OKUN'S LAW AND PHILLIPS CURVE REVISITED: NONLINEAR EVIDENCE FROM THE MOROCCAN ECONOMY

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Abstract:
This study examines the validity of Okun's Law and the Phillips Curve in Morocco within a nonlinear framework, aiming to explain persistent unemployment despite sustained growth. Using annual data from 1981–2024 applying NARDL models, the analysis reveals asymmetric relationships among investment, inflation, growth, and unemployment. Negative shocks in investment and output significantly raise unemployment, while positive shocks yield weaker effects, confirming partial validity of Okun's Law but rejecting the Phillips Curve. Results highlight Morocco's structural rigidities and suggest policy measures promoting inclusive, labor-intensive investment and countercyclical strategies to mitigate adverse shocks and foster sustainable employment.
Keywords : *Okun's Law; Phillips Curve; Nonlinear ARDL (NARDL); Unemployment; Moroccan Economy*

Résumé:
Cette étude examine la validité de la loi d'Okun et de la courbe de Phillips au Maroc dans un cadre non linéaire, dans le but d'expliquer la persistance du chômage malgré une croissance soutenue. À partir des données annuelles de 1981 à 2024 et en appliquant le modèle NARDL, l'analyse révèle des relations asymétriques entre l'investissement, l'inflation, la croissance et le chômage. Les chocs négatifs sur l'investissement et la production augmentent considérablement le chômage, tandis que les chocs positifs ont des effets plus faibles, confirmant la validité partielle de la loi d'Okun mais rejetant la courbe de Phillips. Les résultats mettent en évidence les rigidités structurelles du Maroc et suggèrent des mesures politiques favorisant des investissements inclusifs et à forte intensité de main-d'œuvre, ainsi que des stratégies anticycliques visant à atténuer les chocs.
Mots-clés : *Loi d'Okun ; Courbe de Phillips ; NARDL ; Chômage ; Economie Marocaine*

JEL code : *E24, D25, C51, E60*

Introduction

Over the years, Morocco has maintained a steady and sustainable growth rate, which was temporarily disrupted by the COVID-19 pandemic. However, the Moroccan economy demonstrated strong resilience, rebounding in 2021 and continuing on a path of sustained growth. This resilience and stability have made Morocco an attractive hub for foreign investment, driven by ambitious investment-led strategies to promote structural transformation through trade liberalization, industrial diversification, and major public infrastructure projects (World Bank, 2017; (OCDE, 2020). Yet, despite this consistent growth and ambitious investment, employment in Morocco has remained persistently low (HCP, 2022). This paradox of "growth without employment" raises fundamental questions about the underlying drivers of economic growth in Morocco and the nature of the relationship between these factors in such a context.

According to Okun's Law (Okun, 1962), an increase in output growth should reduce unemployment, while the Phillips Curve (Phillips, 1958) implies an inverse short-run relationship between inflation and unemployment. However, these fundamental economic theories are not always universally applicable. Empirical studies from various contexts have shown that the relationships between growth, inflation, and unemployment can be nonlinear and asymmetric (Keller & Nabli, 2002; Moosa, 2008; Conteh, 2021; Bhattarai, 2016). This seems to be the case in Morocco, where economic growth has not translated into sufficient job creation or new opportunities. Other studies further support this finding (Belinga & Doukali, 2019; Allal et al., 2025), showing only limited employment responses to growth and inflation dynamics. Such divergences point to the presence of structural rigidities and asymmetric adjustments that conventional linear models fail to capture.

As one of the main drivers of economic growth, investment remains a central pillar of Morocco's economic strategy, supported by public spending, as well as private and foreign direct investment across various sectors particularly automotive and aeronautics and extending to future ambitious initiatives such as green energy and lithium batteries used in electric vehicles. (OCDE, 2020; Arbia et al., 2023; OE S et al. 2025). However, its capacity to reduce unemployment sustainably appears constrained by sectoral concentration, skill mismatches, and limited spillover effects (HCP, 2022). These patterns suggest that the effects of investment, growth, and inflation on labor market outcomes may be asymmetric and nonlinear.

Based on this context, the central question of this study is as follows: **Why has Morocco's economic growth failed to generate sufficient employment to reduce the rising unemployment rate?** This leads us to examine whether the traditional macroeconomic relationships described by Okun's Law and the Phillips Curve remain valid in an environment characterized by structural transformation and nonlinearity.

To address this issue, the article is organized as follows: Section 1 reviews the theoretical and empirical literature on the relationships among unemployment, growth, inflation, and investment. Section 2 presents the data and econometric methodology, including the ARDL and NARDL models. Section 3 discusses the empirical findings and their interpretation. Finally, Section 4 concludes with the main results, policy implications, and recommendations for future research.

1. Literature Review:

1.1. Unemployment and Growth:

Before analyzing the relationship between unemployment and investment, it is necessary to first define its connection with economic growth. This relationship, studied in the 1960s, became known as Okun's law, after the economist Arthur Okun. It is a fundamental concept in macroeconomics that has given rise to numerous studies, providing a simple, verifiable, and empirical basis for understanding the link between unemployment and economic growth. However, empirical research has shown that this law is not universal; rather, it varies across countries and

economic contexts. According to his seminal work Potential GNP: Its Measurement and Significance, the principle underlying Okun's law suggests that a one-percentage-point increase in the unemployment rate reduces output by three percentage points (Prachowny, 1993).

Several studies have confirmed the existence of an Okun's law relationship. Marinko & Geldenhuys (2007); Akeju & Olanipekun (2014), provided evidence supporting the validity of Okun's law. Villaverde & Maza (2009), using data from 1980 to 2004, verified the existence of this relationship for most Spanish regions as well as for the economy as a whole. In the case of Nigeria, Onyebuchi Michael et al. (2016) employed a cointegration test, the Vector Error Correction Model (VECM) approach, and the Granger causality test on data spanning 1980 to 2013. Their results indicated that unemployment exerts a negative and significant effect on GDP, highlighting that the causality between unemployment and economic growth is unidirectional, running from economic growth to unemployment.

Similarly, Dritsakis & Stamatiou (2016) found that unemployment and economic growth in Greece between 1995 and 2015 exhibit a unidirectional causal relationship running from unemployment to economic growth. Furthermore, Freeman (2001); Mitchell & Pearce (2010) reaffirmed the existence of the Okun's law relationship; however, they observed that the effect of changes in the unemployment rate on GDP growth is weaker than that implied by Okun's original coefficient.

By contrast, other studies have questioned the universality of Okun's law. Keller & Nabli (2002) suggested that in the MENA region, strong economic growth does not necessarily translate into favorable labor market outcomes. Similarly, Knotek II (2007) found that an economic slowdown is not always accompanied by an increase in the unemployment rate, either in the short or the long run. Along the same lines, Moosa (2008) demonstrated that productivity growth does not lead to higher employment in Algeria, Egypt, Morocco, and Tunisia, indicating that Okun's coefficient is not statistically significant. Supporting this view, Conteh (2021), using an ARDL approach, found no long-run relationship between unemployment and economic growth in Liberia over the period 2001–2019.

Moreover, numerous studies have shown that the magnitude of Okun's coefficient varies across countries, economies, and over time. For instance, Lee (2000) suggested that in OECD countries, the impact of economic growth on unemployment remains valid, but the relationship is neither stable over time nor consistent across nations. Building on this OECD-based analysis, Cazes et al. (2013) supported these findings, noting that during periods of global crisis, unemployment tends to be less sensitive in countries characterized by stronger employee protection. Furthermore, the value of Okun's coefficient may also differ depending on the econometric approach employed.

Sadiku et al. (2015) examined quarterly data for Macedonia (2000–2012) using four different models, the difference model, the dynamic model, the ECM, and the VAR estimation and found mixed evidence regarding Okun's law. Gil-Alana et al. (2020) further confirmed that the Okun coefficient varies considerably depending on the methodological approaches employed. Similarly, Mussida & Zanin (2023) compared classical linear models with robust M-estimation within a rolling regression framework to investigate the instability of coefficients over time. Both approaches confirmed the instability of Okun's coefficient across nine European countries during the period 1981–2021, with the exception of Norway.

Kim et al. (2015) ; Ball et al. (2017); Rahman & Mustafa (2017); Furceri et al. (2020) found that Okun's coefficient varies across countries, suggesting that labor market characteristics and broader economic contexts play a key role in shaping the relationship between unemployment and economic growth. Guisinger et al. (2018) further highlighted that states with more flexible labor markets, lower unionization rates, and a higher share of non-manufacturing employment exhibit greater variations in Okun's coefficient.

The analysis of the relationship between economic growth and unemployment also raises questions regarding its connection with investment. Several studies have emphasized the need to attract foreign direct investment (FDI) into high value-added sectors (Djambaska & Lozanoska, 2015), which requires improvements in human capital (Alalawneh & Nessa, 2020). At the same time, this must go hand in hand with the enhancement of domestic investment.

1.2. Unemployment and Inflation:

The relationship between unemployment and inflation has been central to macroeconomic debates. Keynes (1936) argued that stimulating aggregate demand could reduce unemployment when unused capacity existed, a view that held until the late 1960s. However, this framework broke down in the 1970s, when advanced economies experienced inflationary spirals aggravated by oil shocks. Earlier, Phillips (1958) had identified a short-run trade-off between unemployment and inflation, but subsequent theories of the natural rate (Phelps, 1968; Friedman, 1968) and rational expectations (Lucas, 1973) suggested that this trade-off vanishes in the long run: unemployment reverts to its natural rate while inflation rises. Later contributions emphasized labor and product market imperfections such as union wage bargaining, minimum wages, and rigid employment rules as sources of structural unemployment that weaken the Phillips curve mechanism (Blanchard & Kiyotaki, 1987; Manning, 1995; Pissarides, 2000, 2013). This strand of thought shifted the focus from demand management to structural and institutional reforms as the path to sustainable unemployment reductions.

Empirical studies, however, provide a more nuanced picture. Using OECD data for 1990–2014, Bhattarai (2016) finds that Phillips curve effects remain significant in most economies, though weaker than in earlier decades. This persistence suggests that while inflation has been stabilized by inflation-targeting regimes, unemployment continues to vary widely, making structural labor market reforms essential for meaningful trade-offs. Complementing this, Meloni, Romaniello and Stirati (2022) show that long-term unemployment does not raise the NAIRU, casting doubt on the idea that hysteresis necessarily shifts the inflation–unemployment relationship upward.

Other work has proposed alternative measures of labor market slack. Barnichon & Shapiro (2024) argue that the vacancy–unemployment (V/U) ratio and vacancy-filling costs better capture inflationary pressures than the unemployment rate itself. Their findings, especially in the post-COVID context, highlight that shifts in matching efficiency along the Beveridge curve are central to understanding inflation dynamics.

Evidence at the national level further complicates the conventional narrative. Schreiber & Wolters (2005), focusing on Germany, identify a robust negative long-run relationship between unemployment and inflation, challenging the NAIRU framework that assumes no long-run trade-off. Yet, even in the U.S., results are not uniform. Crump et al. (2024) show that during the post-COVID recovery, inflation was largely the product of supply shocks, but unemployment gaps also mattered, and disinflation followed from shifting expectations rather than higher unemployment. Similarly, Karanassou & Sala (2010) provide evidence of a significant long-run downward-sloping Phillips curve, suggesting that monetary factors influence unemployment beyond the short run and contradicting the classical dichotomy.

In Morocco, the evidence on the Phillips curve is mixed. Belinga & Doukali (2019), using a structural New Keynesian model, show that inflation dynamics are well explained by output gaps and expectations, consistent with a short-run inverse relationship between unemployment and inflation. Similarly, El-Amin & Al-Zu'bi (2022) find that inflation generate higher unemployment rates. By contrast, Allal et al. (2025) conclude that in Morocco higher unemployment is actually associated with higher inflation in both the short and long run, contradicting the classical Phillips curve.

Taken together, this literature reveals an unsettled debate. While early theories concluded that the unemployment–inflation trade-off disappears in the long run, empirical findings are mixed: some studies confirm the vertical Phillips curve, while others uncover persistent negative relationships driven by structural or monetary forces. What emerges consistently, however, is that short-run trade-offs remain, though attenuated, and that long-run outcomes depend heavily on institutional features, labor market frictions, and the role of expectations.

1.3. Unemployment and Investment:

The question of the impact of investment on employment has been addressed very early in the economic literature. Keynesian approaches (Keynes, 1936) highlight the role of the multiplier, according to which an increase in investment raises aggregate demand and fosters employment through a spillover effect on production and consumption. This mechanism is reinforced by Samuelson's (1939) multiplier–accelerator model, which emphasizes how investment, reacting to variations in demand, amplifies economic cycles. Similarly, Harrod (1939) and Domar (1946) stressed the need for a sufficient rate of investment to sustain stable growth and absorb the available labor force, thus laying the foundations of the link between capital and employment.

Neoclassical approaches introduce a different perspective. Solow's model (1956) points out that capital accumulation increases the marginal productivity of labor and stimulates short-term growth, but that capital–labor substitution and diminishing returns limit the long-term effects on employment. From a more empirical standpoint, Okun (1962) established a statistical relationship between growth and unemployment, suggesting that investment, by driving output, indirectly affects employment through GDP dynamics. These theoretical frameworks show that investment is a necessary condition for growth and employment, but not sufficient to guarantee their sustainability.

More recent theories emphasize the qualitative role of investment. Endogenous growth models (Romer, 1986; Lucas, 1988) consider that investments in R&D and human capital generate positive externalities, fostering sustained growth and the creation of skilled jobs. Greenwood, Hercowitz, and Krusell (1997), for their part, underline the role of embodied technological progress in capital, which transforms the productive structure and employment. In parallel, matching models (Mortensen & Pissarides, 1994) emphasize that investment influences the flows of job creation and destruction, depending on labor market conditions.

Public investment plays a decisive role in job creation in Morocco. According to the World Bank (2017), infrastructure spending between 2000 and 2015 had a significant multiplier effect on short-term employment, particularly in the construction sector. However, this impact fades in the medium term in the absence of complementary structural reforms, notably in vocational training, thereby limiting a sustained reduction in unemployment.

Foreign direct investment (FDI) has also contributed to employment dynamics, especially in high value-added sectors. The DELEGATIONS, H. O. P. (2020). reports that FDI in the automotive and aeronautics industries created around 90,000 direct jobs between 2014 and 2019. Moreover, an econometric study based on the ARDL model for the period 1990–2020 shows that FDI exerts a positive and significant effect on Moroccan economic growth in both the short and long run (Arbia, Sobhi & Karim, 2023).

Private investment also plays a key role in reducing unemployment. According to the High Commission for Planning (HCP, 2022), a 10% increase in private investment leads to a 1.2% decrease in the national unemployment rate and a 0.8% decline among young people.

The existing literature presents mixed evidence regarding the validity of Okun's law, the Phillips curve, and the impact of investment on unemployment, particularly in the Moroccan context. Few studies have examined these relationships jointly while considering investment as a key driver of growth and employment. Moreover, the majority of previous analyses rely on linear models, which may overlook possible asymmetries and nonlinear dynamics. This lack of integrated

and nonlinear investigation highlights the need for a comprehensive empirical re-examination of the Moroccan economy.

Building on this observation, the present study hypothesizes that investment reduces unemployment in Morocco and that both Okun's law and the Phillips curve hold true within a nonlinear analytical framework.

2. Data and Methodology:

2.1. Data:

To explore the Moroccan paradox, this study draws on the theoretical frameworks of Okun's law and the Phillips curve, examining the interplay between inflation dynamics, economic growth, labor market conditions, and investment. We use annual data covering the period from 1981 to 2024, with all variables drawn from the World Bank database. The unemployment rate (UNP), investment measured by gross fixed capital formation (INV), the consumer price index (CPI, as a proxy for inflation), and the economic growth rate (GDP) serve as the core indicators of our empirical analysis. The unemployment rate and GDP growth are directly tied to Okun's law, which describes the relationship between output and labor market performance. Investment is included as a driver of long-term growth and job creation, reflecting the productive capacity of the economy. The consumer price index is central to the Phillips curve, which links price dynamics to labor market conditions. Together, these variables provide a comprehensive framework for testing the coexistence of growth, unemployment, and inflation dynamics in Morocco.

In addition, we include trade openness (OUV) and public expenditure (PE) as control variables, also drawn from the World Bank database. Trade openness reflects the degree of integration of the Moroccan economy into global markets, influencing both growth and employment through external demand and competitiveness. Public expenditure captures the role of fiscal policy as a stabilizing tool, affecting aggregate demand, investment incentives, and social spending. By controlling for these structural factors, our model isolates the dynamics of unemployment, growth, and inflation while situating them within the broader macroeconomic environment.

2.2. Methodology:

The most used cointegration techniques are the co-integration test of Engle & Granger (1987) and the co-integration test of Johansen 1988 1991 1996). However, these usual modelling techniques recommend the use of integrated series at the same order I(0) or I(1). In addition, they are suitable for large sample sizes. To address these limitations, Pesaran & Shin (1998), Pesaran et al. (2001) introduced a more versatile and less constrictive approach. The Autoregressive Distributed Lag (ARDL) model, in fact, allows for testing long-term relationships through bounds testing on series that do not share the same integration order, and it also provides more accurate estimates with smaller sample sizes. Thus, the ARDL makes it possible to simultaneously process long-term dynamics and short-term adjustments. It is in this context that equation will be expressed as follows:

$$\begin{aligned}\Delta UNP_t &= \beta_0 + \sum_{i=1}^{p-1} \beta_1 \Delta UNP_{t-i} + \sum_{i=0}^{q-1} \beta_2 \Delta INV_{t-i} + \sum_{i=0}^{q-1} \beta_3 CPI_{t-i} + \sum_{i=0}^{q-1} \beta_4 GDP_{t-i} \\ &+ \sum_{i=0}^{q-1} \beta_5 \Delta OUV_{t-i} + \sum_{i=0}^{q-1} \beta_6 \Delta DP_{t-i} + \theta_1 UNP_{t-i} + \theta_2 INV_{t-i} + \theta_3 CPI_{t-i} \\ &+ \theta_4 GDP_{t-i} + \theta_5 OUV_{t-i} + \theta_6 PE_{t-i} + \varepsilon_t\end{aligned} \quad \textbf{(1)}$$

Where Δ denotes the first difference operator; $\beta_1 - \beta_6$ represent the coefficients of Error Correction Model (ECM); $\theta_1 - \theta_6$ are the coefficients of the long-term relationship; p is lag length of the dependent variable; q is lag length of the explanatory variables; and ε_t is an error term i.i.d $(0, \sigma_\mu^2)$.

However, the ARDL model assumes linearity, implying that both positive and negative shocks to the regressors are presumed to exert an equal level of influence on the target variable. Consequently, the previous model fails to account for the asymmetric response of oil consumption to macroeconomic shocks.

To address this limitation, the symmetric ARDL bounds test previously described is complemented by its asymmetric counterpart, known as the nonlinear autoregressive distributed lag (NARDL) model. This model, popularized by Shin et al. (2014), offers a path for decomposing the regressors into positive and negative partial sums, as defined as follows:

$$X_t^+ = \sum_{i=1}^{t} \Delta x_i^+ = \sum_{i=1}^{t} max\,(\Delta x_i, 0) \quad ; \qquad X_t^- = \sum_{i=1}^{t} \Delta x_i^- = \sum_{i=1}^{t} min\,(\Delta x_i, 0) \tag{2}$$

As demonstrated by Shin, Yu and Greenwood-Nimmo (2011), the previous equation can be written as:

$$\begin{aligned}\Delta UNP_t &= \beta_0 + \sum_{i=1}^{P-1} \beta_1 \Delta UNP_{t-i} + \sum_{i=0}^{q-1} {\beta_2}^+ INV_{q,i}^+ + \sum_{i=0}^{q-1} {\beta_3}^- INV_{q,i}^- + \sum_{i=0}^{q-1} {\beta_4}^+ CPI_{q,i}^+ \\ &+ \sum_{i=0}^{q-1} {\beta_5}^- CPI_{q,i}^- + \sum_{i=0}^{q-1} {\beta_6}^+ GDP_{q,i}^+ + \sum_{i=0}^{q-1} {\beta_7}^- GDP_{q,i}^- + \theta_1 UNP_{t-i} \\ &+ \theta_2 INV_{t-i}^+ + \theta_3 INV_{t-i}^- + \theta_4 CPI_{t-i}^+ + \theta_5 CPI_{t-i}^- + \theta_6 GDP_{t-i}^+ + \theta_7 GDP_{t-i}^- + \theta_8 \mathrm{OUV} \\ &+ \theta_9 \mathrm{PE} + \varepsilon_t\end{aligned} \tag{3}$$

- The first step of this work is to test the order of integration of time series. Indeed, we must ensure that none of them is integrated at order I(2).
- The second step is to verify the existence of a long-term relationship. In this case we are going to use the test proposed by Pesaran et al. (2001), based on F-statistics denoted F_{PSS}, allows to test the following hypotheses : the null hypothesis is the absence of a long-term equilibrium relationship :

  $$H_0: {\theta_2}^+ = {\theta_3}^- = 0, {\theta_4}^+ = {\theta_5}^- = 0, {\theta_6}^+ = {\theta_7}^- = 0$$

  Against the alternative hypothesis

  $$H_1: {\theta_2}^+ \neq {\theta_3}^- \neq 0, {\theta_4}^+ \neq {\theta_5}^- \neq 0, {\theta_6}^+ \neq {\theta_7}^- \neq 0$$
- The third step is to examine the asymmetric dynamic multiplier effects (the effects of ${x_t}^+$ and ${x_t}^-$ on y_t)

The dynamic multipliers are used in this case to present and examine the dynamic adjustment path of unemployment, following a positive and negative unit shock affecting one of its determinants. This supposes the passage from an initial equilibrium to a new equilibrium. For : $h = 0,1,2$ ....

$$m_{INV,h}^+ = \sum_{j=0}^{h} \frac{\partial UNP_{t+j}}{\partial INV_t^+}\,; m_{CPI,h}^+ = \sum_{j=0}^{h} \frac{\partial UNP_{t+j}}{\partial CPI_t^+};\; m_{PIB,h}^+ = \sum_{j=0}^{h} \frac{\partial UNP_{t+j}}{\partial GDP_t^+} \tag{4}$$

$$m_{INV,h}^- = \sum_{j=0}^{h} \frac{\partial UNP_{t+j}}{\partial INV_t^-};\; m_{CPI,h}^- = \sum_{j=0}^{h} \frac{\partial UNP_{t+j}}{\partial CPI_t^-};\; m_{PIB,h}^- = \sum_{j=0}^{h} \frac{\partial UNP_{t+j}}{\partial GDP_t^-} \tag{5}$$

Notice that, by construction, as $h \to \infty$, $m_h^+ \to \beta^+$ and $m_h^- \to \beta^-$, where $\beta^+ = \frac{-\theta^+}{\rho}$ and $\beta^- = \frac{-\theta^-}{\rho}$

3. Results and Discussion:

3.1. Stationarity test:

Table 1. Results of the Augmented Dickey-Fuller (ADF) Test

	Model 3		Model 2		Model 1			
Variable	**ADF**	**p-value**	**ADF**	**p-value**	**ADF**	**p-value**	**Conclusion**	**Integration Order**
UNP	-2.365	0.392	-1.985	0.292	-0.222	0.601	Non stationary	I(1)
INV	-3.077	0.125	-2.605	0.100	-0.745	0.388	Non stationary	I(1)
CPI	-4.073	0.013	-3.544	0.011	-2.848	0.006	Stationary	I(0)
GDP	-13.217	0.000	-12.349	0.000	–	–	Stationary	I(0)
PE	-6.662	0.000	-6.135	0.000	-2.463	0.015	Stationary	I(0)
OUV	-2.645	0.264	-0.536	0.874	0.794	0.881	Non stationary	I(1)

Source: Authors

Based on the results presented in Table 1 above, none of the variables are integrated of order two. Instead, they exhibit a combination of I(0) and I(1) integration orders. The endogenous variable, UNP, is integrated of order one, whereas the exogenous variables are either I(0) or I(1). Consequently, the conditions for applying the ARDL estimation are satisfied.

3.2. Determination of the Optimal Lag Length:

To determine the lag structure, we used the lag selection procedure in EViews, which evaluates specifications based on standard information criteria (AIC, SC, HQ) and selects the optimal lag length. Given our limited sample size, we restricted the maximum to two lags to avoid a loss of degrees of freedom that could compromise estimation reliability. This choice strikes a balance between capturing short-run dynamics and preserving enough observations for robust results.

3.3. ARDL Bound Test:

Table 2. Pesaran's F-Bounds Test Results

F-Bounds Test Null Hypothesis: No levels relationship				
Test Statistic	**Value**	**Significance**	**I(0)**	**I(1)**
F-statistic	**5.428394**	10%	2.37	3.20
k	3	5%	2.79	3.67
		2.5%	3.15	4.08
		1%	3.65	4.66

Source: Authors

Before proceeding to the NARDL estimation, we first need to verify whether a long-run cointegration relationship exists among the variables. To do so, we apply the bounds testing approach developed by Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Specifically, we compare the computed F-statistic with the critical values of I(0) and I(1). As shown in **Table 2.** the F-statistic (5.4283) exceeds all the I(1) critical values at the 10%, 5%, 2.5%, and 1% significance levels. This result confirms the existence of a long-run cointegration relationship among the variables. Having established this, we can now proceed to test for the presence of potential nonlinear relationships between the variables.

Having established stationarity properties and confirmed the existence of a long-run relationship through Pesaran's Bounds test in the ARDL framework, we now proceed with the estimation of the NARDL model. This step allows us to analyze the dynamic multiplier effects of the explanatory variables on unemployment (UNP) and to trace the adjustment path of the dependent variable following shocks to the regressors.

3.4. NARDL estimation:

3.4.1. Bound test:

Table 3. Pesaran's F-Bounds Test Results

F-Bounds Test Null Hypothesis: No levels relationship				
Test Statistic	**Valeur**	**Significativité**	**I(0)**	**I(1)**
F-statistic	**5.612031**	10%	1.99	2.94
k	6	5%	2.27	3.28
		2.5%	2.55	3.61
		1%	2.88	3.99

Source: Authors

Based on the bounds test, we observe that the F-statistic (5.6120) exceeds all the critical values of I(1), confirming the existence of a long-run relationship among the variables. Consequently, we can proceed with the interpretation of our NARDL estimation results. In particular, we will examine the multiplier effects of the exogenous variables on unemployment in order to assess the dynamic adjustment path of unemployment following a positive or negative shock to one of the independent variables.

3.4.2. Model Robustness and Specification Diagnostics

Table 4. Results of Model Robustness and Specification Diagnostics

Diagnostic test	Statistic	Decision
Normality	0.0621	Residuals are normally distributed
Autocorrelation	0.057	No residual autocorrelation
Heteroscedasticity	0.549	Residuals are homoscedastic
Ramsey Specification Test	0.411	The model is correctly specified
Stability Test	Cusum and Cusum Sq	Our model is stable (see appendices)

Source: Authors

The diagnostic tests confirm the overall validity of our model. The normality test indicates that the residuals are normally distributed, while the heteroscedasticity test suggests that they are homoscedastic. Furthermore, the autocorrelation test shows no evidence of serial correlation in the residuals. The Ramsey specification test supports that the model is correctly specified. Finally, the CUSUM and CUSUM of squares tests reveal that the stability condition holds, as the statistics remain within the critical bounds, confirming that our model is stable (see Appendices).

3.4.3. Short-Run Dynamics and Error Correction Representation:

Table 5. Error Correction Model (Short-Run Results)

Variable	Coefficient	Erreur Std.	t-Statistic	Prob.
D(INV_POS)	-0.233055	0.228186	-1.021337	0.3169
D(INV_POS(-1))	0.514148**	0.233245	2.204329	0.0369
D(IPC_POS)	-0.118531	0.174130	-0.680704	0.5023
D(IPC_POS(-1))	-0.517182***	0.146945	-3.519554	0.0017
D(PIB_POS)	-0.024721	0.045041	-0.548851	0.5880
D(PIB_POS(-1))	0.090827	0.056483	1.608045	0.1204
OUV	0.028002***	0.006549	4.275832	0.0002
DP	-0.021157	0.039539	-0.535088	0.5973
CointEq(-1)	-0.693027***	0.091420	-7.580712	0.0000

Note: *, ** and * denotes the significance at 1%, 5% and 10% significance level respectively**

Source: Authors

In the short run, the results show that not all variables are statistically significant. For instance, the immediate effect of positive investment shocks ***D(INV_POS***) is insignificant, but its lagged value ***D(INV_POS(-1))*** turns out to be significant and positive at the 5% level, suggesting

that the positive impact of investment on unemployment materializes with a delay rather than immediately. Similarly, positive shocks in consumer prices ***D(IPC_POS)*** have no immediate effect; however, their lagged value ***D(IPC_POS(-1))*** is negative and highly significant at the 1% level. This indicates that inflationary pressures tend to reduce unemployment in the subsequent period, potentially reflecting short-term Phillips-curve dynamics where rising prices stimulate output and labor demand.

On the other hand, GDP growth ***D(PIB_POS)*** and its lag does not show any significant impact in the short run, highlighting that output changes may not translate directly into short-term variations in unemployment. Trade openness (OUV), however, is strongly positive and significant at the 1% level, suggesting that greater openness is associated with higher unemployment, possibly due to import competition or structural adjustments in the labor market. Public Expenditure (DP) remains insignificant, implying no immediate effect on unemployment in the short run.

As for the error correction term ***(CointEq (-1))*** is negative and highly significant at the 1% level, with a coefficient of –0.693. This confirms the existence of a stable long-run relationship between the variables. The magnitude of the coefficient indicates that approximately 69% of any disequilibrium from the previous period is corrected within the current period. In other words, unemployment converges back to its long-run equilibrium at a relatively fast speed of adjustment.

3.4.4. Long run relationship estimation:

Table 6. Long run results

Variable	Coefficient	Erreur Std.	t-Statistic	Prob.
INV_POS	-0.647190**	0.271111	-2.387179	0.0249
INV_NEG	-1.139844***	0.384418	-2.965118	0.0066
IPC_POS	0.999723**	0.388349	2.574287	0.0164
IPC_NEG	1.609227***	0.486440	3.308170	0.0028
PIB_POS	-0.283441***	0.150308	-1.885740	0.0710
PIB_NEG	-0.348938***	0.153281	-2.276457	0.0316
C	22.47600	5.495188	4.090124	0.0004

Note: *, ** and * denotes the significance at 1%, 5% and 10% significance level respectively**

Source: Authors

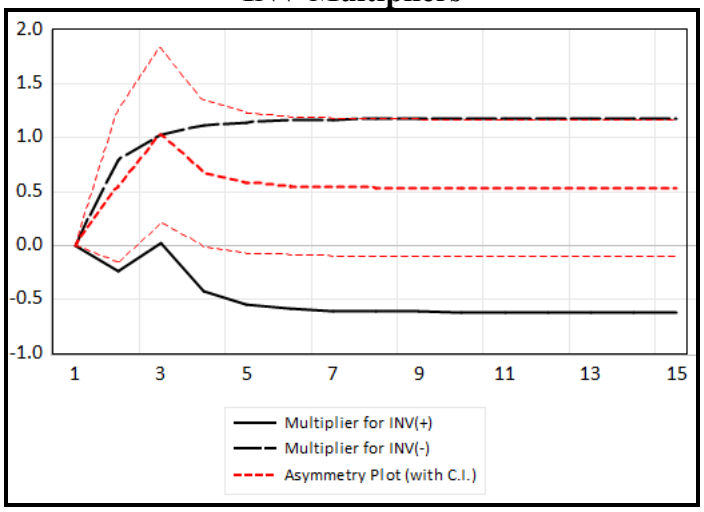
The long-run estimation results reveal several significant relationships between the explanatory variables and unemployment. Investment shocks show asymmetric effects: both positive ***INV_POS*** and negative ***INV_NEG*** investment shocks exert a negative and statistically significant impact on unemployment. However, the magnitude of the effect is stronger for negative investment shocks –1.1398 compared to positive shocks –0.6472, suggesting that contractions in investment worsen unemployment more severely than expansions in investment help reduce it.

Similarly, consumer price shocks also display asymmetry. Both positive ***IPC_POS*** and negative ***IPC_NEG*** shocks are positively and significantly associated with unemployment, with the effect of negative price shocks 1.6092 being stronger than that of positive shocks 0.9997. This indicates that inflationary dynamics whether driven by rising or falling prices tend to increase unemployment in the long run, potentially reflecting instability and distortions in the labor market.

Regarding GDP, both positive ***PIB_POS*** and negative ***PIB_NEG*** output shocks have a negative and significant influence on unemployment, with a slightly stronger effect for negative shocks –0.3489 than for positive shocks –0.2834. This result is consistent with expectations, as higher economic growth tends to reduce unemployment, while contractions in output exacerbate it.

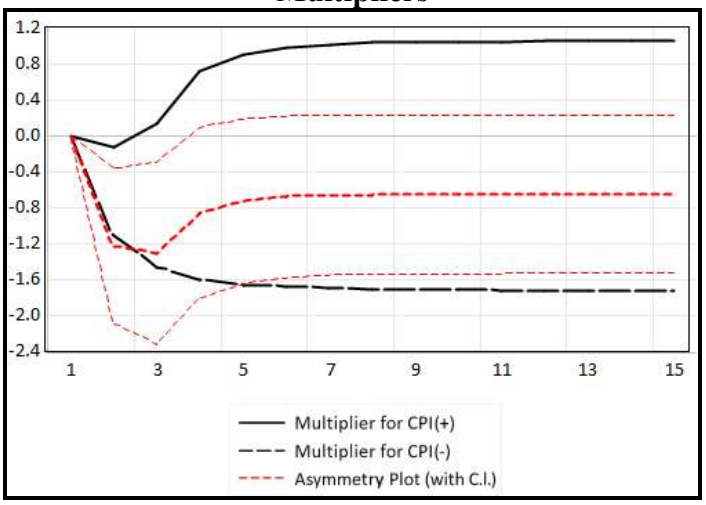
3.4.5. Dynamic Multiplier Effects:

Figure 1. Dynamic Effects of Positive and Negative INV Multipliers



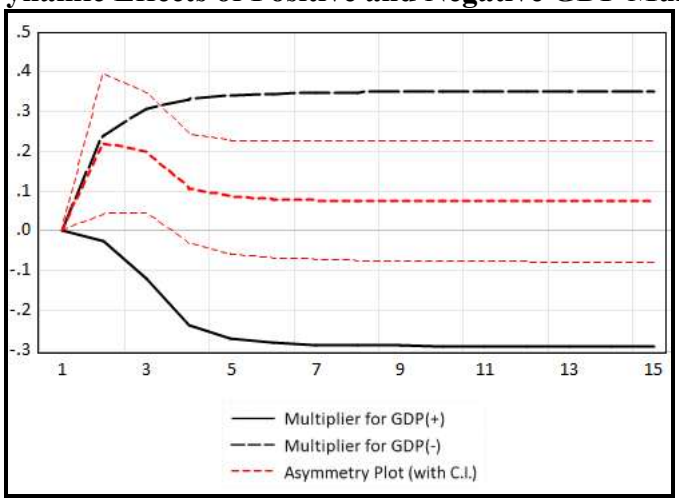
Source: Authors

Fig2. Dynamic Effects of Positive and Negative CPI Multipliers



Source: Authors

Fig3. Dynamic Effects of Positive and Negative GDP Multipliers



Source: Authors

The dynamic multiplier analysis for Morocco reveals notable asymmetries in the response of unemployment to investment, consumer price, and GDP shocks. Positive investment shocks reduce unemployment modestly and only in the short term, with the effect quickly stabilizing and converging toward zero, whereas negative investment shocks generate a sharper and more persistent increase in unemployment, highlighting the greater vulnerability of the labour market to investment contractions as illustrated in the **Fig1**.

As depicted in **Fig2,** a similar asymmetry is observed in the case of consumer prices: rising prices are associated with higher unemployment, consistent with cost-push pressures, while falling prices significantly reduce unemployment, especially within the first three periods, before stabilizing at a lower level.

As for GDP according to **Fig3,** the results align with theoretical expectations where output expansions steadily reduce unemployment, but output contractions trigger a more pronounced and lasting rise in joblessness, underscoring the asymmetric costs of recessions. The asymmetry plots with confidence intervals further confirm the statistical significance of these divergent effects, emphasizing that in Morocco, adverse shocks whether in investment, inflation, or output tend to

exert stronger and more persistent pressures on unemployment than the positive effects generated by favourable shocks.

4. Conclusion:

Our results show that investment does not significantly reduce unemployment in Morocco, and its negative shocks have stronger effects than its positive ones. This contrasts with Meyer & Sanusi (2019), who found a long-run positive impact of investment on employment, and with Bande & Riveiro (2012), who reported that higher investment sustains job creation while declines have persistent adverse effects. Moreover, the traditional Phillips curve is not validated, as no clear inverse link between inflation and unemployment is found. This diverges from the findings of Haschka (2024), Crump et al. (2024), Lasarte-Navamuel et al. (2025), all of whom identified evidence of an inverse or partial Phillips curve relationship. By contrast, economic growth broadly confirms Okun's law, though with an asymmetric impact where recessions increase unemployment more strongly than expansions reduce it. This is in line with Villaverde & Maza (2009) for Spain and Onyebuchi Michael et al. (2016) for Nigeria, while Cazes et al. (2013) highlighted that the strength of this relationship depends on institutional settings such as labor protections.

By relating these results to the real context, even an increase in investment does not meaningfully reduce unemployment, as the jobs created often fail to match the skills and expectations of job seekers. At the same time, low wages and weak bargaining power limit the benefits of existing investments, leading workers to accept inadequate pay that erodes living standards rather than promoting inclusive employment. This structural weakness is further compounded by inflation dynamics that diverge from the traditional Phillips curve. Periods of rising prices often coincide with strong demand, yet because household consumption is concentrated on inelastic goods such as food and energy, thus, the demand does not stimulate formal job creation. Instead, real incomes continue to decline, preventing unemployment from falling. Moreover, supply-side shocks such as droughts or rising energy costs push production costs up, discouraging employers from expanding the workforce and reinforcing the paradox where both inflation and unemployment increase.

Against this backdrop, economic growth remains the only variable that partially aligns with established theory. Morocco's experience broadly confirms Okun's law: GDP expansions reduce unemployment. However, this relationship is highly asymmetric, as contractions in output exert a much stronger and more persistent effect in raising joblessness than expansions do in lowering it. Taken together, these findings reveal a common thread across investment, inflation, and growth: adverse shocks consistently weigh more heavily and for longer on Morocco's labor market than positive developments, underscoring the structural vulnerabilities that hinder the capacity of the economy to generate inclusive and sustainable employment.

The findings highlight the urgent need for Morocco to adopt policies that enhance the ability of growth and investment to generate inclusive employment, while also limiting the asymmetric costs of adverse shocks. Investment policy should prioritize sectors with high labor absorption, especially those integrating youth and women, and support small and medium-sized enterprises, while addressing skill mismatches through education and vocational training. Strengthening wage-setting mechanisms and collective bargaining is equally essential to ensure that job creation translates into decent incomes and protects purchasing power under inflationary pressures. Inflation management requires both demand-side support, through more effective subsidies and social transfers, and supply-side measures, such as improving agricultural resilience and diversifying energy sources. Finally, countercyclical stabilization policies like public works programs or employment guarantees should be scaled up during downturns to prevent recessions from producing persistent unemployment. Together, these measures would help reduce structural asymmetries in Morocco's labor market and foster sustainable, inclusive growth.

Overall, the findings lead to a partial rejection of the research hypothesis. While Okun's law appears to hold in Morocco confirming the inverse relationship between economic growth and unemployment its effect is asymmetric, with recessions exerting a stronger and more persistent impact than expansions. Conversely, the Phillips curve is not validated, as no consistent inverse relationship between inflation and unemployment is observed. Furthermore, investment does not significantly reduce unemployment, and negative investment shocks have a stronger adverse effect than positive ones. These results indicate that the hypothesis is only partially supported, highlighting the structural rigidities that limit the capacity of investment and inflation dynamics to generate inclusive employment in Morocco.

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