia's dynamic economic growth.

Inflation is the sustained increase in the general price level, which can erode the purchasing power of money and disrupt economic activities (Dahal et al., 2024). Inflation, often viewed as the general price increase over time, can positively and negatively affect economic growth (Carre & Drouot, 2004). While moderate inflation is a sign of a growing economy, hyperinflation can lead to economic instability and reduced purchasing power, hindering growth (Kogid et al., 2011). Inflation, unemployment, capital accumulation, and landlockedness profoundly affect economic growth in Asia, each having a unique but comparative function. Moderate inflation can improve expenditure and investment, whereas high inflation diminishes purchasing power, destabilizing economic growth (Dahal et al., 2024; Kogid et al., 2011).

Unemployment, representing the percentage of the jobless labor force, directly affects economic productivity and consumer spending. High unemployment rates can lead to decreased economic output and increased government spending on social support, negatively impacting growth. Unemployment decreases productivity and consumer spending, limiting GDP growth and elevating government fiscal expenses. On the other hand, intense capital buildup via investment in infrastructure and technology raises productivity levels and long-run growth prospects (Solow, 1956). At the same time, landlocked Asian countries experience inefficiency in trade and increased costs, restricting market access and industrial diversification (Faye et al., 2004; Rastogi, 2018). Together, these dimensions form a multi-dimensional growth dynamic, where balanced policies are needed to buffer risks and seize opportunities for sustainable development.

Gross capital formation, reflecting the net investment in physical assets such as infrastructure, machinery, and buildings, is crucial for long-term economic expansion. An increase in gross capital formation signifies more investment in productive assets, which can boost economic growth (Solow, 1956).

Landlockedness, the geographic disadvantage of being surrounded by land without access to the ocean, can significantly impede economic growth. Landlocked countries often face higher transportation costs, limited access to global markets, and dependency on neighboring countries for trade routes, which can constrain economic development (Faye et al., 2004). Landlocked countries often struggle to diversify their economies. The high cost of importing essential inputs and exporting finished goods limits industrial growth and diversification. It can lead to over-reliance on a narrow range of economic activities, often linked to natural resources that are not as dependent on easy access to ports (Rastogi, 2018).

Landlockedness substantially challenges economic growth, primarily through increased costs and logistical complexities. However, strategic policies and international cooperation, such as developing diversified port access and improving governance, can help mitigate these adverse effects and promote sustainable economic development. Asian economic growth has dominated world development discussions, with the continent recording high industrialization rates, technological progress, and mixed macroeconomic stability. The growth patterns in Asian economies continue to be uneven and are prone to structural and policy determinants like inflation, unemployment, capital formation and geographical determinants like landlockedness. While a few nations like China, India, and South Korea have achieved high growth rates over long periods, others continue to face chronic challenges, particularly landlocked and less-developed economies.

Inflation and unemployment, two principal markers of macroeconomic well-being, significantly influence economic performance. Inflationary pressures undermine purchasing power and discourage investment, while unemployment suppresses productivity and consumer spending. Capital formation, including savings, investment, and infrastructure development, primarily drives long-term growth. Landlockedness also presents unique challenges, constraining access to trade, raising transport costs, and lowering integration into global supply chains. Depending on these dynamics, this study seeks to explore how these interconnected factors influence economic growth across Asian economies. Specifically, it addresses the following research questions:

1. How do inflation and unemployment impact economic growth across Asian countries?
2. How does capital formation influence long-term growth in Asian economies?
3. Does the landlockedness of a country hurt the economic growth?

The study's primary focus is to examine the impact of inflation, unemployment, and gross capital formation growth rate on economic growth in the Asian continent. It further aims to explore the effect of the landlockedness of a country on economic expansion.

The paper is divided into six sections. The remaining sections of this study are as follows: A review of relevant theoretical and empirical studies is found in the second section. Section three describes the methodology, which comprises research design,

nature of data, data analyzing process, and estimating strategies. Segment four contains data presentation and analysis. Results are discussed in section five, and section six includes the study's conclusion, policy implication, and limitations.

Literature Review

This study is grounded in Keynesian economics, public finance theory, and institutional economics, integrating insights from prior empirical studies on inequality determinants. The effect of the effectiveness of government and income inequality is based on the institutional theory, i.e., governance-led development (Kaufmann et al., 2010; North, 2005). The association between inflation and inequality is based on the monetarist theory, i.e., the redistribution effect of inflation. Inflation erodes real income and creates inequality by increasing the cost of essential goods for low-income people while benefiting asset holders. (Albanesi, 2007). The interconnection between direct tax and inequality is based on Musgrave's progressive taxation theory. It is based on the norms that progressive direct tax redistributes wealth by taxing higher earners more (Piketty, 2014). The theoretical literature is reviewed at the beginning of the topic, and then the empirical literature is reviewed.

Unemployment and Economic Growth

The relationship between unemployment and economic growth is a central topic in macroeconomics, with significant theoretical and empirical literature exploring this dynamic. Okun's Law often examines this relationship, posing an inverse correlation between unemployment and GDP growth. Okun's Law, first proposed in 1962, suggests that every one percent increase in a country's unemployment rate results in two percent lower than its potential GDP (Porras-Arena & Martín-Roman, 2023). Okun's Law, showing a reverse co-movement of GDP and unemployment, has had limited applicability in the Asian economies due to structural differences and labor market rigidity (Irman et al., 2015). The Phillips Curve illustrates an inverse relationship between inflation and unemployment. In the short run, lower unemployment can lead to higher inflation, while higher unemployment can lead to lower inflation. However, this relationship may break down in the long run (Phillips, 1958).

Neoclassical Growth Theory focuses on capital accumulation, labor force growth, and technological advancement as drivers of economic growth. It suggests that unemployment can result from mismatches between labor supply and demand, technological changes, and rigidities in labor markets. Keynesian theory emphasizes the role of aggregate demand in influencing economic output and employment. In this view, unemployment can persist due to insufficient demand for goods and services, necessitating government intervention to boost economic activity (Pigou, 1936).

Hjazeen et al. (2021) observed the nexus between economic growth and unemployment in Jorden. They found a long-run relationship between the unemployment rate and economic growth. Unemployment negatively impacts on economic growth.

Abdul-Khaliq et al. (2014) observed the relationship between unemployment and economic growth in nine Arabian countries between 1994-2010. They found the negative and significant impact of economic growth on unemployment. One percent increase in economic growth resulted in a 0.16 percent decrease in unemployment. Ojima (2019), Magnani (2013), and Xesibe and Nyasha (2020) also found the adverse effect of unemployment on economic growth.

Dahmani and Rekrak (2015) found a negative relationship between unemployment and economic growth in the short run but no long-term relationship. Rodriguez-Caballero and Vera-Valdes (2020) found the negative impact of unemployment on economic growth in various pandemics. Chuttoo (2020) examined economic growth's effect on employment and Okun's Law's validity in Mauritius. He found the negative cointegration between economic growth and unemployment, which is not statistically significant.

Dritsakis and Stamatiou (2016) examined the effect of unemployment on economic growth in Greece. They found the unidirectional causal relationship between unemployment and economic growth. Ozer (2022) found the unidirectional negative relationship between economic growth and unemployment rate in both the short and long run. A one-unit increase in economic growth reduces the unemployment rate by 1.48 and 0.09 units in the long and short run, respectively. Correa (2023) observed the effect of unemployment, inflation, and FDI on economic growth. He found the negative impact of unemployment and inflation on GDP growth, but FDI has a positive effect.

Inflation and Economic Growth

Classical and neo-classical economists believe that inflation is neutral in the long run, i.e., changes in the money supply only affect nominal variables and not actual variables such as employment and output. According to the Quantity Theory of Money, an increase in money supply makes the price level rise proportionately without altering the actual variables (Lucas, 1980). However, inflation may affect actual output and employment in the short run due to price and wage rigidities. Keynesian economics maintains that inflation and economic growth are connected, especially in the short run. Keynesians believe that moderate inflation can increase economic growth since it reduces real wages, which leads firms to employ more individuals and produce more (Tobin, 1972). However, too much inflation can erode consumer purchasing power and business investment, leading to economic instability and slower growth.

Monetarists, led by Milton Friedman, emphasize the role of monetary policy in controlling inflation. They argue that inflation is always a monetary phenomenon caused by excessive growth in the money supply (Friedman, 1968). Monetarists

believe a stable and low inflation rate is crucial for sustainable economic growth, as high inflation distorts price signals, reduces savings, and hampers investment. New classical and real business cycle theorists argue that inflation can affect economic growth through expectations and supply-side factors. They highlight the role of rational expectations, and the idea that anticipated inflation has minimal real effects, whereas unanticipated inflation can cause misallocations of resources and economic inefficiencies (Sargent & Wallace, 1975).

The Phillips Curve, illustrating a trade-off between unemployment and inflation, has collapsed in several Asian nations due to globalization and monetary policy reforms (Crump et al., 2024)). Empirical research across countries such as India, China, and South Korea shows differences in these relationships, indicating the role of region-specific economic determinants (Ardin, 2023). In the short run, lower unemployment can lead to higher inflation, while higher unemployment can lead to lower inflation. However, this relationship may break down in the long run (Phillips, 1958).

Endogenous growth theory explores the mechanisms through which inflation affects long-term economic growth. According to this theory, inflation can influence growth by impacting investment in human capital, innovation, and technology (Aghion & Howitt, 1992). High inflation can reduce the incentives for investment and innovation by increasing uncertainty and the cost of capital, thereby slowing economic growth.

Several studies suggest that the impact of inflation on growth is non-linear. Khan and Senhadji (2001) identify a threshold effect, where inflation below a certain level (1-3 percent for developed countries and 7-11 percent for developing countries) has no significant impact on growth. Still, inflation above this threshold negatively affects growth. This finding is supported by subsequent research, including Pollin and Zhu (2006), who argue that moderate inflation can be growth-enhancing.

Mallik and Chaudhury (2001) observed the impact of inflation on economic growth in four Asian countries: Bangladesh, India, Pakistan, and Sri Lanka. They found evidence of the long-run positive relationship between GDP growth and inflation. They concluded that moderate inflation is helpful to economic growth.

Kasidi and Mwakanemela (2013) examined the impact of inflation on economic growth in Tanzania. They found the adverse effects of inflation on economic growth. Furthermore, there is no long-run relationship between inflation and economic growth in Tanzania. Ndoricimpa (2017) observed the threshold effects of inflation on economic growth in African countries. He found that a relatively lower level of inflation promotes economic growth in African middle-income countries. After a certain threshold of inflation, it negatively impacts the economic growth. Rihan and Bawady (2018) found a statistically negative impact on economic growth in Egypt.

Yemba et al. (2020) observed the non-linear effect of inflation on economic growth in Cango. They found that inflation rates below 17.2 percent promote economic growth, but any rate beyond that threshold hurts economic growth. Zheng et al. (2024) observed the nexus between inflation and growth. They concluded that

growth maximizing inflation is around 2.4 percent. Yilmazkuday (2022) found the negative impact of inflation on economic growth.

Inflation may have different effects in different contexts due to variations in economic structure, institutional strength, monetary policy credibility, and the stage of development. In emerging economies, moderate inflation can stimulate growth by encouraging investment, while in developed economies, the same level may trigger tightening monetary policies (Fischer, 1993). Additionally, countries with weak financial institutions may suffer more from inflation volatility, which disrupts savings and long-term planning. Therefore, the impact of inflation is highly context-dependent, shaped by both domestic conditions and global economic linkages. (Su & soon, 2024)

Capital Formation and Economic Growth

According to the traditional Solow growth model, labor, capital, and technological advancement drive economic development. Higher production and income levels follow from the increased productive capability of an economy brought about by capital building. Investing in capital goods allows nations to generate more commodities and services, promoting economic development. According to the Solow model, as the effect of capital accumulation reduces due to the Law of declining returns, technological development is required in the long run to maintain development (Jolo & Koc, 2023). Romer's Endogenous Growth Theory expands this by including technology and human capital as necessary components, implying that knowledge and innovation drive long-term development by enhancing productivity and efficiency (Gbenga & Chibuzor, 2023).

Aslan and Altinoz (2021) observed the impact of natural resources gross capital formation on economic growth in the context of globalization. They found capital formation significantly boosts economic growth. A bidirectional causality was found between capital formation and growth in Europe and Asia. Likewise, Topcu et al. (2020) and Zaidi et al. (2019) found a positive impact of capital accumulation in economic expansion.

Onwiodiokit and Otolorin (2021) found a negative and significant impact of gross capital formation on economic growth. Still, human capital formation positively impacts Nigeria's economic growth. Ajose and Oyedokun (2018) found capital formation's negative and non-significant impact on economic growth.

Unez (2013) examined the nexus between capital formation and economic growth in Sub-Saharan countries. He found the bi-directional causality between economic growth and capital formation. Higher economic growth leads to higher capital formation, which, in turn, increases capital formation and results in economic growth. Dahal and Luintel (2021) found the positive impact of capital formation on GDP growth. They found that a one percent increase in capital formation only increased by 0.267 percent.

Landlockedness and Economic Growth

The effect of landlockedness on economic growth has been a subject of intense discussion in financial literature. Among the essential theoretical models examining the phenomenon is the New Economic Geography (NEG) theory, which focuses on spatial factors in promoting economic growth. According to NEG, landlocked countries face higher transport costs and limited access to global markets relative to coastal countries, which can discourage trade, reduce competitiveness, and slow economic growth. These higher costs and logistical barriers translate into lower foreign direct investment (FDI) levels, less access to technology and innovation, and slower economic growth overall (Krugman, 1998).

The Institutional Economics perspective focuses on institutions' role in shaping economic outcomes. From this viewpoint, landlocked countries often struggle with weak institutional frameworks, which can exacerbate the disadvantages of being landlocked. These nations may have less political and economic stability, less effective governance, and higher levels of corruption, all of which can stifle economic growth (North, 2005).

MacKellar et al. (2011) observed the economic growth of landlocked countries. They found the poor financial performance of landlocked countries. Poudel (2014) confirms landlocked countries face economic development obstacles, especially from the transport equation's side. Chaudhary (2021) examined the nexus between landlockedness, corruption, and economic growth in BIMSTEC countries. His finding confirms that the presence of landlockedness hampers economic growth.

While there is a massive corpus of theoretical and empirical literature on the contributions of inflation, unemployment, gross capital formation, and landlockedness to economic growth, there remains an essential gap in the overall consideration of these factors, particularly in the Asian context. Although there have been some individual research works investigating the impact of these factors in specific regions or contexts in Asia, systematic works that consider these economic factors simultaneously in numerous Asian nations are missing. Moreover, interactions between these factors and their joint impact on the economic development of landlocked and coastal Asian countries have not been researched extensively. This study attempts to fill this gap by analyzing how inflation, unemployment, gross capital formation growth rates, and the geographical feature of being landlocked simultaneously affect Asian continental economic growth. The paper aims to bridge this gap by offering detailed analysis and policy recommendations tailored to Asia's unique financial situation.

Based on the objectives of the study and included variables, the following hypotheses are Developed:

Null Hypothesis (H_0): Inflation has no significant impact on economic growth in the Asian continent.

Null Hypothesis (H_0): Unemployment has no significant effect on economic growth in Asian countries.

Null Hypothesis (H_0): The growth rate of gross capital formation has no significant impact on economic growth in the Asian continent.

Null Hypothesis (H_0): Being landlocked does not significantly affect economic growth in Asian countries.

Methodology

Research Design

This study is based on correlational and explanatory research designs because it examines the impact and relationship between dependent and independent variables. Furthermore, the results of the phenomenon or the associations between variables are explained. The positivist research philosophy guides this study, which is deductive and mainly quantitative analysis.

Data and Data Analysis

This study is based on secondary data collected from World Bank reports and the economic surveys of the respective countries. The unbalanced panel data of 38 Asian countries from 1990 to 2023 are used. It uses 1005 data points in the analysis. The countries included, time duration, and data points are presented in Table 1.

Table 1: Included countries, time, and data points

Country	Crossed	Duration	Data Points	Country	Crossed	Duration	Data Points
Armenia*	1	1995-2023	29	Lebanon	20	2009-2023	15
Azerbaijan*	2	1994-2023	30	Malaysia	21	1990-2022	33
Bahrain	3	2001-2023	23	Magnolia*	22	2011-2023	13
Bangladesh	4	1990-2023	34	Nepal*	23	2002-2023	22
Bhutan*	5	1998-2023	26	Oman	24	2009-2023	15
Brunei	6	1990-2023	34	Pakistan	25	1990-2022	33
Cambodia	7	1990-2023	34	Philippines	26	1990-2022	33
China	8	1996-2023	28	Qatar	27	2017-2022	6
Cyprus	9	1990-2023	34	Russia	28	1993-2023	31
Georgia	10	2011-2022	12	Saudi Arabia	29	2001-2023	23
India	11	1994-2023	30	Singapore	30	1990-2022	33
Indonesia	12	1990-2023	34	South Korea	31	1990-2023	34
Iran	13	1990-2023	34	Sri-Lanka	32	1990-2022	33
Iraq	14	2008-2023	16	Syria	33	1990-2023	34
Israel	15	1996-2022	27	Tajikistan*	34	2001-2023	23
Japan	16	1990-2023	34	East Timor	35	2001-2023	23
Kazakhstan*	17	1994-2022	29	UAE	36	2005-2023	19
Kuwait	18	2011-2023	13	Vietnam	37	1996-2023	28
Loas*	19	2001-2023	23	Yemen	38	1994-2023	30
Total			524	+			481

Source: World Bank's Reports and Economic Surveys of respective countries

Note: * Indicates the landlocked country

A dummy variable is used in the study to determine whether or not the landlocked position of a country affects economic growth. Among the 38 countries, Armenia, Azerbaijan, Bhutan, Kazakhstan, Laos, Magnolia, Nepal, and Tajikistan are landlocked countries. Some countries are partly in Asia and other continents. Some statistical and econometric tools like descriptive statistics, covariance analysis, correlation analysis, panel unit root test, Johnsen-Fisher, and Kao residual cointegration test, and Panel Generalized Method of Moments (GMM) are used to explore the impact and relation between dependent and independent variables.

Variables Specification

This study uses four variables: inflation, unemployment, gross capital formation, and economic growth rate. The landlocked position of a country is used as a dummy variable. Economic growth is the dependent variable, and inflation, unemployment, gross capital formation rate, and landlockedness are independent variables.

Model Specification

In the model specification, it is assumed that Inflation (RINF), unemployment (RUNMP), gross capital formation (RGCF), and landlockedness of a country (Dummy) determine the economic growth in Asian countries. In this sense,

$$\text{Economic Growth} = f(\text{Inflation, unemployment, gross capital formation, dummy}) \quad (1)$$

$$\text{In symbol, RGDP} = f(\text{RINF, RUNMP, RGCF, Dummy}) \quad (2)$$

The simple regression model in panel data can be expressed as:

$$X_{it} = \alpha + \beta_1 Y_{it} + \beta_2 Z_{it} + \mu_{it} \quad (3)$$

Where X_{it} is the dependent variable for individual country 'i' at the time 't.' Y_{it} and Z_{it} are dependent variables. In equation (3) α indicates intercept, and β_1 and β_2 indicate the coefficients of independent variables Y and Z. Likewise, μ_{it} is the error correction term.

Panel Generalized Method of Moments (PGMM)

In this study, the panel generalized method of moments (GMM) is used to explore the impact of inflation, unemployment, gross capital formation, and the landlocked position of a country on economic growth in Asian countries. The panel GMM is used to estimate the relationship between variables. It helps to address problems like

measurement errors and omitted variables bias by using multiple conditions to produce more accurate and reliable estimates. The GMM uses multiple moment conditions derived from the data to ensure that the errors or residuals are uncorrelated with the instruments (variables used in GMM estimation). It helps to produce stable and efficient parameter estimates, even when dealing with issues like endogeneity or measurement of errors in panel data. The model specification in the context of panel data using GMM is given below:

In linear form,

$$RGDP_{it} = \alpha_0 + \alpha_1 RINF_{it} + \alpha_2 RUNMP_{it} + \alpha_3 RGCF_{it} + \alpha_4 Dummy_{it} + \mu_i + \varepsilon_{it} \quad (4)$$

Where i and t index the individual country and time, respectively. α_0 is the intercept, and α_1, α_2, α_3, and α_4 are the coefficients to be estimated. μ_i represents the unobserved individual-specific effect, and ε_{it} shows the idiosyncratic error term.

To control for the unobserved individual-specific effect (μi), the first differencing equation (Cheng & Liao, 2015) is used as given below:

$$\Delta RGDP_{it} = \alpha_1 \Delta RINF_{it} + \alpha_2 \Delta RUNMP_{it} + \alpha_3 \Delta RGCF_{it} + \alpha_4 \Delta Dummy_{it} + \Delta\varepsilon_{it} \quad (5)$$

The lagged values of expansionary variables are used as instruments to address potential endogeneity.

The GMM estimation is performed as formulated below:

$$J(\emptyset) = [g(\emptyset)]'W[g(\emptyset)] = 0 \quad (6)$$

Equation (6) $g(\emptyset)$ is the moments' conditions vector, W is the weighting matrix. The weighting matrix is specified as given below:

$$W = \{\frac{1}{N}\sum_{i=1}^{n} Z_i' V_i'^{-1} Z_i\}^{-1} \quad (7)$$

Where Z_i' is the matrix of instruments for individual i and V_i' is a consistent estimate of the variance-covariance matrix of the moment condition. Hansen's J-statistic is estimated as:

$$J = N.Q_N(\hat{\beta}) \quad (8)$$

Where Nis the number of observations and $Q_N(\hat{\beta})$ is the minimized value of GMM objective functions:

$$(\hat{\beta}) = \{\sum_{i=1}^{n} X_i' Z_i W_i Z_i' X_i\}^{-1} \{\sum_{i=1}^{n} X_i' Z_i W_i Z_i' Y_i\} \quad (9)$$

The moment conditions are derived from the orthogonality condition between the instruments and error terms. It is specified as:

$$E[(Zit\Delta\varepsilon\ it)] = 0 \tag{10}$$

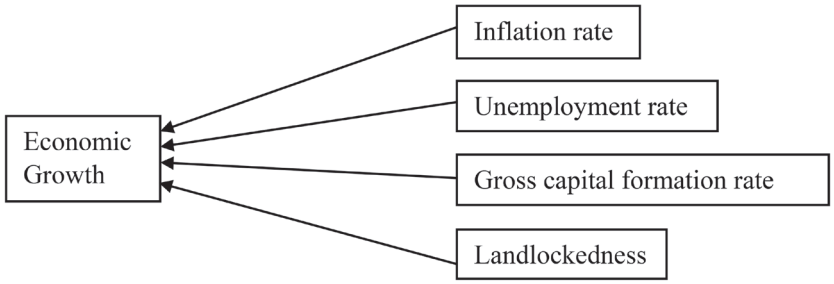
Where Zit is the instrument of lagged values of independent variables. The dynamic panel generalized Method of Moments includes the lagged value of the dependent variable, ΔRGDPit-1; the Arellano Bound estimator (Hall et al., 2006) is used as given below:

$$\begin{aligned}\Delta RGDP_{it} = \beta\Delta RGDP_{it-1} + \alpha_1\Delta RINFit + \alpha_2\Delta RUNMP_{it} + \\ + \alpha_3\Delta RGCF_{it} + \alpha_4\Delta Dummyit + \Delta\varepsilon_{it}\end{aligned} \tag{11}$$

In various conditions, additional moment conditions can be used for lagged dependent variables to ensure valid instruments. The Generalized Method of Moments (GMM) is crucial due to its capacity to provide parameter estimates that are both consistent and efficient when dealing with endogeneity, serial correlation, and heteroskedasticity in econometric models. Panel data analysis extensively utilizes moment conditions produced from the data to effectively leverage robust estimates, even when conventional assumptions about the error structure are broken.

The study's conceptual framework is developed that economic growth is affected by inflation, unemployment, capital formation, and the landlocked position of a country. A conceptual framework is a system of ideas and objectives that guides and structures research, helping to define the problem, the variables, and the relationships between them. The conceptual framework of the study is presented in Figure 1.

Figure 1: Conceptual framework of the study



Source: *Developed by authors*

Presentation and Analysis

Descriptive Statistics

The most important features of a data set can be briefly and comprehensively summarized by descriptive statistics. Usually spanning central tendency measures like mean, median, and mode and variability measures like range, standard deviation, and variance, these steps capture the essence of the data. The key information about the response and predictor variables is listed in Table 2.

Table 2: Key information about the study variables

Base	RGDP	RINF	RUNMP	RGCF
Mean	10.0046	11.94502	6.0897	7.0472
Median	4.8429	4.698	4.9864	6.1504
Maximum	5654.000	1662.216	22.974	435.616
Minimum	-27.994	-10.269	-0.605	-164.509
Std. Dev.	178.288	72.1368	4.0097	25.112
Skewness	31.6133	17.638	1.0637	5.0213
Kurtosis	1001.270	351.958	3.883	92.868
Observations	1005	1005	1005	1005

Note: RGDP= Economic growth rate percent, RINF = Annual inflation rate, RUNMP= Unemployment rate (percent of the total labour force), RGCF= Annual growth rate of total capital formation,

Source: Authors Calculation by using EViews12

Table (2) presents key statistics of four study variables across 1005 observations. Economic growth (RGDP) of the Asian countries exhibits maximum instability with a standard deviation of 178.288, whereas unemployment (RUNMP) is the most stable at 4.0097. Inflation (RINF) and growth in capital formation (RGCF) are in between. All the variables exhibit positive skewness, reflecting high values, with RGDP reflecting maximum skewness. The high kurtosis values, particularly for RGDP and RINF, suggest the existence of outliers. GDP growth, inflation, and capital formation growth are leptokurtic, whereas the unemployment rate is platykurtic. The mean values are more significant than the medians for all the variables, indicating the right-skewed distributions. This summary implies a dataset with high variability and extreme economic occurrences within the observations.

Covariance and Correlation Analysis

Covariance indicates the degree to which two variables change together, revealing the direction of their linear connection but not the strength. Correlation analysis quantifies the strength and direction of the linear relationship between two variables.

While covariance may be any number, correlation is always within the range of -1 to 1, making it more interpretable. The results of covariance and correlation analysis are presented in Table 3.

Table 3: Outcomes of covariance and correlation analysis

Variables	RGDP	RINF	RUNMP	RGCF
RGDP	31755.18 (1.00)	349.38 (0.027)	6.42 (-0.009)	26.12 (0.006)
RINF	349.38 (0.027)	5198.54 (1.00)	7.31 (-0.025)	91.80 (0.051)
RUNMP	6.42 (-0.009)	7.31 (-0.025)	16.06 (1.00)	6.44 (-0.64)
RGCF	26.12 (0.006)	91.80 (0.51)	6.43 (-0.063)	630.0 (1.00)

Note: - The values of the bracket indicate the correlation coefficient

Note: RGDP= Economic growth rate percent, RINF = Annual inflation rate, RUNMP= Unemployment rate (percent of total labour force), RGCF= Annual growth rate of total capital formation

Source: Authors Calculation by using EViews12

Table (3) presents the covariance and correlation coefficient analysis results between four study variables: economic growth, inflation, unemployment, and gross capital formation growth rate. The covariance between economic growth (RGDP) and Inflation (RINF) is 349.38, and the correlation coefficient is 0.027, indicating a fragile positive association. The variance between GDP growth and unemployment (RUNMP) is 6.42, and the correlation coefficient is -0.009, suggesting a fragile negative relation. Likewise, the covariance between economic growth and gross capital formation growth rate is 26.12, and the correlation coefficient is 0.006, representing a very weak positive correlation between these variables. A weak negative correlation (r = -0.063) exists between unemployment and gross capital formation growth rate in Asian countries.

Panel Unit Root Testing

The unit root test is used to test whether the data are predictable. Panel unit root testing is applied whether time series data is stationary, meaning that its statistical properties do not change over time or non-stationary (has a unit root). For the analysis, stationarity of data is required. The results of the unit root test summary of panel data are displayed in Table 4.

Table 4: Results of panel unit root test summary

Methods	RGDP		RINF		RUNMP		RGCF	
	Level	First difference	level	First difference	Level	First difference	Level	First difference
LLC	-7.912	-17.775	-193.66	-80.65	-2.327	-9.635	-9.189	-17.578
	(0.00)	(0.000)	(0.000)	(0.000)	(0.010)	(0.000)	(0.00)	(0.00)
IPS	-10.608	-20.439	-48.55	-33.45	-1.731	-12.836	-12.23	-23.907
	(0.00)	(0.000)	(0.000)	(0.000)	(0.042)	(0.000)	(0.00)	(0.00)
ADF-FC	281.43	565.32	264.66	484.51	96.183	323.54	309.61	629.253
	(0.00	(0.000)	(0.000)	(0.000)	(0.043)	(0.000)	(0.00)	(0.00)
PP-FC	379.23	1012.85	301.52	982.58	110.02	652.927	602.12	1444.64
	(0.00)	(0.000)	(0.000)	(0.000)	(0.004)	(0.000)	(0.00)	(0.00)
Decision	GDP growth (RGDP) is stationary at the level		Inflation rate (RINF) is stationary at the level		Unemployment rate (RUNMP) is stationary at the level.		Gross capital formation growth (RGCF) is stationary at the level.	

Where, LLC= Levin, Lin, Chut, IPS= Im, Pesaran & Shin W- stat, ADF-FC= ADF-Fisher Chi-square, PP-FC= PP-Fisher Chi-square

Note: (a) Benchmark: Individual intercept, (b) Figures in brackets indicate probability values

Source: Authors Calculation.

The panel unit root test results are presented in Table (4). It provides evidence for the stationarity of four economic variables: real GDP growth (RGDP), inflation rate (RINF), unemployment rate (RUNMP), and gross capital formation growth (RGCF). In the panel unit root test summary, various methods like Levin, Lin & Chu (LLC), Im, Pesaran & Shin (IPS), ADF-Fisher Chi-square (ADF-FC), and PP-Fisher Chi-square (PP-FC) are used. These tests are applied to the data series' original level and first difference. The findings suggest that all variables exhibit stationarity at their levels, as shown by the statistically significant test statistics and their associated p-values (all below 0.05). More precisely, the p-values for all tests conducted on all variables are lower than 0.05, which indicates that we may reject the null hypothesis of a unit root. Hence, the GDP growth (RGDP), inflation rate (RINF), unemployment rate (RUNMP), and gross capital formation growth (RGCF) are stable at their current values, indicating that these time series do not need to be differenced to attain stationarity. This means that these time series data have predictable power and can be used in various economic and statistical modeling.

Johansen Fisher and Kao Residual Panel Cointegration Test

The Johansen Fisher and Kao Residual Panel cointegration tests test whether a long-term equilibrium connection exists among panel data variables, but their techniques and assumptions vary. Johansen Fisher test allows for several cointegrating vectors and does not presume homogeneity in the cointegration vectors throughout the panel. Kao Residual test is based on the Engle-Granger two-step approach, which is

especially suited for panel data. It assumes a single cointegrating connection and homogeneity during the panel tests for cointegration by evaluating the residuals of the panel regression for stationarity. The Johansen-Fisher test is more flexible with numerous cointegrating vectors and heterogeneity, whereas the Kao Residual test assumes a single cointegrating connection with homogeneity. Table 5 displays the outcomes of the panel cointegration test.

Table 5: Outcomes of panel cointegration test

Series: RGDP, RINF, RUNMP**,** RGCF**,** Included observation: 1005

Johnsen Fisher Panel Cointegration Test					**Kao Residual Cointegration Test**		
Hypothesized No of CE(s)	**Fisher Stat (from trace test)**	**Prob**	**Fisher Stat (from max-eigen test)**	**Prob**			
None	591.4	0.00	422.7	0.00	ADF	t- statistic	-1.954
At most 1	349.0	0.00	255.5	0.00		Prob	0.054
At most 2	184.0	0.00	142.9	0.00	Residual Variance		59623.7
At most 3	161.4	0.00	161.4	0.00	HAC variance		59478.1

Note: - Probabilities are computed using the asymptotic chi-square distribution

Source: Authors Calculation.

Two cointegration test results are shown in Table (5). The probability values for all proposed number of cointegration equations in the Johnsen-Fisher panel cointegration test are zero or less than 0.05. We thus can reject the null hypothesis of no cointegration among the investigated variables. It implies robust proof of several cointegrating relationships among the variables. Long-run cointegration or equilibrium exists between economic growth, inflation, unemployment, and gross capital building. Strong proof of long-run cointegration among the variables is given by both trace and Max-Eigen tests.

The Kao residual cointegration test result shows the ADF t-statistic is -1.594, and its probability value is 0.054. it is marginally above the general 5 percent significance level. In this case, we fail to reject the null hypothesis of no cointegration at a 5 percent significance level. But it is very close, suggesting weak evidence of cointegration. The residual variance and HAC variance values provide measures of the variability in the residual, with HAC variance correcting for autocorrelation and heteroscedasticity. The Johnsen-Fisher test indicates strong evidence, and the Kao-residual test provides weaker evidence. Still, overall, the results suggest that there is likely a long-run equilibrium relationship between economic growth, inflation, unemployment, and gross capital formation in Asian countries. A cointegration test verifies if there is a long-run equilibrium relationship between two or more non-stationary time series. If the series are cointegrated, they tend to move together over time even though there are short-term deviations. This means that ordinary regression analysis holds, preventing spurious results.

Generalized Method of Moments (GMM)

The Generalized Method of Moments (GMM) is a statistical methodology used for parameter estimation in economic models. The concept is based on the notion that model parameters may be estimated by aligning theoretical moments (such as averages or variances) with their corresponding sample values. The Generalized Method of Moments (GMM) is highly adaptable, enabling efficient estimates even in the presence of intricate models and possible challenges such as heteroskedasticity or autocorrelation. It is particularly effective when the model is over-identified, meaning there are more moment conditions than parameters to estimate. GMM ensures that the differences between observed and expected statistical moments are minimized, resulting in parameter estimates that are both reliable and effective. The results of the panel Generalized Method of Moments (GMM) are listed in Table 6.

Table 6: Results of Panel Generalized Method of Moments (PGMM)

Transformation: First difference, Dependent Variable: RGDP
Cross sections: 38, Unbalanced panel observation: 929

Variable	Coefficient	St. Error	t-statistic	Prob.
RGDP (-1)	2.306	0.0499	46.206	0.000
RNIF	0.1086	0.0023	47.845	0.000
RUNMP	-2.3869	0.0686	-34.798	0.000
RGCF	0.2819	0.0107	26.278	0.000
Dummy	-5.206	14.227	-0.366	0.715
Effects Specification				
Cross section Fixed (First Difference)				
Root MSE	185.465	Mean Dependent Variation		0.087
S.D. Dependent Variation.	4.357	S.E of Regression		185.865
Sum of Residual	31954921	J-Statistic		33.72
Instrument Rank	38	Prob (J-statistic)		0.581

Note: RGDP= Economic growth rate percent, RINF = Annual inflation rate, RUNMP= Unemployment rate (percent of total labour force), RGCF= Annual growth rate of total capital formation, and Dummy indicates the landlockedness of the country.

Source: Authors Calculation.

The lagged value of RGDP has a coefficient of 2.306 with a standard error of 0.0499. The t-statistic is 46.206, and the p-value is 0.000, indicating that it is highly significant. This suggests that past economic growth strongly and positively influences current economic growth. This means that a one-unit change in previous economic growth results in a 2.306-unit change in current economic growth in Asian countries. The coefficient for the annual inflation rate is 0.1086, with a standard error of 0.0023. The t-statistic is 47.845, and the p-value is 0.000, indicating that it is also highly significant. A positive coefficient implies that higher inflation is associated with higher economic growth, which may be controversial but can occur in specific economic settings (e.g., moderate inflation indicating a growing economy). The result shows

that one unit increase in inflation results in a 0.1086 unit increase in GDP growth in the selected 38 countries.

The coefficient for the unemployment rate is -2.3869, with a standard error of 0.0686. The t-statistic is -34.798, and the p-value is 0.000, showing high significance. The negative coefficient indicates that higher unemployment rates are associated with lower economic growth, as expected. The coefficient for annual growth rate of total capital formation is 0.2819 with a standard error of 0.0107. The t-statistic is 26.278, and the p-value is 0.000, indicating high significance. This positive coefficient suggests that increased capital formation positively affects economic growth. The unemployment and capital formation growth rates are individually significant in determining economic growth. One unit increase in unemployment and capital formation rate results in a 2.3869 unit decrease and a 0.2819 unit increase in economic growth, respectively. The coefficient for the dummy variable representing landlocked countries is -5.206, with a standard error of 14.227. The t-statistic is -0.366, and the p-value is 0.715, indicating that it is not statistically significant. It implies that landlocked does not significantly impact economic growth in this model. The result suggests landlocked countries earn 5.206 units less than other countries, but this result is not statistically significant. Based on the coefficients, the estimated equation can be expressed as:

$$RGDP_t = 2.306 * RGDP(-1) + 0.1086 * RINF_t - 2.3869 * RUNMP_t + \\ + 0.2819 * RGCF_t + 5.206 * dummy \quad (12)$$

The Root mean square error (MSE) is 185.465. The Root MSE measures the difference between predicted values and actual values. The value of Root MSE 185.465 is not such an enormous value in the context of 1006 observations and 38 countries. When the values are predicted on a large scale, a Root MSE of 185.465 might be acceptable. The standard deviation (SD) of dependent variation is 4.357. It is the standard deviation of dependent variable economic growth (RGDP). The value of the J-statistic is 33.72, with a probability value of 0.581. the J-statistic is a measure used in GMM to test the validity of the instruments. The P-value of 0.581 suggests that the instruments are valid. The model seems to fit the date well, given the high J-statistic p-value. The results of the residual diagnostic by the Arellano-Bound serial correlation test are listed in Table 7.

Table 7: Residual diagnostic by Arellano-Bound serial correlation test

Arellano-Bond Serial Correlation Test

Test order	m-Statistic	rho	SE(rho)	Prob.
AR(2)	0.124	171221.23	1372178.36	0.9007

Source: Authors Calculation by using EViews12

The Arellano-Bond serial correlation test checks for autocorrelation in the residuals of dynamic panel data models. The AR(2) test yields an m-statistic of 0.124 and

a high p-value of 0.9007, indicating no significant second-order autocorrelation. It suggests that the model does not suffer from second-order serial correlation, which is crucial for the validity of the Arellano-Bond estimator.

Result and discussion

There is a low degree of positive correlation between inflation and economic growth. Likewise, gross capital formation has a low degree of positive association with economic growth. The Johnsen-Fisher cointegration test provides strong evidence of long-run cointegration between inflation, unemployment, capital formation growth rate, and economic growth. The previous year's economic growth is also responsible for increasing the current economic growth of Asian countries. One unit increase in last year's economic growth results in a 2.306 increase in present economic growth. Inflation, unemployment, and gross capital formation determine economic growth. Each unit increase in inflation and gross capital formation results in 0.1086 and 0.2819 unit increase in economic growth in Asian countries, respectively. The finding of Mallik and Chaudhury (2001) also shows the positive effect of inflation on economic growth. But Kasidi and Mwakanemela (2013), Ndoricimpa (2017), Yemba et al. (2020), and Yilmazkuday (2022) found the negative impact of inflation after a certain threshold on economic growth. Aslan and Altinoz (2021), Topcu et al. (2020), Zaidi et al. (2019), and Dahal and Luintel (2021) found the positive impact of gross capital formation on economic growth. However, Onwiodiokit and Otolorin (2021) and Ajose and Oyedokun (2018) found that capital formation hurts economic growth.

Unemployment is also statistically significant to explain economic growth. One unit increase in the unemployment rate results from a 2.3869 unit decrease in economic growth in Asian countries. Hjazeen et al. (2021), Ojima (2019), Xesibe and Nyasha (2020), and Correa (2023) found the negative impact of unemployment on economic growth. However, Dahmani and Rekrak (2015) could not find a long-run relationship between unemployment and economic growth. Unemployment decreases economic growth by lowering consumer spending and reducing the overall demand for goods and services.

Additionally, it results in a loss of productivity and potential output, hindering the economy's ability to grow. The landlocked countries earn 5.206 units less than non-landlocked countries, but this result is not statistically significant. The findings of MacKellar et al. (2021), Poudel (2014), and Chaudhary (2021) align with this finding because they concluded that the presence of landlockedness hampers economic growth. Landlockedness hampers economic growth by limiting access to major international trade routes, increasing transportation costs, and reducing trade opportunities. Additionally, reliance on neighboring countries for port access can lead to political and logistical challenges, further restricting economic development.

Conclusion, policy implications, and limitations

In this study, the impact of inflation, unemployment, gross capital formation, and landlockedness on economic growth in Asian countries is examined. There is a low degree of positive correlation between inflation and economic growth. Likewise, gross capital formation has a low degree of positive association with economic growth. The Johnsen-Fisher cointegration test provides strong evidence of long-run cointegration between inflation, unemployment, capital formation growth rate, and economic growth. The previous year's economic growth is also responsible for increasing the current economic growth of Asian countries. One unit increase in last year's economic growth results in a 2.306 increase in present economic growth. Inflation, unemployment, and gross capital formation determine economic growth. Each unit increase in inflation and gross capital formation results in 0.1086 and 0.2819 unit increase in economic growth in Asian countries, respectively. Unemployment is also statistically significant to explain economic growth. One unit increase in the unemployment rate results from a 2.3869 unit decrease in economic growth in Asian countries. The landlocked countries earn 5.206 units less than non-landlocked countries, but this result is not statistically significant.

The results of this research provide many policy recommendations for Asian nations seeking to improve their economic development. Initially, governments need to enact measures that mitigate inflation and foster consistent pricing levels since even a marginal rise in inflation may benefit economic growth. Furthermore, it is crucial to promote investment in gross capital formation by offering incentives and establishing a supporting infrastructure, considering its substantial and beneficial influence on economic development. Furthermore, it is imperative to tackle the issue of unemployment since elevated unemployment rates significantly negatively impact economic growth. Hence, it is essential to implement policies that foster job creation and enhance the capabilities of the workers. Moreover, while the economic drawback of landlocked nations is apparent, this component did not show statistical significance in our analysis, suggesting that other factors may alleviate these drawbacks. Finally, the significant impact of past economic expansion on present development highlights the need to implement enduring and lasting economic strategies to establish a favorable path of progress. Policies should focus on reducing unemployment and promoting capital formation, as both significantly influence economic growth. Additionally, targeted support for landlocked countries and inflation control measures could enhance regional economic stability and growth.

This study uses both qualitative and quantitative determinants of economic growth in the context of Asian countries. The unbalanced panel data of 38 Asian countries are used, which spans from 1990 -2023. It uses secondary data collected from the World Bank's Reports and economic surveys of respective countries. Three independent variables, inflation, unemployment, and gross capital formation; one dependent

variable, economic growth; and one dummy variable, landlockedness, are used in the study. The descriptive statistics, covariance and correlation analysis, Johnsen-Fisher and Kao residual cointegration test, and Generalized Method of Moments (GMM) are used to explore the impact of inflation, unemployment, gross capital formation, and landlockedness of a country on economic growth. A discussion of potential omitted variable bias or alternative econometric techniques can be used to further study. Therefore, further study is necessary using more countries, time duration, variables, data points, and statistical tools for more comprehensive and reliable results.

Declarations

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Conflict of interest

There is no conflict of interest/Competing interests.

Availability of data and material

The data that support the findings of this study are openly available in the website of World Bank (www.worldbank.org).

Code availability

The computer program results are shared through the tables in the manuscript.

Authors' contributions

Prem Bahadur Budhathoki: Conceptualization, Writing – original draft, Formal analysis, and Validation.
Arjun Kumar Dahal: Methodology, Software, Investigation, Data curation.
Ganesh Bhattarai: Writing – review and editing, Supervision, Visualization.

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