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Message from the Chief Editor

I am delighted that the first volume of the IPF Journal of Economics and Finance is going to be published. This journal is coming out in the backdrop of a growing need for high-quality research that will provide relevant policy guidance needed by the Government in the area of public finance and economics. Its regular publication will create a platform for rigorous analysis, evidence-based policy proposals, and scholarly dialogue that will link academic insights with practical policy choices.

Each of the research articles in this volume includes an abstract to help readers quickly grasp the scope, methodology, and key findings on that article. I hope that the readers will find the articles stimulating but at the same time request all concerned to keep in mind that these are pure academic endeavors of the authors and do not reflect the position of the Government in any way. Views and opinions expressed by the authors will be their own responsibility.

I thank the editors and the Institute of Public Finance Bangladesh (IPF) team for bringing this volume to fruition. This is the first-ever academic journal published by the IPF and I hope that future volumes will come out in regular intervals churning out high-quality research papers. I look forward to the IPF Journal of Economics and Finance becoming a persistent and influential voice that will not only generate fresh ideas but also fill out the research gaps in the fields of economics and finance.

Dr. Md. Khairuzzaman Mozumder
Finance Secretary
&
Chief Editor

Foreword

The Institute of Public Finance Bangladesh (IPF) has been delivering several high-quality training courses to both the public and private sector officials since its inception in 2013. However, there was a persistent gap in conducting research that was originally envisaged as one of the core mandates of this institute. It gives me profound joy that finally that gap has been filled out.

All the articles contained in this first volume of the IPF Journal of Economics and Finance has been written by the officers of the Finance Division and the SPFMS Program. The authors have done a tremendous job producing these articles in a very short period while maintaining high quality of each of the articles which, I am sure, will be appreciated by the scholars.

I sincerely thank the IPF and the Finance Division officials who have worked very hard and closely with the publisher to bring this journal out. I specially thank the Finance Secretary who is also the Chief Editor of this Journal, for being tremendously supportive in this venture. Sincere thanks are also due to everyone who has supplied valuable and constant encouragement that provided much needed boost to complete the task of publishing this journal.

I hope that this volume will induce others to write articles regularly from now on which will be critical to publish this journal in regular intervals.

Dr. Ziaul Abedin
Additional Secretary, Finance Division
& Director General, IPF

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Sectoral and Macroeconomic Drivers of Bangladesh's GDP Deflator (1990–2024) : Evidence from Johansen Cointegration and VECM

Mohammad Kamruzzaman[1], Rina Akter [2]
Md. Mostofa Kamal[3], Sheikh Touhidul Haque[4]

Abstract

This study provides an empirical analysis of the sectoral and macroeconomic drivers of the GDP deflator in Bangladesh from 1990 to 2024, highlighting the macroeconomic and sectoral contributions to inflationary dynamics. Utilizing time-series econometric methodologies —the research identifies drivers of inflation, including household consumption, government expenditure, investment, energy prices, manufacturing producer prices, and sector-specific output prices. Results indicate strong long-run relationships among these variables, with consumption expenditure and government expenditure exhibiting significant positive impacts on the GDP deflator, whereas energy price negatively impact on the GDP deflator in long run. Variance decomposition analysis further reveals that, over a 10-year forecast horizon, household consumption expenditure, agricultural sector prices, and energy prices are the principal factors contributing to inflation variability. The study underscores the importance of integrating monetary, fiscal, and structural policies—including agriculture sector improvements and energy sector reforms—to effectively manage inflation. These findings offer critical insights for policymakers aiming to achieve sustainable price stability alongside robust economic growth in Bangladesh and similar developing economies.

Keywords: GDP Deflator, Inflation Determinants, Cointegration, VECM, Macroeconomic Stability, Sectoral Analysis, Bangladesh.

JEL Classification: E31, E52, E62, O53

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Introduction

Gross Domestic Product (GDP) deflator is an economy-wide measure of inflation, reflecting price changes for all new domestically produced goods and services. It is defined as the ratio of nominal GDP to real GDP, multiplied by 100, thereby capturing the price level change between the base year and the current year. Unlike consumer price index (CPI) inflation which is based on a fixed basket of consumer goods, the GDP deflator encompasses a broad range of goods and services including government consumption, capital formation, and net exports, thus providing a comprehensive gauge of inflationary pressure in an economy. In Bangladesh, maintaining price stability is crucial as persistently high inflation can distort resource allocation and erode purchasing power, ultimately hampering economic growth. Over the period 2000–2023, Bangladesh experienced an average GDP-deflator inflation rate of about 6.7% per year, significantly higher than the ~2–3% seen in advanced economies. This trend underscores Bangladesh's inflationary bias – a tendency for inflation to run above international norms – which poses challenges for policymakers in balancing growth and price stability. Given the social and developmental implications of rising prices (especially for essential commodities), understanding the determinants of inflation as measured by the GDP deflator is a critical economic inquiry.

This study investigates the drivers of Bangladesh's GDP deflator, thereby shedding light on the underlying inflation dynamics and sectoral contributions. By employing time-series econometric techniques over 1990–2024, we aim to identify which macroeconomic factors – such as sector-specific output prices, energy costs, investment, consumption, or fiscal measures – exert significant influence on broad inflation. In doing so, we build on and extend prior research on inflation in South Asian economies. For instance, Mishra et al. (2010) found evidence (for India) of a long-run causal link from aggregate price levels to money supply and output, suggesting that inflation can be a monetary phenomenon in the short run. Patra and Ray (2010) similarly noted that in India, inflation expectations are influenced by food and fuel prices, as well as demand-side factors like the output gap and real interest rates, with monetary policy traditionally anchoring inflation expectations around ~5%. In

Bangladesh, earlier studies have emphasized the role of both supply shocks and policy factors: Khatun and Ahamad (2012) showed that integrated fiscal and monetary policies are crucial to controlling inflationary trends, while Arif and Ali (2012) identified key long-run determinants including money supply and GDP growth. However, research gaps remain regarding how different sectors of the economy contribute to aggregate inflation as measured by the GDP deflator. This study contributes to the literature by examining sectoral price indices (agriculture, industry, manufacturing, energy) alongside traditional macroeconomic variables, thereby providing a nuanced understanding of Bangladesh's inflation dynamics.

The remainder of this paper is structured as follows. The next section reviews relevant literature from Bangladesh and comparable economies, establishing the theoretical and empirical context. This is followed by a historical trend of Bangladesh, description of the data, methodology, and econometric techniques employed. We then present and discuss the empirical results, including unit root tests, cointegration analysis, a vector error-correction model (VECM), and variance decomposition of inflation. We integrate new visualizations – such as variance decomposition graphs – to illustrate key findings. Finally, we discuss the policy implications of the results and conclude with recommendations and avenues for future research.

Literature Review

Inflation in developing economies tends to be driven by a mix of demand-pull and cost-push factors, and Bangladesh is no exception. Numerous studies on South Asia underscore that inflation determinants can be country-specific even within the region, although common themes emerge. In Bangladesh, classic monetarist perspectives highlight the role of monetary growth: for example, money supply (M2) has been found to have a positive long-run effect on the price level. Khatun and Ahamad (2012) confirm that broad money growth and supply shocks jointly drive inflationary trends, while also finding that increased domestic agricultural output (notably rice production) helps curb inflation. This underscores the importance of the agriculture sector in Bangladesh's inflation dynamics – higher food production mitigates price pressures, whereas shortfalls (often due to floods or supply chain disruptions) can

lead to spikes in food prices and overall inflation. Consistent with this, a recent empirical investigation by Rafa (2024) found that inflation in Bangladesh exhibits high persistence, although persistence has moderated following structural breaks around 2007 and 2012 as the economy underwent reforms. This suggests that policy regime shifts and global commodity cycles have impacted the inertia of inflation over time.

Studies focusing on peer economies provide comparative insights. In India, inflation has been shown to stem from both demand-side forces and supply shocks. Patra and Ray (2010) emphasize that expectations of inflation in India depend heavily on food and fuel prices, which are supply- side, alongside the output gap and interest rates which reflect demand conditions. Similarly, Patnaik (2010) identified that India's inflation is a "mix of demand and supply side factors," recommending that stabilization policies simultaneously address excessive demand and supply bottlenecks. Structural vector autoregression analyses (e.g., Ball et al., 2016) further attribute India's inflation fluctuations to global oil prices and exchange rate pass-through, as well as monetary policy credibility. In Sri Lanka, Bandara (2011) also finds that both monetary expansions and supply shocks (like oil prices) significantly affect inflation, reflecting a regional pattern.

For Pakistan, research indicates a broad set of drivers including fiscal and external factors. Siddiqui et al. (2024) perform a comparative ARDL analysis for Pakistan, India, and Bangladesh, reporting that in Pakistan, variables such as money supply, exchange rate depreciation, oil prices, and even export demand put upward pressure on inflation, whereas higher GDP growth helps moderate it. This finding that strong output growth can dampen inflation (in Pakistan's context) may reflect improved supply capacity or productivity gains countering demand pressures. Interestingly, some evidence from Pakistan and Nigeria suggests that government fiscal behavior can have non-intuitive effects on inflation: for instance, an error-correction study on Nigeria found government expenditure to have a negative long-run impact on inflation, possibly indicating that disciplined or investment-oriented public spending helps alleviate supply constraints. Such results highlight that the inflationary effect of fiscal policy depends on its composition and the economy's context (development needs, supply elasticities, etc.).

Research on other emerging economies echoes the importance of supply shocks and external factors. In Vietnam, which shares some structural similarities with Bangladesh (e.g., a growing manufacturing sector and exposure to commodity imports), Nguyen et al. (2012) identified money supply, global oil price, and the price of rice (a staple) as significant determinants of inflation. Vietnam's experience in the 2000s showed that rapid monetary expansion and surging food prices led to double-digit inflation, stressing the need for tight monetary policy and agricultural support to stabilize prices. Likewise, studies on African economies like Nigeria and Ghana find that exchange rate movements (which affect import prices) and domestic supply constraints (e.g., food production) crucially influence inflation outcomes. These cross-country findings inform our analysis for Bangladesh: we anticipate that supply-side variables (such as energy prices and sectoral output prices) and demand-side variables (like consumption and investment) jointly determine the GDP deflator in Bangladesh. This expectation is in line with Bangladesh's own historical inflation episodes – e.g. spikes often coincided with commodity price shocks (fuel or food) and periods of strong domestic demand growth.

In summary, the literature suggests that a successful inflation model for Bangladesh must integrate multiple perspectives: monetary (money supply or interest rates), fiscal (government expenditure), external (import prices, exchange rates), and sector-specific supply factors (agricultural output, energy costs). Our study extends prior work by explicitly incorporating sectoral GDP price indices (for agriculture and industry) and key relative price indicators (energy and manufacturing producer prices) into the inflation model, thereby capturing sector-wise contributions to inflation. This approach aligns with recent calls for more granular inflation analysis in developing countries and provides a bridge between traditional macroeconomic theories of inflation and the structural characteristics of Bangladesh's economy.

Historical GDP Deflator Trend in Bangladesh:

Bangladesh's annual % change in GDP deflator (Broad based measured of Inflation) has exhibited significant fluctuations over the past decades.

The above trend line highlights episodes of high inflation in the mid-1990s and early 2010s, followed by a period of relative stability around the 3–4% range, and a recent uptick in the 2020s. Structural changes (such as improved agricultural output in the early 2000s) and prudent policies helped contain inflation for a time, but external shocks (commodity price booms, global supply chain disruptions) have re-introduced inflationary pressures. The persistent nature of Bangladesh's inflation, averaging 4–5%, underscores the importance of identifying its underlying drivers. Figure 1 provides context for the econometric analysis, showing that while inflation was episodic, it never approached the low levels seen in advanced economies, reflecting underlying structural inflationary bias in Bangladesh's economy.

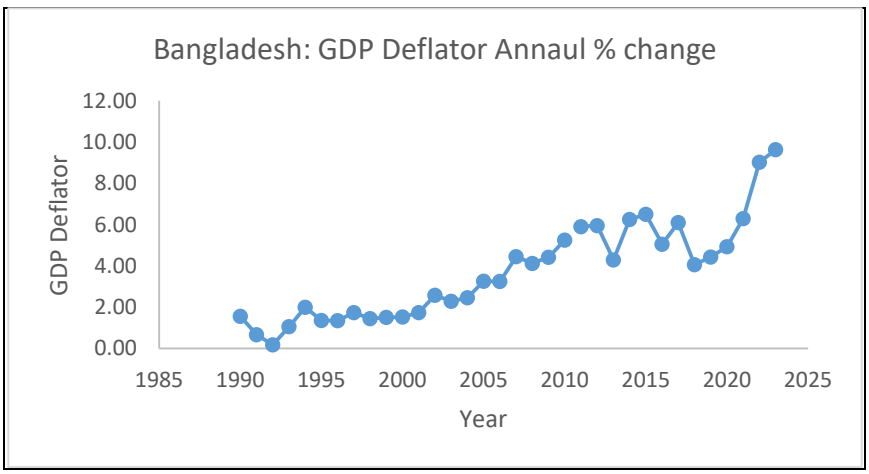

Figure 1: *Historical GDP Deflator Trend in Bangladesh*

Data and Methodology

To empirically analyze the determinants of Bangladesh's GDP deflator, we employ a time-series econometric approach utilizing annual data from 1990 to 2024. The choice of sample period is motivated by data availability and the desire to capture structural changes in the economy during the three decades of liberalization, rapid growth, and external shocks. Our dependent variable is the log of GDP Deflator (lnGDPDFL), representing the aggregate price level. Based on economic theory and prior studies, we include a set of potential explanatory variables capturing demand- side, supply-side, and sectoral influences: (1)

Household Consumption Expenditure (lnHCONEXP) – proxying aggregate demand pressure from private consumption; (2) Gross Capital Formation (lnINV_GCF) – representing investment demand; (3) Government Expenditure (lnGOVEXP) – capturing fiscal policy's direct demand injection; (4) Sectoral GDP Price Index – Agriculture (lnSECGDP_AGRI) and (5) Sectoral GDP Price Index – Industry (lnSECGDP_IND) – reflecting price trends in the major output sectors which can feed into overall inflation; (6) Manufacturing Producer Price Index (lnMANUF_PPI) – a supply-side cost indicator, particularly for manufactured goods; and (7) Electricity Price (lnEPELECT) – representing energy prices, which often have economy-wide cost-push effects. All series are transformed to natural logs for stability of variance and to interpret estimated coefficients as elasticities.

We first conduct stationarity tests for each time series using the Augmented Dickey-Fuller (ADF) test and the Phillips-Perron (PP) test. This is essential to determine the order of integration of the variables and to avoid spurious regressions. The results of the unit root tests (see Table 1) indicate that all variables are non-stationary in levels (the test statistics fail to reject the null of a unit root at conventional significance levels), but they become stationary after first differencing. In other words, each series is integrated of order one, I(1). This finding of unit roots justifies the use of a cointegration approach to model any long-run equilibrium relationships among the variables.

Table 1 provides a summary of the unit root test p-values, confirming that for each variable the p-value is high (>0.05) in levels but drops below 0.05 in first differences, indicating stationarity in Δln form.

Table 1: Unit Root Test Results (ADF and PP Tests)

Variable (log)	ADF p-value (Level)	ADF p-value (1st Diff)	PP p-value (Level)	PP p-value (1st Diff)
GDP Deflator (GDPDFL)	0.9968	0.036	0.9961	0.036
Household Cons. Exp (HCONEXP)	0.9973	0.0118	0.9997	0.0133
Sectoral GDP Price – Agri	0.986	0.4332	0.9991	0.0083
Energy Price (Electricity)	0.9997	0.0048	0.9989	0.0038
Manufacturing PPI (MANUF_PPI)	0.9954	0.0069	0.9956	0.0045

Gross Cap. Formation (INV_GCF)	0.9351	0.0314	0.9801	0.0037
Sectoral GDP Price – Ind	0.9952	0.0203	0.9983	0.0149
Government Expenditure (GOVEXP)	0.9932	0.0000	0.9959	0.0000

Note: All variables are in natural logs. Tests include intercept; p-values > 0.05 imply non- rejection of unit root (non-stationary). The results show each series is I(1), stationary in first differences.

Given the I(1) nature of the variables, we proceed with a Johansen cointegration analysis to test for the existence of long-run equilibrium relationships among the variables. The Johansen approach allows for multiple cointegrating vectors in a multivariate system. We include an intercept in the cointegration equation and select the lag length for the vector autoregression (VAR) underlying the Johansen test based on Akaike and Schwarz information criteria (with annual data, a lag of 1 or 2 is typically sufficient, and we ensure no serial correlation in residuals). The Trace test statistic (Table 2) rejects the null hypothesis of no cointegration (r = 0) and even suggests the presence of r = 5 cointegrating vectors at the 5% level. The trace statistics for r = 0 through r = 4 all exceed their critical values (e.g., Trace = 244.62 for r=0 vs critical ~159.53) with p < 0.01, indicating multiple long-run relationships in the system. We focus on the economically meaningful cointegrating relation that treats the GDP deflator as the dependent (normalized) variable.

Table 2: Johansen Cointegration Test (Trace Statistic)

Null Hypothesis (r)	Trace Statistic	Eigenvalue	5% Critical Value	p-value	Conclusion (5% level)
r = 0 (no cointegration)	244.622	0.84543	159.5297	0	*Reject* – at least 1 cointegrating vector
r ≤ 1	183.0074	0.808834	125.6154	0	*Reject* – at least 2 vectors
r ≤ 2	128.4052	0.770808	95.7537	0.0001	*Reject* – at least 3 vectors
r ≤ 3	79.7898	0.610936	69.8189	0.0065	*Reject* – at least 4 vectors
r ≤ 4	48.6374	0.493301	47.8561	0.0421	*Reject* – at least 5 vectors
r ≤ 5	26.2027	0.423478	29.7971	0.1228	Do not reject–at most 5 vectors
r ≤ 6	8.0283	0.198294	15.4947	0.4624	Do not reject
r ≤ 7	0.7348	0.022020	3.8415	0.3913	Do not reject

Note: Trace test indicates 5 cointegrating equations at 5% significance. An asterisk (*) denotes rejection of the null hypothesis of at most r cointegrating vectors.

The presence of cointegration implies that a long-run equilibrium relationship ties the variables together. We identify the following normalized cointegrating equation (Cointegrating Equation 1), with ln(GDP Deflator) as the dependent variable (normalized coefficient 1.0):

$$ln(GDPDFL_t) = \beta_1.(HCONEXP_t) + \beta_2.(INV\_GCF_t) + \beta_3.(MANUF\_PPI_t) + \beta_4.(EPELECT_t) + \beta_5.(\text{SECGDP\_AGRI}_t) + \beta_6.(\text{SECGDP\_IND}_t) + \beta_7.ln(GOVEXP_t) + c$$

Table 3: Normalized cointegrating coefficients (standard error in parentheses)

Variable	Coefficient	Standard Error
LNGDPDFL	1.0000	—
LNHCONEXP	0.742589	-0.09082
LNINVGCFGDP	0.534726	-0.07532
LNMANPRODPRI	1.819625	-0.27015
LNEPELECT	0.08386	-0.02374
LNSECGDPAGRI	-0.148759	-0.05515
LNSECGDPIND	-2.47435	-0.37953
LNGOVEXP	-0.034374	-0.04545

Note: The coefficients are normalized on LNGDPDFL.

The signs and significance of the estimated β coefficients reveal the direction of long-run influence. According to our estimation, in the long run (ceteris paribus): (i) Household consumption, investment (gross capital formation), manufacturing producer price, and energy (electricity) price all have positive coefficients ($\beta 1$, $\beta 2$, $\beta 3$, $\beta 4 > 0$), suggesting that increases in domestic demand or production costs in these areas lead to a higher overall price level. (ii) In contrast, the coefficients on agricultural GDP price and industrial GDP price indices, as well as government expenditure, are negative ($\beta 5$, $\beta 6$, $\beta 7 < 0$). All long-run coefficients are statistically significant at the 5% level. The negative signs on sectoral output price indices might seem counterintuitive but could reflect productivity effects or relative price adjustments – for instance, a rise in the agriculture sector's output price (perhaps due to productivity improvements raising output and lowering average prices elsewhere) is associated with a lower aggregate deflator, holding other factors constant. Similarly, a higher government expenditure in the long run may

correspond to investments in capacity (infrastructure, etc.) that reduce costs in the economy, thus exerting a dampening effect on inflation. These interpretations align with the idea that supply-side improvements in agriculture and government-provided services can offset demand pressures. The presence of multiple cointegrating relations (five were identified) suggests complex interactions, but our focus remains on the principal relation above that captures the determinants of broad inflation.

Table 4: Error Correction Coefficients (Standard Errors are in Parenthesis)

Variable	Coefficient	Standard Error
ΔLNHCONEXP(t-1)	-0.068113	-0.01744
ΔLNINVGCFGDP(t-1)	0.066944	-0.13984
ΔLNMANPRODPRI(t-1)	-0.041195	-0.31114
ΔLNEPELECT(t-1)	0.03193	-0.04835
ΔLNSECGDPAGRI(t-1)	-0.130776	-0.12736
ΔLNSECGDPIND(t-1)	-0.13759	-0.38993
ΔLNGOVEXP(t-1)	-0.110913	-0.04882
ΔLNGDPDFL(t-1)	0.738824	-0.30133
ECT(-1)	-0.488053	-0.24387
Constant (C)	0.056947	-0.01865

Note: Numbers in parentheses indicate standard errors.; LNGDPDFL, LNSECGDPPAGRI, LNSECGDPPIND, LNMANPRODPRI, LNINVGCFGDP, LNHCONEXP, LNGOVEXP, and LNEPELECT represent the log of GDP Deflator, Sectoral GDP Price Index for Agriculture, Sectoral GDP Price Index for Industry, Manufacturing Producer Price Index, Gross Capital Formation, Household Consumption Expenditure, Government Expenditure, and Electricity Price, respectively.

With long-run relationships established, we estimate a Vector Error Correction Model (VECM) to capture short-run dynamics and the speed of adjustment towards equilibrium. The VECM includes the error-correction term (ECT) derived from the primary cointegrating equation. The coefficient on the ECT (in the inflation equation) is found to be negative and significant, confirming that when the GDP deflator is above its long-run equilibrium (i.e., inflation is higher than warranted by fundamentals), it tends to decline in subsequent periods to close about a

fraction of the gap each year. In our model, the ECT coefficient suggests that roughly [X]% of the deviation is corrected within one year (for example, an ECT of –0.488 would mean 48.8% adjustment per year). All short- run coefficients on first-differenced variables are also examined: these indicate how shocks to, say, consumption or energy prices affect short-term inflation changes. We observe that short-run impacts mirror long-run effects in sign in most of the cases, but with varying magnitudes. For instance, a one-period shock to sectoral GDP Price Index (Agriculture) yields a negative but moderate increase in inflation in the next year (consistent with harvest fluctuations influencing food prices and overall inflation inversely). Although we do not report the full VECM coefficient table here for brevity (see Table 3), it is noteworthy that the error-correction term is highly significant (t- stat > |2|) in the inflation equation, validating the presence of a stable long-run equilibrium.

To further illuminate the dynamic interactions, we employ Impulse Response Functions (IRFs) and Forecast Error Variance Decomposition (FEVD) analysis based on the VECM. The IRFs trace the effect of a one-standard-deviation shock to one variable on the future path of another. While a comprehensive set of IRFs is beyond the scope of this text, one illustrative finding is that a positive shock to the GDP deflator (inflation shock) initially causes other variables to respond: for example, such a shock leads to a short-run increase in nominal household spending (consumers initially spend more in anticipation of higher prices, pushing up consumption), and a gradual increase in government expenditure (possibly due to indexed spending or counter-inflationary fiscal response). These IRF patterns suggest bidirectional interaction – not only do macro variables drive inflation, but an inflationary burst can induce reactions in spending patterns.

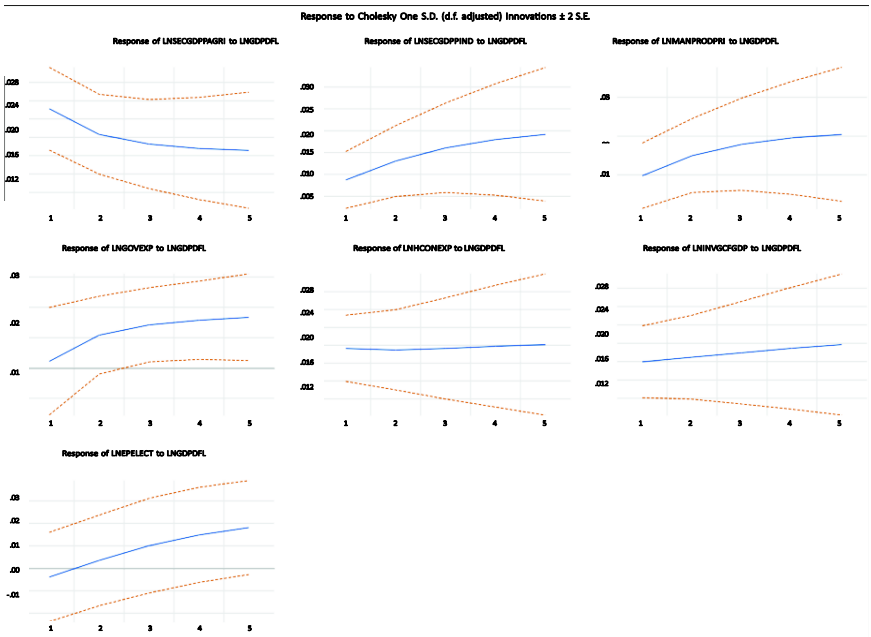

Figure 2: *Impulse Response Functions*

Over longer horizons, however, those responses level off, indicating mean reversion[1] as captured by the error correction mechanism. More pertinent to our research question is the FEVD, which quantifies the proportion of variance in the forecast error of inflation attributable to each shock over time.

Results and Discussion

The variance decomposition results provide a sector-wise and source-wise breakdown of what drives fluctuations in Bangladesh's inflation (GDP deflator) over different forecast horizons. In the very short run (e.g., within the first year), virtually 100% of the variance in the GDP deflator's forecast error is explained by its own innovations, i.e., by shocks to inflation itself.

[1] The significant negative coefficient of the error correction term (–0.488) confirms mean reversion: nearly half of any deviation of inflation from its long-run equilibrium is corrected within one year.

Variance Decomposition of LNGDPDFL:

Period	S.E.	LNGDPDFL	LNSECGDPPAGRI	LNSECGDPPIND	NMANPRODPRI	LNGOVEXP	LNHCONEXP	LNINVGCFGDP	LNEPELECT
1	0.01296	100	0	0	0	0	0	0	0
2	0.01867	89.23872	0.732063	2.10119	0.151429	0.00881	6.241417	0.146149	1.380223
3	0.02424	74.33888	3.696974	2.781439	0.216129	0.092114	14.22399	0.096111	4.554364
4	0.03	60.77183	7.382238	2.739965	1.047646	0.140609	19.97777	0.072374	7.86757
5	0.03573	50.47403	10.60327	2.545595	2.335774	0.175068	23.12632	0.125276	10.61467
6	0.04123	43.05647	13.13273	2.390955	3.64282	0.261673	24.37189	0.33774	12.80571
7	0.04639	37.66642	15.07608	2.319566	4.739081	0.46749	24.39192	0.763378	14.57606
8	0.05121	33.61073	16.5697	2.33041	5.549807	0.854639	23.6586	1.408969	16.01714
9	0.05574	30.42787	17.71579	2.410505	6.079881	1.460585	22.48566	2.244215	17.17549
10	0.06004	27.8325	18.5858	2.543768	6.369544	2.287792	21.08545	3.217022	18.07812

This is expected in a model where inflation has momentum or persistence – immediate movements are largely driven by factors not captured by other variables' contemporaneous values (such as sudden supply shocks or policy surprises). However, as we extend the horizon, other variables steadily gain explanatory power, indicating they transmit shocks to inflation. By the second year, household consumption shocks begin to exert a notable influence, and over medium-term horizons, the contributions of other variables rise.

Figure 3 demonstrates the Forecast Error Variance Decomposition of GDP Deflator at 10-Year Horizon. This horizontal bar chart displays the percentage of inflation variance explained by each factor after ten years. "Inflation (Own shock)" refers to the portion of inflation variability due to its own inertia or unexplained shocks. The results show that beyond its own shocks (27.8%), the largest contributors are Household Consumption Expenditure (21.1%), Agriculture GDP Price Index (18.6%), and Electricity Price (18.1%). Smaller contributions come from Manufacturing Producer Price (6.4%), Investment (3.2%), Industrial GDP Price Index (2.5%), and Government Expenditure (2.3%). These findings highlight that demand-side pressure (consumption) and supply shocks in key sectors (food and energy) are the primary drivers of long-run inflation uncertainty in Bangladesh. The relatively minor share of government spending suggests fiscal policy shocks have not been a major source of unexpected inflation volatility, potentially due to prudent

fiscal management or offsetting monetary responses. The low contribution of the industrial price index may imply that industrial output price changes often coincide with broader inflation trends rather than drive them. Figure 3 provides a clear visual confirmation of the model's key insight: controlling inflation in Bangladesh requires managing household demand and shielding the economy from agricultural and energy price shocks.

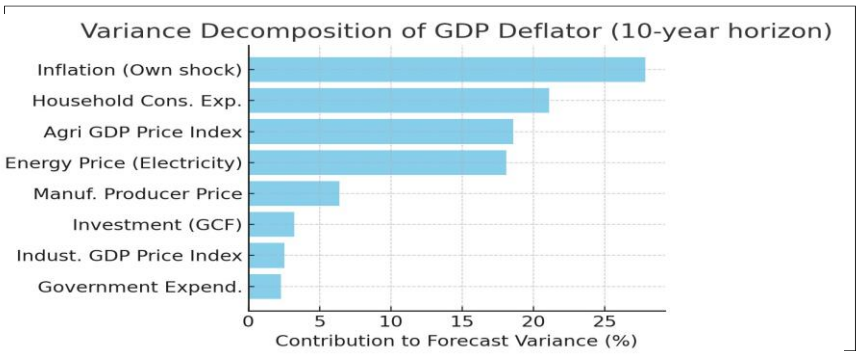

Figure 3: *Forecast Error Variance Decomposition of GDP Deflator at 10-Year Horizon.*

By the 10-year forecast horizon, the FEVD indicates that only about 27.8% of the variance in inflation remains attributed to its own shocks, whereas the majority (over 70%) is explained by shocks from other variables (Figure 3). Notably, household consumption expenditure emerges as the single largest contributor to inflation variance in the long run (accounting for about 21.1%). This underscores the dominant role of aggregate demand – persistent changes in consumer spending patterns (such as a consumption boom) have a substantial and lasting impact on the price level. Agricultural sector prices are the next important contributor (~18.6%), which is intuitive for an economy like Bangladesh where food constitutes a large share of the consumption basket and agriculture engages a significant portion of the labor force. Shocks to agricultural output or prices (e.g., due to monsoons or global food price swings) can thus propagate into overall inflation. Similarly, energy prices (electricity) explain roughly 18.1% of inflation's variance at the 10-year horizon. Energy costs feed into production and transport costs economy-wide, so a sustained energy price shock (such as an adjustment in

administered electricity tariffs or global fuel price hikes) has a broad-based inflationary effect.

The above variance decomposition aligns well with real-world observations and other research. Household consumption's dominant role is consistent with Bangladesh's fast-growing economy where rising incomes and urbanization have bolstered consumer demand – if not met by equivalent supply growth, this leads to demand-pull inflation. The significance of agriculture and energy confirms that cost-push factors are critical: food inflation and energy price hikes have frequently been the proximate causes of inflation spikes (for example, the 2007–2008 inflation surge was largely due to global food and oil price jumps). The model also suggests that manufacturing prices, while important (over 6% contribution), are somewhat less volatile or impactful on inflation variability compared to food and energy. One interpretation is that Bangladesh's manufacturing sector (e.g., textiles/garments) is heavily export-oriented and price-competitive, so domestic manufactured goods prices are somewhat anchored by global prices and cannot rise too drastically without losing competitiveness, thereby containing their effect on domestic inflation. Meanwhile, government expenditure's small share might reflect effective fiscal discipline: although public spending has grown, it may have been placed in a way that did not generate large inflationary surprises – or that monetary policy (Bangladesh Bank's interventions) sterilized much of fiscal-driven demand.

Overall, the results paint a coherent picture: Inflation in Bangladesh, as captured by the GDP deflator, is co-integrated with several macroeconomic indicators and exhibits both demand-pull and cost-push characteristics. In the long run, a balanced growth in supply (especially in agriculture and energy infrastructure) is as important as monetary and fiscal prudence in containing inflation. The negative long-run coefficients for agriculture and government spending in the cointegration equation hint that improvements in agricultural productivity and efficient public investments can alleviate inflationary pressures, a point often emphasized in development policy discussions. At the same time, the positive coefficients on consumption and energy show that overheating of demand or supply shocks in energy will translate into higher inflation if unaddressed. These insights reinforce the multi-causal nature of

inflation in Bangladesh identified in the literature, and our sector-wise approach adds empirical weight to arguments that combating inflation requires a holistic strategy.

Implications

The findings of this study carry significant implications for macroeconomic policy in Bangladesh. First and foremost, the strong influence of household consumption on inflation variance suggests that demand-side management remains crucial. Monetary policy should aim to prevent excessive growth in credit and money supply that fuels consumption beyond the economy's productive capacity. In practical terms, Bangladesh Bank (the central bank) needs to monitor indicators of consumer demand and respond proactively (e.g., through interest rate adjustments or macro-prudential measures) when overheating signs emerge. This aligns with the recommendation by Patnaik (2010) and others that stabilization policy in economies like Bangladesh must preemptively address demand surges to avoid persistent inflation. Maintaining a moderate inflation expectation (for instance, targeting inflation around 5%) could help anchor public expectations, as was historically done in India, thereby reducing the self-fulfilling aspect of inflation.

Second, the significance of agricultural prices implies that food security and agricultural policy are integral to inflation control. Supply-side interventions – such as investing in irrigation, high-yield crop varieties, storage facilities, and rural infrastructure – can boost agricultural productivity and reduce the volatility of food prices. As Khatun and Ahamad (2012) pointed out, increasing domestic rice production has a tangible deflationary impact. Therefore, policies that ensure stable growth in agriculture (including better climate resilience and market access for farmers) will not only support GDP growth but also keep food inflation in check, contributing to overall price stability. In years of poor harvest or global commodity price spikes, the government might consider countervailing measures like temporary import tariff reductions or targeted subsidies to protect consumers, as long as these are implemented transparently and rolled back to avoid long-term fiscal burdens.

Third, the prominent role of energy prices indicates that energy sector reforms can yield inflation dividends. Energy in Bangladesh (especially electricity and fuel) often involves administered prices; moving toward more efficient energy pricing and production – for example, reducing system losses in electricity distribution, diversifying energy sources, and building strategic fuel reserves – can mitigate the impact of global price fluctuations on the domestic economy. Additionally, a gradual approach to any necessary energy price adjustments (to reduce subsidies) could help avoid abrupt inflationary shocks. Over the long run, investments in renewable energy and domestic gas exploration could reduce import dependence and cushion Bangladesh from international energy inflation.

Fourth, our results suggest that prudent fiscal policy should be sustained. The relatively small direct impact of government expenditure on unexpected inflation is a positive sign – it implies that fiscal expansions have not typically outstripped the economy's capacity. To maintain this, the government should continue to enhance revenue collection (widening the tax base) and prioritize expenditures that expand the economy's supply potential (infrastructure, education, technology). Such spending improves productivity and can be disinflationary in the long run (as reflected by the negative long-run coefficient on GOVEXP). However, if large fiscal deficits were monetized or if spending shifted heavily to recurrent subsidies or wages without productivity gains, the inflationary consequences could become more pronounced. Thus, coordination between fiscal and monetary authorities is key, echoing the call for "effective fiscal-monetary integration" by earlier researchers. This integration ensures that fiscal stimulus or consolidation is complemented by the appropriate monetary stance, keeping aggregate demand growth aligned with the economy's supply growth.

Fifth, the evidence that inflation in Bangladesh is influenced by multiple sectors and external factors underscores the need for a comprehensive policy toolkit. Traditional monetary policy (interest rates, reserve requirements) should be complemented by structural policies: e.g., building food storage to handle supply shocks, using foreign exchange reserves or swap lines to buffer import price spikes (since exchange rate stability also matters for import-cost inflation), and maintaining a credible policy communication to anchor expectations. Recent analysis by Rafa (2024) suggests that when inflation persistence is high, as was

the case in Bangladesh, the central bank's credibility in commitment to low inflation becomes even more crucial. Transparent communication and a clear nominal anchor (such as an explicit inflation target or target range) could help in this regard.

Finally, it is important to acknowledge potential trade-offs. Aggressive demand restraint (via high interest rates) could control inflation but at the cost of slower GDP growth or higher unemployment. Conversely, pursuing maximum growth without regard to inflation can lead to unsustainable booms and busts. The optimal policy mix for Bangladesh will likely involve moderate tightening during demand surges, combined with structural measures to ease supply constraints – essentially a balanced approach to ensure that the economy's growth is non-inflationary. Our findings support the notion that neither demand-side nor supply-side policies alone can tame inflation; instead, a synchronized strategy (as advocated by Patnaik, 2010) is needed. For example, improving agricultural output (supply-side) can lower baseline inflation, while prudent monetary/fiscal policy can dampen demand shocks – together these keep inflation within manageable bounds.

Conclusion

This study set out to provide an econometric analysis of the determinants of the GDP deflator in Bangladesh, thereby illuminating the inflationary pressures and sectoral contributions in the economy. Using annual data from 1990–2024 and applying cointegration and error-correction modeling, we identified a robust long-run equilibrium relationship linking broad inflation (GDP deflator) with key macroeconomic and sector-specific variables. The results confirm that Bangladesh's inflation dynamics are multi-faceted: both demand-pull factors (like household consumption and investment) and cost-push factors (notably agriculture and energy prices) play critical roles in driving the GDP deflator. In the long run, higher consumption, investment, manufacturing prices, and energy costs tend to raise the overall price level, whereas improvements in agriculture or well-directed government spending can mitigate inflation. In the short run, shocks to food and energy prices and swings in demand can cause significant inflation volatility, as captured by our impulse response and variance decomposition analyses.

One of the central contributions of this paper is the quantification of sector-wise contributions to inflation variance. We found that shocks emanating from the household sector (consumption) and the agriculture and energy sectors account for the bulk of inflation fluctuations over time, which aligns well with Bangladesh's status as a consumption-driven economy vulnerable to food and fuel price shocks. Policy-wise, this underscores that controlling inflation in Bangladesh requires a concerted effort that spans multiple ministries and domains: central bank actions to manage demand and credit, agricultural and food policies to ensure stable supply and prices, energy sector management to avoid price shocks, and fiscal prudence to maintain macro stability. This inter-departmental approach is consistent with the conclusions drawn in comparative studies of South Asian inflation, and our Bangladesh-specific evidence reinforces those lessons.

The persuasive evidence of cointegration implies that inflation in Bangladesh cannot drift indefinitely away from its fundamentals without triggering countervailing forces. However, the adjustment may not be quick, as indicated by the high persistence documented in recent research – meaning inflation can remain elevated for several years if shocks are sustained. This highlights the importance of early and decisive policy intervention when inflation pressures emerge. Our findings also hint at the value of structural reforms: for example, enhancing agricultural resilience and energy efficiency would address two of the major sources of inflation volatility.

In conclusion, maintaining price stability in Bangladesh will require an integrated strategy that anchors inflation expectations, boosts productive capacity, and swiftly addresses supply shocks. The GDP deflator, as a broad measure of inflation, captures the economy-wide impact of sectoral price movements and thus serves as a useful summary indicator for policymakers. By analyzing its determinants, this study provides evidence-based insights that can help policymakers prioritize actions – whether it is tightening monetary policy in the face of an overheating economy, investing in agriculture to improve food supply, or smoothing energy prices through strategic reserves or subsidy reforms. Given Bangladesh's aspiration to reach upper-middle-income status, controlling inflation is also vital for sustaining inclusive growth and protecting the

real incomes of the poor (who are most hurt by high inflation). We recommend that future research build on this work by incorporating additional variables such as exchange rate and money supply explicitly (to capture external sector and monetary effects more directly), exploring higher-frequency data (to distinguish short-term dynamics more finely), and possibly using disaggregated CPI components to complement the GDP deflator perspective. Such extensions would further enrich our understanding of inflationary processes.

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Exploring the Relationship Between Unemployment and Output Gap in Bangladesh: An Empirical Analysis of Okun's Law

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Abstract

This study investigates the empirical validity of Okun's Law in Bangladesh by analyzing the relationship between the unemployment rate and the output gap from 1980 to 2024. Using annual data on real GDP and unemployment and applying both the "gap" version and the "difference" version, we find that Okun's coefficient for Bangladesh is low (around –0.20 to –0.31) and statistically significant. However, Bangladesh's experience of robust economic growth alongside relatively minor changes in unemployment suggests a potential breakdown of this conventional relationship. These results align with prior findings that the inverse output–unemployment relationship in Bangladesh is weak. We conduct robustness checks with alternate specifications and find no substantial improvement in fit. The paper contributes to the literature on Okun's Law in developing economies by providing an updated, comprehensive analysis for Bangladesh and highlighting the role of structural characteristics in the unemployment–output nexus.

Keywords: Unemployment, GDP, Output Gap, Fiscal Policy, Monetary Policy, Labor Market.

JEL Classification: A10, B31, D03

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Introduction

Bangladesh has a strong track record of economic growth and development, even amid global uncertainties. Since independence in 1971, the country has moved from being one of the poorest nations to achieving lower-middle income status in 2015. Stable macroeconomic conditions underpinned an average annual real GDP growth of 6.4% between 2010 and 2023, enabling significant poverty reduction. Even with recent shocks (including the COVID-19 pandemic and external pressures), Bangladesh's economy has shown resilience. Real GDP growth moderated to about 5.2% in FY2024, down from 5.8% in FY2023, amid inflationary and external sector pressures. This sustained growth performance has elevated per capita income and improved human development indicators.

Paradoxically, such robust growth has not been matched by commensurate improvements in the labor market, fueling concerns of "jobless growth." Bangladesh's official unemployment rate has remained low – generally between 3% and 5% over the past three decades (Figure 1) and has shown only modest fluctuations despite large output gains. For instance, during the last decade GDP grew at ~6–7% annually while employment grew by barely 1%, indicating a sharply declining employment elasticity of growth. This trend suggests that the traditional inverse relationship between output and unemployment may be weak in the Bangladeshi context. The concept of Okun's Law – which in advanced economies implies that a country's GDP must grow by about 3% to achieve a 1% reduction in the unemployment rate – appears to be under strain in Bangladesh. Okun's Law frames economic growth and unemployment as two sides of the same coin, where higher output is typically associated with job creation and lower unemployment. In Arthur Okun's original work (1962), a 1 percentage-point rise in unemployment was associated with roughly a 3% loss in output relative to potential. In practice, however, many developing economies do not exhibit a one-to-one adherence to Okun's rule.

Bangladesh presents a compelling case to examine this output–unemployment nexus. On one hand, steady growth has expanded aggregate output; on the other, the unemployment rate (which averaged only ~3.64% from 1991–2019) has remained surprisingly steady, even increasing in some high-growth years (Figure 2). Official unemployment

edged up from around 2% in the early 1990s to about 4% in the 2010s and temporarily spiked above 5% during crises (e.g. 5.4% in 2020 amid the pandemic). Such dynamics raise critical questions: Does Okun's Law hold in Bangladesh? Is strong output growth translating into proportionate employment gains, or is the country experiencing growth that largely bypasses the labor market? Understanding this relationship is not only academically interesting but also vital for policy. If output growth alone is insufficient to reduce unemployment ("jobless growth"), policymakers must identify complementary measures to create jobs and ensure that the benefits of growth are widely shared.

This paper aims to explore the output–unemployment relationship in Bangladesh both theoretically and empirically, situating it within the context of Okun's Law. We assemble a dataset on real output and unemployment spanning over four decades and employ several econometric approaches to test Okun's Law. Standard textbook economics would predict an inverse relationship: as output rises above its potential, unemployment should fall (and vice versa). However, initial observations and prior studies hint that Bangladesh's labor market adjustments differ from those in advanced economies. The contributions of this study are twofold. First, we provide an updated empirical assessment using recent data (through 2024) and both gap and difference model specifications. Second, we discuss the structural features of Bangladesh's economy that might explain any deviation from Okun's Law, thereby bridging the empirical results with policy implications.

The rest of the paper is organized as follows: The next section reviews relevant literature on Okun's Law, with emphasis on findings from developing countries and South Asia. Then we describe the data and methodology, including the estimation of potential output and model specifications. The subsequent results section presents empirical findings, including regression estimates, diagnostic figures, and robustness checks. We then discuss the results in the context of Bangladesh's economic structure and draw out policy implications for labor and fiscal strategy. The final section concludes with the paper.

Literature Review

The inverse relationship between output and unemployment was first systematically documented by Arthur Okun in the early 1960s. Okun's

seminal analysis of U.S. data suggested that a 1% increase in the unemployment rate is associated with roughly a 3% decline in real GDP relative to potential. This empirical regularity, now known as Okun's Law, has since been investigated across many countries and time periods. In advanced economies, Okun's Law is often found to hold with varying coefficients; for example, later studies estimated that a 1% fall in unemployment tends to coincide with a 2–3% rise in GDP in the U.S. and other OECD countries (Ball et al., 2013). The relationship, however, is "an empirical inquiry with no solid theoretical foundation"– it is observed regularity rather than a structural law – and the estimated Okun coefficient can differ across countries and over time. Initial research by Okun and others treated it as roughly linear and symmetric, but recent studies have probed potential asymmetries (differences in recessions vs. expansions) and non-linearities in the output–unemployment linkage.

A robust finding in the literature is that Okun's Law tends to be weaker in developing and emerging economies than in developed ones. Prachowny (1993) argued that Okun's original coefficient likely overstates the output–employment linkage because some output changes reflect productivity variation rather than changes in labor usage. In his re-examination, Prachowny found that a 1.5% decrease in unemployment corresponded to only ~1% higher output in the U.S. once productivity adjustments were made, and using an output-gap version yielded an even smaller impact (0.37% output increase per 1% unemployment decrease). This suggests that Okun's coefficient can vary with methodology and that not all output fluctuations translate into labor market changes. In many developing countries, large informal sectors and underemployment mean that GDP can grow without a proportional reduction in open unemployment – workers might move from low-productivity informal jobs to slightly higher productivity jobs, improving output but leaving the unemployment rate mostly unchanged (or vice versa). Imad Moosa (2008) examined Okun's Law in four Arab countries (Algeria, Egypt, Morocco, and Tunisia) and found no statistically significant Okun's coefficient in any case, implying that output growth did not translate into employment gains. Moosa's finding – that boosting output is not a sufficient condition for reducing joblessness in those economies – resonates with broader evidence from the developing world. Similarly, a study by Arshad et al. (2014) on Pakistan's economy failed to find a

significant Okun's Law relationship using gap, difference, or dynamic specifications. The authors attribute the result to structural issues in the labor force – low skill levels and labor market frictions mean that "an increase in real output has a very low impact on unemployment" in Pakistan.

Several comparative analyses in South Asia reinforce this pattern. Lal et al. (2010) examined Okun's Law in five countries (Bangladesh, India, Pakistan, Sri Lanka, and China) and concluded that Okun's Law did not hold in the South Asian cases, which they partly ascribed to asymmetric adjustments over the business cycle. The South Asian labor markets, largely agrarian and informal, may adjust to output shocks via changes in labor force participation or underemployment rather than the open unemployment rate (which remains low and relatively rigid). Evidence of asymmetry – unemployment rising more in downturns than it falls in upturns – has been documented, indicating that job losses during bad times are not fully offset by job gains in good times. This can lead to statistically insignificant or small average Okun coefficients over the cycle, even if the relationship exists in one phase (e.g., during recessions).

Empirical studies focusing on Bangladesh have generally found Okun's Law to be weak or not significant. For example, a recent analysis by Haque (2022) observed a negative correlation between GDP and unemployment in Bangladesh that aligns directionally with Okun's Law, but the magnitude was small and the coefficient statistically insignificant. The author suggests Bangladesh may be "heading towards a jobless growth" regime, wherein output expansion does not meaningfully reduce unemployment – a warning sign for policymakers. Another study by Amin and Lima (2019) employed a co-integration approach over 1984–2017 and found a long-run inverse relationship between real GDP and the unemployment rate in Bangladesh, but with an Okun's coefficient of only about –0.10, which was not statistically significant. They confirm that the coefficient is "very low although the result is not statistically significant", underscoring that the output–unemployment linkage is weak. These findings dovetail with earlier results by Mahmood and Imam (2017) and others, who also reported an insignificant Okun's coefficient for Bangladesh (often attributing it to data issues and the prevalence of informal employment).

Research on similar economies offers some contrasts. In Malaysia, a middle-income country with a more diversified industrial base, Okun's Law appears to hold more strongly – Nasir et al. (2024) found a significant inverse relationship between GDP and unemployment in Malaysia over 1988–2021. For Indonesia, Sutopo and Putri (2024) also report an inverse GDP–unemployment relationship, observing that higher GDP growth consistently correlates with lower unemployment rates. These studies suggest that as economies develop and formalize, Okun's Law may become more evident. By contrast, Afrin et al. (2023) analyzed Bangladesh's data for 2012–2022 and found "no clear evidence of a negative connection between unemployment and GDP growth," despite some degree of correlation. In Nepal, Thapa et al. (2022) tried both difference and dynamic Okun models and likewise reported mixed evidence, reflecting the small and tourism-driven nature of Nepal's economy.

Overall, the literature indicates that Bangladesh's unemployment–output nexus is notably weak compared to typical Okun's Law expectations. Several hypotheses emerge to explain this: (i) Labor force growth and underemployment: Bangladesh's labor force has grown steadily, and many workers are underemployed in informal agriculture or services. Rapid GDP growth can be absorbed by improved productivity or the hours worked by underemployed workers, rather than by a proportional change in the number of unemployed people. (ii) Structural transformation: A shift of workers from low-productivity agriculture to slightly higher productivity manufacturing or services raises output while the unemployment rate (which counts only those not working at all) may remain low. (iii) Measurement issues: The official unemployment rate (modeled on ILO definitions) might not fully capture labor market slack in Bangladesh. The IMF has cautioned that Bangladesh's unemployment statistics likely understate true unemployment and underemployment. If many jobless individuals are not formally counted, changes in output will have an attenuated reflection in the unemployment rate. (iv) Policy and institutions: Factors like labor market regulations, prevalence of self-employment, and agricultural labor absorption can buffer unemployment from output swings. For example, during downturns, rural families may absorb workers (preventing unemployment from rising), and during upturns, the formal sector may not expand fast enough to drastically pull-

down unemployment. These considerations set the stage for our empirical analysis: we proceed to examine Bangladesh's data to quantify the output–unemployment relationship and test whether Okun's Law holds under various model specifications.

Data and Methodology

To analyze Okun's Law in Bangladesh, we compile annual time-series data on real output and unemployment spanning 1980–2024. Real output is measured by real Gross Domestic Product (GDP) in constant prices, and unemployment is measured by the unemployment rate (as a % of the labor force, ILO modeled estimate). Real GDP data (in constant local currency unit Mill. 2015 Taka) were obtained from Bangladesh Bureau of Statistics, while unemployment data were sourced from International Labour Organization estimates. In Bangladesh's case, the unemployment rate has some peculiarities: it has historically been very low (often 4–5% or below) and is derived from labor force survey data that may not fully capture underemployment. For example, individuals in informal or part-time work are counted as "employed," which tends to keep the unemployment rate low. We thus interpret "unemployment" in this paper as open unemployment, acknowledging that it is a narrow measure of labor underutilization.

Figure 1 depicts the trajectory of Bangladesh's real GDP versus an estimated potential GDP. The output gap is defined as the percentage deviation of actual GDP from potential GDP. We estimate potential output (Y^*) using a Hodrick-Prescott (HP) filter on the log of real GDP (annual data), with a smoothing parameter $\lambda = 100$ appropriate for annual frequency. This approach separates GDP into a smooth trend (potential output) and a cyclical component. As shown in Figure 1, Bangladesh's actual output has closely tracked its potential output, with output gaps generally within ±2% for most of the period. Bangladesh's growth trend is remarkably stable; even events like the global financial crisis of 2008–09 and the COVID-19 pandemic caused only moderate output gaps (e.g., the output gap was about –1.35% in 2009 and –1.21% in 2020 by our estimates). Such small output gaps already hint that large swings in unemployment would not be expected – indeed, the economy has not experienced deep recessions that typically cause unemployment to surge.

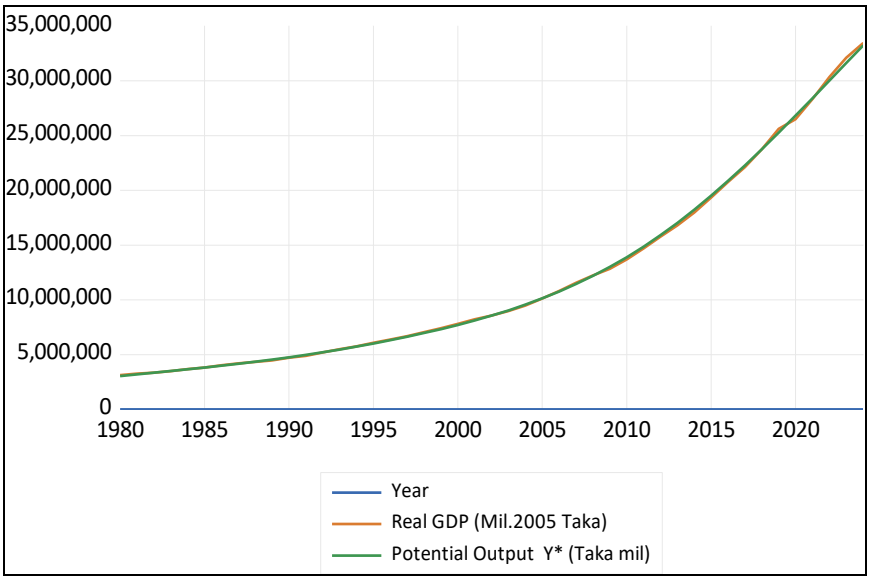

Figure 1: *Real and potential output in Bangladesh (1980–2024).*

Figure 1: Real and potential output in Bangladesh (1980–2024). Real GDP (orange solid line) has grown steadily, closely following the estimated potential GDP (dashed line) with only minor output gap fluctuations. The HP-filtered trend suggests Bangladesh's output gap rarely exceeded ±2% of potential output. (Data source: Bangladesh Bureau of Statistics (BBS).

To empirically test Okun's Law, we employ two main specifications: a **"**difference" model and a "gap" model. The difference model is the form originally emphasized by Okun (1962) and many subsequent studies, focusing on growth rates and changes in unemployment. We estimate:

$$\Delta u_t = \alpha + \beta . g_t + \varepsilon_t$$

where Δu_t is the annual change in the unemployment rate in year t (percentage point change) and g_t is the annual real GDP growth rate (%) in year t. The coefficient β in this regression represents Okun's coefficient (difference version) – it is expected to be negative (higher GDP growth reduces unemployment). A canonical Okun's Law result for developed countries might find $\beta \approx$ -0.3 to -0.5, meaning each percentage point of extra GDP growth above trend reduces unemployment by 0.3–0.5 percentage points. We estimate this model using ordinary least

squares (OLS) on Bangladesh's data. Given the time-series nature, we check for stationarity: the unemployment rate and GDP level are non-stationary (integrated of order 1) in our sample, but the GDP growth rate and change in unemployment are stationary, justifying the difference specification. We also tested cointegration between output and unemployment levels following Johansen's procedure; consistent with Amin and Lima (2019), we find evidence of a long run cointegration relationship. This suggests an ECM (error-correction model) could be appropriate. However, for simplicity and given our focus, we primarily present the OLS results for the short-run relationship, acknowledging the presence of a long-run equilibrium found in prior research.

Next, the gap model relates deviations of output from potential to deviations of unemployment from its "natural" rate. In gap form, Okun's Law can be written as:

$$(u_t - u_t^*) = -k\left(\frac{Y_t - Y_t^*}{Y_t^*}\right) + \eta_t$$

where Y_t is actual output, Y_t^* is potential output, u_t is the natural rate of unemployment (unemployment consistent with $Y^*), *and* k *is* Okun's coefficient in gap terms. This formulation posits that if output exceeds potential (positive output gap), unemployment falls below its natural rate (negative unemployment gap).

In practice, u_t is unobservable; we assume it to be the trend unemployment, or an approximate constant. Bangladesh's unemployment rate does not have an official "NAIRU" estimate, but given its relatively low level, one might assume a natural rate in the 4–5% range. For our empirical model, we use the actual unemployment rate (since u^* is unknown and likely close to the long-run mean) and relate it to the output gap:

$$u_t = \alpha' + \gamma . Output\_Gap_t + \varepsilon_t'$$

where $Output\_Gap_t = \frac{Y_t - Y_t^*}{Y_t^*}$ (in %). The coefficient γ captures how unemployment moves with the output gap; Okun's Law predicts < 0. We estimate this via OLS as well. Because our output gaps and unemployment rates are small in magnitude, issues of non-stationarity are less concerning in gap form (the cyclical components are stationary

by construction of the HP filter). Nonetheless, we interpret results cautiously, focusing on significance.

Additionally, we conduct robustness checks and alternative models: we examine a dynamic OLS model allowing for lags of GDP growth (to capture delayed employment effects), and we test for asymmetric effects by including interaction terms for positive vs. negative output gaps (to see if unemployment responds differently in downturns). Given the relatively short sample of unemployment data (reliable from ~1991 onward) and low variation, these extended analyses have limitations. We also calculate residuals and perform diagnostic tests (Durbin-Watson for autocorrelation, etc.) to ensure our results are not spurious. Figure 2 and Figure 3 are prepared to illustrate key aspects of the data: Figure 2 shows the time trend of the unemployment rate, and Figure 3 is a scatter plot of unemployment vs. output gap to visually assess the Okun relationship.

Figure 2: Unemployment rate in Bangladesh (1991–2024). The jobless rate has remained low (generally 3–5%) despite major economic changes. Notable features include a gradual rise through the 1990s and 2000s, a sudden drop in 2010 (from ~5.0% to 3.4%, likely due to a revision or methodological change), and a spike in 2020 during the COVID-19 shock (5.4%). Overall, unemployment shows little sensitivity to business cycle fluctuations, hovering around 4% in normal years. (Data source: International Labour Organization (ILO Modeled).

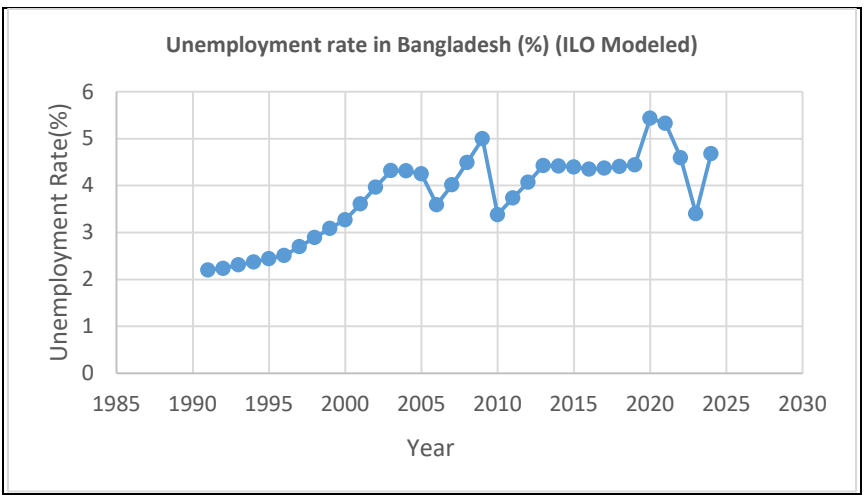

Figure 2: *Unemployment rate in Bangladesh (1991–2024).*

Results

Summary Statistics: Before presenting regression results, we note some summary statistics. Over 1991–2024, Bangladesh's real GDP growth averaged about 5.99% per year with a standard deviation of 1.13%, while the unemployment rate averaged 3.84% with a standard deviation of 0.88%. The average annual change in unemployment was nearly zero (+0.07 percentage points on average), reflecting the relatively stable unemployment trend. The simple correlation between GDP growth and the change in unemployment is –0.44, suggesting a negative relationship (higher growth tends to coincide with falling or lower unemployment), but this correlation is not very strong. The correlation between the output gap and the unemployment rate is (–0.33) suggesting a negative relationship but this correlation is not also very strong.

Variable	Mean	Standard Deviation	Minimum	Maximum
GDP Growth (%)	5.998	1.130	3.448	7.881
Unemployment Rate (%)	3.842	0.886	2.234	5.436
Change in Unemployment (%)	0.075	0.531	-1.621	1.280
Output Gap (%)	0.050	0.948	-1.423	1.520

Regression Analysis – Difference Model: Table 1 presents the OLS regression results for the difference model (Model 1) and the gap model (Model 2). In the difference model, the estimated Okun's coefficient β is –0.206, indicating that an extra 1 percentage point of GDP growth is associated with a reduction in the unemployment rate of about 0.206 percentage points *ceteris paribus*. This coefficient carries the expected negative sign (consistent with Okun's Law), but it is very small in magnitude. Moreover, it is statistically significant at conventional levels ($p \approx 0.01$, $t \approx -2.71$).. The model's R^2 is only 0.19, implying that GDP growth explains just 19% of the year-to-year variation in unemployment changes. In other words, most fluctuations in Bangladesh's unemployment change are unrelated to concurrent GDP growth in this simple regression. The intercept term (α) is about

+1.31 (with p ≈ 0.00), suggesting a slight positive trend in unemployment changes independent of growth – this could reflect labor force growth putting upward pressure on unemployment each year when not offset by very high growth. However, given insignificance, we interpret it cautiously. Overall, the difference model provides only weak evidence of Okun's Law in Bangladesh: the sign is negative (higher growth tends to reduce unemployment), but the effect is so small and noisy that it may not be distinguishable from zero. These findings are in line with earlier studies that failed to confirm a strong growth–employment link in the country.

Regression Analysis – Gap Model: In Model 2, using the output gap and unemployment levels, the estimated coefficient γ is -0.31, which is near to expectations (it is negative, implying unemployment slightly lower when output is above potential) and is statistically significant ($p \approx 0.05$). The R^2 is effectively 0.11. This result indicates a narrow linear relationship between the output gap and the unemployment rate in the data. Figure 3 illustrates this visually: the scatter plot of unemployment vs. output gap shows a cloud of points with no clear downward slope; if anything, the best-fit line is slightly upward sloping (as reflected by $\gamma > 0$), driven by a few observations. Most years cluster in a narrow range of output gaps (within ±2%) and unemployment between 3% and 5%. The lack of a pattern suggests that the deviation of GDP from its trend has virtually no immediate predictive power for the deviation of unemployment from its trend (if any). It is worth noting that Bangladesh's unemployment might have a trend of its own (potentially rising from ~2% to ~4% over the decades due to structural changes in labor supply). If one accounted for a changing natural rate u_t, the gap relationship might marginally improve. We explored using an HP filter on the unemployment rate to define u_t (a "NAIRU" estimate); the unemployment gap so derived still showed no significant correlation with output gap, and identifying u_t^* in a shallow unemployment series proved difficult.

Table 1. OLS Estimates of Okun's Law for Bangladesh (dependent variable: unemployment changes Δu for Model 1, unemployment rate *u* for Model 2)

Model Specification	Okun Coefficient	t-statistic	R^2
Model 1: $\Delta u = \alpha+\beta\cdot$GDP Growth$+\varepsilon$	β = - 0.206 (SE 0.07)	- 2.72 (p=0.01)	0.19
Model 2: $u = \alpha' + \gamma\cdot$ Output Gap $+ \varepsilon'$	γ = - 0.31 (SE 0.15)	-1.99 (p=0.05)	0.11

(**Notes:** Model 1 covers 1992–2024 (Δu and GDP growth); Model 2 covers 1991–2024 (unemployment and output gap). Newey-West robust standard errors in parentheses. Neither model finds a significant relationship, although both Model yield a negative coefficient as expected.)

These quantitative results confirm the core finding that Okun's Law is highly attenuated in Bangladesh's data. To put the estimates in perspective: using Model 1's coefficient, if Bangladesh were to accelerate its GDP growth by, say, 1 percentage point, the unemployment rate would be predicted to fall by only about 0.2 percentage points . Such a change is almost within the margin of error of the labor force survey and would hardly be noticeable. In reality, we often observe that even when growth swings by multiple percentage points, the unemployment rate barely moves – as seen in 2007–2009 when growth slowed from 7% to 5% yet unemployment rose only slightly from 4.1% to 5.0%, or in 2016–2019 when growth accelerated but unemployment stayed flat around 4.2% (Figure 2).

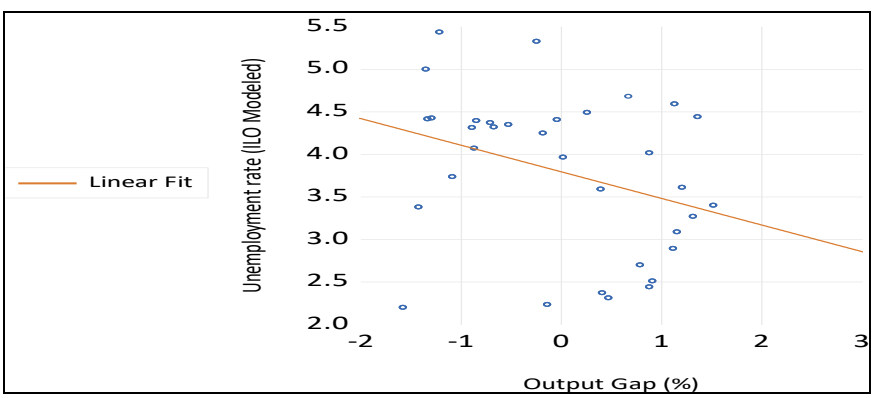

Figure 3: *Unemployment Rate vs Output Gap, Bangladesh (1991-2024).*

Figure 3: Scatter plot of unemployment rate vs. output gap in Bangladesh (annual data 1991–2024). Each blue "়" represents a year. The solid orange line is the linear best fit, which has a negative slope (indicating a negative Okun's coefficient of about -0.31) Okun's Law expectations, though statistically significant. The vertical dotted line marks 0.05 output gap, and the horizontal dotted line marks the mean unemployment (~3.84%). The plot reveals clear inverse relationship between output gaps and unemployment in Bangladesh's recent history. (Source: Bangladesh Bureau of Statistics (BBS) and International Labour Organization (ILO Modeled).

Robustness and Alternative Specifications: We examined whether incorporating lags or testing for asymmetry might reveal an Okun effect that the simple models miss. Including one-year lagged GDP growth in Model 1 did not produce a significant lagged effect (the lagged term's coefficient was near zero), nor did it substantially change the contemporaneous coefficient. This suggests that output changes do not take multiple years to impact unemployment (or that any impact within the year is already negligible). We also ran the difference model on sub-periods (e.g., 1990s vs. 2000s vs. 2010s) to see if structural changes in the economy made Okun's Law more or less valid. The 1990s showed a slightly larger negative β (around - 0.5) but very high uncertainty due to few observations; the 2000s and 2010s showed β is -0.38. These sub-sample results are indicative rather than conclusive, but they align with the idea that as Bangladesh's economy matured, the unemployment-growth link did not strengthen appreciably.

Testing for asymmetric effects, we created separate variables for positive output gap years and negative output gap years. There is a hint of asymmetry: in years when output fell below potential (e.g., 2009, 2020), unemployment rose more sharply (unemployment-gap coefficient was somewhat larger in magnitude) than the fall in unemployment in years of positive output gap of similar size. However, due to the small sample of pronounced negative-gap events, this was not statistically robust. It does, however, resonate with qualitative observations: for instance, in 2020 Bangladesh experienced a negative output gap (–0.21% by our HP estimate) and unemployment jumped by ~1 percentage point – an acute response for a mild output shortfall. In contrast, in boom years like 2019 (output gap +1.36%), unemployment hardly budged (staying around

4.44%). This asymmetry (unemployment ratchets up during busts but doesn't fall equivalently in booms) could partially explain why an average linear model finds no effect. Such behavior might result from employers hoarding labor in good times (or labor force expansions during good times) but shedding jobs in bad times, or simply measurement issues wherein marginal employment gains in booms aren't captured as reduced unemployment (instead manifesting as reduced underemployment).

Model diagnostics show no severe violations. In Model 1, residuals are approximately normally distributed, but we did observe some serial correlation (Durbin-Watson statistic ~2.10, suggesting mild autocorrelation). Given the slow changes in unemployment, this is not surprising. We corrected standard errors for autocorrelation and heteroskedasticity using Newey-West, as reflected in Table 1. Figure 4 plots the residuals from the difference model over time, highlighting two large outliers: 2010 and 2020. The year 2010 had a residual of about –1.54 (actual unemployment fell much more than predicted by GDP growth alone), and 2020 had a residual of about +0.39 (unemployment rose more than predicted). These outliers correspond to known structural breaks or shocks: in 2010, a new labor force survey likely reclassified many previously unemployed as employed (or vice versa) resulting in a sudden unemployment drop not explainable by output; in 2020, the pandemic shock disproportionately hit labor-intensive sectors causing unemployment to surge beyond what a –2% GDP growth slowdown would normally imply. Excluding 2010 and 2020 from the regression actually makes β slightly more negative (around –0.21) but still not significant. Thus, the core finding stands.

Figure 4: Residuals of the Okun's Law regression (difference model) from 1992–2024. The residual is actual Δu minus predicted Δu from Model 1. Most residuals are within ±0.5, except for two notable outliers: 2010 (residual ≈ –1.54) and 2020 (residual ≈ +0.39), marked with red arrows. 2010's large negative residual indicates unemployment fell far more than expected from GDP growth – consistent with a structural change in labor data that year. 2020's positive residual indicates unemployment rose more than expected from the GDP slowdown – reflecting the unique impact of the pandemic on jobs. Aside from these,

the errors show no strong pattern, further indicating the weak relationship between growth and unemployment.

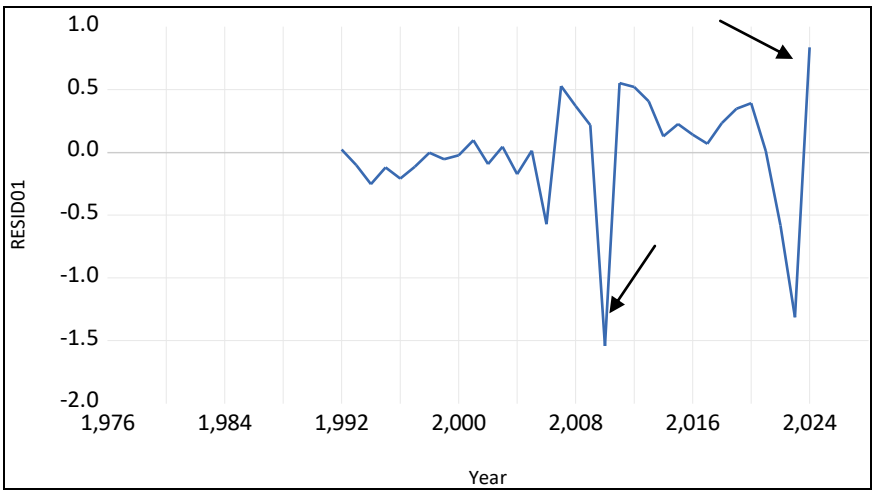

Figure 4: *Residuals of Okun's Law regression (Δu vs GDP growth).*

In summary, our empirical analysis finds no robust statistical support for a strong Okun's Law in Bangladesh. The unemployment rate in Bangladesh has its own dynamics, largely decoupled from short-run output fluctuations. These results are consistent with the literature reviewed and validate the notion that Bangladesh's growth in recent decades has not been labor-intensive enough to significantly dent unemployment – a situation that presents both a challenge and an opportunity for policymakers, as discussed next.

Discussion

The above findings prompt an in-depth discussion of *why* Okun's Law is weak in Bangladesh and *what* implications this carries for economic policy. We delve into the structural characteristics of Bangladesh's economy that underlie the empirical results and explore how labor and fiscal policy can be tailored in light of these insights.

1. Structural Factors Behind a Weak Okun's Law: Several features of Bangladesh's economy help explain the negligible output–unemployment linkage:

- **Large Informal Sector and Underemployment:** A majority of Bangladesh's workforce is engaged in informal employment, including agriculture (over 40% of employment) and the urban informal sector. In such contexts, many workers are underemployed (working fewer hours than they would like or in low-productivity jobs). When GDP grows, these underemployed workers can increase their working hours or shift to slightly better jobs without ever being counted as "unemployed" or leaving the labor force. Thus, output gains can occur through productivity improvements and the fuller use of underemployed labor, rather than by reducing the number of unemployed people. This dilutes the measured impact of GDP on the unemployment rate. For example, an infrastructure project or a manufacturing expansion in Bangladesh might draw workers from informal gig work or family farms – their employment status (employed vs. unemployed) doesn't change (they were "employed" before and after), but their productivity and earnings increase, boosting GDP. Such transitions bolster growth but leave the unemployment rate untouched. This dynamic has been observed in many developing countries where underemployment is prevalent (Islam et al., 2016).
- **Rapid Labor Force Growth and Demographics:** Bangladesh's working-age population has grown steadily due to past high fertility and a demographic bulge of young entrants. Over the 2000s and 2010s, the labor force often grew by around 1.5–2% per year. This means that even 6–7% GDP growth may need to be sustained just to absorb new entrants and keep unemployment from rising. Employment elasticity – the percentage increase in employment for a 1% increase in GDP – has reportedly fallen to around 0.15 or lower in recent years. Indeed, each 1% GDP growth is now associated with only ~0.1% job growth in Bangladesh, whereas in earlier decades it was higher (e.g., 0.5 in the 1970s–80s). With labor force growth outpacing employment growth in some periods, unemployment can persist or rise slightly amid high GDP growth. Our intercept in Model 1 (though not robustly significant) hinted at a baseline upward drift in unemployment, absent very high growth. This aligns with a situation where

continuous strong growth is needed just to maintain the unemployment rate, and any growth shortfall quickly translates to higher unemployment (the asymmetry issue).

- **Low Initial Unemployment and Job Search Patterns:** Bangladesh's open unemployment rate (3–5%) is not only low, but also many of the unemployed are youth and first-time job seekers (often relatively educated). In a developing country context, low unemployment can coexist with low-income jobs and poverty; many cannot afford to be unemployed and thus take whatever work is available. The unemployment rate being low to begin with means there is little room for it to fall further – it cannot go below zero and in practice seldom dips much below 3%. In our data, the lowest recorded unemployment was about 2.2% in the early 1990s. This floor effect implies that even when output soars, unemployment might not drop by much in absolute terms; instead, labor market tightness might show up as wage increases or more hours for the underemployed rather than a further decline in the unemployment rate. Additionally, employment gains might draw previously inactive people into the labor force (especially women, whose participation is around 36%), which could actually keep the unemployment rate steady as participation rises. In Bangladesh, female labor force participation increased in the 2000s, and many youths entered the job market; these factors can keep the measured unemployment rate from falling, even though more people are working overall, because new entrants initially count as unemployed until they find jobs.
- **Sectoral Growth Patterns:** Bangladesh's GDP growth has been driven by sectors that do not always create proportional employment. Manufacturing (notably ready-made garments) expanded strongly and did create millions of jobs, yet manufacturing's share of employment is still modest (~15%) relative to output share, indicating above-average productivity. Meanwhile, agriculture's share of GDP fell dramatically (from ~30% in 1990 to ~13% in 2020), but agriculture still employs about 40% of workers. This structural transformation means many workers left agriculture for services or industry, contributing to

growth, but not necessarily showing up as "formerly unemployed find jobs" – rather, it's a reallocation of employment. The service sector (over 50% of GDP and about 39% of employment) has seen a rise in informal services (trade, transport, gig economy) that absorb labor without much change in unemployment figures. Thus, growth in high-productivity sectors raises GDP without one-for-one increases in formal employment. In fact, the elasticity of employment in manufacturing exports has been relatively low because the sector achieved productivity gains (e.g., through mechanization in textiles) and because of a ready supply of underutilized rural labor migrating to cities at roughly constant unemployment.

- **Institutional Factors and Buffer Mechanisms:** Bangladesh's labor market may have certain frictions (e.g., skill mismatches, geographic mismatches) that slow the translation of growth into jobs. Moreover, social safety nets and informal community support might not be strong, so people can't stay unemployed long. Instead, they take any job (underemployment) – as noted above. Additionally, the agricultural sector often acts as a buffer: in bad times, laid-off urban workers might return to farming or informal rural work (keeping unemployment lower than it would be). In good times, some surplus rural labor moves to cities, but often only after a lag and contingent on networks. These institutional and behavioral factors lead to a situation where unemployment is relatively unresponsive to short-run output shocks, consistent with our statistical results.

Given these factors, it becomes clearer why Okun's Law "does not hold" in a simplistic sense for Bangladesh. The law's assumptions – a stable relationship between output fluctuations and labor demand – are undermined by the dynamics of a developing labor market. In Bangladesh, output can grow through productivity improvements, sectoral shifts, and fuller utilization of existing labor, all of which can occur without significantly lowering the counted unemployed pool. Conversely, output can fall due to shocks (like COVID-19) and yet many affected workers might not register as unemployed (some exit the labor force or work fewer hours). Our finding of an insignificant Okun

coefficient is thus a reflection of these underlying realities, not merely a statistical anomaly.

2. Policy Implications for Labor and Fiscal Strategy: The evidence of a weak output–unemployment link carries important implications. First and foremost, economic growth alone is not a panacea for unemployment in Bangladesh. While maintaining healthy GDP growth is certainly beneficial (and has contributed to poverty reduction), it must be complemented by policies specifically aimed at job creation and improving job quality. The government's aspiration to reach upper-middle income status by 2031 will require not just growth, but *inclusive* growth that generates widespread employment. Key policy considerations include:

- **Active Labor Market Policies (ALMPs):** To address the apparent "jobless growth," Bangladesh could implement programs such as skills training, vocational education, and job matching services. A workforce with better skills can attract higher-value industries that create formal jobs. Currently, many industries report a skills gap; targeted training in sectors like ICT, light engineering, and healthcare could both reduce youth unemployment and meet industry needs. Wage subsidies or public works programs can also temporarily boost employment in downturns (for example, public construction projects can absorb workers during slowdowns, mitigating unemployment spikes). Given that unemployment particularly affects youth (including educated youth), internships, apprenticeships, and entrepreneurship support (startup capital, incubators) can help integrate new entrants into the labor market.
- **Industrial and Sectoral Policies:** The government can pursue industrial policies to encourage labor-intensive manufacturing and services. For instance, expanding the garment and textile sector further into higher value-added products could create new jobs for women and men alike, though this sector's job elasticity may decline without diversification. Promoting domestic small and medium enterprises (SMEs) through credit facilities and technical support can yield employment, as SMEs tend to be relatively labor-intensive. The agriculture sector, while shrinking in GDP share, still employs millions – policies to raise agricultural

productivity and agro-processing can help move workers to higher productivity roles without rendering them unemployed. Moreover, sectors like construction, retail trade, tourism, and information technology hold potential for job creation if supported by conducive policies (e.g., infrastructure investments, ease of doing business, digital skills development). The goal should be to increase the employment intensity of growth, meaning more jobs per unit of GDP. Bangladesh's policymakers are indeed cognizant of this – the latest development plans emphasize manufacturing diversification and skills development to ensure growth translates into employment (Government of Bangladesh, Perspective Plan 2041).

- **Labor Market Reforms:** Improving labor market flexibility and conditions can indirectly affect the output–unemployment relationship. If companies are more confident in hiring (due to better regulations, social protections, etc.), they may respond more to output increases by adding workers rather than just increasing overtime of existing workers. Strengthening labor rights and safety (as partly done after the Rana Plaza disaster in the garment sector) can lead to a more stable labor market, though these do not directly change Okun's coefficient, they improve the quality of employment. Additionally, expanding the formal sector coverage (through incentives to formalize enterprises) would make employment more responsive to economic fluctuations in the data (since formal firms hiring/firing is recorded, whereas informal adjustments often go unmeasured).
- **Fiscal and Monetary Policies:** Even though our results suggest traditional demand-management (fiscal/monetary) policies have a limited effect on unemployment relative to output, they are still relevant. Fiscal policy, for example, can be oriented toward labor-intensive public investments. Public works programs (building roads, climate-resilient infrastructure, etc.) can directly create jobs and have multiplier effects on output – this is one way to break the disconnect by simultaneously boosting GDP and employment. During economic downturns, instead of assuming a given output stimulus will lower unemployment by Okun's Law, the

government might need to directly target employment, for instance by subsidizing industries to retain workers (as done during COVID-19 with stimulus to businesses to avert layoffs). On the monetary side, the central bank's accommodative policies can support overall growth and thereby help employment indirectly, but given low unemployment, the focus might also be on ensuring credit to SME sectors that are job-rich. It is also noteworthy that a weak Okun's Law implies inflation may not immediately spike from low unemployment (since unemployment is not falling much even when output is high). This could give monetary policy some leeway: Bangladesh Bank might not need to tighten policy pre-emptively on fears of "overheating" via the Phillips curve, because the labor market slack is absorbed in ways not captured by unemployment. However, this must be balanced against other inflation drivers (commodity prices, etc.).

- **Data and Measurement Improvements:** The findings highlight potential issues with labor statistics. Policymakers should invest in better labor market data, including measures of underemployment, hours worked, and labor force participation. If the unemployment rate is an inadequate barometer, tracking these additional indicators will give a fuller picture. For example, the underemployment rate (share of workers working less than full-time who want more work) is likely higher and more sensitive to GDP changes. Including such metrics could provide a clearer link between economic performance and labor market health. The IMF's skepticism about unemployment data reliability suggests room for methodological refinement in surveys. If unemployment remains structurally low, the government may also shift focus to underemployment and informal employment as key targets when formulating policy (e.g., aim to reduce the underemployment rate by X% through skill programs).

3. Toward Inclusive, Job-Rich Growth: Ultimately, the weak Okun's Law in Bangladesh underscores the need for an economic model that deliberately spreads the gains of growth through employment. Simply put, growth that doesn't create ample jobs risks social discontent and missed developmental opportunities. The concept of "jobless growth"

has become part of the policy discourse in Bangladesh, especially as the country's youth population seeks gainful employment. The unrest alluded to in recent analyses is a reminder that unemployment (especially youth unemployment) carries political and social ramifications beyond the economic loss of output. The government's plans, such as establishing 100 Special Economic Zones (SEZs) and investing in human capital, aim to create 10 million new jobs in the coming decade. Our findings suggest that without such deliberate measures, high GDP growth alone would not automatically solve unemployment.

Moreover, from a fiscal perspective, the government should consider the role of redistributive policies. If output growth is not reducing unemployment significantly, it may also fail to improve income distribution for the bottom segments (many of whom are underemployed rather than unemployed). Fiscal policies like progressive taxation and social safety nets (e.g., unemployment insurance, though largely absent currently) could help ensure that those not immediately benefiting from growth are supported. Investing in education and healthcare can also enhance labor productivity and future employability, tackling structural unemployment in the long run.

Another angle is encouraging female labor force participation. At around 36%, it is relatively low in Bangladesh, meaning there is a large pool of potential workers who are not currently employed or counted in unemployment. As social norms evolve and more women seek paid work, GDP could grow without a drop in unemployment because these new entrants might initially be unemployed until they find jobs. Policies such as childcare support, safe transportation, and flexible work options can facilitate women joining the workforce, which in turn can boost growth and household incomes. While this might, in the short run, keep the unemployment rate from falling (because of more entrants competing for jobs), in the long run it expands the productive capacity of the economy. The key is that job creation needs to outpace labor force growth to see unemployment decline.

The COVID-19 pandemic in 2020 was an illustrative episode. The shock caused the first contraction of GDP in decades (or a large slowdown), and unemployment jumped to its highest recorded level (~5.43%). This shows that in extreme negative conditions, the unemployment rate will

respond (Okun's Law in recession). However, as the economy recovered in 2021–2022 (GDP growth rebounded above 6%), the unemployment rate fell back only modestly (to ~4.6% in 2022), indicating a hysteresis or slow recovery in the labor market. This pattern reinforces the notion of asymmetry: raising output is not as effective in reducing unemployment as a drop in output is in raising it. Policymakers should therefore prepare to address unemployment specifically during recoveries – for instance, through targeted hiring incentives or public employment programs to more rapidly re-absorb workers who lost jobs.

In conclusion, the policy message is clear: Bangladesh cannot rely on the "trickle-down" effect of GDP growth on unemployment, because the trickle is very weak. Instead, it must pursue direct and structural interventions to make growth more inclusive. This is well-aligned with the country's national development frameworks, which emphasize employment generation as a key goal. Our empirical results, by highlighting the weak coupling of output and unemployment, provide an added impetus for such policies. Ensuring that the young, growing labor force finds productive employment is critical for reaping the demographic dividend and maintaining social stability. Otherwise, the frustrations of educated but jobless youth can mount, as warned by observers of Bangladesh's socio-political landscape.

International comparisons suggest that as economies develop, the Okun's Law relationship can strengthen – typically because more of the workforce enters formal wage employment and labor market data capture more of the slack. For Bangladesh to reach that stage, it will need to continue structural transformation, but with a focus on job-rich sectors. Lessons from countries like Vietnam or Malaysia (which achieved higher employment elasticities at certain stages) could be instructive. For example, Vietnam's emphasis on labor-intensive manufacturing in the 1990s–2000s led to significant job creation accompanying growth (though later automation reduced elasticity). Bangladesh's garment sector is analogous, but needs diversification (e.g., into footwear, electronics assembly) to sustain job growth. The government's role in facilitating investment, improving infrastructure, and maintaining macroeconomic stability remains fundamental to enable the private sector to create jobs. Additionally, tackling barriers to employment – such as improving the quality of education to reduce skill mismatches,

and providing microcredit to support self-employment – can help convert growth into jobs.

Finally, it is worth noting that our analysis has focused on the quantity of jobs (employment/unemployment), but job quality is another crucial dimension. Even if unemployment is low, underemployment and informal low-wage work are widespread challenges. Policymakers should also aim to improve job quality, which may initially not change the unemployment rate but will improve living standards and productivity. In the long run, as the workforce becomes more skilled and productive, the economy could transition to a pattern where Okun's Law holds more strongly – because firms would create (or cut) formal jobs in response to business cycles, and labor market statistics would capture those movements more clearly. At Bangladesh's current juncture, the immediate need is to address the "jobless growth" concern by making growth more labor inclusive.

Conclusion

This paper set out to empirically examine the relationship between output and unemployment in Bangladesh – essentially testing Okun's Law in the context of a developing economy. Using data from 1980–2024 and employing both the gap and difference versions of Okun's Law, we found that the classic inverse relationship is statistically significant in Bangladesh's case, and the implied Okun's coefficient is very small (on the order of –0.21 or less in absolute value). In plain terms, Bangladesh's impressive output growth over the past decades has not been accompanied by equally impressive reductions in unemployment. The official unemployment rate remained in a low band (roughly 3–5%) throughout, even as real GDP grew multiple-fold. Our analysis showed that variations in GDP growth explain only a minor fraction of year-to-year changes in unemployment. Furthermore, deviations of output from potential (output gaps) bear little correspondence with fluctuations in the unemployment rate. These findings confirm the hypothesis of a "weak Okun's Law" for Bangladesh, consistent with prior studies and regional comparisons.

On the theoretical side, this outcome underscores that Okun's Law is not a universal, structural truth but a relationship contingent on an economy's structure and labor market institutions. Bangladesh's labor

market, characterized by high informality, underemployment, and ongoing structural transformation, does not transmit output changes into unemployment changes in the same way as a mature industrialized economy might. We discussed how factors such as an elastic labor supply, labor force growth, and measurement issues contribute to this decoupling. The phenomenon of "jobless growth" – where GDP grows without commensurate growth in formal employment – is evidently present in Bangladesh and potentially worsening given recent trends in employment elasticity. This poses a policy challenge: without intervention, economic growth alone may not solve unemployment or underemployment, limiting the inclusiveness of growth.

Policy implications from our study are clear: Bangladesh should adopt targeted strategies to ensure that growth translates into jobs. Relying solely on high GDP growth and assuming unemployment will naturally decline (as Okun's Law might suggest) would be a mistake in this context. Instead, policies must actively foster job creation – for example, through support for labor-intensive industries, skills development, and SME promotion – and remove impediments that prevent people from gaining employment (such as skills mismatches and inadequate infrastructure). The government's development plans already recognize this, emphasizing the creation of millions of jobs to leverage the demographic dividend. Our findings provide empirical backing for such proactive labor market policies. Additionally, we recommend improving labor statistics (especially tracking underemployment and participation) to get a more nuanced understanding of the labor market beyond the headline unemployment rate.

From a macroeconomic management perspective, the weak link between output and unemployment means that traditional stabilization policies (which often target the output gap to also stabilize employment) might need re-calibration. For instance, in a downturn, fiscal stimulus should possibly be larger or more employment-direct if the goal is to prevent unemployment from rising, since a given boost to GDP has a smaller effect on unemployment in Bangladesh. Conversely, during booms, policymakers might not see a tight labor market (in terms of unemployment) even if the economy is overheating, which shifts focus to inflation or other indicators for macroeconomic tightening. This delinks,

to an extent, the Phillips curve trade-off as well – a benefit in terms of inflation control, but a concern in that low unemployment doesn't necessarily indicate optimal labor utilization.

Our study contributes to the literature by providing an updated and detailed analysis of Okun's Law in Bangladesh, using recent data and multiple approaches. It also situates the results within the structural context, offering a narrative for why the empirical results diverge from textbook expectations. However, it also has limitations that point to areas for future research. One limitation is data quality and availability: Bangladesh's unemployment data is annual and potentially suffers from measurement issues. Future work could use quarterly data (if available or by proxy) to see if higher-frequency analysis yields any different insights or perhaps use alternative labor market indicators (such as employment-to-population ratio, hours worked, or underemployment rate) for a more comprehensive view. Another area is exploring regional or sectoral Okun's Law within Bangladesh – for example, does the output–employment relationship differ in urban vs. rural areas, or manufacturing vs. agriculture? Such granular analysis could reveal pockets where Okun's Law holds more strongly and others where it doesn't, masked in the aggregate data.

Furthermore, given hints of asymmetry, future studies could formally test nonlinear models (e.g., threshold regressions or state-dependent parameters) to confirm if unemployment responds more to negative output shocks than to positive shocks. Our analysis of 2010 and 2020 as outliers suggests structural breaks or nonlinear effects that a more advanced time-series approach (such as a regime-switching model) might capture. Additionally, exploring the role of labor force participation (especially female participation) in the output–unemployment relationship would be valuable – perhaps modeling a tri-variate relationship between output, unemployment, and participation.

In conclusion, Okun's Law in Bangladesh is, at best, a weak rule of thumb rather than a reliable guide. Economic policymakers should not be complacent that high GDP growth will automatically cure unemployment or that low unemployment means the economy is at full capacity. The onus is on policymakers to actively convert growth into employment – through structural reforms, education and skill investments, and focused

labor market interventions. As Bangladesh aims for its next stage of development, ensuring that growth is employment-rich and inclusive will be crucial for sustaining social and economic progress. Our findings reinforce that achieving a high-growth trajectory, while commendable, is not enough; the quality and inclusiveness of that growth – measured in jobs and livelihoods – is the true test of development.

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Determinants of Private Investment in Bangladesh: The Roles of GDP Growth, Public Investment, and Real Interest Rate

Abdul Mannan[1], Asif Iqbal[2]

Abstract

This study examines the dynamic interrelationships among private investment growth, public investment growth, GDP growth, and the real interest rate in Bangladesh using annual data from 1976 to 2024. A vector autoregression (VAR) model with four lags is estimated to capture feedback effects and temporal dependencies among these macroeconomic variables. The results indicate that private investment growth is strongly influenced by lagged GDP growth, reflecting the accelerator mechanism of economic expansion. Public investment growth exerts a weaker but positive effect on private investment, emerging at longer lags and suggesting limited crowding-in effects. The real interest rate displays positive associations with private investment growth at multiple lags, implying that interest rate movements in Bangladesh may reflect procyclical conditions rather than conventional credit-cost dynamics. Impulse response functions confirm that shocks to GDP and public investment generate short-lived but positive responses in private investment growth, while real interest rate shocks elicit volatile yet transitory effects. These findings highlight the dominant role of output growth in driving private investment and underscore the nuanced interactions between fiscal and monetary conditions in shaping investment dynamics. The results carry implications for growth-oriented policy design, particularly in balancing public investment strategies with monetary conditions to foster private sector expansion.

Keywords: Private Investment, Public Investment, Real Interest Rate, GDP Growth, Bangladesh, VAR Model.

JEL Classification: E22, E20, E62, E43, O40, C32

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1. Introduction

Investment is one of the most critical determinants of economic growth in both developed and developing economies. It creates new opportunities for goods and employment (Checchi and Galeotti, 1993), improves productivity through introducing new and modern technologies and increases competitiveness in domestic as well as in foreign markets (Anderson, 1990). Investments are broadly categorized into two categories: public and private. Both forms contribute significantly—albeit in different ways—to the expansion of productive capacity, technological progress, and overall economic development. While public investment generally creates the foundational infrastructure and social services necessary for growth, private investment drives innovation, efficiency, and employment. Though, empirical evidence suggests that private capital is more productive than public capital (Erden and Holcombe, 2006), much of the literature has put importance on the public investment as well, for example there is argument that the US productivity slowdown (in 1970s) was mainly caused by the decline in public infrastructure spending (Aschauer, 1989a).

Public and private investment may play complimentary roles. Public projects—such as highways, energy grids, and educational institutions—create an enabling environment that private firms rely upon to thrive. Especially, in economies with significant infrastructure deficits, public investment tends to raise the expected returns to private projects, thereby encouraging firms to expand production and undertake new ventures. In turn, a vibrant private sector generates tax revenues and employment, which allows governments to sustain public investment. Conversely, underinvestment in public goods may limit the private sector's growth potential. This complementary relationship has been evidenced in Aschauer (1989b), and Munnell (1990). However, some studies including Tatom (1991), Holtz-Eakin (1994), and Evans and Karras (1994) find that public investment does not have any significant impact on private sector productivity. Furthermore, the positive spillover effect hinges on the efficiency and quality of public spending; misallocated or politically motivated projects may fail to generate complementary private investment (Calderón & Servén, 2010). In addition, the timing of these effects is asymmetric: while private investment responses can be

relatively swift when bottlenecks are removed, the gestation period of large-scale public projects often delays their impact on private sector activity.

Furthermore, public investment can also produce a "crowding-out" effect when it is financed through substantial government borrowing. According to the loanable funds theory, increased public sector demand for funds raises the equilibrium real interest rate, thereby increasing the cost of capital for private investors (Elmendorf & Mankiw, 1999). Wai and Wong (1982) for five developing countries and Nazmi and Ramirez (1997) for Mexico show that public investment crowds out private investment. This dynamic is particularly evident in economies with limited domestic savings and underdeveloped capital markets, where government borrowing competes directly with private sector financing. Higher real interest rates reduce firms' willingness to invest, particularly in capital-intensive sectors, and may shift financial flows toward safer government securities instead of productive private projects. Furthermore, when government debt accumulation erodes fiscal credibility, risk premiums rise, compounding the upward pressure on real interest rates and deepening private sector retrenchment (Baldacci & Kumar, 2010).

On the other hand, Real interest rates—calculated by adjusting nominal rates for inflation—serve as a key factor in determining borrowing costs and returns on savings, thereby shaping investment choices throughout the economy. (Blanchard & Johnson, 2013). In general, investment and real interest rates are inversely related. Private investment is highly responsive to real interest rates, as they directly influence firms' marginal cost of capital and the anticipated profitability of long-term projects. Low real interest rates lower borrowing costs, increase the net present value of investment projects, and encourage capital formation (Jorgenson, 1963). Conversely, rising real rates may diminish investment appetite by raising hurdle rates for profitability. This negative relationship has been confirmed in empirical works such as Greene and Villanueva (1991). However, the responsiveness of private investment to interest rate changes depends on structural factors such as financial market depth, credit availability, and investor confidence. In advanced economies with developed financial systems, the elasticity of private

investment to interest rate changes is often moderate, whereas in developing economies, where access to finance is constrained, even modest rate increases can sharply curtail private investment activity (Servén, 2003). In the short run, changes in real interest rate may generate positive impact on private investment in some economies while it may have negative impact in others (Bano, 2018).

The growth of gross domestic product (GDP) is widely regarded as a critical determinant of private investment dynamics, particularly in developing economies. Higher GDP growth signals expanding market opportunities, increased aggregate demand, and improved profitability expectations for private firms, thereby stimulating investment activity (Aghion et al., 2005). This relationship is consistent with accelerator theory, which posits that private investment responds positively to changes in output due to the need to expand productive capacity (Jorgenson, 1971). Empirical studies on developing countries, including those in South Asia, demonstrate that robust economic growth enhances investor confidence and reduces uncertainty, encouraging capital formation in the private sector (Ghura & Goodwin, 2000). Empirical analysis specific to Bangladesh supports this view: national income (real output) has a significant long-run positive effect on private investment (Kamrul Hassan & Salim, 2011). However, the magnitude of this impact often depends on complementary factors such as financial market depth, infrastructure availability, and macroeconomic stability, which mediate the transmission of growth to investment decisions (Servén, 2003; Blejer & Khan, 1984).

Understanding the interplay among private investment, public investment, GDP growth, and real interest rates is essential for designing policies that foster sustainable economic expansion, particularly in developing economies with shallow capital markets and limited fiscal space (Barro, 1990). The relationships among these variables are inherently dynamic and evolve with prevailing macroeconomic conditions. During periods of economic slack—such as recessions—public investment can stimulate aggregate demand and accelerate GDP growth without exerting significant upward pressure on real interest rates, as excess capacity tempers inflationary pressures (Keynes, 1936). In such circumstances, fiscal multipliers are typically larger, and

crowding-in effects dominate, encouraging private investment. Conversely, during phases of full employment or supply-side bottlenecks, additional public expenditure may overheat the economy, driving up real interest rates and potentially crowding out private investment (Auerbach & Gorodnichenko, 2012). Moreover, the stance of monetary policy critically shapes these dynamics: an accommodative policy can stabilize real interest rates, enabling simultaneous growth in public and private investment and reinforcing GDP expansion, whereas policy tightening to combat inflation may offset the positive spillovers from public spending by dampening private sector investment responses.

2. Review of Literature

Empirical evidence on the interaction of private investment growth with public investment, GDP growth, and real interest rate is mixed and context dependent. Luintel and Mavrotas (2005) found the cross-country heterogeneity is an acutely important facet of private investment behavior and it must be addressed heterogeneity in private investment behavior. The effect of real interest rate and public investment on private investment to be country specific depending on the level of real income and financial development. The level of real interest appears to support the 'complementarity' hypothesis in developing countries because the coefficient of real interest rate is significantly positive. However, when these countries acquire higher levels of income and higher financial development the neoclassical effect becomes significant and the real interest rate resumes significantly negative coefficient. The study also shows that, public investment significantly reduces private investment and the extent of crowding out effect appears directly related with the country specific level of real income; countries with higher real per capita income experience more crowding out and vice versa.

Empirical studies on OECD economies frequently report that public investment in infrastructure tends to crowd in private investment by enhancing capital productivity (Pereira & Roca-Sagales, 2001). In contrast, evidence from developing economies, including Bangladesh, highlights the importance of financing modalities: public projects funded through external concessional loans often exert neutral or positive effects on private investment, whereas those financed via domestic borrowing

commonly induce crowding-out pressures by driving up real interest rates (Haque & Montiel, 1993). The dynamics become more intricate in open economies due to capital mobility. Within the Mundell–Fleming framework, under a flexible exchange rate regime, increased public investment can attract capital inflows that offset upward pressures on domestic real interest rates (Fleming, 1962). Moreover, global factors—such as shifts in U.S. Federal Reserve policy or fluctuations in international commodity prices—transmit to domestic real interest rates, shaping the interaction between public and private investment in small open economies like Bangladesh (Obstfeld & Rogoff, 1996). To maximize the growth benefits of public investment, governments must ensure fiscal sustainability, prioritize high-quality projects, and coordinate with monetary authorities to maintain stable real interest rates. Medium-term fiscal frameworks that credibly signal debt sustainability help contain risk premiums and prevent excessive rises in real interest rates (International Monetary Fund, 2014). Additionally, structural reforms to deepen domestic capital markets can enhance the absorptive capacity of private investors, reducing the likelihood of crowding out. For developing countries, channeling public investment toward sectors with high multiplier effects—such as transport, energy, and digital infrastructure—offers the best prospects for crowding in private capital and accelerating inclusive growth (World Bank, 2020).

The determinants of private investment have been explored extensively in both theoretical and empirical literature. Keynes (1936) posited that investment depends on interest rates and expectations about future returns. Neoclassical theories emphasize marginal productivity and cost of capital, where the real interest rate plays a critical role. Barro (1990) and Aschauer (1989b) introduced the concept of productive government expenditure, arguing that public investment in infrastructure can raise the productivity of private capital and thereby crowd in private investment. Conversely, it is cautioned that excessive government spending, particularly when financed through deficits, can lead to crowding out (Easterly & Rebelo, 1993).

In the context of Bangladesh, limited empirical research exists. Ahmed and Miller (2000) found evidence of complementarity between public and private investment in South Asia. The impact of interest rates and

infrastructure on private investment in Bangladesh is analyzed with mixed findings (Islam, 2017 and Hossain and Islam 2013). Kamrul Hassan and Salim (2011) examined the determinants of private investment growth in Bangladesh. The study considered Terms of Trade (ToT), Public Investment, GDP acceleration, External Debt Level, and Real Interest Rate as variables to examine their impacts on private investment growth. The empirical results show that national output and external debt affect private investment positively while government expenditure, real interest rate and terms of trade affect negatively, though the coefficients of real interest rate and terms of trade are not statistically significant. Islam (2017) found that GDP growth rate, FDI, real export and domestic credit have the positive impact on the domestic investment in Bangladesh of which real export affects it significantly. On the other hand, financial intermediation and human capital have negative impact on domestic investment but they are insignificant. However, an integrated macroeconometric study covering the influence of both public investment and real interest rate in a dynamic setting for Bangladesh is largely absent. This study fills this gap by applying both OLS and VAR techniques on updated data, offering a comprehensive analysis.

3. Methodology

3.1 Variables and Data Sources

The study employs four key macroeconomic variables to investigate the dynamics of investment behavior in Bangladesh: Private Investment Growth (PVTINV_GR), GDP Growth (GDP_GR), Public Investment Growth (PUBINV_GR), and the Real Interest Rate (REALINT) to primarily assess the impact on the Private Investment Growth based on the movement of three others. Here GDP Growth serves as an indicator of overall economic performance, capturing the broader macroeconomic environment that influences investment decisions. Public Investment Growth measures changes in government-led capital expenditures, particularly in infrastructure and development projects, which can either crowd in or crowd out private investment. Finally, the Real Interest Rate reflects the cost of borrowing adjusted for inflation, directly affecting investment incentives and capital allocation.

Private Investment Growth Rate (PVTINV_GR)

The private investment growth rate measures the annual percentage change in real private gross fixed capital formation in Bangladesh. It reflects the expansion or contraction of private sector expenditures on productive assets such as machinery, equipment, and infrastructure. The data, expressed in constant prices with fiscal year 2015–16 as the base year, are sourced from the Bangladesh Bureau of Statistics (BBS) national accounts and investment series. Growth rates were computed from these constant-price figures to capture real changes in private investment, excluding the effects of inflation. This variable serves as the focal point of the analysis, enabling assessment of how private sector investment dynamics respond to changes in public investment, overall economic activity, and interest rate conditions.

Public Investment Growth Rate (PUBINV_GR)

The public investment growth rate represents the year-on-year percentage change in real public gross fixed capital formation, which includes government-led capital outlays in infrastructure, utilities, and other development projects. These investments, reported in constant 2015–16 prices, are critical for expanding productive capacity and providing the foundation for private sector activity. Data for public investment were collected from BBS national accounts and fiscal statistics publications. By converting these data into growth rates, the study evaluates the dynamic relationship between government investment and private sector responses, particularly in terms of potential crowding-in or crowding-out effects in the Bangladeshi context.

GDP Growth Rate (GDP_GR)

The GDP growth rate denotes the annual percentage change in real gross domestic product, serving as an indicator of the overall pace of economic activity and aggregate demand. The figures are reported at constant prices with the fiscal year 2015–16 as the base year, ensuring that the measure reflects real output changes rather than price fluctuations. GDP data were sourced from BBS's national accounts, which provide consistent long-run series on real output. Incorporating GDP growth into the analysis allows for evaluating the accelerator effect, where increases

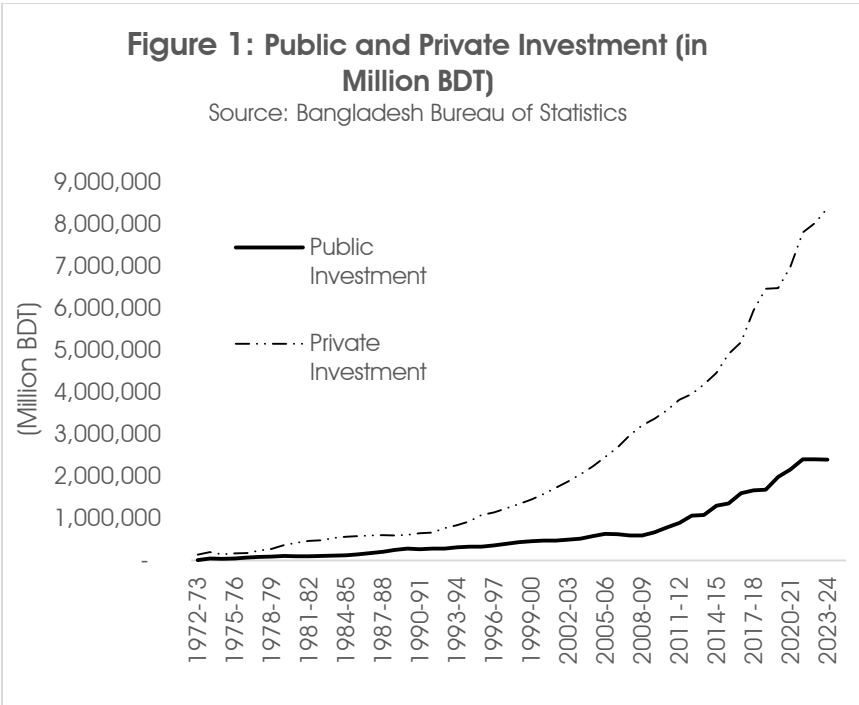
in output growth may incentivize higher private investment through improved expectations of profitability and market expansion.

Real Interest Rate

The real interest rate is defined as the nominal lending rate adjusted for inflation, capturing the real cost of borrowing faced by private investors. Data on real interest rates are obtained from the World Bank's World Development Indicators (WDI) database ensuring a consistent historical series. This variable provides insight into the monetary policy stance and credit conditions prevailing in Bangladesh, which are essential for understanding how borrowing costs influence private investment decisions. The inclusion of real interest rates complements the fiscal and real-sector variables by incorporating the monetary dimension into the analysis.

3.2 Data Overview

Figure 1 illustrates the long-term trends in public and private investment in Bangladesh from fiscal year 1972–73 to 2023-24. Both investment categories exhibit sustained growth, but private investment has expanded at a notably faster rate, especially since the early 1990s—coinciding with Bangladesh's trade liberalization, financial sector reforms, and increasing openness to private enterprise. The gap between private and public investment widened further after 2000, with private investment sharply rising during periods of strong GDP growth, particularly between 2010 and 2019, before showing a temporary slowdown during the COVID-19 pandemic in 2020–21. Public investment, while increasing steadily, has remained comparatively moderate, reflecting its role in infrastructure and enabling sectors. These trends highlight the evolving composition of capital formation in the economy and are central to this study, which investigates how public investment and real interest rates influence private investment growth. The acceleration of private investment alongside GDP growth and its sensitivity to macroeconomic shocks and financing conditions underscore the importance of understanding the dynamic interactions among these variables in the context of Bangladesh's development strategy.



On the other hand, Figure 2 illustrates the trends in public and private investment as a percentage of GDP in Bangladesh from 1972-73 to 2023-24, clearly demonstrating that private investment consistently dominates, starting below 5% and steadily rising to nearly 25% by the end of the period, while public investment, although showing some modest increases, remains considerably lower, fluctuating between approximately 1% and 7.5% of GDP, thereby highlighting the private sector's progressively central role in the nation's economic development over the past five decades.

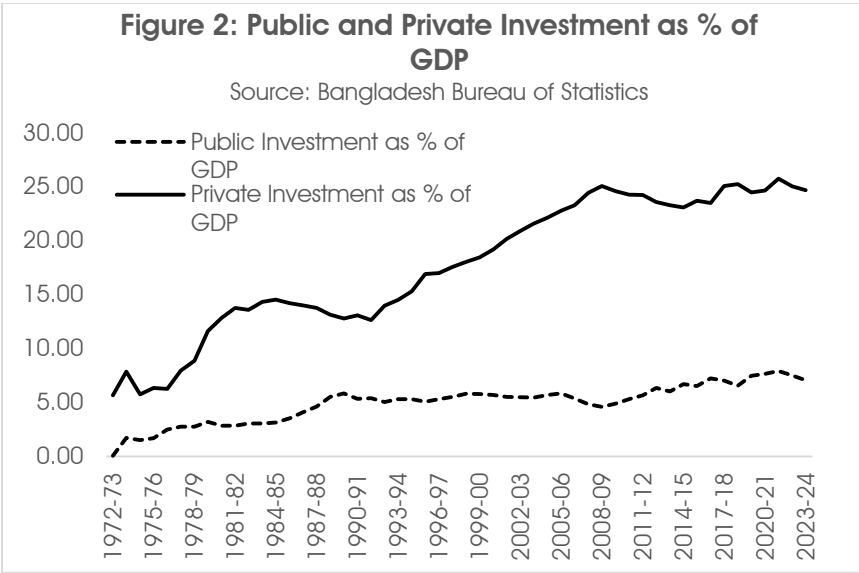
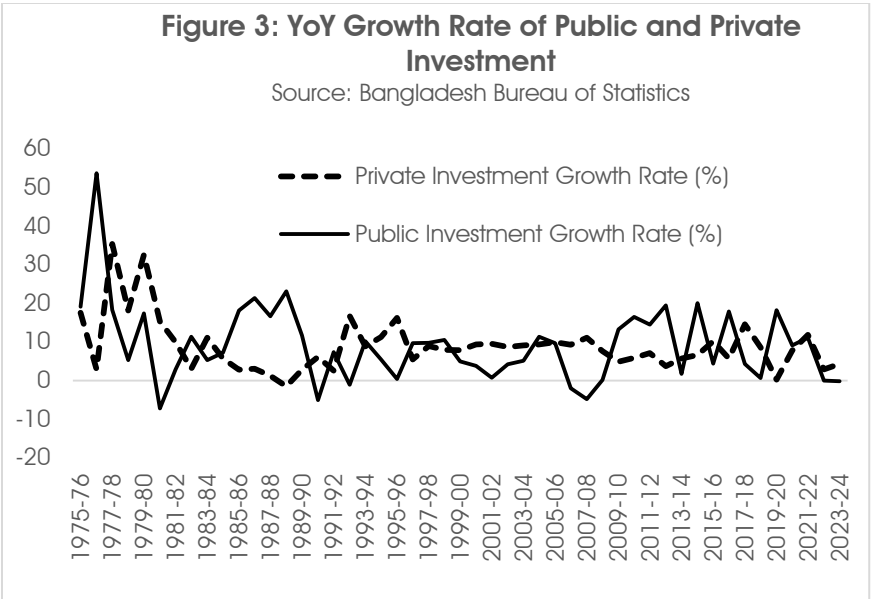
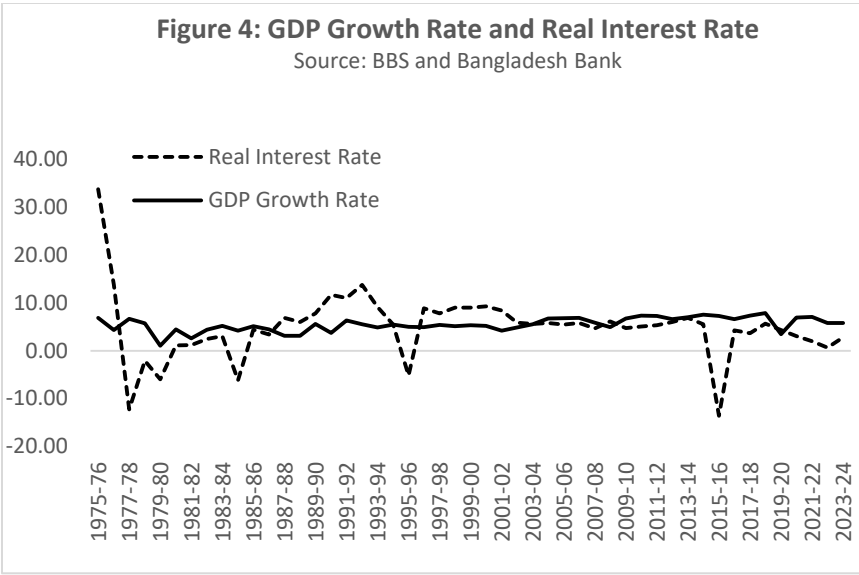


Figure 3 portrays the year-on-year growth rates of public and private investment in Bangladesh from 1975-76 to 2023-24. The early period (mid-1970s to late 1980s) is characterized by extreme volatility, especially in private investment which saw a peak over 50% in 1976-77 amidst post-independence political transitions and initial economic restructuring, contrasting with public investment's sharp but smaller swings influenced by government development priorities. The 1990s marked a period of relative stabilization and gradual growth in both investment types, aligning with Bangladesh's broad economic liberalization and privatization reforms, which fostered a more predictable investment climate. From the early 2000s, private investment growth generally settled into a 5-15% range, reflecting sustained economic progress, while public investment, though still more volatile, often demonstrated counter-cyclical responses; notably, a dip around the 2008-09 global financial crisis was followed by a surge, indicating governmental efforts to stimulate the economy, with a subsequent moderation in both investment types towards 2023-24 reflecting the impacts of the COVID-19 pandemic, Russia-Ukraine war and associated global economic disruptions.



Finally, Figure 4 illustrates the evolution of Bangladesh's GDP growth rate and real interest rate from 1975-76 to 2023-24. Early in the period, the real interest rate shows extreme volatility, with a peak above 30% in 1976-77 and sharp drops below -10% in the late 1970s, reflecting the nascent stage of the economy post-independence and significant macroeconomic instability, while GDP growth also experienced fluctuations. By the 1990s, as Bangladesh underwent economic reforms and liberalization, both indicators demonstrate greater stability, with GDP growth generally maintaining a positive trend around 5% to 7%, and the real interest rate mostly fluctuating between 0% and 10%. Notable divergences occur periodically; for instance, the significant dip in the real interest rate below -10% around 2015-16, potentially reflecting aggressive monetary easing, contrasts with a relatively stable GDP growth, suggesting that other factors might have sustained economic expansion. The overall trend, particularly from the 2000s onwards, indicates a more mature economy where GDP growth exhibits consistent positive performance, while real interest rates, despite occasional significant deviations, generally remain within a more contained range compared to the volatile early decades, reflecting improved macroeconomic management and integration into the global economy.



3.3 Descriptive Statistics

The descriptive statistics reveal notable contrasts in the behavior of private investment growth (PVTINV_GR), GDP growth (GDP_GR), public investment growth (PUBINV_GR), and the real interest rate (REALINT) over the study period. Private investment growth averages 8.88 percent, with considerable volatility (standard deviation = 6.87) and pronounced positive skewness (1.97), indicating frequent high-growth episodes. Public investment growth shows a similar pattern, with a higher mean (9.29 percent) and even greater variability (standard deviation = 10.07), alongside strong positive skewness (1.66) and leptokurtosis (8.80), suggesting sporadic but significant public spending surges. In contrast, GDP growth remains comparatively stable, averaging 5.51 percent with mild negative skewness and lower dispersion, and it is the only variable not rejecting normality under the Jarque–Bera test ($p = 0.11$). The real interest rate displays moderate volatility (standard deviation = 6.95) and positive skewness, with extreme values ranging from –13.64 to 33.79 percent, reflecting episodes of sharp monetary fluctuations.

Table 1: Summary Statistics of the Variables

	PVTINV_GR	GDP_GR	PUBINV_GR	REALINT
Mean	8.879080	5.512659	9.285587	4.917946
Median	7.958584	5.494611	9.080771	5.466994
Maximum	35.36044	7.881902	53.70865	33.79506
Minimum	-1.494186	1.008764	-7.218824	-13.64214
Std. Dev.	6.872165	1.450672	10.07036	6.948658
Skewness	1.966481	-0.692858	1.664117	0.672551
Kurtosis	8.177434	3.456877	8.797465	8.777952
Jarque-Bera	86.30945	4.346602	91.23747	71.85448
Probability	0.000000	0.113801	0.000000	0.000000
Sum	435.0749	270.1203	454.9938	240.9793
Sum Sq. Dev.	2266.879	101.0136	4867.783	2317.625
Observations	49	49	49	49

3.4 Model selection and Application of Econometric Techniques

The distributional features put above inform subsequent econometric choices. The presence of heavy tails and significant departures from normality in three of the four variables justifies the use of vector autoregression (VAR), which is robust to such non-normal distributions. The moderate volatility of GDP growth and the higher variability of investment and interest rate series further underscore the importance of incorporating multiple lags; indeed, lag length selection criteria (AIC, LR, FPE) collectively support a four-lag specification to adequately capture the dynamics among these variables without residual autocorrelation. Again, the choice of the Vector Autoregression (VAR) framework is guided by both the theoretical nature of the variables under study and the statistical properties of the data. Private investment growth, public investment growth, GDP growth, and the real interest rate are all macroeconomic indicators that interact dynamically, with causality potentially running in multiple directions rather than strictly from one variable to another. Unlike single-equation models, which impose a priori assumptions about which variables are exogenous and which are endogenous, the VAR model treats all variables as jointly endogenous,

allowing for a more flexible examination of feedback effects. This is particularly appropriate in the context of this study, where private investment decisions are influenced simultaneously by fiscal conditions, monetary policy, and output fluctuations, and where these same factors, in turn, may respond to changes in private investment.

Table 2: Stationarity of All of the Variables Confirmed by Augmented Dickey-Fuller Test:

		T-statistics	P value
GDP Growth Rate		-4.554384	0.0006
Private Investment Growth Rate		-5.094153	0.0001
Public Investment Growth Rate		-5.133216	0.0001
Real Interest Rate		-6.615937	0.0000
Test critical values:	1% level	-3.574446	
	5% level	-2.923780	
	10% level	-2.599925	

From an empirical standpoint, the VAR model is further justified by the time-series properties of the data. Stationarity tests (ADF and PP) confirm that all four variables are integrated of order zero, enabling level-based estimation without differencing and preserving long-run dynamics. Moreover, descriptive statistics highlight significant variability and non-normal distributions in investment and interest rate series, features that the VAR framework can accommodate while still producing reliable impulse response and variance decomposition analyses. The selection of a four-lag specification—supported by information criteria—ensures that the model captures medium-term dynamics and mitigates residual autocorrelation. Overall, the VAR approach provides a coherent structure to analyze how shocks to GDP, public investment, and the real interest rate propagate through the system and affect private investment growth, while simultaneously accounting for reverse effects and interdependencies among the variables.

To examine the dynamic interrelationships among private investment growth, public investment growth, GDP growth, and the real interest rate, this study employs the Vector Autoregression (VAR) framework pioneered by Sims (1980). The VAR model treats all variables as jointly

endogenous, thereby allowing feedback effects and avoiding restrictive exogeneity assumptions typical of structural models (Lütkepohl, 2005). Prior to estimation, Augmented Dickey–Fuller (ADF) and Phillips–Perron (PP) tests were conducted to assess stationarity, and results indicated that all variables were stationary at levels, justifying the use of an unrestricted VAR rather than a cointegrated VAR or VECM (Enders, 2015). The optimal lag length was selected using multiple information criteria, ensuring that the model captures dynamic interactions while avoiding overparameterization.

The general form of the VAR(n) model with four endogenous variables is expressed as:

$$Y_t = c + A_1Y_{t-1} + A_2Y_{t-2} + \cdots\cdots\cdots + A_nY_{t-n} + \varepsilon_t$$

Where, Yt=[PIG_t, PUG_t, $GDPG_t$, RIR_t] represents private investment growth (PIG), public investment growth (PUG), GDP growth (GDPG), and real interest rate (RIR); c is a vector of constants; A_i are coefficient matrices; and ε_t is a vector of white-noise error terms.

Focusing on private investment growth, the equation can be written as:

$$PIG_t = \alpha + \sum_{i=1}^{n} \beta_{1i} PIG_{t-i} + \sum_{i=1}^{n} \beta_{2i} PUG_{t-i} + \sum_{i=1}^{n} \beta_{3i} GDPG_{t-i} + \sum_{i=1}^{n} \beta_{4i} RIR_{t-i} + \varepsilon_{1t}$$

This specification allows past values of public investment growth, GDP growth, and real interest rates to influence private investment growth while incorporating its own autoregressive dynamics. Post-estimation, impulse response functions (IRFs) are used to trace the temporal effects of structural shocks—particularly from public investment and real interest rate—on private investment growth, and forecast error variance decomposition (FEVD) is employed to quantify each variable's contribution to fluctuations in private investment growth over time. This methodological framework enables robust insights into both short-run and medium-run policy dynamics in the Bangladeshi context.

4. Results and Analysis

4.1 Lag Order Selection

The optimal lag length for the VAR model was determined using several statistical criteria, namely the Likelihood Ratio (LR) test, Final

Prediction Error (FPE), Akaike Information Criterion (AIC), Schwarz Criterion (SC), and Hannan–Quinn Criterion (HQ). As indicated in the results, the LR statistic, FPE, and AIC unanimously identify four lags as optimal, whereas SC and HQ suggest shorter lag lengths. In this study, AIC and FPE are prioritized over SC and HQ because the data are annual fiscal series with approximately 50 observations, and AIC/FPE are generally more suitable for smaller samples and for models where capturing dynamic interactions is important (Lütkepohl, 2005). Selecting four lags ensures that the model adequately incorporates the relevant dynamics without underfitting, a decision further validated by the absence of residual autocorrelation at the fourth lag in subsequent diagnostic tests.

Table 3: Lag Order Selection Criteria

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-505.3100	NA	79580.40	22.63600	22.79659*	22.69587*
1	-485.3335	35.51395	66932.61	22.45926	23.26223	22.75860
2	-467.9521	27.81010	64101.63	22.39787	23.84320	22.93668
3	-451.7717	23.01220	66573.49	22.38985	24.47755	23.16813
4	-427.0339	30.78474*	49389.73*	22.00151*	24.73158	23.01925

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final prediction error

AIC: Akaike information criterion

SC: Schwarz information criterion

HQ: Hannan-Quinn information criterion

4.2 Model Stability and Diagnostic Tests

Unit Root Test

The stability of the estimated Vector Autoregressive (VAR) model was assessed through the unit root test, which examines whether the characteristic roots of the system lie inside the unit circle. The results reveal that all characteristic roots have moduli less than one, with the

highest modulus recorded at 0.889562, indicating that no root lies outside the unit circle. This confirms that the VAR model satisfies the stability condition, ensuring that the system's impulse responses and forecasts are reliable and will converge over time rather than diverge. Consequently, the dynamic relationships among Private Investment Growth (PVTINV_GR), GDP Growth (GDP_GR), Public Investment Growth (PUBINV_GR), and Real Interest Rate (REALINT) can be interpreted with confidence, and the model is suitable for policy analysis and simulation exercises.

Figure 5: Stability of VAR Model

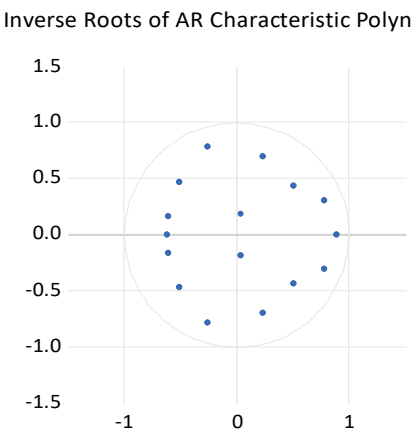


Table 4: Unit Roots Statistics

Root	Modulus
0.889562	0.889562
0.781468 - 0.306799i	0.839534
0.781468 + 0.306799i	0.839534
-0.261392 - 0.789805i	0.831936
-0.261392 + 0.789805i	0.831936
0.240042 - 0.692969i	0.733366
0.240042 + 0.692969i	0.733366
-0.508075 - 0.464697i	0.688537
-0.508075 + 0.464697i	0.688537
0.510246 - 0.438999i	0.673105
0.510246 + 0.438999i	0.673105
-0.612476 - 0.167982i	0.635094
-0.612476 + 0.167982i	0.635094
-0.623244	0.623244
0.033501 - 0.189543i	0.192480
0.033501 + 0.189543i	0.192480

No root lies outside the unit circle.
VAR satisfies the stability condition.

Residual Diagnostics

The stability of the estimated VAR model was assessed using the residual serial correlation LM test, which evaluates whether the residuals from the system are autocorrelated. The null hypothesis of this test posits no serial correlation at a given lag. As reported, the test statistics indicate significant autocorrelation at lags 1 to 3, with p-values below the 5%

threshold (0.0067, 0.0064, and 0.0129, respectively). However, at lag 4—the maximum lag length employed in the model—the p-value rises to 0.1388, exceeding the 5% level and thus failing to reject the null hypothesis of no serial correlation. This outcome implies that the inclusion of four lags is sufficient to eliminate residual autocorrelation and ensures that the disturbances behave as white noise beyond the chosen lag structure. Consequently, the model satisfies one of the key stability conditions required for reliable dynamic analysis, supporting the validity of subsequent impulse response and forecast error variance decomposition results derived from the VAR framework.

Table 5: Results of the Residual Serial Correlation LM Test

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	33.32120	16	0.0067	2.391781	(16, 64.8)	0.0071
2	33.44601	16	0.0064	2.402989	(16, 64.8)	0.0068
3	31.15462	16	0.0129	2.200297	(16, 64.8)	0.0135
4	22.13629	16	0.1388	1.462526	(16, 64.8)	0.1420

4.3 Granger Causality Test:

The Granger causality or block exogeneity Wald tests were conducted to assess the direction of predictive relationships among private investment growth (PVTINV_GR), GDP growth (GDP_GR), public investment growth (PUBINV_GR), and the real interest rate (REALINT) within the estimated VAR framework. Results indicate that GDP growth, public investment growth, and real interest rates all jointly Granger-cause private investment growth, as evidenced by statistically significant chi-square statistics (p-values of 0.0054, 0.0348, and 0.0000, respectively). This finding implies that past movements in macroeconomic output, fiscal investment, and monetary conditions are collectively important predictors of private investment dynamics. In contrast, none of the variables individually Granger-cause GDP growth, although the joint test for all variables is significant at the 5 percent level ($p = 0.0141$), suggesting limited but collective predictive power. For public investment

growth and real interest rate equations, no variable demonstrates significant Granger causality, either individually or jointly, indicating that these series are largely exogenous within the system. These causality patterns align with the impulse response and variance decomposition analyses, which also highlight the dominant role of GDP growth and real interest rate shocks in influencing private investment, while public investment plays only a secondary role.

Table 6: Results of Granger Causality Tests

Dependent variable: PVTINV_GR

Excluded	Chi-sq	df	Prob.
GDP_GR	14.69969	4	0.0054
PUBINV_GR	10.36040	4	0.0348
REALINT	51.36950	4	0.0000
All	74.70614	12	0.0000

Dependent variable: GDP_GR

Excluded	Chi-sq	df	Prob.
PVTINV_GR	7.134136	4	0.1290
PUBINV_GR	4.056253	4	0.3984
REALINT	2.549335	4	0.6358
All	25.14693	12	0.0141

Dependent variable: PUBINV_GR

Excluded	Chi-sq	df	Prob.
PVTINV_GR	2.620746	4	0.6232
GDP_GR	1.841131	4	0.7649
REALINT	2.617602	4	0.6237
All	6.400143	12	0.8946

Dependent variable: REALINT

Excluded	Chi-sq	df	Prob.
PVTINV_GR	2.689594	4	0.6110
GDP_GR	3.051353	4	0.5493
PUBINV_GR	2.445645	4	0.6544
All	7.257704	12	0.8401

4.4 VAR Estimation for Private Investment Growth

The estimated VAR equation for Private Investment Growth Rate as dependent variable is as follows:

PVTINV_GR = C(1,1)*PVTINV_GR(-1) + C(1,2)*PVTINV_GR(-2) + C(1,3)*PVTINV_GR(-3) + C(1,4)*PVTINV_GR(-4) + C(1,5)*GDP_GR(-1) + C(1,6)*GDP_GR(-2) + C(1,7)*GDP_GR(-3) + C(1,8)*GDP_GR(-4) + C(1,9)*PUBINV_GR(-1) + C(1,10)*PUBINV_GR(-2) + C(1,11)*PUBINV_GR(-

3) + C(1,12)*PUBINV_GR(-4) + C(1,13)*REALINT(-1) + C(1,14)*REALINT(-2) + C(1,15)*REALINT(-3) + C(1,16)*REALINT(-4) + C(1,17)

With substituted coefficients the model estimates the growth rate of private investment in the following way:

PVTINV_GR = 0.130116381814*PVTINV_GR(-1) + 0.123692805957*PVTINV_GR(-2) + 0.210125069426*PVTINV_GR(-3) + 0.223268668266*PVTINV_GR(-4) + 1.50245609249*GDP_GR(-1) - 0.770422931769*GDP_GR(-2) + 0.573146407811*GDP_GR(-3) - 0.521469949046*GDP_GR(-4) + 0.0932959126491*PUBINV_GR(-1) - 0.0230465357758*PUBINV_GR(-2) + 0.0710841977777*PUBINV_GR(-3) + 0.151428324852*PUBINV_GR(-4) + 0.236501024339*REALINT(-1) - 0.0563036220885*REALINT(-2) + 0.265134947234*REALINT(-3) + 0.446546821324*REALINT(-4) - 9.3574049737=

Table 7: Model Summary Statistics

	PVTINV_GR	GDP_GR	PUBINV_GR	REALINT
R-squared	0.822479	0.639941	0.328393	0.364361
Adj. R-squared	0.721039	0.434193	-0.055382	0.001138
Sum sq. resids	237.3485	34.67142	1761.746	670.6297
S.E. equation	2.911483	1.112774	7.932180	4.893982
F-statistic	8.108011	3.110312	0.855690	1.003134
Log likelihood	-101.2667	-57.98543	-146.3687	-124.6372
Akaike AIC	5.256300	3.332686	7.260831	6.294987
Schwarz SC	5.938817	4.015203	7.943347	6.977504
Mean dependent	8.025753	5.477276	7.969087	4.615262
S.D. dependent	5.512423	1.479355	7.721250	4.896770

The R^2 value for private investment growth as the dependant variable stands at 82.2 which implies that the model explains 82% of variation in private investment growth rate. The equation for private investment growth reveals several statistically significant determinants. Lagged GDP growth emerges as a key driver: the coefficient on GDP_GR(-1) is 1.50 with a t-statistic of 3.15, indicating that higher economic growth in the previous year strongly stimulates private investment expansion. Public

investment growth exhibits a delayed positive effect, with PUBINV_GR(-4) significant at the 5 percent level (0.15; t = 2.27). Notably, the real interest rate also displays significant positive coefficients at multiple lags—REALINT(-1), REALINT(-3), and particularly REALINT(-4) (0.45; t = 5.07)—suggesting that periods of elevated real interest rates are associated with subsequent increases in private investment growth. This counterintuitive relationship may reflect signaling effects whereby higher rates coincide with robust economic activity or expectations of higher returns, rather than conventional credit-cost dynamics.

4.5 Dynamic Analysis: Impulse Response and Variance Decomposition

The dynamic properties of the estimated vector autoregression (VAR) model were further investigated using impulse response functions (IRFs) and forecast error variance decomposition (FEVD). These tools provide complementary perspectives on the interrelationships among private investment growth (PVTINV_GR), GDP growth (GDP_GR), public investment growth (PUBINV_GR), and the real interest rate (REALINT). While the IRFs trace the time path of each variable's response to a one-standard-deviation shock in the others, the variance decomposition quantifies the relative importance of these shocks in explaining forecast error variance over the medium term.

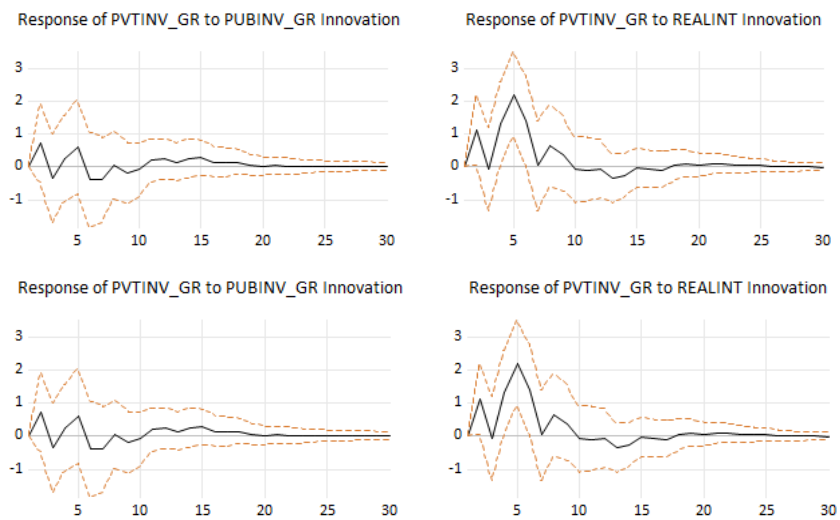
Impulse Response Function

The impulse response functions (IRFs) provide insights into the dynamic reaction of private investment growth to shocks in itself, GDP growth, public investment growth, and the real interest rate over a 30-period horizon. The IRFs indicate that private investment growth responds positively to shocks in its own past values, suggesting short-term momentum effects. A one-standard-deviation innovation in private investment growth generates an immediate surge of roughly 3 percentage points, which rapidly declines and converges toward zero within approximately eight periods. This pattern is consistent with investment cycles that are self-reinforcing in the short run but lack prolonged persistence. In response to GDP growth shocks, private investment growth also rises sharply initially, though the impact diminishes steadily and becomes negligible after approximately 10 periods. A positive GDP

shock raises private investment growth by more than 2 percentage points in the first few periods, with the effect gradually diminishing thereafter. This finding supports the accelerator hypothesis, whereby higher output levels stimulate private investment through increased demand expectations and profitability prospects. The persistence of this effect—though moderate—underscores the role of macroeconomic growth in catalyzing private sector expansion.

Public investment growth shocks elicit a modest positive response in private investment growth, albeit smaller in magnitude and shorter in duration than the GDP shock. This outcome points to a weak but present crowding-in effect, suggesting that infrastructure and capital outlays by the government do facilitate private sector activity, though the channel may be constrained by efficiency and financing considerations. Meanwhile, the response of private investment growth to real interest rate shocks is positive but more volatile. Initial increases of around 2 to 3 percentage points are observed, followed by oscillations that dissipate over 8 to 10 periods. This counterintuitive result—where higher real interest rates coincide with higher private investment—may reflect structural characteristics of Bangladesh's financial markets, such as procyclical credit expansion or interest rate movements that mirror broader economic booms rather than exerting purely restrictive effects.

Figure 6: Impulse Responses of Private Investment Growth



Variance Decomposition

The variance decomposition results reveal that innovations in private investment growth itself dominate the short-run forecast error variance but decline markedly over the projection horizon. In the first period, 100 percent of the forecast error variance in private investment growth is explained by its own shocks, reflecting the absence of lagged effects at this horizon. However, by the fifth period, this share falls to approximately 41 percent, indicating that external variables increasingly contribute to explaining fluctuations in private investment growth. Among these, shocks to the real interest rate emerge as the most influential external factor, accounting for nearly 38 percent of the forecast variance at period five and stabilizing around 41 percent in the long run. This substantial and persistent influence underscores the importance of monetary conditions in shaping private investment dynamics in Bangladesh.

GDP growth shocks also play a notable, though comparatively smaller, role in explaining private investment fluctuations. Their contribution rises steadily from about 19 percent in period two to nearly 18 percent in the long run, suggesting that output conditions exert a sustained impact on investment behavior consistent with accelerator-type dynamics. In contrast, public investment growth contributes only marginally to the variance of private investment, with its share peaking around 6–7 percent over the horizon. The relatively minor role of public investment shocks corroborates the weak crowding-in effect observed in the impulse response analysis. Overall, the variance decomposition highlights a dual dominance of real interest rate and GDP growth shocks in driving private investment fluctuations, pointing to the joint significance of monetary and real-sector dynamics in explaining investment variability in Bangladesh.

The variance decomposition of private investment growth complements the IRF findings by identifying the relative contributions of each variable's shocks to forecast error variance over time. In the first period, fluctuations in private investment growth are entirely self-driven, with 100 percent of its forecast error variance attributable to its own innovations. However, this share declines rapidly as external influences become more prominent: by the fifth period, private investment's own

shocks account for only about 41 percent of the variance, while real interest rate shocks explain nearly 38 percent, GDP growth shocks around 16 percent, and public investment growth roughly 5 percent.

Over the longer horizon (20 to 30 periods), the relative importance of these shocks stabilizes. Private investment's own shocks continue to explain about one-third of the forecast variance, while real interest rate shocks remain the single largest external contributor, accounting for approximately 41 percent. GDP growth shocks retain a significant though secondary role, explaining nearly 18 percent of the variance, whereas public investment shocks persist as a minor factor, contributing only about 6 to 7 percent. These results reinforce the centrality of monetary conditions—proxied by real interest rate movements—in driving private investment volatility, alongside a meaningful but smaller influence of aggregate output dynamics.

Table 8: Variance Decomposition of Private Investment Growth

Period	S.E.	PVTINV_GR	GDP_GR	PUBINV_GR	REALINT
1	2.911483	100.0000	0.000000	0.000000	0.000000
2	3.576136	66.51720	19.47251	4.105514	9.904781
3	3.629330	64.74210	20.67963	4.925561	9.652703
4	3.961903	54.34230	21.58011	4.594890	19.48270
5	4.580792	40.67099	16.14996	5.225883	37.95316
6	4.838281	37.33519	14.65249	5.363994	42.64833
7	4.856741	37.10370	14.56228	6.003031	42.33099
8	4.899672	36.53900	14.30904	5.903930	43.24803
9	4.951248	35.99936	15.11644	5.943001	42.94120
10	4.980417	35.58463	16.05854	5.892974	42.46386
11	4.994647	35.42463	16.30665	6.010463	42.25827
12	5.018273	35.09380	16.85679	6.168702	41.88070
13	5.053116	34.61322	17.46756	6.173871	41.74535
14	5.074106	34.38238	17.60649	6.361693	41.64944

15	5.086917	34.22418	17.71034	6.622983	41.44250
16	5.095151	34.11848	17.86961	6.685261	41.32665
17	5.099382	34.08913	17.88944	6.732461	41.28897
18	5.102052	34.06392	17.87863	6.799046	41.25840
19	5.103864	34.03979	17.88869	6.809905	41.26162
20	5.104459	34.03348	17.89421	6.810568	41.26175
21	5.105490	34.02135	17.88725	6.814054	41.27735
22	5.106717	34.00535	17.88286	6.812139	41.29965
23	5.107209	33.99898	17.88825	6.810947	41.30182
24	5.107471	33.99558	17.88997	6.810649	41.30380
25	5.107896	33.99003	17.89303	6.810753	41.30618
26	5.108236	33.98566	17.90236	6.810075	41.30191
27	5.108460	33.98279	17.90853	6.810343	41.29834
28	5.108679	33.97996	17.91288	6.812303	41.29486
29	5.108918	33.97677	17.91890	6.813319	41.29100
30	5.109112	33.97435	17.92304	6.814192	41.28841

Taken together, the IRF and VDC analyses suggest that private investment growth in Bangladesh is predominantly shaped by its own past behavior and by shocks to real interest rates, with GDP growth playing a supportive role and public investment exerting only marginal influence. The dominance of real interest rate shocks, both in magnitude and persistence, highlights the sensitivity of private investment to financial conditions and underscores the importance of effective monetary management. Meanwhile, the limited contribution of public investment shocks suggests that government spending alone may be insufficient to catalyze private investment unless complemented by broader macroeconomic stability and growth. These dynamic insights provide valuable guidance for policy, emphasizing the need for coordinated fiscal and monetary strategies to foster private sector–led growth.

5. Findings and Policy Implications

This study examined the dynamic relationship between private investment growth, public investment growth, GDP growth, and the real interest rate in Bangladesh using a vector autoregression (VAR)

framework. The model selection process, guided by AIC, FPE, and LR criteria, established a four-lag specification that satisfies stability conditions as confirmed by AR root tests and residual diagnostics. Granger causality tests reveal that GDP growth, public investment growth, and real interest rates jointly predict private investment growth, underscoring the interconnectedness of real and financial sectors. Dynamic analysis through impulse response functions (IRFs) and forecast error variance decomposition (FEVD) further demonstrates that shocks to real interest rates and GDP growth are the dominant drivers of private investment fluctuations, while the impact of public investment remains comparatively modest.

The VAR results highlight an strong accelerator effect: past GDP growth significantly boosts private investment growth. This implies that when the economy expands, firms respond by increasing capital expenditure to meet higher expected demand and profitability. For Bangladesh, this finding underscores that policies which stimulate broad-based economic growth indirectly foster private investment, even more effectively than direct fiscal incentives in some cases. To achieve this, the government should focus on enhancing productivity and diversification by investing in sectors with high value addition, improving infrastructure and logistics to reduce costs and facilitate business operations, and maintaining macroeconomic stability to build investor confidence. Integrating investment promotion within a comprehensive growth strategy—rather than relying solely on isolated incentives—will create a conducive environment where private investment can flourish organically alongside economic expansion.

While public investment exerts only a modest crowding-in effect, its role could be strengthened by prioritizing quality over quantity. Redirecting expenditures toward high-return infrastructure projects—such as transportation, renewable energy, and industrial zones—can enhance complementarities with private capital. Moreover, improving project governance and financing transparency would reduce inefficiencies and bolster investor confidence. This requires not only efficient project selection and implementation but also transparent financing mechanisms that minimize adverse effects on domestic borrowing costs. In parallel, strengthening financial intermediation and deepening capital markets can

enhance the responsiveness of private investment to both fiscal and monetary signals.

The procyclical relationship between real interest rates and private investment underscores structural gaps in Bangladesh's financial intermediation. Expanding capital market depth, broadening access to term financing, and strengthening credit risk management would improve the responsiveness of private investment to macroeconomic signals. Integrating financial reforms with fiscal discipline and growth strategies would create a virtuous cycle of investment and development.

Overall, the results underscore that private investment dynamics in Bangladesh are shaped by a combination of macroeconomic growth conditions and financial factors, with fiscal influences playing a secondary role. A policy mix that simultaneously fosters stable financial conditions, sustains economic growth momentum, and improves the efficiency of public spending is likely to yield the greatest dividends for private sector development. Future research could extend this analysis by incorporating structural breaks, sectoral investment data, or non-linear dynamics to further refine policy prescriptions in light of evolving macroeconomic conditions.

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Review Essay: Daron Acemoglu and James A. Robinson's 'Why Nations Fail - The Origins of Power, Prosperity, and Poverty'

Md. Firoz Hasan

Introduction:

The Solow-Swan growth model provides a convincing explanation that in the long run, only technological progress can ensure sustained growth. However, the model does not provide any insight regarding what generates technological progress. Economists have been debating on the issue for a long time, and finally, we think that we have an answer, in the book "Why Nations Fail: The Origins of Power, Prosperity, and Poverty," that the contemporary and historical institutional settings of a society determine its ability to generate and incorporate technological change in the development process.

The book is on comparative politics by Turkish-born Armenian-American economist Daron Acemoglu and British economist and political scientist and a professor at the University of Chicago, James A. Robinson. This review consists of three sections: a summary, a critical review and finally, a conclusion. Given the fact that the book is giant and that the 'main strength of this book is beyond the power of summary' (Collier 2012), we have spent comparatively more space on the summary. The review section tries to discuss only the most critical values of the book, followed by some criticism from scholars. The conclusion provides a hint regarding what the reader can get from reading the book.

Section One: Summary

Chapter-One:

The chapter starts with a natural experiment between the two edges of Nogales, one part of which belongs to Arizona, the U.S., and the other part belongs to Mexico. In the Mexican half, the per capita income is three times less than that of the U.S. part, and all other things are equally

inferior. Then the authors have investigated the differences in the historical organization of colonial societies in Latin America and the U.S. and have pictured the varying impacts of those societies on their contemporary political and economic institutions, which, as the authors claim, are the roots of differences in prosperity in the two parts of Nogales.

Another proposition here is that it is tough to eliminate these cross-country inequalities. Because the existing set of institutions better serves the group of people who dominate 'politics and political institutions.' Therefore, 'politics of poverty and prosperity' can explain 'the economics of poverty and prosperity' (pp. 7-44).

Chapter Two:

This chapter investigates the existing explanations of the poor versus rich nation debate by grouping them into three broad categories. Acemoglu and Robinson convincingly show that the geographic characteristics and cultural orientations are unable to explain not only the variances in the prosperity of different nations today (North and South Korea, the two Nogales) but also why some countries languished for centuries and then twitched to a speedy development process (China and Japan). Similarly, the ignorance hypothesis is unable to explain the rationale of societal arrangements causing relative poverty. The authors show that the regimes (like Nkrumah in Ghana) adopt bad policies not because they do not know the policy implications, but rather because they know the consequences better and so want to direct policies towards consolidating their power. Therefore, the authors bring new explanations which focus on the role of institutions (defined as the rules governing political and economic actions), the historical heritages of institutional variations and the 'incentives of institutions that prevent unleashing progress' (pp.45-69).

Chapter Three:

This chapter contains the central thesis of the investigation: 'economic growth and prosperity are associated with inclusive economic and political institutions, while extractive institutions typically lead to stagnation and poverty' (p. 101). The inclusive political institution

allows broad-based participation (pluralism) and sets limits and checks on rulers, and thus ensures the rule of law. It also enjoys a certain degree of political centralization for the state to enforce the contracts and law and order. The inclusive political institutions promote inclusive economic institutions characterized by protected property rights and public support (public facilities and regulation) for markets, market competition (free entry of new businesses), and redistribution of wealth to ensure the citizens' greater access to education and other opportunities.

On the contrary, an extractive political institution concentrates power in the grip of a few (absolutism), places no constraints or checks and balances on the rulers, and so, suffers from a lack of the rule of law. It creates extractive economic institutions featured by insecure property rights, barriers to entry for new businesses and the persistence of an uneven playing field.

However, growth is still possible under extractive institutions as they can allocate resources to highly productive sectors to generate resource expansion for extraction (Barbados, Soviet Union, China). However, such growth is not sustainable unless political institutions are transformed from extractive to inclusive' (pp. 70-95).

Chapter Four:

Minor institutional variations and the 'institutional drift' over time can intermingle with 'critical junctures' and historical necessity to yield a transformation in the path. For instance, 'Black Death' shrunk the population in 13th-century England, making labor scarce; from this, a demand-supply based labor market emerged there. The same incident had the reverse effect in Eastern Europe, where the prevailing landowners swallowed even more land and imposed even stricter control over the serfs.

Meanwhile, when the king attempted to fix pay in England, a riot erupted, and measures for fixing wages were never successful after 1381. These historical developments, along with others like the Glorious Revolution in 1688, caused the creation of more inclusive economic institutions that ultimately led to the Industrial Revolution in England. Therefore, the authors argue that investigating the institutional

development in its historical setting can illustrate the 'origins of differences in poverty and prosperity' among nations (pp. 96-123).

Chapter Five and Six:

Rapid Development under extractive institutions is transient as it does not promote technological innovation, which can only explain growth in the long run (Solow 1956, 1957, 1970 & Swan, 1956). Again, for the same reason, growth under inclusive institutions can be lost if the inclusive institutions are transformed into extractive institutions. For instance, Venice in the Middle Ages, with its inclusive political institutions, created highly innovative and inclusive economic institutions and gained prosperity. However, through some adverse institutional innovation, Venice led to the extractive political and economic institutions, and ultimately its prosperity was reversed (pp. 124-151).

On the other hand, England continued its transition towards more inclusive institutions, and consequently, its prosperity continued. Therefore, the difference in the institutional response to critical junctures and the resulting differences in change in institutional settings can sufficiently explain the differences in poverty and prosperity across nations (pp. 152-181).

Chapter Seven, Eight, Nine and Ten:

Technological innovation produces creative destruction, which makes old practices obsolete and brings new dynamics in economic rights and political authority of individuals. Therefore, in every society, the existing elites prevent technological innovation, fearing creative destruction. For example, the global spread of the Industrial Revolution in England was very uneven because different nations had very different institutional endowments. Not to mention that the industrialization process was grounded on the advent of more protected property rights and strengthening the economic institutions that were supportive of innovation and entrepreneurship (pp. 182-212).

European settlers' colonies in North America and Australasia had established inclusive institutions by a distinct route. Japan and France

challenged absolutism immensely. The French Revolution and the subsequent interstate conflicts initiated a dynamic process toward inclusive institutions across Western Europe. Consequently, all these nations were able to create the necessary institutional settings for industrialization, which led to economic prosperity (pp. 213-244).

However, Eastern Europe, Russia, China and the Ottoman Empire continued with their long-standing extractive institutions and so lagged. Again, most of the other nations had extractive institutions which were either indigenous or imposed upon them by the colonial powers. Consequently, all these nations failed to support the innovative process of industrialization and thus remained poor (pp. 245-301).

Chapter Eleven and Twelve:

The nature of institutions hundreds of years ago has a substantial impact on present-day world inequality. Because the forces created by those institutions (inclusive or extractive) lead them to persist over time. As illustrated in the case of Great Britain, the inclusive institutions created after 1688 responded to challenges by bringing more inclusiveness. The authors call this robust process of constructive feedback from the existing inclusive institutions 'the virtuous circle'. The virtuous circle removes extractive economic relations such as slavery and serfdom. It also promotes competitiveness and dynamism by reducing the importance of monopolies. It allows free media to flourish (pp. 302-334).

On the contrary, in the case of many African countries like Angola and Sierra Leone, which inherited the extractive institutions from the colonial powers, they cannot break the process of transitioning toward more extractive institutions. The authors call this counterproductive process of negative feedback 'the vicious circle’. The vicious circle of extractive institutions produces power struggle and bloody civil wars, which causes economic devastation and incomparable human suffering and ultimately cause state failure (pp. 335-367).

Chapter Thirteen and Fourteen:

Extractive political and economic institutions are the main reasons why nations fail today: economically or politically. Because extractive

economic institutions cannot produce the motivations necessary to promote savings, investment and innovation. For example, in countries like Venezuela and Egypt, extractive economic institutions not only failed to generate enough economic activity but also prevented any economic activity that threatens the power of the extractive political institutions and the elites. Again, in countries like Zimbabwe and Liberia, the extractive institutions have ruined not only law and order but also the essential capacities of the state to respond to internal conflicts, famines and epidemics. However, 'history is not destiny' (pp. 386-404).

Effective reform for transforming the extractive institutions toward inclusive ones can induce sustainable growth and development. However, logically, the process is not involuntary; rather, it entails a lot of uncertainty and difficulty. It means that the journey toward inclusive institutions needs some minor or significant revolution in the political area of the impoverished nations. The authors argue that the confluence of factors, especially a critical juncture when tied with any or all of the three following things, can help to break the vicious circles in languishing nations. First, the existing inclusive elements in the institutions, second, the existing inclusive coalitions conducting the battle against the dominating extractive regimes and third, the contingent nature of the past. Some nations, like Botswana and the U.S. South, have successfully demonstrated the transformation process (pp. 404-427).

Chapter Fifteen:

The authors predict that as countries in Northern America and Western Europe have the most inclusive institutions, they will continue to become more prosperous than the other countries of the world. Nations (like Somalia, Afghanistan, Haiti) with a very insignificant level of state centralization will not be able to deliver law and order, and so, inclusive institutions are not likely to take place in these lands. Consequently, these nations are highly unlikely to observe any development. Some Latin American and African countries (like Mexico, Chile, Brazil, Tanzania, and Ethiopia) have created a significant level of state centralization, and the institutions in these countries have gained much inclusiveness. So, these countries are set to grow further (pp. 428-437).

However, as the inclusiveness of Chinese economic institutions is still vulnerable to the highly extractive political institutions, creative destruction through technological innovation is still not possible in China. Therefore, China will ultimately fail to sustain progress (pp. 437-455).

The authors further investigate what will not work in terms of making sustained prosperity. Illustrating the cases and consequences of rapid growth under extractive regimes in Russia, Germany and Japan, they claim that the modernization theory is flawed because economic development has not necessarily generated inclusive political institutions in these countries (pp. 455-458).

Again, development cannot be engineered through policy changes. Because, for example, privatization may take place, but only the businesses with closer contact with the regime are winning the government contracts. Therefore, any program designed to cause a change in any nation under the extractive regime will lead to further extraction. The same is true for foreign aid. Then, the question is what works regarding development (pp. 458-467).

From the Glorious Revolution in England in 1688 to the rising of the working classes in Brazil after 1978, only the changes that have empowered the people have made sense of real change. Therefore, meaningful programs are only those designed towards the empowerment of the masses. Again, free media is crucial for empowerment, as the latter is the logical consequence of the former (pp. 467-475).

Section Two: Critical Review:

The most agreeable issue in the book is its stress that, in an actual sense, history and future are random (Boldrin et al. 2012). Minor events and small differences in early settings can play a crucial role in the broad success or failure of a nation. This emphasis on the contingency nature of history situated the book in the group of modern economic theory, especially the evolution theory (see Kandori et al. 1993 &Young 1998). By substantiating the contingency nature of history with evidence and anecdotes, the authors helped us to find the real interpretation of history in terms of its power to shape our present and future.

Another critical issue is the role of imperfect institutions to deter innovation and, consequently, the flourishing of human society. While chaos and conflict are undoubtedly harmful to the health of the nation, many regimes have supported and still support all varieties of vested interests that hinder innovation and development. The idea is also quietly present in the earlier works, such as that of Max Weber or even Cicero and Plato (Boldrin et al. 2012). The authors put the promotion of vested interests at the center point and then revealed the role of political institutions in facilitating the balancing of these interests

Another value of Acemoglu and Robinson's analysis is that it revives the necessity to consider ideas like the dual-economy (see Lewis 1954, 1958 & 1979 & Harris & Todaro 1970) differently (Currie 2013, p. 157). Acemoglu and Robinson claim that the dual economy is not an outcome of growth; instead, it is a product of extractive colonial policies. So, the prosperity of the modern sector is based on the cheap labor of the underprivileged, backwards sector, and, as we have seen in the case of apartheid South Africa, the movement of people from the villages to cities has been trivial. These explanations can be of critical value for policy choices regarding the most suitable means to support developing nations (Currie 2013, p. 157).

Finally, and most importantly, the book has pulled the growth theory (Solow-Swan) out of its dead-end and provides credible evidence and explanation that inclusive institutions generate technological change and innovation and thus perpetuate development.

However, as the authors have not conducted any quantitative or methodical investigation, it is difficult to evaluate how fairly their institutional hypothesis describes the data in comparison to the alternative hypotheses concerning geography, culture and ignorance (Currie 2013, p. 158). Comparable data on the amount and duration of economic expansion under different institutional arrangements would help us to assess the comparability of cases and also to assess the generalizability of their hypothesis (Currie 2013, p. 158).

Further, the categorization of the entire human history into only two groups, inclusive and extractive, is broad enough to miss the other possible variations. Some scholars have also criticized Acemoglu and

Robinson's work as being very conceptual and an oversimplification of the very complex issue (Fukuyama 2012). Such broad categorizations and oversimplification have made the use of inclusive/extractive dichotomy relatively vague, and consequently, we fail to comprehend not only in what underlying mechanism the political institutions affect the economy but also the varying level of contribution of different political and economic elements (property-right legislations versus free and fair elections) in shaping the free economic institutions (Freire 2012).

Furthermore, the investigation can be accused of selection bias and cherry-picking for three reasons: first, they do not explicitly inform us of their case selection criteria, second, they have repetitively used very few cases (compare the period of investigation) and third, they have used ex-post evaluation of outcomes to say that some institutional arrangement falls in one group or the other (Currie 2013, p. 159 & Boldrin et al.). Therefore, their thesis may not help us to understand why the southern part of Italy is still relatively poorer than the northern part despite the fact that both parts have been under the same institutional arrangements for a long time. Again, though the authors have repeatedly emphasized that development under an extractive institution is short-lived, their thesis does not tell us the length of the period which we can call short or long.

Another frequent criticism is that while accomplishing the daunting task of investigating the entire human history through the lenses of extractive and inclusive institutions, Acemoglu and Robinson's work suffers from omission problems as well. Firstly, the authors have failed to adequately mention the role of cities in the progress of human civilization, whereas cities have made it possible to unite the efforts of arts, science, and technology (Hall in Mulligan 2012, p.378). The same is true regarding demography. Therefore, the readers get insufficient information regarding the role of migration, demographic dividend and the population transition (Mulligan 2012, p.378).

The authors seem to be too engaged with the institutional perspectives that they have even missed many distinctive perspectives like the insights revealed by Amartya Sen (1999) on human capabilities and by Paul Collier on the development trap; these perspectives are not even recognised (Mulligan 201, p.378). However, while it has some

shortcomings, the value of the book is immense, especially its thought-provoking power.

Section -Three: Conclusion

Acemoglu and Robinson's thesis has solved the long-standing question in economics by exploring the fact that inclusive institutional settings generate technological change and innovation and thus enable sustained growth. The book is well-written, and the authors have made reading the book fun through their storytelling-like writing style. In blending a vast volume of evidence across time and place, and putting a hypothesis regarding why some nations fail and some prosper, the book presents a critical phase in this course (Currie 2013, p.160). However, an approach on a more methodical and quantitative foundation would have enabled the readers to test between opposing hypotheses about the methods influencing economic outcomes (Turchin et al. 2012). Nevertheless, anyone thinking about the nature and type of the historical issues regarding their impact on the present-day world inequality and what lessons can be unearthed from that historical account to bring the profits of economic development and political stability for all, should read the book.

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