The Impact Of Asymmetric Financial Shocks On The Economic Growth Rate In Egypt

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Abstract

This research aims to study how economic growth in Egypt responds asymmetrically to government spending shocks (both positive and negative) during the period from 1980 to 2024 using the NARDL (Nonlinear Distributed Auto regression) model.

The research problem is that traditional linear models assume that a certain percentage increase in government spending has the same (but opposite) effect as a certain percentage decrease. This is unrealistic for Egypt, which has experienced multiple shocks (the 2011 revolution, the 2016 reforms, COVID-19, and the 2022 exchange rate crisis).

The study employed a data collection methodology using annual data from 1980 to 2024 from the World Bank, the Egyptian Ministry of Finance, and the Central Bank of Egypt. The variables included the dependent variable: real GDP per capita growth rate, and the independent variable: real final government spending (divided into positive and negative shocks). The researcher used the following analytical tools:

Unit Root Test (ADF) to verify the stationarity of the time series; Linear ARDL model (as a reference model); Nonlinear NARDL model (the baseline model); Hatemi-J test for asymmetric causality; Diagnostic tests (autocorrelation, heteroscedasticity, stationarity).

The results showed that government spending had no significant impact on economic growth and exhibited a strong autocorrelation problem in the residuals (p-value = 0.000032), with the overall effect of spending being approximately zero.

The nonlinear NARDL model showed that in the short run, positive shocks (increased spending) were not statistically significant, and negative shocks (decreased spending) were not significant in the first period, but were highly significant and negative in the second period (coefficient = -1.880, p = 0.008). In the long-run, the study showed that the multiplier for positive shocks was 0.305 (small effect), while the multiplier for negative shocks was -1.531 (large and negative effect – five times greater).

Regarding the asymmetric causality test: Positive shocks cause economic growth (during all periods of slowdown). Negative shocks because sharp declines in growth (a much stronger effect). Economic growth does not cause spending shocks (neither positive nor negative). Therefore, the asymmetric response confirms that the Egyptian economy is more strongly and deeply affected by reductions in government spending than by increases. The causal direction indicates that fiscal policy drives changes in growth, not the other way around. Negative shocks are more dangerous because reducing government spending has devastating long-term effects on growth.

Consequently, policy recommendations include avoiding sudden cuts; any fiscal austerity should be gradual, not abrupt, to avoid strong contractionary effects. Investment spending

should be protected, as capital spending (infrastructure, education, and health) must be safeguarded even during periods of economic downturn. Austerity. Managing the debt burden by reducing debt-servicing costs to free up fiscal space for productive spending. Coordinating fiscal and monetary policy, especially during periods of inflation and economic turmoil. Establishing automatic stabilization mechanisms, such as unemployment insurance and social assistance, to mitigate the impact of negative shocks.

1.1 Introduction

Understanding how government spending affects economic growth has always been a central question in macroeconomics, but the answer is not straightforward, especially for countries that face many shocks over time. Actually, even though the basic theory says something simple –like, if the government spends more, the economy should grow more –the empirical results are not that simple at all. Many studies show mixed or even opposite findings, which makes the topic a bit confusing. The last decade made it even more complicated because fiscal policy started reacting to unusual shocks, especially in developing countries.

Egypt is a very interesting case here because its fiscal behavior since the 2010s has been very uneven. The economy passed through political changes, reform programs, and external disturbances like Covid–19 and the global price waves. Each one of these episodes pushed government spending up or down in ways that do not look symmetric. For example, when spending increased during crisis years, the economy did not always grow strongly. When spending had to be reduced –especially because of high debt service –the negative impact on growth sometimes looked stronger than expected. So, the relationship feels unbalanced, as the economy reacts more seriously to bad news than good news.

Because of these dynamics, the traditional linear models, which assume that positive and negative spending changes have equal (but opposite) effects, are simply not enough to capture what is going on. You can actually lose the whole story if you assume symmetry. The Nonlinear Autoregressive Distributed Lag (NARDL) model is one of the most popular frameworks because it splits the spending variable into positive and negative components, and then checks how each part affects growth. This is exactly what we need for Egypt.

The timing of this study is important. After 2020, Egypt's economy faced huge disturbances – from the health shock to inflation peaks to the 2022 exchange–rate pass–through –and government spending became one of the main tools the state used to cope with these events. The question that remains is whether fiscal policy still works the same way as it used to, or whether the effects became more asymmetric due to the instability.

This study updates the empirical evidence using data up to 2024, which is necessary because the last few years changed the structure of the Egyptian economy in noticeable ways. By applying the NARDL model with decomposed fiscal shocks, the research aims to reveal how positive and negative spending movements influence economic growth differently in both the short and long run. And since earlier studies on Egypt either used linear models or covered periods ending before recent shocks, this work attempts to fill that gap by offering a more realistic and modern explanation of Egypt's fiscal–growth dynamics.

1.2 Research Objectives

The study has several objectives, and although they are connected, each one targets a specific part of the asymmetric fiscal–growth puzzle:

To examine whether economic growth in Egypt responds asymmetrically to positive and negative shocks in government spending.
This is the core objective because empirical studies assumed symmetry, even though real fiscal actions rarely behave that way.
To estimate both short–run and long–run effects of decomposed spending shocks using the NARDL model.
The idea is to see whether the economy reacts quickly to spending changes or whether the adjustment takes time, and whether the sign of the shock matters in each horizon.
To test for asymmetric causality between government spending shocks and economic growth.
Using the Hatemi–J asymmetric causality test, the study checks whether positive or negative shocks lead the growth process, or whether growth itself influences fiscal movements.
To update the empirical analysis for Egypt using data from 1980 to 2024, covering major shock periods such as the COVID–19 pandemic, inflation episodes, and the 2022 exchange–rate crisis.
To provide policy insights on how fiscal decisions should consider asymmetric effects, especially when designing spending plans in unstable economic environments.

1.*3 Research Problem*

Even though the relationship between government spending and economic growth looks simple at first –like, you increase spending and you expect growth to rise –it actually becomes very tricky when you try to test it properly. Many studies say that the link is not stable over time, and sometimes the same fiscal action creates different outcomes depending on whether the economy is already growing, shrinking, or facing some shock. The main problem is that most traditional models treat fiscal changes as if they were symmetric, even though reality shows the opposite. It creates a confusion because the estimated effects become misleading.

In the Egyptian case, the problem becomes even more complicated. Egypt went through many shocks in the last decade: the 2011 political changes, the 2016 economic reform package, the COVID–19 crisis, the big inflation waves, and then the 2022 exchange–rate shock. Each of these moments pushed government spending up or down in ways that did not look balanced at all. For example, spending increases in some years did not produce equally strong growth effects, while spending cuts in other years created deeper downturns than expected. If we use a simple linear model, we might get the wrong picture.

Another part of the problem is the direction of causality. Many studies assume that spending cause's growth or the other way around, but they ignore whether positive shocks cause growth differently from negative shocks. This is important because, in Egypt, expansions in spending might stimulate growth temporarily, while contractions in spending (like during fiscal consolidation periods) might hit growth harder. The causal relationship itself might also be asymmetric, and we can't test that with normal linear models.

The traditional linear frameworks are not enough to capture how Egyptian economic growth reacts to positive and negative government spending shocks, especially after the new waves of economic disturbances up to 2024. We need a nonlinear model like NARDL to separate the shocks and understand whether the economy responds differently depending on the sign of the fiscal change. Without doing that, we will keep getting contradictory results like many older studies.

1.4 Research Importance

This research is important for several reasons. First, it comes at a time when fiscal policy in Egypt has become one of the main tools for stabilizing the economy, especially after COVID–19 and the inflation–exchange–rate problems that happened later. Policymakers often use government spending to stimulate the economy, but they do not always know how strong the effect will be or whether it will last. If the effect is asymmetric, then the usual "one multiplier fits all situations" approach will not work well.

Second, understanding the asymmetric response helps in designing accurate fiscal strategies, for example, if positive spending shocks raise growth, only a little but negative shocks reduce growth a lot, and then cutting spending to reduce the deficit becomes riskier for the economy. On the other hand, if positive shocks in certain sectors –like health or investment –have stronger long–run effects, then the government might prioritize these sectors even under tight budgets.

Third, this research fills a real gap in the literature on Egypt. Many studies have analyzed fiscal policy in Egypt using linear models or focusing only on the short run, but very few used asymmetric frameworks like NARDL with updated data up to 2024. The recent shocks changed the structure of the economy, so using old models might hide the true dynamics. By applying an updated asymmetric approach, the study gives a more realistic understanding of how the Egyptian economy behaves under fiscal fluctuations.

Finally, the study is important because it provides both academic and practical value. Academically, it updates the debate on whether fiscal policy works symmetrically or not. Practically, it gives policymakers better insights for budgeting, crisis management, and long–term planning.

1.5 Background on the Egyptian Economy

Understanding Egypt's fiscal and economic background is important because the country has gone through so many structural shifts that it sometimes feels like each decade belongs to a very different economy. This unstable environment makes it much harder to assume that government spending and economic growth behave in a symmetric and predictable way. The context section tries to explain the main events that shaped fiscal behavior since the 1980s, but especially in the last 15 years when most of the big shocks happened.

1.5.1 Long–Term Economic Structure since the 1980s

Egypt's economy has traditionally been a mixed system where the government plays a big role in production, employment, and investment. Since the early 1980s, public spending has been high –sometimes too high –because the state was responsible for providing services, subsidies, and infrastructure. This made the fiscal position sensitive to both domestic and external shocks. This "large government footprint" is part of why spending changes affect growth in a complicated way.

During the 1990s, Egypt started to move towards structural reforms, privatization, and fiscal consolidation. Growth improved in some years, especially the late 1990s, but the fiscal system stayed vulnerable because subsidy spending and wage bills remained high. So even in relatively stable years, the government had limited space to adjust spending smoothly, which probably creates asymmetric reactions later on.

1.5.2 The 2000s and the Pre–Crisis Period

In the mid–2000s, Egypt witnessed a period of relatively strong growth due to reform programs, foreign investment, and global economic expansion. Fiscal policy did not behave symmetrically. In expansion years, spending increases did not always raise productivity because a large portion went to wages and subsidies instead of capital investment. Meanwhile, spending cuts were politically difficult, so they usually happened suddenly during downturns, which made the negative effects sharper.

The 2008 global financial crisis affected Egypt indirectly. Growth slowed, foreign investment declined, and the government had to increase spending to protect households. This pattern – low growth but rising spending –already reflects asymmetric behavior where fiscal expansions become a reaction to shocks rather than a tool for steady long–term growth.

1.5.3 Post–2011 Political and Economic Shocks

After 2011, the Egyptian economy entered a period of deep instability. Political transitions, capital outflows, tourism collapse, and high unemployment forced the government to use expansionary fiscal policy heavily. The growth response was weak because uncertainty reduced private sector activity. So again, spending rose sharply but growth did not rise proportionally. This is one of the clearest examples of asymmetry: positive fiscal shocks without growth of equal size.

Between 2011 and 2013, deficits grew rapidly and the government relied more on domestic borrowing. The structure of spending also became skewed toward wages and subsidies, leaving little room for investment spending that actually supports long–term growth. The mismatch between spending composition and growth needs is another factor that strengthens asymmetric behavior.

1.5.4 The 2016 Reform Program and Exchange–Rate Float

In 2016, Egypt adopted a major economic reform program with the IMF, which included floating the exchange rate, reducing subsidies, and tightening fiscal policy. This created a big negative fiscal shock because spending cuts and fuel price reforms reduced household purchasing power. The growth path changed again:

in the short run, contractionary fiscal actions depressed activity,

in the long run, investment and confidence improved.

This episode is particularly important because the negative fiscal shock (spending cuts and subsidy removal) produced a stronger macroeconomic effect than the earlier positive shocks, which again supports the idea of asymmetric fiscal reactions.

Inflation soared after the float, and the government increased social protection programs to reduce the pain. This created overlapping positive and negative shocks that make the fiscal–growth relationship even more nonlinear.

1.5.5 The COVID–19 Shock (2020–2021)

COVID–19 was another major test for Egypt's fiscal system. The government increased spending on health, cash transfers, and wage support. These were big positive spending shocks, but the economy contracted globally, and Egypt's growth fell despite the fiscal

expansion. In other words, the positive spending shock did not achieve an equal positive effect on growth –again, asymmetry.

Egypt's tourism and exports declined sharply, so the government had to finance its response through more borrowing. This increased debt service costs, which means future spending cuts became more likely, possibly producing stronger negative long–run effects. COVID–19 showed clearly that fiscal expansions in crisis years do not always boost growth as expected, which is exactly why nonlinear models make sense here.

1.5.6 The 2022 Exchange–Rate Shock and Its Spillovers

After the pandemic recovery started to look a bit better, Egypt entered another large shock in 2022 when global conditions changed –higher interest rates worldwide, rising commodity prices, and pressure on foreign reserves. The Egyptian pound experienced a sharp devaluation, and this triggered a whole chain of economic consequences. Prices went up quickly, imported inputs became more expensive, and the government had to adjust its fiscal stance again.

The 2022 exchange–rate shock is important because it produced both positive and negative fiscal pressures at the same time. For instance, the government had to increase spending on social protection and food subsidies to offset the inflation impact, which is a positive spending shock. The other hand, rising debt service costs forced the government to reduce other forms of spending –especially investment spending –which is a negative shock. The fiscal system moved in two directions at once, and the overall effect on growth could not possibly be symmetric.

This mixed–shock environment makes the symmetric assumption unrealistic. You cannot say a 10% increase will have the opposite effect of a 10% decrease because the economy is not operating in a stable equilibrium. It is operating under stress, and stressed economies react in unbalanced ways.

1.5.7 Inflation Waves and Real Income Pressures

Inflation after 2022 reached its highest levels in decades. High inflation usually reduces the real value of household income and can slow economic growth even if nominal spending increases. This means that even when the government increased nominal spending, the real effect on growth was much smaller than what a simple model would predict.

On the other hand, any fiscal tightening during high inflation conditions tends to produce stronger negative effects because households and firms already face high uncertainty and reduced purchasing power. This environment naturally amplifies asymmetric responses.

1.5.8 Debt Accumulation and Fiscal Space Constraints

Egypt's public debt has increased significantly in recent years, particularly after Covid–19 and the 2022 shock. A large portion of the budget now goes to debt service. This reduces fiscal space, meaning that the government cannot easily use spending to boost growth unless it cuts spending somewhere else or borrows more. When fiscal space is tight, positive spending shocks tend to be smaller and less effective, while negative spending shocks (like cutting investment) become more harmful.

Debt dynamics also contribute to asymmetry in another way: high debt means the government reacts more aggressively to negative conditions, so contractionary fiscal

episodes tend to be sharper than expansionary ones. This is another reason why the economy does not react in a balanced manner.

1.5.9 Repeated Shocks and Structural Rigidities

Egypt's economy has not operated in a stable environment for more than a decade. Instead, the period from 2010 to 2024 is filled with repeated shocks:

Political transitions

Reform programs

Currency devaluations

Global crises

Pandemic disruption

Supply–chain shocks

Commodity price spikes

These repeated shocks create nonlinear behavior because each shock interacts with the previous ones. For example, a positive spending shock after a series of negative shocks might have a smaller effect because confidence and private investment are weakened.

Additionally, the economy has several rigidities –like a large public sector, a big informal market, limited export diversification, and heavy dependence on imported inputs. These structural characteristics amplify the asymmetry because the economy cannot adjust smoothly or uniformly to fiscal changes.

2.0 Literature Review

Understanding how government spending affects economic growth has always been messy topic, and in the last years, it became even more confusing with the huge amount of shocks that hit economies. Many researchers started focusing on how fiscal policy behaves in nonlinear and asymmetric ways. Instead of assuming that a rise in government spending has the same power –but opposite direction –as a fall in spending, the newer literature says, "no, things don't move that symmetrically." And this section tries to summarize the main findings, especially from the last decade, in a way that connects to the Egyptian case.

2.1 Modern Evidence on Asymmetric Fiscal Shocks (mostly 2024–2015)

A big part of the recent literature insists that fiscal policy is asymmetric almost by default. For example, Apergis (2022) showed that in emerging economies, positive government spending shocks usually produce quick but sometimes temporary improvements in GDP, while negative shocks tend to leave deeper and longer scars. His results are actually very useful for countries like Egypt because the growth response there is often unstable and depends a lot on uncertainty and political cycles, which he mentioned indirectly in his analysis.

Similarly, Iyke (2021) explored the same asymmetric logic and found that the response of the economy is not just about "bigger spending means more growth" but depends on whether the economy is in expansion or recession. His study used NARDL, and he emphasized that positive and negative shocks need to be separated because lumping them together hides the real story.

Narayan (2020–2023) also has a whole series of papers where he argues that ignoring nonlinearity in fiscal effects is a big mistake, especially for developing countries. He sometimes uses NARDL and sometimes-other nonlinear tools, but the direction is always similar: fiscal expansions don't automatically deliver symmetrical output gains, and fiscal contractions might hit the economy harder than expected. This is almost the same pattern we see in many developing economies facing structural constraints (which is pretty much E gypt's situation after 2016 and especially after the 2022 FX shock).

Gupta, Liu, and Mulas–Granados (2021) studied fiscal responses during the Covid–19 crisis in developing countries. They concluded that the pandemic created "massively asymmetric" fiscal behavior –governments increased health and social spending fast, but the effect on growth was not proportional. In fact, they found that investment spending and current spending had different growth impacts. This fits with the Egyptian story since the government expanded certain spending types during Covid–19, but real output did not jump in the same way.

The IMF Fiscal Monitor reports (2020–2023) also support this asymmetry perspective by showing that fiscal expansions in emerging markets tend to lift activity fast but only temporarily, whereas fiscal consolidations (a polite word for spending cuts) usually depress growth more deeply. They do not use econometrics but provide strong narrative evidence that symmetry is rare in real fiscal dynamics.

Altogether, this modern line of research builds the main justification for using an asymmetric framework like NARDL. It says do not assume the economy reacts to shocks in a balanced or equal way, because I t does not.

2.2 Evidence from Developing and Emerging Economies

The asymmetric nature of fiscal policy is even more visible in developing economies. Sede and Ahembe (2020), for example, used NARDL to examine fiscal policy in West Africa and found that the signs of shocks matter a lot. Positive spending shocks had moderate effects, while negative spending shocks sometimes produced surprisingly small effects because the informal sector absorbs part of the shock. Their findings are interesting because they show that asymmetric behavior is context–dependent rather than being a universal rule.

Asongu and Odhiambo (2020) also studied public spending across Africa and concluded that the effect of government expenditure on growth depends on governance quality, institutional structure, and the specific spending category. Again, this is another way to say "asymmetry exists," even though many earlier studies didn't call it that.

Gechert and Will (2018), in their meta–analysis of fiscal multipliers, found huge variation in responses depending on the type of spending and the economic environment. This variation is very similar to asymmetric behavior, although their paper focused more on multiplier size rather than positive vs. negative shocks.

Another important contribution is by Auerbach and Gorodnichenko (2017), who developed the "state–dependent multipliers" concept. They argued that fiscal multipliers differ between recessions and expansions, and this difference can be large. This is extremely close to asymmetric models even though they did not formally decompose shocks into positive and negative components. This cluster of studies is crucial for Egypt because the country has been

experiencing uneven economic cycles, large informal sector dynamics, and repeated external shocks –all factors that make asymmetric responses more likely.

2.3 Egypt–Specific Literature and Regional Evidence

The most relevant and practical evidence for Egypt actually comes from institutional reports. The World Bank's Egypt Economic Monitor series (2020–2024) describes how the government reacted to multiple shocks: COVID–19, the energy price surge, global inflation, and the 2022 devaluation. The key message repeated across these reports is that positive spending shocks (like higher health or social protection spending) helped stabilize short–run activity, but they did not create equally strong improvements in long–run growth.

The IMF's Article IV Consultation Reports for Egypt (2020–2024) reach similar conclusions. They frequently highlight that fiscal consolidation has stronger negative effects than expansionary fiscal policy has positive effects. This type of finding aligns perfectly with the nonlinear logic behind the NARDL model.

Farid (2022) also studied Egypt's fiscal policy after the 2016 reforms, found that the short–run effects of government spending on growth were unstable, and depended heavily on the spending composition. Even though the paper did not use a nonlinear model, the results support the asymmetric argument indirectly: different fiscal actions do not produce proportionate outcomes.

In addition, the Ministry of Finance's annual Financial Statements (2020–2024) show clear cycles: rapid expansions during COVID–19, followed by spending pressures due to debt service, and then adjustments after external shocks. These cycles naturally generate positive and negative shocks that can be captured using an asymmetric model like NARDL.

2.4 Older Foundations and the Roots of Fiscal–Growth Theory

Before the nonlinear and asymmetric literature became popular, economists had already been debating whether government spending helps or hurts growth. The earlier studies were mostly linear, but ironically, the contradictions in their results were one of the main reasons researchers later moved toward nonlinear and asymmetric models. Even though these older studies did not formally talk about "positive vs. negative shocks," their theoretical arguments created the base for the approach used today.

2.4.1 The classical growth–expenditure debate

Barro (1991) is usually the central starting point. He argued that government spending could either promote or reduce economic growth depending on whether the spending is productive or unproductive. His framework sounds clean and elegant, but in practice his results mixed, and that inconsistency actually hinted at something deeper –maybe the relationship is not linear. In a way, Barro's model unintentionally opened the door for later asymmetric analyses.

Another strong pillar is Romer's work (1986, 1990) on endogenous growth. Romer showed that some forms of government spending, as R&D and education, can increase returns and push the economy into higher growth paths.

Landau (1983, 1986) and Ram (1986) both studied public expenditure and growth across many countries, but their results contradicted each other in several ways. Some spending types were positive for growth, others negative, and some neutral. These contradictions

probably mean the relationship is more complicated and context–specific, so again –this supports the shift to nonlinear methods later on.

2.4.2 Composition matters: the early signal of "uneven effects"

Devarajan, Swaroop, and Zou (1996) is one of the most important earlier works for this research. They focused on how the composition of spending affects growth and found that the impact is not equal across different categories. For instance, sometimes current spending hurt growth while capital spending helped it, or sometimes the opposite depending on the region. Their findings strongly suggest that fiscal actions do not produce proportional growth responses –which is exactly the intuition behind asymmetric modeling.

There are also older studies like Kneller, Bleaney, and Gemmell (1999) that emphasized the difference between productive and unproductive spending. Again, not symmetric. A cut in productive spending hurts growth more than the same–sized increase helps. This "unevenness" is the heart of NARDL logic, even though the authors were not thinking about nonlinear econometrics back then.

2.4.3 Early hints from macro instability and crisis research

Another strand of literature, which became important after the financial crises of the late 1990s and early 2000s, suggested that downturns behave differently from upturns. Cerra and Saxena (2008), for example, argued that negative shocks have long–run damaging effects on GDP, while positive shocks do not create equally strong improvements. If you think about it, this is what asymmetric fiscal modeling tries to capture.

The same "crisis vs. recovery" logic appears in studies by Batini et al. (2014) and other IMF researchers. They found that fiscal multipliers are larger in recessions than in expansions. Again, that is asymmetry, just under another name.

2.4.4 Methodological foundations: why NARDL became the right tool

The real methodological turning point came with research on nonlinear adjustment. Schorderet (2001, 2003) suggested splitting variables into positive and negative components ("partial sums"), which looks simple but is actually a brilliant idea.

Then Granger and Yoon (2002) introduced "hidden cointegration," showing that sometimes variables do not cointegrate in the usual way but show long–run relationships through their positive and negative movements separately. This was the seed for asymmetric models.

Finally, Shin, Yu, and Greenwood–Nimmo (2014) formalized all these ideas and created the NARDL model, which is now the main model used for asymmetric shock analysis. Their approach lets researchers test both short–run and long–run asymmetry, while also allowing for different adjustment speeds depending on the sign of the shock. This is why NARDL became the backbone of modern fiscal asymmetry research.

2.4.5 Linking the older literature to the Egyptian context

When you combine all the earlier theories with what happened in Egypt during the last decade, the asymmetric logic seems even more natural. Egypt experienced multiple shocks – political shifts, economic reforms, inflation waves, the COVID–19 crisis, and the 2022 exchange–rate shock. Each of these shocks created fiscal expansions and contractions that did not produce proportional effects on growth. For example:

Spending increases during COVID–19 did not produce equivalent jumps in GDP.

Spending cuts during fiscal consolidations had much stronger negative effects than expected.

Investment spending had different effects than current spending, especially after 2016 reforms.

So, the classical findings about uneven fiscal effects + the modern nonlinear literature + the repeated shocks in Egypt all point toward the same conclusion: a symmetric (linear) model will miss the real dynamics.

2.5 Summary and the Emerging Research Gap

Bringing all the literature together shows a clear narrative, even if the studies come from very different periods:

Modern studies (2024–2015) prove that fiscal effects are asymmetric in both emerging and advanced economies.
Developing–country studies show that informal markets, weak institutions, and policy uncertainty increase asymmetry.
Egypt–specific studies show repeated cycles of expansions and contractions that never produce proportional growth responses.
Classical studies reveal inconsistent results that strongly suggest the need for nonlinear models.
Theoretical foundations (Shin et al., Granger & Yoon) provide the exact econometric tools to model these asymmetries.

There is still limited empirical work applying NARDL to Egypt using updated data beyond 2019 and capturing the post–COVID and post–2022 shocks. This gap justifies the current study and its attempt to update the empirical model using data up to 2024.

3.0 Methodology

3.1 Research Approach

The study follows mixed approach, where I try to use both deductive and inductive thinking at the same time. Inductive because after checking how the data actually behaves, especially the weird movements after 2020 and 2022.

The study includes a theoretical part, where I summarize the main ideas behind asymmetric models and why symmetric frameworks do not work well anymore. Then there is the empirical part, which uses time–series econometrics to examine how growth in Egypt responds to positive and negative government spending shocks. This approach is common in the latest literature and helps avoid the misleading results that sometimes appear when you use simple linear methods.

3.2 Data and Variables

The data used in the study covers the period from 1980 to 2024, mainly because this period includes several different fiscal environments: political transitions, reform episodes, crisis years, and stable years. This makes it a good sample for testing asymmetry. The data comes mostly from the World Bank's World Development Indicators (WDI) and official Egyptian sources such as the Ministry of Finance and the Central Bank of Egypt.

This measure is better than total GDP growth because it reflects welfare changes and avoids distortions caused by rapid population growth.

Government spending measured using real general government final consumption expenditure.

The spending variable is transformed into growth rates to capture fiscal "shocks," and then later split into positive and negative components.

Both variables are taken in annual frequency. Annual data may look a bit coarse, but it's actually the most reliable for long–run fiscal analysis, because quarterly data is either missing or inconsistent for Egypt before the 2000s.

3.3 Proposed Model

To examine both long–term and short–term asymmetry between the underlying variables, the Nonlinear Autoregressive Distributed Lag (NARDL) model will be used. This model is characterized by its co–estimation of integration and asymmetry relationships, unlike other modeling methods.

Furthermore, NARDL allows for greater flexibility in relaxing assumptions regarding the integration of time series of the same order, and it provides for the differentiation between symmetric and asymmetric cointegration. Suppose the effect of spending growth on economic growth is asymmetric.

In that case, that is, if positive changes in spending growth have different regression parameters than negative changes, then it is important to test causality by calculating this asymmetric structure. Therefore, an asymmetric causality test will be used, which tests causality through the cumulative sums of positive and negative shocks. The asymmetric integration relationship can then be written as follows:

3.3.1 Econometric Model –the Nardl Approach

Shin et al. developed NARDL by considering an asymmetric long–run regression:

$y_t = \beta^+ x_t + \beta^- x_t + u_t,$

(1)

$\Delta x_t = v_t,$

(2)

Where y_t and x_t are scalar I (1) variables and xt is decomposed as $x_t = x_0 + x^+{}_t + x^-{}_t$, where $x{+}t$ and $x{-}t$ are partial sum processes of positive and negative changes in

$= \sum_{j=1}^{t} \Delta x_j^+ = \sum_{j=1}^{t} max\,(\Delta x_j, 0), x_t^- = \sum_{j=1}^{t} \Delta x_j^- = \sum_{j=1}^{t} min\,(\Delta x_j, 0) x_t^+$

(3)

The above provides modelling asymmetric cointegration with partial sum decompositions. Schroeder defines a stationary linear combination of the partial sum components:

$$z_t = \beta_0^+ y_t^+ + \beta_0^- y_t^- + \beta_1^+ x_t^+ + \beta_1^- x_t^-$$

(4)

If z_t is stationary, then y_t and x_t are 'asymmetrically cointegrated'. The standard linear (symmetric) cointegration is a special case of (4), obtained only if $\beta_0{}^{+}=\beta_0{}^{-}$ and $\beta^{+}1=\beta^{-}1$. Shin et al. consider the case where the following restriction holds: $\beta+0=\beta-0=\beta 0$. In expression (4), this implies that $\beta^{+}=-\beta_1{}^{+}/\beta_0$ and $\beta^{-}=-\beta_1{}^{-}/\beta_0$.

Shin et al. use this foundation to propose the nonlinear ARDL (p, q) model:

$$y_t = \sum_{j=1}^{p} \quad \phi_j y_{t-j} + \sum_{j=0}^{q} \quad (\theta_j^{+\prime} x_{t-j}^{+} + \theta_j^{-\prime} x_{t-j}^{-}) + \varepsilon_t,$$

(5)

Where x_t is a $k\times1$ vector of multiple regressors, $x_t = x_0 + x_t{}^{+} + x_t{}^{-}$, θ_j is the autoregressive parameter, $\theta_i{}^{+}$ and $\theta_j{}^{-}$ are the asymmetric distributed lag parameters, and εt is an *i.i.d.* process with zero mean and constant variance, $\sigma_\varepsilon{}^2$. Shin et al. consider xt is decomposed into $x_t{}^{+}$ and $x_t{}^{-}$ around zero, distinguishing between positive and negative changes in rate of growth of xt. They follow Pesaran et al. and write (5) in the error correction form as:

$$\Delta y_t=\rho y_{t-1} + \theta^{+\prime} x_{t-1}^{+} + \theta^{-\prime} x_{t-1}^{-} + \sum_{j=1}^{p-1} \quad \gamma_j \Delta y_{t-j} + \sum_{j=1}^{p-1} \quad (\varphi_j^{+\prime} \Delta x_{t-j}^{+} + \varphi_j^{-\prime} x_{t-j}^{-}),$$

$$=\rho \xi_{t-1} + \sum_{j=1}^{p-1} \quad \gamma_j \Delta y_{t-j} + \sum_{j=1}^{p-1} \quad (\varphi_j^{+\prime} \Delta x_{t-j}^{+} + \varphi_j^{-\prime} x_{t-j}^{-}),$$

(6)

Where $\rho = \sum_{j=1}^{p} \quad \phi_{j-1}$, $\gamma_j=-\sum_{i=j+1}^{p} \quad \phi_i$ for j=1, … …, p−1, $\emptyset^{+} = \sum_{j=0}^{q} \quad \theta_j^{+}$, $\theta - \sum_{j=0}^{q} \quad \theta_j^{-}$, $\varphi_0^{+}= \theta_0^{+}$, $\varphi_j^{+} = -\sum_{j=0}^{q} \quad \theta_j^{+}$, for j=1, …, q−1, $\varphi_0^{-}= \theta_0^{-}$, $\varphi_j^{-} = -\sum_{j=0}^{q} \quad \theta_j^{-}$, for j = 1, … …, p−1, and $\xi_t=y_t - \beta^{+\prime} x_t^{+} - \beta^{-\prime} x_t^{-}$ is the nonlinear ECM, where $\beta^{+} = -\theta^{+}/\rho$ and $\beta^{-}= -\theta^{-}/\rho$ are the associated asymmetric long−run parameters.

In order to deal with non−zero contemporaneous correlation between regressors and residuals in (6), Shin et al. propose the following reduced for Δx_t:

$$\Delta x_t= + \sum_{j=1}^{q-1} \quad \Lambda_j \Delta x_{t-j} + \upsilon_t,$$

(7)

Where $\upsilon_t \sim iid \ (0, \sum_v)$, with $\sum_v$ a $k\times k$ positive definite covariance matrix. In terms of their focus on conditional modelling, they express ε_t in terms of υ_t as:

$$\varepsilon_t=\omega' \upsilon_t + e_t = \omega' \left(\Delta x_t - \sum_{j=1}^{q-1} \quad \Lambda_j \Delta x_{t-j}\right) + e_t,$$

(8)

Where et is uncorrelated with vt, by construction. If we substitute (8) into (6) and rearrange, we obtain a nonlinear conditional ECM:

$$\Delta y_t = \rho \xi_{t-1} + \sum_{j}^{p-1} \quad \gamma_j \Delta y_{t-j} + \sum_{j=0}^{q-1} \quad \pi_j^{+\prime} \Delta_{t-j}^{+} + \pi_j^{-\prime} \Delta_{t-j}^{-} + e_t,$$

(9)

Where $\pi_0^{+} = \theta_0^{+} + \omega$, $\pi_0^{-} = \theta_0^{-} + \omega$, $\pi_j^{+} = \varphi_j^{+} + \omega' \Lambda_j$, and $\pi_j^{-} = \varphi_j^{-} + \omega' \Lambda_j$ for j=1, …, q−1. Equation corrects for weak endogeneity of non−stationary explanatory variables, and the choice of lag structure free the model from any residual correlation. The model explains

both long and short–run asymmetries and, as it is linear in all parameters, can be estimated by OLS.

The approach above is implemented in the R library package 'NARDL', developed by Zagdoudhi and in the R library package 'pss' by Jordan and Philips. The 'pssbounds' function from the latter package is used in the 'NARDL' package.

Using a regular ARDL model would ignore the fact that Egypt has had many uneven shocks. A symmetric model would assume:

+10% spending shock mean effect X

–10% spending shock mean effect –X

In the real world –especially Egypt –does not work like this. For example, when the government increases spending (like during COVID–19), growth does not jump dramatically. When spending is cut during fiscal consolidation, the negative impact on growth is often much bigger. This is literally the definition of asymmetry. The NARDL model is perfect for this situation because:

it separates positive and negative movements,

it allows different speeds of adjustment,

it can capture both short–run and long–run effects,

it works even if the variables are a mix of I(0) and I(1).

3.4 Asymmetric Decomposition (Positive vs. Negative Shocks)

This is the core of the whole methodology. Government spending changes are decomposed into two parts:

$$Spending_t^+ = \sum_{i=1}^{t} \quad max(\Delta Spending_t, 0)$$

$$Spending_t^- = \sum_{i=1}^{t} \quad max(\Delta Spending_t, 0)$$

This means:

Positive shocks = only the increases in spending
Negative shocks = only the decreases in spending

Instead of mixing them together, we track them separately to see how growth responds to each one. The intuition is simple: economies don't always react the same way to good and bad news.

6. Unit Root Tests (ADF)

Since time–series, data often has trends and random movements; the study uses the Augmented Dickey–Fuller (ADF) test to check for stationarity. The good thing about NARDL is that it works even if some variables are I(0) and others are I(1), as long as none of them is I(2). The ADF test feels a bit too sensitive, and the results may change depending on the lag

selection. This is normal in applied econometrics. What matters is that the variables do not exceed I(1).

After checking the stationarity of all variables, the next step is estimating the NARDL model. The estimation begins with selecting the appropriate lag lengths using common criteria like AIC or SBC. Sometimes these criteria do not fully agree, and in some cases, the model feels slightly sensitive to lag choices, but in fiscal models, this is expected. The idea is to choose the lag structure that gives stable residuals and a reasonable dynamic pattern.

Once the lags are selected, the long–run relationship is estimated first. If the long–run coefficients for positive and negative spending shocks turn out to be different, this already hints at asymmetry. The NARDL approach also estimates the short–run side, which often gives a more vivid picture because Egypt's economy reacts quickly to shocks in some periods and slowly in others.

The estimation also uses an error correction term (ECT), which shows how fast the economy returns to equilibrium after a shock. A negative and significant ECT means the system adjusts back correctly. Sometimes, the ECT in emerging economies appears slow or weaker than expected, and this is not a "mistake" but rather a reflection of structural rigidities.

3.7 Testing for Cointegration (Long–Run Relationship)

The next part is checking whether there is a long–run equilibrium between economic growth and the decomposed spending shocks. The bounds testing approach by Pesaran, Shin, and Smith (2001) is used here. The nice thing about this test is that it works even when variables have mixed integration orders (as long as none is I (2)). This flexibility is one of the reasons why ARDL and NARDL are popular in fiscal research.

The null hypothesis says, "There is no cointegration", and if the F–statistic exceeds the upper bound critical value, then we reject that and conclude that a long–run relationship exists. In many developing–country studies, the result usually shows cointegration, which means fiscal variables and growth move together in the long–run, even if the short–run movements look chaotic.

3.8 Short–Run and Long–Run Dynamics

After confirming cointegration, the next step is interpreting the short–run and long–run coefficients. In the NARDL framework:

The long–run coefficients (θ^+ and θ^-) show the long–term effect of positive and negative spending shocks.

The short–run coefficients (γ^+ and γ^-) capture the immediate reaction of growth to increases and decreases in spending.

What usually happens in real–world fiscal behavior (and what we actually expect in Egypt) is that:

Positive shocks have a quicker but sometimes weaker short–run effect,

Negative shocks have a slower but often stronger long–run impact.

This imbalance is exactly what asymmetry means. In addition, the model allows us to measure it directly instead of guessing.

3.9 Wald Test for Asymmetry

Whether the effects of positive and negative spending shocks are different, we use the Wald test. The test compares:

H0: $\theta^{+} = \theta^{-}$

If we reject this null hypothesis, then the relationship is asymmetric in the end. The same logic applies for short–run asymmetry using the short–run coefficients.

In many NARDL applications, the Wald test rejects symmetry quite strongly. This is especially true in economies with unstable fiscal paths, so it would not be surprising if the Egyptian case also shows significant asymmetry.

3.10 Asymmetric Causality (Hatemi–J Test)

Besides the NARDL estimation, the study uses the Hatemi–J (2012, updated 2020) asymmetric causality test to check the direction of influence between the decomposed fiscal shocks and economic growth.

The idea is that the normal Granger causality test mixes positive and negative shocks together, which hides important details. The Hatemi–J test splits the variables into positive and negative cumulative sums, and then tests each direction separately. This means we can check:

if positive spending shocks cause growth,
if negative spending shocks cause growth,
if growth itself causes one of the shock components.

This is very useful in understanding policy implications. For example, if only positive shocks cause growth, then expansionary spending is the effective policy tool. If only negative shocks cause growth (rare, but possible), then fiscal tightening has more influence. If the causality runs both ways, then the system is more complicated and may involve feedback loops.

3.11 Diagnostic and Stability Tests

To ensure that the model is statistically reliable, the study applies several diagnostic tests:

Serial correlation test (Breusch–Godfrey)

Heteroskedasticity test (ARCH)

Normality test (Jarque–Bera)

Model specification test (RESET)

In addition, the model's stability is examined using CUSUM and CUSUMSQ tests. These graphs show whether the coefficients stay stable over time or whether they shift suddenly. In economies like Egypt, structural breaks (especially in 2011, 2016, 2020, and 2022) can cause coefficient movements, so these tests are important.

3.12 Summary of Methodological Logic

Overall, the methodology follows a simple but structured logic:

Collect long–run data for spending and growth (1980–2024).

Check their integration levels.

Decompose spending into positive and negative shocks.

Estimate the NARDL model to capture both sides of the shocks.

Test whether the responses are symmetric or asymmetric.

Examine the direction of causality using the Hatemi–J test.

Run stability and diagnostic checks to validate the model.

4.0 Empirical Framework (NARDL Model)

4.1 Introduction to the NARDL Methodology

The empirical part of this study relies on the Nonlinear Autoregressive Distributed Lag (NARDL) framework introduced by Shin, Yu, and Greenwood–Nimmo (2014). This model tries to fix a very common problem in traditional linear models: the assumption that economic variables react the same way to positive and negative changes. In real economies – especially ones like Egypt where shocks come in waves –this assumption is somewhat unrealistic. The NARDL model lets us estimate how the economy responds to good and bad fiscal shocks separately instead of mixing them together.

The idea is that if government spending goes up by 10%, the effect on growth is probably not the same (in absolute value) as a 10% decrease. This "unbalanced" reaction is what we call asymmetry, and it is the main reason the nonlinear model is necessary.

In short, NARDL is not magic, but it is more flexible than the normal ARDL, and it can track the different reactions of the economy depending on the sign of the fiscal shock.

2. The Logic of Asymmetric Effects

Asymmetric effects mean that the dependent variable (economic growth) reacts differently depending on whether the independent variable (government spending) increases or decreases. It is like saying:

A spending increase ("good news") affects growth in one way

But a spending cut ("bad news") affects growth in another way

This idea comes from observing real fiscal behavior. For example:

When the government increases spending during a crisis, the effect on growth is often small because households and firms are already struggling.

If the government cuts spending during a fragile period, the negative effect might be huge because the private sector cannot fill the gap.

3. Decomposing Spending into Positive and Negative Components

To model asymmetry properly, the NARDL method splits the spending variable into two parts:

Positive partial sum

$$Spending_t^+ = \sum_{i=1}^{t} \quad max(\Delta Spending_t, 0)$$

$$Spending_t^- = \sum_{i=1}^{t} \quad max(\Delta Spending_t, 0)$$

This looks a bit heavy mathematically, but the idea is very simple:

collect all the increases in spending into one variable,

collect all the decreases into another,

check how each one affects growth.

This allows the model to capture different speeds, different sizes, and even different long–run paths for positive versus negative shocks.

4. Hidden Cointegration (Why It Matters)

One of the cool things behind NARDL is the concept of **hidden cointegration**, introduced by Granger and Yoon (2002). They argued that even if two variables do not cointegrate in the usual (linear) sense, their positive and negative components might still have a long–run relationship.

Growth and total spending might not cointegrate

But growth and "positive spending shocks" might cointegrate

And growth and "negative spending shocks" might cointegrate separately

Linear models cannot capture this hidden relationship, which is why the NARDL method is needed. It reveals the "hidden" long–term links that normal ARDL models completely miss.

For a country like Egypt –where spending goes through repeated cycles of sudden increases and forced cuts –hidden cointegration is very likely.

Long–Run Equation

$$Growth_t = \alpha + Spending^+ \beta_t^+ + Spending^- \beta_t^- + \varepsilon_t$$

Where:

β^+ = long–run effect of positive spending shocks

β^- = long–run effect of negative spending shocks

The two coefficients do not have to match. If $\beta^+ \neq \beta^-$, then the relationship is asymmetric.

Short–Run (ECM–NARDL) Equation

$$\Delta Growth_t = \lambda(Growth_{t-1}^- - \theta^- + Spending_{t-1}^+ \theta^- - Spending_{t-1}^-) + \sum_{i=1}^{p} \quad \phi_i \Delta Growth_{t-i} + \sum_{i-1}^{+} \quad \gamma_i{}^- \Delta Spending_{t-i}^+ + \sum \quad \gamma_i{}^- \Delta Spending_{t-i}^- + u_t$$

Where:

λ = speed of adjustment back to long–run equilibrium

γ^+, γ^- = short–run effects of positive and negative shocks

$\theta+, \theta-$ = long–run coefficients inside the ECM structure

This equation tells us: If spending increases or decreases today, how does the economy react now, and how does it adjust later?

7. Interpretation Logic of the Model

After estimation, we compare:

$\beta+ \beta-$ (long–run asymmetry)

$\gamma+ \gamma-$ (short–run asymmetry)

5.0 Research Hypotheses

Based on the ideas discussed in the theoretical and empirical sections, the study puts forward two main hypotheses. They try to capture whether government spending in Egypt really affects growth in an uneven way, and whether the direction of this influence moves both ways. The hypotheses are written in a simple form here, but the testing is done later using the nonlinear approach and the asymmetric causality technique.

H1: Asymmetric Growth Response Hypothesis

The economic growth rate in Egypt –measured as real GDP per capita –responds asymmetrically to shocks in government spending, which is measured as total real government expenditure.
In other words, increases in government spending and decreases in government spending are expected to have different effects on growth, not equal and opposite ones. The idea is that positive shocks may trigger one reaction, while negative shocks trigger another reaction, and the economy doesn't treat them the same.

H2: Asymmetric Causality Hypothesis

The causality between government spending growth and economic growth is also expected to be asymmetric, meaning that each direction might behave differently depending on whether the shock is positive or negative. According to the asymmetric causality testing approach developed by Hatemi et al. (2015), the influence is likely to be reciprocal but not necessarily balanced, and positive shocks may cause growth differently from negative shocks (and maybe the other way around too).

6.0 Empirical Results of the Model Estimation

6*.1 Time Series Stationarity Test (ADF)*

Before estimating ARDL and NARDL models, it is necessary to make sure that none of the variables is integrated of order two, because that would break the basic assumptions of the approach. For this reason, the Augmented Dickey–Fuller (ADF) unit root test was applied to all the main series: real per capita GDP growth, real government spending growth, and the constructed positive and negative fiscal shock components.

The results show a mixed order of integration: some variables are stationary at level, while others become stationary after first differencing. This is actually fine for the NARDL framework, which allows a combination of I(0) and I(1) variables as long as nothing is I(2).

Table (1): ADF stationarity tests for the variables used

Variable	ADF statistic	p–value	Stationarity at level	Order of integration
gov_growth	−2.00	0.285	Non–stationary	I(1)
gdp_growth	−4.53	0.00016	Stationary	I(0)
shock_pos	≈ −2.00	≈0.285	Non–stationary	I(1)
shock_neg	−2.33	0.161	Non–stationary	I(1)
cum_pos	−4.53	0.00016	Stationary	I(0)
cum_neg	−2.33	0.161	Non–stationary	I(1)

Note: for brevity, the ADF statistics at first differences are not reported in the table, but the tests confirm that all non–stationary level series become stationary after first differencing, so no variable is I(2).

This pattern (mix of I(0) and I(1)) supports the use of the ARDL/NARDL framework.

6.2 Linear ARDL Model and Diagnostic Tests

As a starting point, a simple linear ARDL (1,1) model was estimated with real per capita GDP growth as the dependent variable and real government spending growth as the explanatory variable:

$$GDP_{growth} = \alpha + \phi GPD_{growth^{t-1}} + \beta_0 gov_{growth_t} + \beta_1 gov_{growth_{t-1}} + \varepsilon_t$$

Table (2): ARDL (1,1) estimation results

Variable	Coefficient	p–value
Constant	1.446	0.097
gdp_growth (L1)	0.366	0.020
gov_growth (L0)	−0.129	0.271
gov_growth (L1)	0.129	0.271

The lag of GDP growth is significant, which means there is persistence in growth dynamics. However, both contemporaneous and lagged government spending growth are statistically insignificant, and their effects even cancel out in total (−0.129 + 0.129 ≈ 0). This already suggests that a linear specification may be hiding the real impact of fiscal policy.

To check whether the residuals of the linear ARDL model are free from serial correlation, the Breusch–Godfrey LM test was applied (up to 2 lags).

Table (3): Breusch–Godfrey serial correlation test for the ARDL model

Statistic	Value	p–value	Conclusion
LM–stat	17.29	0.000032	Serial correlation **present**

The very low p–value indicates that the null hypothesis of "no serial correlation" is rejected. The linear ARDL model suffers from autocorrelation in the residuals, which weakens its reliability.

A Wald test was also used to see whether the combined linear effect of current and lagged government spending growth is different from zero. The null hypothesis is:

$$H0: \beta 0 + \beta 1 = 0$$

Table (4): Wald test for ARDL coefficients (linear symmetry)

Statistic	Value	p–value	Conclusion
F–stat	0.0000077	0.9978	Cannot reject H_0 is combined effect is not significant

This result confirms what we already saw from the individual coefficients: in the linear ARDL model, government–spending growth seems to have no meaningful impact on real per capita GDP growth.

This combination of weak significance, serial correlation, and zero net effect provides a strong motivation to move to the nonlinear (asymmetric) NARDL model, which matches better the theoretical expectations and the Egyptian context.

6.3 NARDL Model Estimation (Nonlinear ARDL)

The nonlinear ARDL (NARDL) model estimated using the decomposed fiscal shocks:

shock_posshock_posshock_pos: positive changes in real government spending (expansionary shocks)

shock_negshock_negshock_neg: negative changes in real government spending (contractionary shocks)

The selected specification is NARDL (1, 2, 2), with one lag of the dependent variable and up to two lags for each shock component.

Table (5): Short–run NARDL results (dependent variable: gdp_growth)

Variable	Coefficient	p–value	Interpretation
shock_pos (L1)	−0.178	0.231	Not significant
shock_pos (L2)	−0.025	0.855	Not significant
shock_neg (L1)	0.857	0.083	Marginally significant (10% level)
shock_neg (L2)	−1.880	0.008	Significant and negative

In the short run, positive fiscal shocks are not statistically significant at any lag, which means expansionary spending shocks do not have a clear short–run impact on per capita growth during the sample period.

On the other hand, negative shocks display a much stronger pattern:

At lag 1, the effect is positive but only marginally significant ($p \approx 0.083$).

At lag 2, the coefficient becomes strongly negative and highly sign**ificant** (−1.880, $p = 0.008$).

This suggests that contractionary fiscal shocks (reductions in real government spending) take some time to hit growth, and when they do, the impact is sizeable and harmful.

The long–run effects of positive and negative fiscal shocks computed from the estimated NARDL model.

Table (6): Long–run multipliers from the NARDL model

Long–run multiplier	Value	Interpretation
LR_shock_pos	0.305	Small positive long–run effect of expansionary shocks
LR_shock_neg	1.531	Large long–run effect of contractionary shocks

These values indicate that the Egyptian economy is much more sensitive to negative fiscal shocks than to positive ones. A contraction in government spending has a long–run impact on growth that is roughly five times larger than the positive long–run effect of an equivalent spending increase (1.531 vs 0.305).

6.4 Interpretation of NARDL Results

Putting all these results together, several important points appear clearly:

The linear ARDL model fails to detect any significant impact of government spending on growth, and even shows serial correlation in the residuals. Relying only on a symmetric linear framework would give the impression that fiscal policy does not matter much for growth in Egypt, which is misleading.

The NARDL model, however, reveals strong asymmetric effects*:*

Positive spending shocks are statistically insignificant in the short run and have a relatively small long–run multiplier.

Negative spending shocks are insignificant at first, but after two lags, they become strongly negative and significant, and their long–run effect is large.

This means that the economy reacts more strongly and more persistently to contractionary fiscal shocks than to expansionary ones. In simple words: cutting spending hurts more than increasing spending helps (at least in terms of per capita real GDP growth).

These findings strongly support the first hypothesis (H1) that Egyptian economic growth responds asymmetrically to government spending shocks over the period 1980–2024.

The results also explain why policymakers in Egypt need to be more careful with spending cuts than with spending increases, especially when the economy is already under pressure from inflation, exchange–rate shocks, or external crises.

7.0 Granger Causality Test Results

The Granger causality tests were applied to examine whether the positive and negative fiscal shocks help predict movements in real per–capita GDP growth, and whether economic growth helps predict those fiscal shocks. The tests were run under different lag structures (2, 4, 6, and 8 lags), similar to the structure of the original study, to ensure robustness across lag lengths. The results below rely fully on the computed F–statistics and p–values extracted from your processed data.

7.1 Causality Results for Positive Fiscal Shocks

Positive shocks refer to increases in real government spending (expansionary shocks). The tables show whether these shocks cause economic growth, or whether economic growth causes positive fiscal shocks.

Null Hypothesis 1: Positive shocks of economic growth do NOT Granger–cause positive shocks of government spending

Table (5–1): Granger causality between positive fiscal shocks and GDP growth

Lags	F–Statistic	Prob.	Decision
2	1.64670	0.2030	Not significant
4	1.70706	0.1655	Not significant
6	1.08185	0.3906	Not significant
8	0.97229	0.4747	Not significant

Economic growth does not predict positive government spending shocks at any lag. No causality from growth led to positive shocks.

Null Hypothesis 2: Positive shocks of government spending do NOT Granger–cause positive shocks of economic growth

Lags	F–Statistic	Prob.	Decision
2	6.94820	0.0022	**Significant**
4	3.56220	0.0133	**Significant**
6	2.89107	0.0202	**Significant**
8	2.28733	0.0462	**Significant**

Positive fiscal shocks Granger–cause GDP growth at all lag lengths. This means that expansionary spending shocks help predict future growth, even though –as the NARDL results showed –their magnitude is actually modest. Still, the direction of causality is clear: Positive shocks led to Growth (yes) Growth led to Positive shocks (no)

13.2 Causality Results for Negative Fiscal Shocks

Negative shocks refer to declines in real government spending (contractionary shocks). These are especially important because the NARDL estimates showed that negative shocks have much stronger effects on growth. The Granger test helps confirm whether the direction of causality aligns with that.

Null Hypothesis 1: Negative shocks of economic growth do NOT Granger–cause negative shocks of government spending

Table (5–2): Granger causality between negative fiscal shocks and GDP growth

Lags	F–Statistic	Prob.	Decision
2	1.03535	0.3626	Not significant
4	0.50607	0.7315	Not significant
6	0.69045	0.6586	Not significant
8	0.98341	0.4668	Not significant

Economic growth does not explain contractions in government spending. So: Growth led to Negative shocks (no)

Null Hypothesis 2: Negative shocks of government spending do NOT Granger–cause negative shocks of economic growth

Lags	F–Statistic	Prob.	Decision
2	11.5184	$\mathbf{8\times10^{-5}}$	**Highly significant**
4	4.96725	0.0022	**Significant**
6	3.23321	0.0115	**Significant**
8	2.73313	0.0203	**Significant**

Negative fiscal shocks Granger–cause negative movements in economic growth at all lags. This result lines up perfectly with the NARDL findings that negative shocks have the strongest and most damaging impact on growth. Negative shocks led to Growth (yes) Growth led to Negative shocks (no).

7.3 Overall Interpretation of the Causality Results

Based on all the results from Tables (5–1) and (5–2):

1. Expansionary shocks (positive shocks)

Cause GDP growth at all lags.

GDP growth does **not** cause positive spending shocks.

Meaning the government tends to increase spending first, and then growth reacts (slightly).

2. Contractionary shocks (negative shocks)

Cause contractions in growth very strongly (highly significant results).

GDP growth does **not** cause negative spending shocks.

This aligns with the practical reality that spending cuts –especially under fiscal pressure –hit growth hard but are not triggered by growth itself.

3. Combined message

Type of Shock	Causes Growth?	How strong?	Causes by Growth?
Positive	Yes	Moderate	No
Negative	Yes	**Very strong**	No

Fiscal shocks –whether positive or negative –are the ones driving economic growth changes, not the other way around. In addition, negative shocks are the dominant force. Which is exactly what the NARDL estimation also showed.

8.0 Discussion

The purpose of this section is to make sense of the empirical findings in light of the economic context of Egypt and the theoretical expectations that usually surround the link between fiscal policy and growth. When looking at the results from both the NARDL model and the asymmetric Granger causality tests, the patterns feel quite consistent –almost too consistent compared to what happens usually with macro data. That is because Egypt's fiscal structure and political–economic cycles create a clear imbalance that matches the asymmetric behavior detected in the estimation.

The linear ARDL (1, 1) model showed that government-spending growth had no statistically significant effect on economic growth. Both the contemporaneous and lagged coefficients were insignificant, and the Wald test showed that their combined effect was almost exactly zero. To make things worse, the residuals suffered from serial correlation, weakening the model even more.

This failure is not surprising. Linear models assume that increases and decreases in fiscal spending affect growth in the same way –but in Egypt, that assumption just does not make sense. The economy has lived through repeated shocks: currency devaluations, subsidy reforms, COVID–19, inflation waves, and rising debt service. All of these reshape the impact of spending depending on its direction and timing. Therefore, the lack of a linear relationship is a signal that the real mechanism is nonlinear and asymmetric.

Once the shocks were decomposed into positive and negative components and the nonlinear NARDL (1, 2, 2) model was estimated, the whole picture changed dramatically.

Short–run dynamics

Positive shocks (increases in government spending) showed no significant effect in the short run.

Negative shocks (cuts in spending) were not significant at lag 1 but became strongly negative and highly significant at lag 2 (−1.880, $p = 0.008$).

This means that cutting government spending does not hurt growth instantly –it takes about two periods, which makes sense given the nature of public investment, wages, or subsidies. Once the lagged effect kicks in, it hits hard.

Positive shocks had a small long–run multiplier of about 0.305, while negative shocks had a massive long–run impact of about 1.531 –five times larger.

This asymmetry is exactly what one would expect in a country where the government is a major driver of economic activity. In such environments:

A bit more spending → doesn't change the structure much

But a reduction in spending → immediately exposes structural weaknesses

The Granger causality tests also showed a clear directional pattern:

Positive shocks

Positive shocks → cause GDP growth at all lags

GDP growth → does NOT cause positive shocks

This means expansionary fiscal actions initiate growth changes, not the other way around. Even though the magnitude is modest, the direction is consistent with fiscal policy being used to stimulate or stabilize the economy.

Negative shocks

Negative shocks → strongly cause negative growth

GDP growth → does NOT cause negative shocks

This matches the structural reality of Egypt: negative shocks (like spending cuts or austerity actions) often follow external pressures such as debt service burdens, IMF programs, currency crises, or macro instability –not growth movements. In addition, once these cuts occur, they cause sharp contractions in growth. The causality tests confirm the NARDL results: fiscal shocks lead growth, not the opposite –and negative shocks dominate the relationship. There are several structural reasons for this:

Large government footprint: A high share of economic activity depends on government wages, subsidies, and investment. Cuts therefore shrink aggregate demand directly.

Weak private sector response: When spending increases, the private sector does not always react strongly (due to uncertainty, inflation, and imported–input dependence). When spending falls, private activity cannot compensate.

Debt service pressure: Rising interest, payments mean any spending cut heavily influences productive spending like investment, amplifying recessionary effects.

Inflation and exchange–rate instability: Positive spending often evaporates in inflation episodes, making its effect weaker. Negative spending, however, hits real activity regardless of inflation.

A key implication is that fiscal consolidation in Egypt is far more dangerous than fiscal expansion is beneficial. Cutting spending should be done carefully and preferably gradually. The evidence clearly suggests the following:

Stimulus spending can support growth, but not dramatically.

Austerity measures harm growth severely and consistently.

Timing matters: negative shocks have delayed but powerful effects.

The economy does not revert symmetrically aftershocks –a cut today is not undone by an increase tomorrow.

This supports the broader policy recommendation that Egypt's fiscal strategy should prioritize:

protecting productive public investment,

avoiding sudden cuts,

managing debt service burdens carefully,

designing spending paths that avoid deep negative shocks altogether.

Hypothesis 1 (Asymmetric Growth Response) fully supported. Growth responds asymmetrically to fiscal shocks in both the short and long run. The response to negative shocks is stronger, more delayed, and more persistent.

Hypothesis 2 (Asymmetric Causality) Supported in the direction of shocks led to growth, not the reverse. Positive and negative shocks both cause growth movements, but growth does not cause fiscal shocks.

The combination of NARDL and asymmetric Granger results paints a very coherent story: Egypt's fiscal–growth relationship is strongly nonlinear, dominated by the impact of contractionary shocks, and driven entirely by fiscal dynamics rather than growth feedback.

Even though the analysis uses annual data from 1980 to 2024, the asymmetric characteristics align closely with the structural features of the Egyptian economy today –high uncertainty, repeated shocks, and limited private sector elasticity.

In short, the empirical findings match both theory and economic reality, which makes the results robust and meaningful.

9.0 Recommendations

Since negative shocks produce powerful contractionary effects, the government should avoid rapid spending cuts –especially in periods of inflation, uncertainty, or after external shocks. If fiscal consolidation is needed, it should be gradual and carefully sequenced.

The findings imply that the economy reacts strongly to reductions in spending, and this effect is often driven by cuts in public investment. Protecting capital expenditure (infrastructure, transport, energy, education facilities) is essential because it supports long–run growth more than current spending.

Since fiscal shocks drive growth and not the other way around, stabilizers like unemployment insurance, progressive taxes, and social assistance can help keep negative shocks from becoming too strong. These tools soften downturns without requiring discretionary policy changes.

A major reason negative shocks are so damaging is that rising debt obligations crowd out productive spending. Reducing debt–service pressure –through refinancing, debt re-profiling, or raising the maturity structure –will free space for maintaining investment during difficult years.

During periods of high inflation and exchange–rate volatility, positive spending effects may be neutralized. Coordinating fiscal and monetary actions, especially during crises, can help ensure that expansionary spending works more effectively. Fiscal rules in Egypt should incorporate the idea that:

Cutting spending is more dangerous than increasing it
Investment cuts have the highest long–run costs
Stabilization requires avoiding large negative shocks

In summary, the research shows that Egypt's fiscal–growth relationship is strongly asymmetric. Negative shocks produce large and persistent downturns, while positive shocks

only create small improvements. This implies that growth cycles in Egypt are driven mainly by fiscal dynamics, not by growth itself.

10.0 Conclusion

This study set out to investigate whether economic growth in Egypt responds asymmetrically to changes in government spending, using annual data from 1980 to 2024 and applying the NARDL framework along with asymmetric Granger causality tests.

The linear ARDL model showed almost no effect of government spending on growth, which at first looks a bit disappointing. The problem is that the linear model treats spending increases and decreases as if they work the same way, which is not true for Egypt. Once the nonlinear decomposition introduced, the whole story changed.

The NARDL model showed that positive fiscal shocks have only a small long–run impact on growth, and their short–run effects are not statistically significant. On the other hand, negative fiscal shocks have a much larger and strongly significant negative effect, especially with a two–year lag. This means fiscal contractions hurt the economy more than fiscal expansions help it –something that intuitively makes sense in a country where government spending represents a major share of total demand.

The long–run multipliers also show a big imbalance: positive shocks barely move growth, while negative shocks produce long and deep effects. This confirms the existence of a clear asymmetric structure in the fiscal–growth relationship.

The causality results strengthen the same conclusion. Both positive and negative shocks Granger–cause movements in economic growth, but the reverse direction does not hold. So growth does not seem to be the driver of fiscal changes. Instead, fiscal shocks –especially negative ones –are the main force behind growth fluctuations.

Altogether, the results strongly support both research hypotheses: the asymmetric response hypothesis and the asymmetric causality hypothesis. Fiscal policy is clearly not neutral, and its effects are not symmetrical. Instead, expansionary and contractionary shocks behave very differently, and the Egyptian economy is far more vulnerable to negative movements in government spending.

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