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A Comparative Analysis of the Asymmetric Impact of Innovation and Economic Growth in Vietnam: A Linear and Nonlinear ARDL Approach

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Abstract

This study analyzes the impact of the Global Innovation Index (GII) and the Consumer Price Index (CPI) on Vietnam's economic growth (GDP) using both ARDL and NARDL models. The ARDL model results indicate that innovation has a positive long-term effect on GDP growth. The NARDL model reveals an asymmetric impact of innovation: increases in the GII promote economic growth, while decreases have an insignificant effect. The error correction term (ECT) is negative and statistically significant, confirming a long-run equilibrium relationship with an adjustment speed ranging from 24.83% to 28.85% per year. By simultaneously analyzing the effects of GII and CPI within a dynamic modeling framework and uncovering the asymmetric impact of innovation, this study addresses a gap in previous research. The empirical findings provide important policy implications for promoting innovation, managing CPI effectively, and fostering sustainable economic growth in Vietnam.

Keywords: Innovation, Consumer Price Index, Economic Growth, ARDL, NARDL.

Introduction

In the context of a global shift towards a knowledge-based economy, innovation has emerged as one of the key drivers of growth and sustainable development. According to endogenous growth theory, creativity and technological advancement serve as the engine of long-term economic growth [1]. King and Levine also emphasize that innovation is the decisive factor behind differences in growth across countries [2]. In practice, innovation has been recognized by the World Intellectual Property Organization (WIPO) as an essential component of long-term growth and has become a strategic pillar in many developed economies such as the United States, Germany, and China [3]. Empirical studies further show that innovation not only enhances technological progress but also improves institutional frameworks and business models, thereby contributing to economic growth [4,5]. Although the role of innovation in the modern economy is widely acknowledged, empirical evidence on the relationship between innovation capacity and economic growth remains limited and inconclusive particularly in developing economies.

Over the past two decades, Vietnam has emerged as a prominent country in Southeast Asia for institutional reform, innovation capacity development, and foreign investment attraction. One of the most notable indicators of this progress is Vietnam's consistently high ranking in the Global Innovation Index (GII) compared to countries with similar income levels. Despite having a relatively low per capita GDP, Vietnam has frequently been ranked among the top 50 most innovative economies in recent years. This raises an important academic and practical question: Does an improvement in GII ranking actually translate into real economic growth in Vietnam? Furthermore, most existing studies still examine the relationship between innovation and growth from a linear perspective, assuming that increases and decreases in innovation capacity produce symmetric economic effects. However, empirical reality in developing countries often suggests otherwise: improvements in innovation may involve absorption lags, while declines can quickly weaken growth. Recent studies such as Poutanen and Qamruzzaman have begun to address this issue through nonlinear and asymmetric modeling frameworks [6,7]. However, most of these studies focus on financial innovation or aggregated data, rarely analyzing the

specific effect of GII on GDP at the individual country level.

To fill this gap, this study proposes applying the Autoregressive Distributed Lag (ARDL) and Nonlinear ARDL (NARDL) models to examine the relationship between GII and GDP in Vietnam during the period 2007–2023. The GII variable is measured by dividing the ranking by the number of countries ranked each year, thus reflecting Vietnam's relative innovation capacity. Additionally, the Consumer Price Index (CPI) is included as a control variable in the model, as it reflects broader macroeconomic volatility in Vietnam. This study pursues three main objectives: (i) to determine whether GII has a significant effect on Vietnam's GDP in both the short and long run; (ii) to test whether the impact of GII on GDP is asymmetric between the increasing and decreasing phases of GII; and (iii) to clarify the role of CPI in the relationship between innovation and growth.

Through a quantitative approach, this research aims to provide updated empirical evidence that can inform innovation policy planning linked to long-term economic growth in Vietnam. Beyond addressing the academic question of the role of innovation capacity in the growth of a developing country like Vietnam, the study offers significant contributions both theoretically and practically. From a theoretical perspective, first, the study expands the innovation–growth framework by incorporating asymmetric effects of innovation on GDP. Second, it clarifies the role of GII as a proxy for innovation capacity within ARDL/NARDL dynamic models—an approach that is still rare, as most existing research relies on financial proxies such as R&D investment or patent counts. Third, the study integrates GII and CPI into a unified analytical framework to simultaneously assess the direct impact of innovation and the supportive/spillover role of foreign investment on growth, thereby extending the theoretical scope from univariate to more practical multivariate analysis. From a practical standpoint, the study provides updated empirical evidence relevant to the Vietnamese context, where the country is positioning itself as an innovation-driven economy transitioning toward knowledge-based growth. The findings will help policymakers better understand the scale and nature of innovation's impact on the economy. Moreover, the results can guide innovation policies that are tailored to different phases of development. If asymmetric effects are confirmed, innovation promotion policies should be differentiated between periods of growth and decline in innovation capacity-challenging the common assumption that simply "raising the GII" will automatically boost economic growth.

The remainder of this paper is structured as follows:

- Section 2 Provides a Literature Review
- Section 3 Outlines the Research Methodology
- Section 4 Presents the Results and Discussion and finally,
- Section 5 Concludes with Policy Implications.

Literature Review

According to endogenous growth theory, particularly in Schumpeterian models, innovation plays a central role in driving long-term economic growth [1,3]. Unlike exogenous growth models, where technology is treated as an external factor, endogenous theories argue that technology and innovation originate within the economic system—through investment in R&D, human capital, and supportive institutions [8]. Innovation helps improve resource allocation efficiency, enhance labor productivity, and create competitive dynamics in the economy [9]. As such, innovation is regarded as a "catalyst" for development, especially in rapidly industrializing economies like Vietnam [10]. Recently, Dempere analyzed data from 120 countries and found that innovation has a positive effect on GDP, but an insignificant impact on the Consumer Price Index (CPI), and a negative correlation with self-employment—particularly in economies with high rates of necessity-driven entrepreneurship [11].

Xiao, using data from 59 countries between 1995 and 2020, observed that while technological innovation fosters economic growth, it may also exacerbate income inequality if not accompanied by appropriate human capital development and institutional policies [12]. Similarly, Tang, using quantile regression analysis across 73 countries, found that technological innovation can increase income inequality, although this effect can be mitigated through public spending and export diversification [13]. These studies suggest that while innovation is essential for economic growth, it can also lead to undesirable outcomes such as widening income inequality if not supported by suitable policies. Therefore, further research is needed to better understand how innovation affects various dimensions of the economy and society, and how to design policies that maximize its benefits while minimizing associated risks. The Global Innovation Index (GII) measures national innovation capacity across multiple dimensions, including institutions, human capital, infrastructure, technological advancement, and knowledge outputs [3]. Unlike single-indicator measures such as R&D expenditure or patent counts, the GII offers a more comprehensive and balanced perspective—especially useful for developing countries where innovation often takes place outside formal sectors. However, most quantitative studies still prefer traditional indicators and rarely employ the GII as a primary variable in econometric models [14]. Dempere used the GII to assess its impact on GDP, CPI, and self-employment but did not explore the GII–CPI relationship as an intermediate mechanism affecting economic growth [11]. Moreover, although some studies have included GII in quantitative analyses, their applications have mostly been limited to cross-sectional regressions rather than time-series models. For instance, Al-Zaroog and Baqir used GII to evaluate the impact of innovation on economic growth in developing countries and found a positive and statistically significant relationship [15]. Bate analyzed the determinants of innovation performance using data from 63 countries, but did not conduct time-series analysis [16]. Likewise, Nasir and Zhang employed panel data from 105 countries to examine the relationship between innovation inputs, outputs, and efficiency, without focusing on time-series modeling [17].

Most econometric studies on innovation implicitly assume that the effect of GII on GDP is linear—that is, a given increase in GII has the same (but opposite) effect as a corresponding decrease. However, this assumption contradicts the real nature of innovation, which is inherently nonlinear, complex, and often characterized by time lags [6]. In a developing economy, increases in GII may yield delayed effects on GDP, as innovation initiatives take time to translate into productivity gains. Conversely, declines in GII may have a quicker negative impact due to loss of investor confidence, cuts in innovation budgets, and reduced inflows of high-quality capital. Therefore, the NARDL model—which allows the decomposition of GII into two separate series (GII^{+} and GII^{-}) representing positive and negative changes—is better suited to capturing this asymmetric

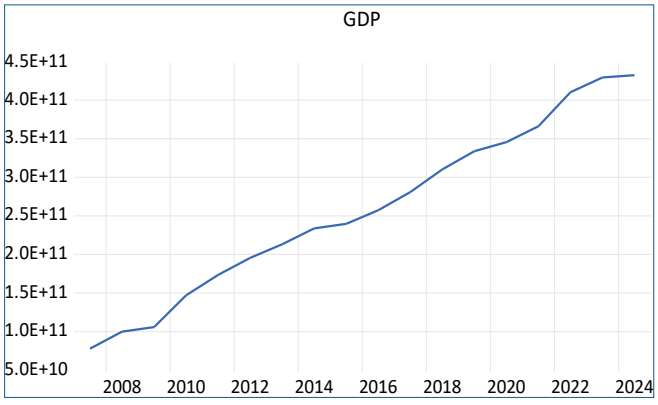
effect. Ignoring such nonlinearity could lead to underestimation or misinterpretation of the results. Moreover, the relationship between innovation and economic growth does not exist in isolation. Macroeconomic variables such as the Consumer Price Index (CPI) can indirectly influence the effectiveness of innovation by affecting input costs, consumer confidence, and the investment climate. Some recent studies indicate that CPI may weaken the positive effect of innovation if it causes macroeconomic instability. For example, Balkar and Çildir found that high inflation can diminish the effectiveness of innovation in promoting economic growth in developing countries [18]. Additionally, Vann (showed that technological innovation can influence the CPI, which in turn affects economic growth [19]. Hence, incorporating CPI as a control variable is necessary to accurately reflect the relationship between GII and GDP.

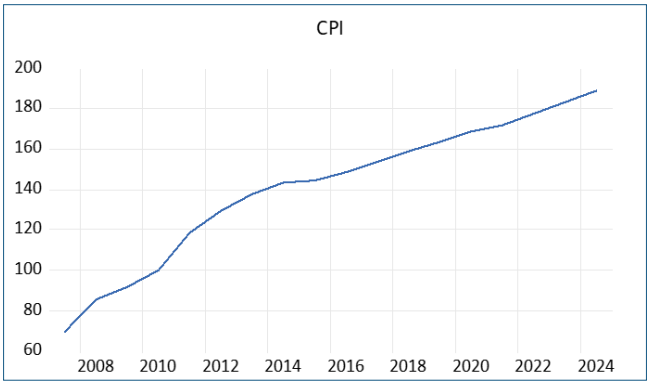
Although numerous studies on GII and innovation in Vietnam exist at the descriptive or regional comparative level, no quantitative study has yet applied ARDL/NARDL models to examine the asymmetric effect of GII on GDP within a time-series framework. Furthermore, no prior research in Vietnam has combined GII and CPI in a single dynamic model. This study, therefore, not only expands the methodological toolkit for analyzing innovation's impact but also offers a practical approach tailored to Vietnam's ongoing shift from extensive (capital- and labor-based) growth to intensive growth driven by knowledge and innovation.

Research Methodology

Data Source and Description

Vietnamese data on GDP, CPI, and GII over the 18-year period from 2007 to 2024 were collected from the World Bank. The trends of GDP, CPI, and GII over time are illustrated in Figure 1 below.





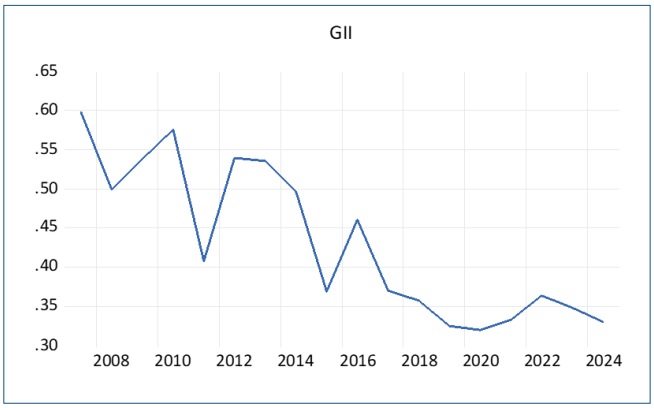


Figure 1: The Graph of GDP, CPI and GII.

Source: Authors' calculations based on data using EViews.

Table 1 presents the descriptive statistics of the dataset, in which the GII variable is defined as the ratio of Vietnam's GII ranking to the total number of economies ranked in that year.

Table 1: Descriptive Statistics.

	GDP	CPI	GII
Mean	2.51×10^{11}	140.8978	0.431662
Median	2.48×10^{11}	146.4789	0.389039
Maximum	4.33×10^{11}	189.0734	0.598131
Minimum	7.74×10^{10}	69.6950	0.320611
Std.Dev	1.14×10^{11}	35.2201	0.097184
Skewness	0.017561	-0.5853	0.358013
Kurtosis	1.88625	2.2720	1.550310
Jarque-Bera Test	0.931130	1.4253	1.960721
Probability	0.627780	0.4903	0.375176

From Table 1, we can confirm that the variables GDP, CPI, and GII are approximately normally distributed, and there are no significant anomalies or outliers in the dataset.

Model Selection

This study employs the ARDL model to analyze the dataset from 2007 to 2024.

ARDL Model

The study adopts the ARDL (Autoregressive Distributed Lag) modeling framework based on the ARDL bounds testing approach, which is particularly suitable for small sample sizes. One key advantage of the ARDL model is that it does not require all variables to be integrated of the same order, as long as none of them are integrated beyond order one, I(1).

The general form of the ARDL model employed in this study is specified as follows:

$$\underbrace{\widehat{GDP}}_{\text{Economic growth}} = f\left(\underbrace{\widehat{GII}}_{\text{Global Innovation Index}}, \underbrace{\widehat{CPI}}_{\text{Control macroeconomic variable}}\right) \quad (1)$$

Using a linear ARDL model, where p represents the lag order of

the dependent variable (GDP), and p_1, p_2 denote the lag orders of the independent variables GII and CPI, respectively, the ARDL specification can be written as:

$$GDP_t = \alpha_o + \sum_{i=1}^{p} \alpha_{1i} GDP_{t-i} + \sum_{i=1}^{p_1} \alpha_{2i} GII_{t-i} + \sum_{i=1}^{p_2} \alpha_{3i} CPI_{t-i} + \varepsilon_t \quad (2)$$

In this study, EViews software is used to determine the optimal lag length for each variable.
The bounds test for the ARDL model is based on the following equation:

$$DGDP_t = a_o + \sum_{i=1}^{p} a_{1i} DGDP_{t-i} + \sum_{i=1}^{p} a_{2i} DGII_{t-i} + \sum_{i=1}^{p} a_{3i} DCPI_{t-i} + b_1 \ln GII_{t-1} + b_2 \ln CPI_{t-1} + \varepsilon_t \quad (3)$$

Where D is the first-difference operator and ln denote the natural logarithm of variables. In equation (3), b_1, b_2 represent the long-run effects of the explanatory variables on GDP, while a_{1i}, a_{3i}, a_{3i} (i = 1,2, …, p)) measure their short-run effects on GDP.

By reparametrizing the equation into an error correction model (ECM), equation (3) becomes:

$$DGDP_t = a_o + \sum_{i=1}^{p} a_{1i} DGDP_{t-i} + \sum_{i=1}^{p} a_{2i} DGII_{t-i} + \sum_{i=1}^{p} a_{3i} DCPI_{t-i} + mECT_{t-1} + \varepsilon_t \quad (4)$$

In this context, the coefficient m of the error correction term (ECT) measures the extent to which GDP adjusts to deviations from the long-run equilibrium in each period and the speed at which the system returns to equilibrium following a short-term shock.

Nonlinear Autoregressive Distributed Lag (NARDL) Model
In practice, the Global Innovation Index (GII) may have an **asymmetric effect** on GDP. Therefore, we decompose the key independent variable (GII) in the model into two components: the **cumulative positive changes** and **cumulative negative changes,** denoted as@CUMDN(lnGII)t and @CUMDP(lnGII)t , respectively. These components are defined as follows:

$$@CUMDN(\ln GII)_t = \sum_{s=1}^{t} \ln GII_s^- = \sum_{s=1}^{t} \text{Min}(\ln GII_s, 0) \quad (5)$$

$$@CUMDP(\ln GII)_t = \sum_{s=1}^{t} \ln GII_s^+ = \sum_{s=1}^{t} \text{Max}(\ln GII_s, 0) \quad (6)$$

By substituting Equations (5) and (6) into Equation (3), we obtain **model** as follows:

$$DGDP_t = a_o + \sum_{i=1}^{p} a_{1i} DGDP_{t-i} + \sum_{i=1}^{p} a_{2i}^- D@CUMDN(GII_{t-i}) + \sum_{i=1}^{p} a_{2i}^+ D@CUMDP(GII_{t-i}) + \sum_{i=1}^{p} a_{3i} DCPI_{t-i} + a_1^- @CUMDN(GII_{t-1}) + a_1^+ @CUMDP(GII_{t-1}) + a_2 \ln CPI_{t-1} + \omega_t \quad (7)$$

By substituting Equations (5) and (6) into Equation (4), we obtain the **Nonlinear ARDL (NARDL)** model as follows:

$$DGDP_t = a_o + \sum_{i=1}^{p} a_{1i} DGDP_{t-i} + \sum_{i=1}^{p} a_{2i}^- D@CUMDN(GII_{t-i}) + \sum_{i=1}^{p} a_{2i}^+ D@CUMDP(GII_{t-i}) + \sum_{i=1}^{p} a_{3i} DCPI_{t-i} + mECT_{t-1} + \omega_t \quad (8)$$

Results and Discussion
Table 1 presents the descriptive statistics of the variables GDP, CPI, and GII. The results indicate that all three variables follow a normal distribution and there are no serious anomalies or irregularities in the data.

The results of the unit root tests for GDP, CPI, and GII are reported in **Table 2** below.

Table 2: Unit Root Test. Null Hypothesis: The Variable Has a Unit Root.

Variable	Constan without trend		Order of Integration
	Level 0	Constan without trend	
GDP	-0.465	-4.135***	I(1)
CPI	-3.3877**	-3.118**	I(0)
GII	-1.035	-7.01***	I(1)

Note: ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively
Source: Authors' calculations based on data using EViews.

The unit root test results in **Table 2** show that the variables **GDP** and **GII** are non-stationary at level but become stationary after taking the first difference at the 5% significance level, indicating that they are integrated of order one, I(1). The variable **CPI** is stationary at level at the 5% level, i.e., I(0). Therefore, the variables GDP, CPI, and GII satisfy the requirements for applying the **ARDL** or **NARDL** modelling framework. The results of the **Bounds Test** for cointegration among GDP, CPI, and GII are presented in **Table 3** below.

Table 3: Bound Test Result. Null Hypothesis: No Leves Relationship.

F-Statistic	F-Bounds Test (Interept and no trend)					
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
7.470	2.170	3.190	2.720	3.830	3.880	5.300

Source: Authors' calculations based on data using EViews.

The results of the **Bounds Test** in **Table 3** show that the F-statistic value is **9.045**, which exceeds the upper bound critical value at the **1% significance level**. This confirms the **existence of a long-run cointegration relationship** among the variables **GDP, CPI,** and **GII.** Based on the results of the unit root tests and the Bounds Test, we proceed to estimate the **ARDL model** for the variables GDP, CPI, and GII. Given the small sample size, a **lag length of 2** is selected for all variables. The **Akaike Information Criterion (AIC)** is used to select the optimal model specification, and the results are shown in **Figure 3** below.

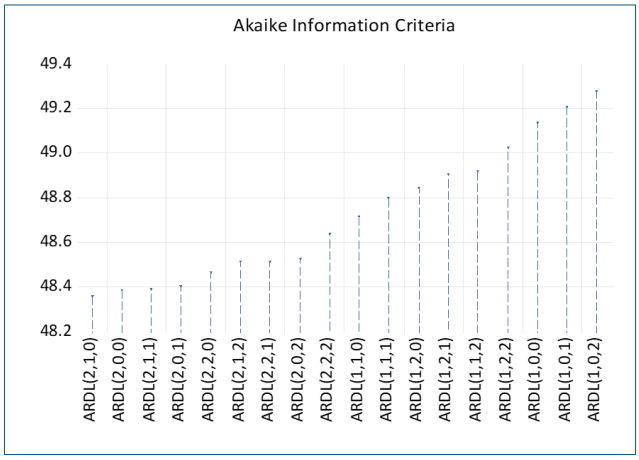


Figure 2: Model ARDL Selection Criteria.

Based on **Figure 2,** the optimal model specification is **ARDL(2,1,0).** The estimation results of the ARDL model are presented in **Table 4** below.

Table 4: ARDL Estimation Output.

Dependent Variable is: GDP Deterministics: no constant and no trend (Case 1) Selected model: ARDL(2,1,0)		
Variable	Coefficient	Prob
GDP(-1)	0,2895	0,2570
GDP(-2)	0,4378**	0,0424
CPI	1,29 x 10^{9}*	0,0851
CPI(-1)	-7,65 x 10^{8}	0,2565
GII	1,32 x 10^{11}**	0,0127
C	-4,20 x 10^{10}	0,2648
@TREND	2,99 x 10^{10}	0,0005
Adjusted R – Squared	0,9958***	
F-Statistic	587,1341***	
Prob (F-Statistics)	0,0000	
Model test diagnosis	Statistic	P-value
Breusch- Godfrey serial correlation LM test	F-sta = 1,2082	0,3542
Heteroskedasticity: ARCH	F-sta = 0,2126	0,6524
Ramsey RESET test	F-sta = 0,5843	0,4666

Note: ***, *, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
Source: Authors' calculations based on data using EViews.

The estimation results of the ARDL(2,1,0) model in Table 5 show that GDP in the previous period does not affect current GDP, but GDP from two periods earlier has a positive effect (coefficient of 0.4378) on current GDP at the 5% significance level. The current CPI has a positive effect on GDP (coefficient of 1.29 × 10^{9}) at the 10% significance level. The current GII also has a positive effect on GDP (coefficient of 1.32 × 10^{11}) at the 5% significance level. The trend variable has a positive effect on GDP at the 1% significance level (coefficient of 2.99 × 10^{10}). The model fits well, with an adjusted R-squared of 99% at the 1% significance level. The diagnostic tests confirm that the ARDL(2,1,0) model does not suffer from autocorrelation, has constant error variance (no heteroskedasticity), and has the correct functional form at the 1% significance level. This indicates that the ARDL(2,1,0) model is correctly specified, stable, and reliable. The CUSUM and CUSUM of Squares plots for the ARDL(2,1,0) model are shown in Figure 3 below.

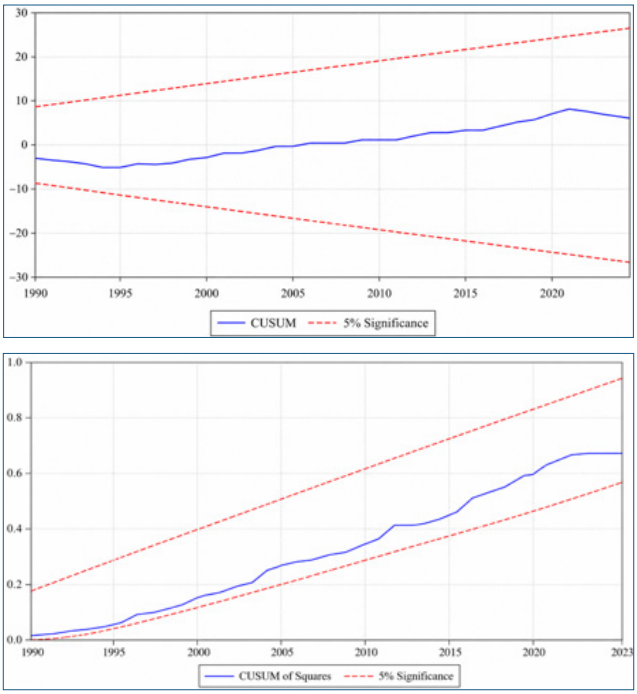


Figure 3: ARDL Plot of CUSUM and CUSUM of Squares.

From **Figure 3**, it is confirmed that both the **CUSUM** and **CUSUM of Squares** lines remain within the 5% significance bounds throughout the entire period, indicating that the **ARDL (2,1,0) model is structurally stable** over the study period. The **short-run and long-run estimation results** of the ARDL model are presented in **Table 5** below.

Table 5: Long- Run and Short – Run Under ARDL.

Dependent Variable is: D In GDP Deterministics: has intercept and trend Selected model: ARDL(2,1,0)		
Variable	Coefficient	Prob.
Long- run		
GDP(-1)	-0,2483***	0,0006
CPI(-1)	5,21 x 10^{8}	0,1185
GII	1,32 x 10^{11} **	0,0127
C	-4,2 x 10^{11}	0,2648
@TREND	2,99 x 10^{10} ***	0,0005
Short- run		
ECT(-1)	-0,2483***	0,0001
DGDP(-1)	0,2378**	0,022
DGDI	1,29 x 10^{9} **	0,0395

Note: ***, *, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.

Source: Authors' calculations based on data using EViews.

The results in Table 6 show that, in the long run, the Global Innovation Index (GII) has a significantly positive impact on changes in economic growth at the 5% significance level (coefficient: 1.32×10^{11}). In contrast, lagged GDP has a negative impact on current economic growth, statistically significant at the 1% level, while lagged CPI does not have a statistically significant effect. The trend variable positively affects changes in GDP at the 1% level of significance. In the short run, past changes in GDP and current changes in CPI both have a positive and statistically significant effect on current GDP changes, at the 5% significance level. The error correction term ECT(-1) is negative and highly statistically significant at the 1% level, confirming the presence of a long-run cointegration relationship and indicating that the system adjusts back to equilibrium at a speed of approximately 24.83% per year. The Akaike Information Criterion (AIC) is used to select the optimal NARDL model, and the result is shown in Figure 4 below.

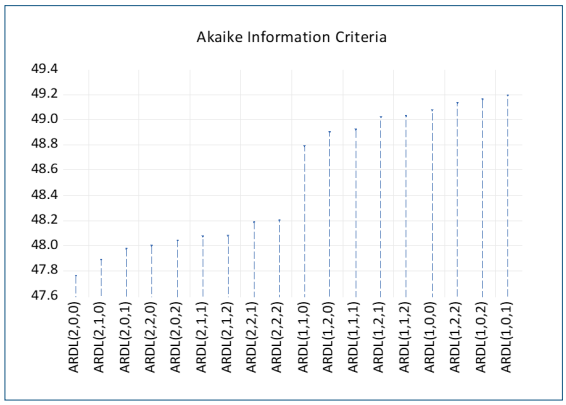


Figure 4: Model NARDL Selection Criteria.

Based on **Figure 4,** the optimal model specification is **NARDL(2,0,0)**. The estimation results of the ARDL model are presented in **Table 6** below.

Table 6: NARDL Estimation Output.

Dependent Variable is: D GDP Deterministics: has intercept and trend Selected model: NARDL(2,0,0)		
Variable	Coefficient	Prob
GDP(-1)	-0,2585***	0,0000
CPI	1.73×10^{9} ***	0,0030
@CUMDP(GII)	$1,99 \times 10^{11}$ ***	0,0003
@CUMDN(GII)	$-9,22 \times 10^{9}$	0,8760
DGDP(-1)	1,004***	0,0005
C	$-4,7 \times 10^{10}$	0,1523
@TREND	$4,05 \times 10^{10}$***	0,0000
Adjusted R – Squared	0,809***	
F-Statistic	11,591***	
Prob (F-Statistics)	0,00086	
Model test diagnosis	Statistic	P-value
Breusch- Godfrey serial correlation LM test	F-stas = 3,1176	0,1076
Heteroskedasticity: ARCH	F-stas = 2,1033	0,1707
Ramsey RESET test	F-stas = 2,2265	0,1614

Note: ***, *, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
Source: Authors' calculations based on data using EViews.

The estimation results of the NARDL (2,0,0) model presented in Table 7 show that lagged GDP has a negative effect on current GDP changes (coefficient: –0.2482) at the 1% significance level, while current CPI has a positive effect on current GDP changes (coefficient: 1.73×10^{9}) at the 1% level. The one-period lag of GDP change also has a positive impact on current GDP change (coefficient: 1.004) and is statistically significant at the 1% level. The NARDL model reveals an asymmetric effect of GII on GDP: the positive component of GII has a statistically significant positive impact on GDP changes (coefficient: 1.99×10^{11}) at the 1% level, whereas the negative component of GII has no significant effect on current GDP change. The trend variable also positively affects current GDP changes. The model shows a good fit, with an adjusted R-squared of 80.9%, statistically significant at the 1% level. Diagnostic test results confirm that the NARDL (2,0,0) model does not suffer from autocorrelation, has homoscedastic residuals, and is correctly specified in terms of functional form at the 1% significance level. This indicates that the NARDL (2,0,0) model is correctly specified, structurally stable, and reliable. The CUSUM and CUSUM of Squares plots of the NARDL (2,0,0) model are presented in Figure 5 below.

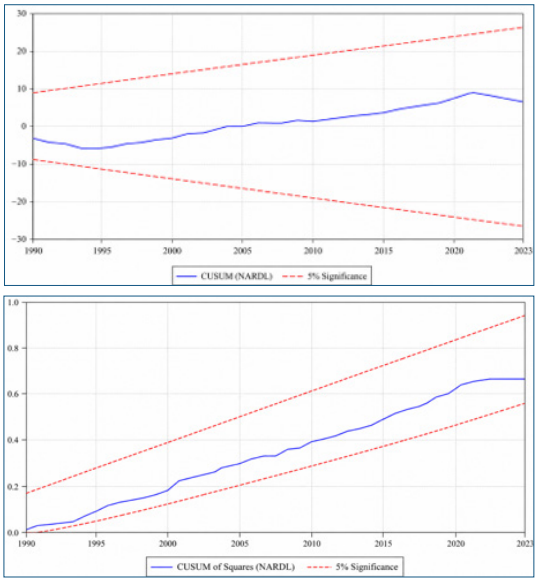


Figure 5: NARDL Plot of CUSUM and CUSUM of Squares.

From Figure 5, it is confirmed that both the CUSUM and CUSUM of Squares lines remain within the 5% significance bounds throughout the entire period, indicating that the NARDL(2,0,0) model is structurally stable over the entire study period. The short-run and long-run estimation results of the NARDL model are presented in Table 7 below.

Table 7: Long- Run and Short – Run Under NARDL.

Dependent Variable is: D In GDP Deterministics: has intercept and trend Selected model: NARDL(2,0,0)		
Variable	Coefficient	Prob.
Long- run		
GDP(-1)	-0,2585***	0,0000
CPI	1,73 x 10^{9} ***	0,003
@CUMDP(GII)	1,99 x 10^{11} ***	0,0003
@CUMDN(GII)	-9,22 x 10^{9}	0,8760
C	-4,7 x 10^{10}	0,1523
@TREND	4,05 x 10^{10} ***	0,0000
Short- run		
ECT(-1)	-0,2585***	0,0000
DGDP(-1)	1,004***	0,000

Note: ***, *, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
Source: Authors' calculations based on data using EViews.

The results in Table 7 indicate that, in the long run, the NARDL (2,0,0) model confirms that positive changes in innovation have a significantly positive impact on changes in economic growth at the 1% significance level, while negative changes in innovation do not have a statistically significant effect on changes in economic growth. Meanwhile, lagged GDP has a negative effect on current GDP changes (coefficient: –0.2483), and both current CPI and the trend variable have positive effects on current GDP changes at the 1% significance level. In the short run, the one-period lagged change in GDP promotes current GDP change (coefficient: 1.004) with strong statistical significance at the 1% level. The error correction term ECT(-1) is negative and highly statistically significant at the 1% level, confirming the existence of a long-run cointegration relationship, with an adjustment speed toward equilibrium of approximately 25.85% per year.

Conclusion and Policy Implications

Conclusion

This study has analysed the relationship between the Global Innovation Index (GII), the Consumer Price Index (CPI), and economic growth (GDP) in Vietnam using both ARDL and NARDL estimation methods, with the aim of capturing both linear and nonlinear effects in the short and long run. The ARDL model results indicate that in the long run, the GII has a significantly positive effect on economic growth at the 1% significance level. In the short run, changes in current CPI have a positive effect on current GDP at the 5% level. More importantly, the results from the NARDL model reveal the presence of an asymmetric relationship between GII and GDP. Specifically, increases in GII have a significantly positive impact on economic growth, while decreases in GII do not have a statistically significant effect. This underscores the critical role of innovation in promoting economic growth and highlights the importance of maintaining an upward trend in GII over time. Furthermore, the error correction term ECT(-1) is negative and statistically significant in both models, confirming the existence of a long-run cointegration relationship and the system's ability to adjust back to equilibrium over time.

Additionally, the results from both the ARDL and NARDL models indicate that CPI affects economic growth in different ways depending on the phase and context. In certain cases, current CPI positively influences GDP with strong statistical significance, suggesting that a well-controlled inflation rate can support growth. However, there is also evidence—particularly from the ARDL model—that high CPI levels may negatively impact GDP, indicating the necessity to maintain CPI within a reasonable and stable range to ensure the effectiveness of innovation in driving economic growth. This study contributes to filling a gap in the existing literature, which has mainly focused on the separate direct impacts of either CPI or GII on GDP, without exploring the asymmetric mechanism of innovation's effects or analyzing the joint impact of both factors within a unified dynamic framework. The application of the NARDL model to test the asymmetry between positive and negative changes in GII represents a key novelty of this study. It expands the traditional approach and provides a more comprehensive perspective on the driving forces behind economic growth in the context of Vietnam.

Policy Implications

Based on the empirical findings, this study not only clarifies the role of innovation and CPI in economic growth but also provides several important policy implications. The following policy recommendations are intended to support policymakers in designing sustainable economic development strategies, effectively leveraging the momentum of innovation, and optimizing the management of foreign investment flows. First, Vietnam should prioritize the development of an innovation ecosystem. The government should continue to increase investment in research and development (R&D), support innovation centers, startup incubators, and technology transfer programs. At the same time, a favorable legal and regulatory environment should be established to encourage innovation and technology adoption in the private sector. Second, to sustain the positive impact of innovation, long-term strategies are needed to continuously improve the components of the Global Innovation Index (GII), such as the quality of higher education, technological infrastructure, and firms' innovation capacity. Specific targets should be integrated into a National Innovation Strategy to ensure long-term stability and improvement of the GII in the future.

Third, Vietnam should implement flexible macroeconomic adjustment policies to support economic rebalancing, particularly in the face of external shocks. Given that the estimated speed of adjustment back to equilibrium ranges from 24.83% to 28.85% per year, maintaining macroeconomic stability and responding promptly to fluctuations are essential. Fourth, controlling the Consumer Price Index (CPI) through flexible interest rate and monetary supply management is necessary to keep CPI within a stable target range. This helps create a favorable macroeconomic environment that encourages investment and enhances the effectiveness of innovation in promoting economic growth. Finally, policies for the development of human capital for innovation need to be emphasized. It is crucial to strengthen digital skills, creative thinking, and innovation capacity training from the primary and secondary education levels through to higher education. Additionally, mechanisms to incentivize, reward, and attract talent in high-tech sectors and R&D should be developed to ensure a strong human resource base for innovation and future economic growth.

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