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The Impact of Public External Debt On Economic Growth in Morocco, Egypt and Ecuador: Ardl Economic Model, And Why These Countries Can't Converge to A Developed Country?

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Abstract:

The research intends to improve the existing knowledge on the debt-growth nexus by analyzing the link between different countries, in our case between Morocco, Egypt and Ecuador.Scholars have debated the influence of external debt on economic growth since the debt crisis that began in the 1980s. This article investigates how external debt impacts the economic growth of selected deeply indebted countries via the debt overhang and debt crowding out effect. This is accomplished by analyzing data from three deeply indebted countries around the world from 1970 to 2023.The estimation results suggest that external debt influences economic development through debt overhang. Furthermore, to highlight debt servicing effect, The article discovered that the selected countries do not pay (serve) more than 95% of their total debt.

We used a deductive approach based on a thorough literature review that incorporated both theoretical and empirical data. We then conducted an economic analysis using the ARDL model to assess the impact of public debt (domestic and foreign) on Morocco's, Egypt's and Ecuador's economic growth. We gathered annual data from 1975 to 2023 to conduct an experimental study. This empirical study used the ARDL model to examine how external debt, capital formation, population growth, and inflation affect economic growth. The model also looked at the precise mechanisms via which public debt affects the economy.

Keywords: External Debt, Debt overhang, Debt crowding out, External debt – Economic Growth- ARDL Model.

1.Introduction:

The study's findings point to a long-term negative link between external debt and economic growth, with higher external debt leading in slower growth rates. The analysis also investigated the effect of total service

debt on economic growth. The paper emphasizes the negative impact of debt overhang on long-term growth, with service debt contributing to the problem.

Debt has had a significant impact on Morocco's economic policies, social conditions, and political landscape. While borrowing has allowed Morocco to invest in essential infrastructure and development projects, the cost of debt servicing has stretched public budgets and posed obstacles to economic growth and stability. Going forward, Morocco's capacity to manage its debt responsibly, diversify its economy, and attract foreign investment will be critical to its long-term development and prosperity.

GDP is the total gross value added by all resident producers in the economy, plus any product taxes and minus any non-product subsidies. It is estimated without taking into consideration the depreciation of produced assets or the depletion and deterioration of natural resources. GDP's yearly percentage growth rate at market prices, assuming a stable domestic currency. The aggregates are calculated using constant 2010 US dollars.

• Morocco's GDP growth rate in 2022 is 1.26%, down 6.76% from 2021.

• Morocco's GDP growth rate in 2021 was 8.02%, a 15.2% increase from 2020.

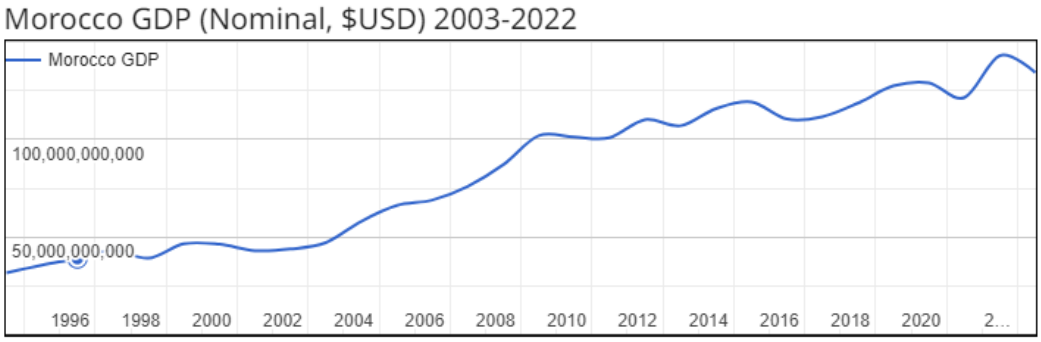
• Morocco's GDP growth rate in 2020 was -7.18 percent, down 10.07% from 2019.

• Morocco's GDP growth rate in 2019 was 2.89%, down 0.17% from 2018.

Gross Domestic Product (GDP) of Morocco:

Year	GDP Nominal (Current USD)	GDP Real (Inflation adj.)	GDP change	GDP per capita	Pop. change	Population
2022	$134,182,000,000	$125,203,000,000	1.08%	$3,354	1.01 %	37,329,064
2021	$142,867,000,000	$123,865,000,000	7.93%	$3,352	1.01 %	36,954,442
2020	$121,348,000,000	$114,765,000,000	-7.19%	$3,137	1.03 %	36,584,208
2019	$128,920,000,000	$123,652,000,000	2.89%	$3,415	1.04 %	36,210,898
2018	$127,341,000,000	$120,178,000,000	3.07%	$3,353	1.11 %	35,839,760
2017	$118,541,000,000	$116,603,000,000	5.06%	$3,290	1.21 %	35,446,392

Year	GDP Nominal (Current USD)	GDP Real (Inflation adj.)	GDP change	GDP per capita	Pop. change	Population
2016	$111,573,000,000	$110,989,000,000	0.52%	$3,169	1.20 %	35,023,457
2015	$110,414,000,000	$110,414,000,000	4.34%	$3,190	1.18 %	34,607,588
2014	$119,131,000,000	$105,817,000,000	2.72%	$3,094	1.23 %	34,204,780
2013	$115,739,000,000	$103,015,000,000	4.12%	$3,049	1.30 %	33,787,571
2012	$106,937,000,000	$98,936,906,349	3.06%	$2,966	1.34 %	33,355,241
2011	$110,081,000,000	$95,997,143,876	5.52%	$2,917	1.37 %	32,912,588
2010	$100,865,000,000	$90,971,302,169	3.50%	$2,802	1.36 %	32,467,016



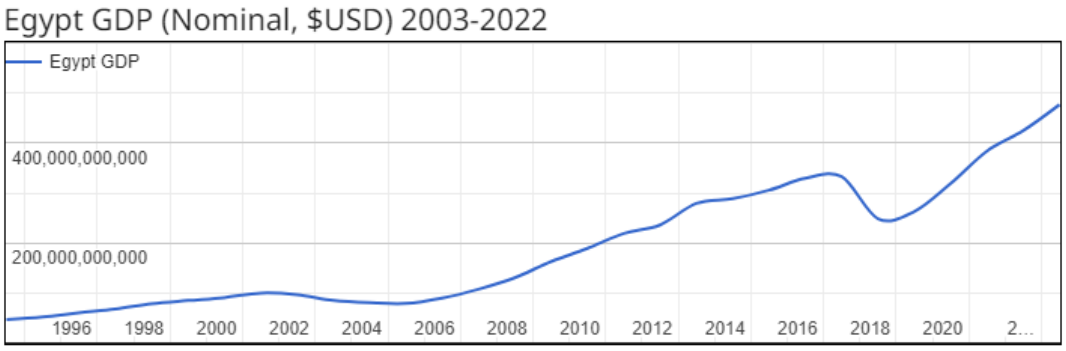
Egypt's financial issue necessitates a comprehensive solution that combines immediate budgetary austerity with long-term structural reforms. Egypt can address its financial issues and create the groundwork for long-term economic growth by reducing public spending, improving debt management, fostering economic diversification, and strengthening social and political stability. International cooperation and support will be critical in accomplishing these objectives.

- Nominal (current) Gross Domestic Product (GDP) of Egypt is $476,748,000,000 (USD) as of 2022.

- Real GDP (constant, inflation adjusted) of Egypt reached $358,053,000,000 in 2022.

- GDP Growth Rate in 2022 was 6.59%, representing a change of 28,049,000,000 US$ over 2021, when Real GDP was $425,778,000,000.

- GDP per Capita in Egypt (with a population of 112,618,250 people) was $4,030 in 2022, an increase of $192 from $3,837 in 2021; this represents a change of 5.0% in GDP per capita.



Gross Domestic Product (GDP) of Egypt:

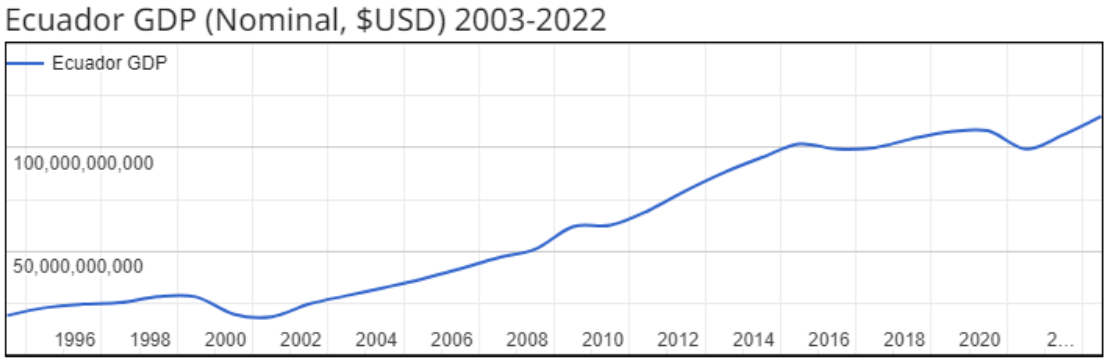
Year	GDP Nominal (Current USD)	GDP Real (Inflation adj.)	GDP change	GDP per capita	Pop. change	Population
2022	$476,748,000,000	$453,827,000,000	6.59%	$4,030	1.50 %	112,618,250
2021	$424,672,000,000	$425,778,000,000	3.29%	$3,837	1.50 %	110,957,008
2020	$383,818,000,000	$412,213,000,000	3.55%	$3,771	1.64 %	109,315,124
2019	$318,679,000,000	$398,081,000,000	5.55%	$3,701	1.77 %	107,553,158
2018	$262,589,000,000	$377,141,000,000	5.33%	$3,569	1.92 %	105,682,094
2017	$248,363,000,000	$358,053,000,000	4.18%	$3,453	2.02 %	103,696,057
2016	$332,442,000,000	$343,683,000,000	4.35%	$3,381	2.06 %	101,644,589
2015	$329,367,000,000	$329,367,000,000	4.37%	$3,307	2.12 %	99,597,342

Year	GDP Nominal (Current USD)	GDP Real (Inflation adj.)	GDP change	GDP per capita	Pop. change	Population
2014	$305,595,000,000	$315,570,000,000	2.92%	$3,236	2.30 %	97,528,654
2013	$288,434,000,000	$306,629,000,000	2.19%	$3,216	2.33 %	95,333,553
2012	$279,117,000,000	$300,071,000,000	2.23%	$3,221	2.27 %	93,161,001
2011	$235,990,000,000	$293,536,000,000	1.76%	$3,222	2.13 %	91,093,059
2010	$218,984,000,000	$288,446,000,000	5.15%	$3,234	1.94 %	89,196,072

Gross Domestic Product (GDP) of Ecuador:

The impact of debt on Ecuador's economic growth is a significant concern for the country. Ecuador's public debt has been increasing steadily over the years, reaching around 40% of its GDP in 2020. High levels of debt can hinder economic growth by reducing government spending on essential services, increasing borrowing costs, and potentially triggering debt crises. A study by the World Bank found that for every 1% increase in debt-to-GDP ratio, economic growth decreases by 0.2%. You can find more information on this topic in the World Bank's report "Ecuador Economic Update: Building Resilience in a Challenging Environment" (2019).

Nominal (current) Gross Domestic Product (GDP) of Ecuador is $115,049,000,000 (USD) as of 2022.
Real GDP (constant, inflation adjusted) of Ecuador reached $100,395,000,000 in 2022.
GDP Growth Rate in 2022 was 2.95%, representing a change of 2,881,120,488 US$ over 2021, when Real GDP was $97,753,879,512.
GDP per Capita in Ecuador (with a population of 17,823,897 people) was $5,646 in 2022, an increase of $118 from $5,528 in 2021; this represents a change of 2.1% in GDP per capita.



Gross Domestic Product (GDP) of Ecuador

Year	GDP Nominal (Current USD)	GDP Real (Inflation adj.)	GDP change	GDP per capita	Pop. change	Population
2022	$115,049,000,000	$100,635,000,000	2.95%	$5,646	0.80 %	17,823,897
2021	$106,166,000,000	$97,753,879,512	4.24%	$5,528	0.78 %	17,682,454
2020	$99,291,124,000	$93,781,977,160	-7.79%	$5,345	1.19 %	17,546,065
2019	$108,108,000,000	$101,702,000,000	0.01%	$5,865	1.70 %	17,340,021
2018	$107,562,000,000	$101,690,000,000	1.29%	$5,964	1.73 %	17,049,547
2017	$104,296,000,000	$100,395,000,000	2.37%	$5,990	1.54 %	16,759,519
2016	$99,937,696,000	$98,072,699,669	-1.23%	$5,942	1.47 %	16,505,139
2015	$99,290,381,000	$99,290,381,000	0.10%	$6,104	1.44 %	16,266,225
2014	$101,726,000,000	$99,192,306,979	3.79%	$6,186	1.44 %	16,035,124
2013	$95,129,659,000	$95,571,238,386	4.95%	$6,046	1.51 %	15,807,128
2012	$87,924,544,000	$91,066,617,872	5.64%	$5,848	1.60 %	15,572,194

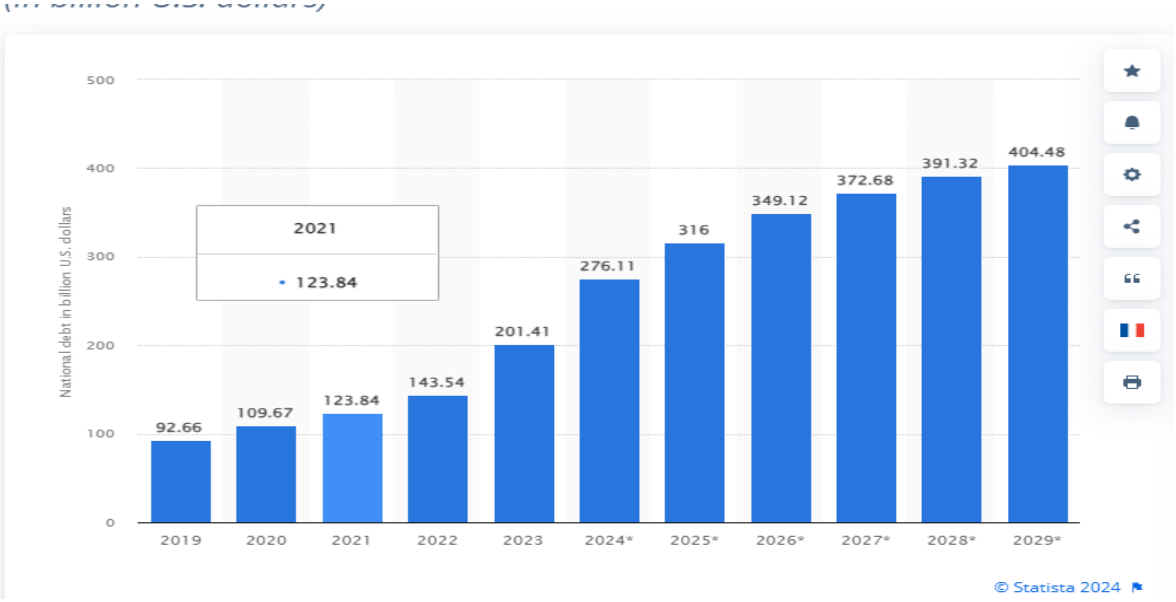
Year	GDP Nominal (Current USD)	GDP Real (Inflation adj.)	GDP change	GDP per capita	Pop. change	Population
2011	$79,276,664,000	$86,203,073,183	7.87%	$5,625	1.66 %	15,326,227
2010	$69,555,367,000	$79,915,230,251	3.53%	$5,301	1.69 %	15,076,695

Sources:
World Bank - World Bank national accounts data, and OECD National Accounts data.
World Population Prospects: The 2022 Revision - United Nations Population Division
https://www.worldometers.info/gdp/ecuador-gdp/

Total external debt for the tree countries:

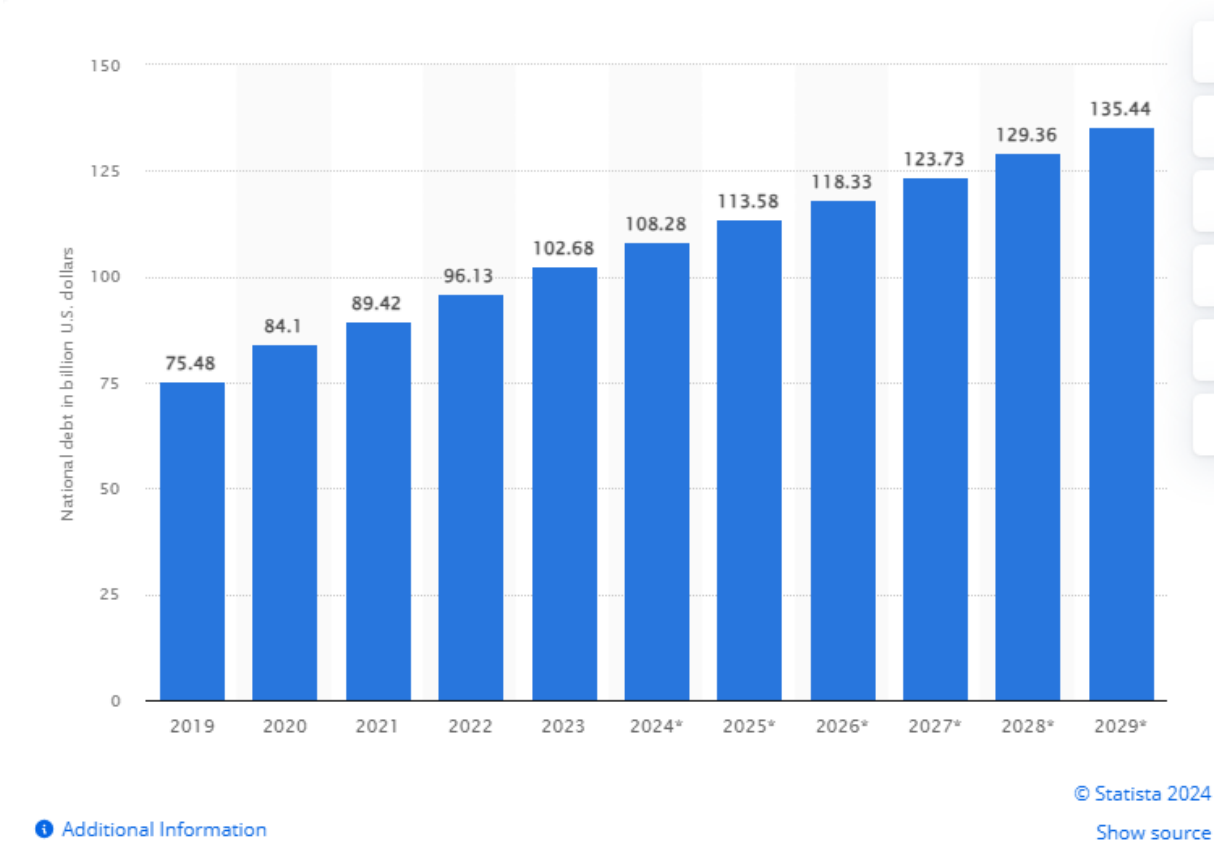
Total external debt is the sum of public, publicly guaranteed, and private nonguaranteed long-term debt, use of IMF credit, and short-term debt. Short-term debt includes all debt having an original maturity of one year or less and interest in arrears on long-term debt. Data are in current U.S. dollars.
Egypt external debt for 2022 was $163,104,422,408, a 11.72% increase from 2021.
Egypt external debt for 2021 was $145,995,005,748, a 10.12% increase from 2020.
Egypt external debt for 2020 was $132,572,383,019, a 15.37% increase from 2019.
Egypt external debt for 2019 was $114,910,260,650, a 15.54% increase from 2018.

Egypt: National debt from 2019 to 2029(in billion U.S. dollars)



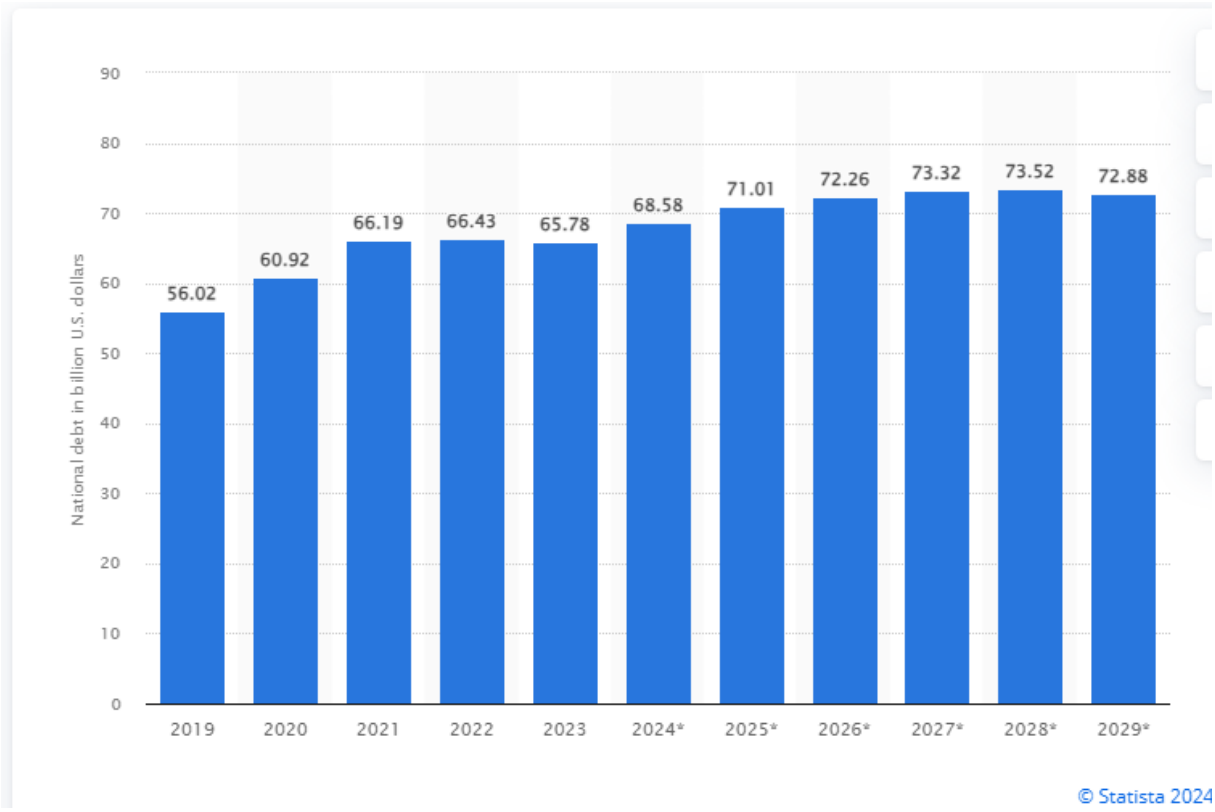
Morocco external debt for 2022 was $64,713,313,952, a 1.01% decline from 2021.
Morocco external debt for 2021 was $65,373,182,866, a 0.52% decline from 2020.
Morocco external debt for 2020 was $65,712,482,515, a 19.48% increase from 2019.
Morocco external debt for 2019 was $55,000,076,805, a 9.1% increase from 2018.

Morocco: National debt from 2019 to 2029(in billion U.S. dollars)



Ecuador external debt for 2022 was $60,684,713,935, a 4.5% increase from 2021.
Ecuador external debt for 2021 was $58,070,204,213, a 2.92% increase from 2020.
Ecuador external debt for 2020 was $56,423,149,419, a 8.73% increase from 2019.
Ecuador external debt for 2019 was $51,895,193,769, a 15.43% increase from 2018.

Ecuador: National debt from 2019 to 2029(in billion U.S. dollars)



Ecuador's external debt has been a major issue throughout its modern history, effecting both its economic policies and international relations. The country's external debt dynamics reflect the larger issues confronting many emerging countries. Here's a summary of significant aspects of Ecuador's external debt: Historical Context: During the 1970s oil boom, Ecuador borrowed more from international lenders due to higher oil profits. Ecuador's debt increased at the time as it funded infrastructure projects and economic programs.

Ecuador experienced the global debt crisis in the 1980s, caused by rising interest rates and falling commodity prices, like other Latin American countries. The country struggled to service its debt, prompting multiple rounds of restructuring.

Ecuador has defaulted on its debt many times, including in 1999 and 2008. The 2008 default was especially contentious, as then-President Rafael Correa called the country's foreign debt "illegitimate" and refused to pay, citing the detrimental terms under which the loan had been collected.

External debt is part of a country's total debt. Creditors outside of the country often require repayment in foreign currency or goods and services. The total debt includes public debt, guaranteed debt, long-term unsecured private debt, IMF financing, and short-term debt.
Short-term foreign debt has a one-year or shorter maturity. In Medium-long term debt, which includes IMF credits, has a maturity of more than one year.

The total servicing of external debt includes repayments, principal, and interest payments. This is short-term debt service.

2. Debt according to different thoughts:

2.1 The debt classic view:

The classics view debt as a future tax. This negatively impacts both current and future generations, capital accumulation and consumption. According to David Ricardo (1817), economic agents view loans as postponed taxes over time. They act as if they have a future tax to pay.

They will make decisions based on the expectation of higher taxes. Households prioritize cautious savings over spending to avoid future tax rises.Adam Smith (1759) believed that debt should not be used inefficiently. Debt can sometimes motivate the government to make wasteful expenditures. Jean Baptiste Say (1799) advocated for restrained public borrowing. No Not only does it lead to increased governmental spending, which harms the economy's wealth and worth, but it also demands interest payments. As a result, the loan may have a snowball effect. Interest on previous debts might be paid alongside fresh debts.

2.2 The neoclassical view of debt:

On the other hand, for the neoclassicals, too much debt slows down the economy. Most of
The revenue created is used to pay the debt burden. In fact, debt is no longer used to finance.
productive activities, but rather to increase the debt burden.
More recently, for the monetarist school, in particular Milton Friedman, financing of a deficit economy through borrowing expands public sector activity to the detriment of private sector. More specifically, recourse to borrowing would result in diversion of savings from individuals to the public sector.
The use of savings by the public sector causes an increase in demand on available funds on the markets. As a result, the State issues Treasury bonds at an interest rate higher than
that of the market. This would cause an increase in interest rates. This increase in the rate
would lead to an increase in the inflation rate, a drop in investment and, therefore, a slowdown in economic activity.
All in all, according to Hayek (1989), debt is artificial economic growth. It is based on a potential level of investment greater than the effort of the nation Source: Bailly et al. (2006).
The implementation of monetary policies intended to revive demand, i.e. growth in
money supply greater than GDP growth will lead to an increase in the inflation rate.

Overall, the State must simply ensure its sovereign mission based on resources generated by its own sources. These economists consider that all state intervention is ineffective. However, other schools of thought reject these hypotheses.
They think that a budget deficit justified, controlled and financed by borrowing can be economically efficient not only in the short term, but also in the long term.

2.3 The Keynesian vision of debt:

Contrary to the various classical reasonings, for Keynesians, debt does not create burdens for future or present generations.
The new investments created enable economic development. The burden of debt will eventually decrease.
In short, the principle of balanced budget must not be always respected.
A justified and controlled budget deficit can be a factor of economic recovery and fight against unemployment.
Indeed, stimulating overall demand through the multiplier effect can promote sustainable economic growth.
From the Keynesian perspective, Harrod and Domar (1939, 1948, 1947), as it is mentioned below, demonstrate that, to achieve a rate of economic growth guaranteed, a state can resort to borrowing to cover the public deficit.
The hypothesis of the basis of this model is that there will not be economic growth without investment.
The growth of production would be an increasing function of capital. Furthermore, with economic opening and financial liberalization, foreign investors will benefit from this additional demand. However, if the budget deficit persists at long term and debt becomes excessive, the stock of debt increases significantly.
It is interesting to note that in recent decades the role of the multiplier effect has become limited with the rise in debt indicators, even in developed countries. Before moving on to the second part, it is useful to review the main contemporary theories of economic growth. Our goal is to discover the determinants of economic growth and assess the importance of external financing.
in the process of economic development.

3. Economic growth and the business cycle:

The use of GDP makes it possible to measure income from production within a territory.
The advantage of added value is that it prevents the same production to be considered several times.
Thus, we remove the value of the goods consumed for production. Therefore, GDP makes it possible to quantitatively measure the volume of actual production. As a result, it is made up of a commercial product evaluated through prices and a non-market product evaluated based on the costs of production factors.
Overall, economic activity evolves in a cyclical manner, alternating between expansion phase and a recession phase:

- Expansion is an increase in the rate of economic growth. She corresponds to an ascending phase of the economic cycle. This is an increase of the volume of production and demand over a short or medium period.

- Recession is a downward phase of the economic situation. She corresponds to a reduction in the rate of economic growth for at least two consecutive quarters, even with a positive rate of economic growth. The Recession is often observed following a sudden change in prices.
This one leads to a contraction in overall demand with a reduction in production, investment, trade, employment and consumption.

The critical points in these two phases are the crisis and the recovery:

Crisis often spreads following widespread financial market disruptions or a set of political events. Both touch the stability and economic operation with negative repercussions on macroeconomic aggregates.
In particular, a long period of recession results in numerous bankruptcies, rising unemployment and decline in purchasing power. Indeed, a recession is a mild form of economic crisis.
On the other hand, depression is a deeper form, The recovery corresponds to a phase of continuous expansion, The economic growth rate reached the previous peak.

The economic cycle gives us an idea of the fluctuation of national production,
global income and global employment.
Indeed, it is marked by an expansion or a widespread contraction in many sectors of the economy. GDP is one of main macroeconomic aggregates to draw up an economic cycle over a period.

3.1 Theoretical:

Some economists question the capacity of external financing to stimulate economic growth of a country (Nurkse, 1953; Rostow, 1960). If a country goes into debt, it is necessarily to make investments. However, some studies question the ability of a country to honor its commitments (Krugman, 1988; Reinhart and Rogoff, 2009).
According to the radical paradigm, external financing can only be an impoverishment mechanism of an economy. It is none other than a new manifestation of imperialism. Without putting forward solid alternative solutions.
On the other hand, according to the liberals, the external financing is the manifestation of the spirit of solidarity between countries. Developed countries make capital available to developing countries to enable them to cover their deficits and savings and keep them on the path to economic growth. However, the confusion between the economic and the extra-economic calls into question the real issues of external debt.
Between the two views, an intermediate current establishes an empirical relationship between the external financing, national savings and economic growth (Krugman, 1988).
The main objective is to show that from certain thresholds, external financing can be considered as an obstacle to economic growth, recent work on external debt and economic growth (e.g. Patillo et al.,2002; Cordella et al., 2005; de Flores et al., 2007), in the same line of research Krugman (1988), Sachs (1989) and Cohen (1992) demonstrate that for low debt levels, there is a positive effect on economic growth. However, they prove that after certain levels of debt stock the effect on economic growth becomes negative. All in all, investment is the main channel through which debt affects.
economic growth. Furthermore, Patillo et al. (2004) emphasize the importance of factor productivity as another channel that correlates external debt and economic growth.
Research suggests that there are multiple reasons that could lead to this result. A first hypothesis is debt overhang. Indeed, she describes a situation where the stock of debt exceeds repayment capacity. It occurs when the cost of debt combines with a decline in a country's trade.
As a result, it is accompanied by a reduction in spending on education, health and infrastructure which puts the country in a bad economic situation. More explicitly, for Krugman (1988), the country has a

problem of over-indebtedness when the expected current value and potential future transfers of resources are less than its debt.
Flores et al. (2007) provide more explicit theoretical arguments on debt overhang.
Figure 2 presents the Laffer curve of external debt (debt stock), the expected payments and amortization (reimbursement value).
From origin to point A, the probability of not paying is almost zero for a small amount of debt.
Consequently, the margin of the debt to be repaid in relation to the outstanding debt is 1.
However, after this level, debt repayment increases at a lower rate in relation to the accumulation of debt. It is less likely that the indebted country will be to manage a larger amount of debt. The risk of not paying is greater.

The marginal impact of debt is harmful for creditors. For them, the increase in debt amounts will only reduce the capacity for future repayments.

3.2 The Concepts of Solvability/Sustainability:

The issue of external debt sustainability raises significant concerns.
Diverse approaches are being explored. They specifically address the sustainability of fiscal deficits or public debt.

3.2.1 Theoretical approach

The study of debt dynamics is based on the state's intertemporal budget constraint (solvability or financing stability).

❖ Origin of the State's Intertemporal Constraint:
The government, like any other economic agent, is subject to budgetary constraints. However, all public expenditures should be funded through taxes, internal or external borrowing, or well-managed money creation.
The concept of solvency was first introduced by a Swedish economist Wicksell in 1898, then by Metzler and Patinkin in the 1950s, and then by others, including Branson in 1972. Solvability constraints have become a key topic in macroeconomic analysis.

❖ Intertemporal constraint without monetary creation:
The constraint that the state must face is as follows:

$$D_t - D_{t-1} = G_t - T_t + r_t \mathrm{x} D_{t-1}$$

$$D_t = G_t - T_t + (1 + r_t) \mathrm{x} D_{t-1}$$

D_t, G_t, T_t, r_t, $and\ G_t - T_t$ represent the outstanding debt for the year, excluding interest charges, the amount of the receivable tax, the nominal interest rate, and the primary deficit.

Debt is considered sustainable, or an entity is solvable, if the current debt is covered by future budget surpluses of an adequate amount.

❖ Intertemporal constraint model with monetary creation:

(1) $D_{t+1} = G_t - T_t + (1 + r_t) \text{x} D_t$

(2) $PIB_{t+1} = PIB_t\,(1 + g_t + i_t)$

$(\mathbf{1})/(\mathbf{2}) \rightarrow D_{t+1}/PIB_{t+1} = (G_t - T_t + (1 + r_t) \text{x} D_t)/(PIB_t\,(1 + g_t + i_t))$

To ensure debt sustainability with monetary creation, the nominal interest rate at time t (r_t) must be equal to the nominal growth rate of the PIB at time t (g_t), plus the inflation rate at time t (i_t) ➔$r_t = g_t + i_t$. Overall, public debt is considered sustainable if the nominal interest rate on the debt is equal to the fluctuation in inflation rates and the rate of economic growth.
Recently, two additional approaches have been proposed to explain the concept of sustainability. The traditional approach assumes that a country will only repay its debt if it has sufficient resources. The second approach supports the idea that a country will only pay its debt if it has an interest in doing so.

3.2.2 Traditional Approach:

The solvability criterion assumes that the debt approaches zero. This is a theoretical criterion that is both operational and mechanically difficult to implement. In practice, what is important is that the country can continue to receive external financing as long as it pays interest on its debts on a regular basis. This condition differs fundamentally from the first. It aligns with the fact that debt repayment progresses on a consistent basis.
To quantify this situation, we use the concept of sustainability. Theoretical models generally assume that this criterion is sufficient. According to Raffinot (1998), this is a circumstance where the endowment ratios do not indicate an explosive tendency. However, it is difficult to ensure this.
The sustainability threshold might be high and unsustainable. There is a minimum level of consumption or public expenditure that must be maintained. Evaluating this level of analysis is challenging from an economic perspective. It depends on a government's ability to accept a reduction in citizens' living standards during austerity policies. This threshold can be evaluated empirically. The goal is to observe debt indicators in countries that do not meet debt servicing obligations.

In the early 1980s, a new theoretical movement proposed a unique approach to evaluating sustainability. Debt repayment is analyzed because of a country's desire to maximize its interest, without the possibility of seizure or guarantee from the creditor.

The goal is no longer to determine if the debtor has sufficient resources to pay, but rather if there is an interest in doing so, unlike previous models. This approach converges with the over indebtedness hypothesis.

In some cases, highly indebted economic agents may lose interest in investment. However, this approach suggests that political interests influence the theoretical framework for resolving debt issues.

3.2.3 Dynamic Debt: Interest rates, inflation, and primary budget surplus:

There are two basic strategies for controlling debt as a percentage of GDP. On the one hand, it reduces the interest rate at which the government borrows. In contrast, a balanced or expanded primary budget surplus (SBP) is required. To lessen the debt burden, the country's genuine economic growth must be stimulated through regulated inflation.
Specifically, a country's debt-to-PIB ratio at a given date can be defined as:

(1) $\text{debt ratio}_t = debt_t / PIB_t$

The value of a debt at a given date t is determined by the previous year's debt (t-1), the interest rate used by the state, and the primary deficit/surplus incurred by the country throughout the year.

(2) $debt_t = debt_{t-1} \text{ x } (1 + r) - SBP_t$

The value of the PIB for the year t is equal to the PIB for the year (t-1) multiplied by "1+ the nominal growth rate" at the date t.

(3) $PIB_t = PIB_{t-1} \text{ x } (1 + growthratio_t)$

Using the equation (2)/ (3), we get the following:

(4) $\text{debt ratio}_t = (debt_{t-1} \text{ x } (1 + r) - \text{SBP} / PIB_{t-1} \text{ x } (1 + growthratio_t)) - SBP_t / SBP_t$

Divide the debt-to-income ratio (t-1) by the PIB-to-income ratio (t-1) to calculate the repayment rate (t-1).
The primary debt created by the PIB in value (t-1) corresponds to the primary debt in percentage of the PIB at the specified date, consequently, we have the following equation:

(5) $\text{debt ratio}_t = \text{debt ratio}_{t-1} \text{ x } (\boldsymbol{t}+\boldsymbol{r}/\ \boldsymbol{t}+\boldsymbol{c}) - (\boldsymbol{SBPen} \% PIB_t)$

This equation allows us to examine the stability of the debt dynamics. If the interest rate (r) is larger than the nominal growth rate (c), the debt dynamics become unstable, unless the economy has an established primary surplus. When debt dynamics are unstable, the solvability constraint looks to be even more unstable.

3.3 The growth theory.

3.3.1 Definition:

Economic growth is a quantitative term that refers to a yearly variation in percentage of GDP. To eliminate the problem of price fluctuations, economic growth can be estimated in constant currency (excluding of inflation). In truth, GDP is adjusted for price variations. This allows us to quantify economic growth in volume (real GDP). Thus, the economic growth rate represents the evolution of production over time. This measurement allows us to calculate the proportion of fluctuation in GDP between two different periods:

Economic growth rate = [($PIB_t - PIB_{t-1}$)/ PIB_{t-1}] x 100

Overall, economic activity develops in a cyclical way, alternating between expansion and recession phases:

- Expansion is defined as an increase in the economic growth rate. She represents an upward phase of the economic cycle. This refers to a growth in offer and demand over a short or medium period.

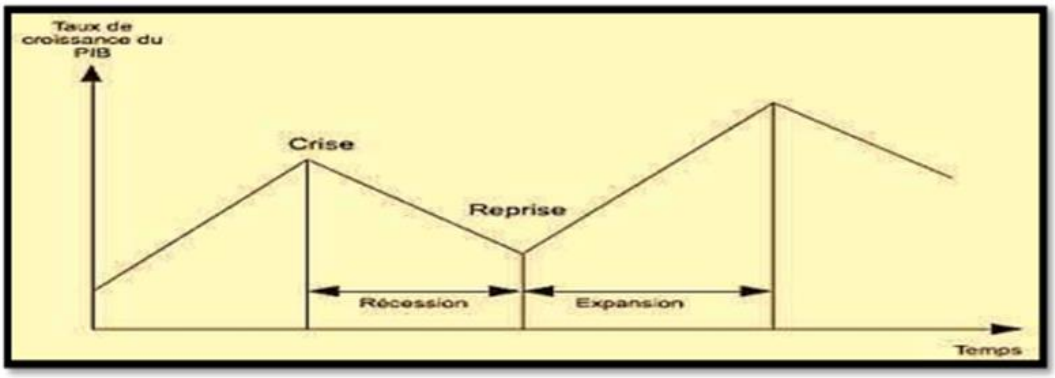
- A recession is a period when the economy experiences a decline. She refers to a decrease in the rate of economic growth for at least two consecutive quarters, notwithstanding a positive rate of growth. Recessions are frequently noticed following a dramatic change in prices. This one causes a contraction in overall demand by reducing production, investment, trade, employment, and consumption. The important points in these two phases are the crisis and the recovery:

A crisis frequently develops following major financial market disruptions or a series of political developments. Both have an impact on the economy's stability and manner of operation, resulting in negative macroeconomic aggregates. A prolonged recession leads to a large number of bankruptcies, increased unemployment, and a decrease in purchasing power. A recession is a milder form of an economic crisis. Depression, on the other hand, is a more serious condition.

- Recovery refers to a time of continuous expansion. The economic growth rate has surpassed the previous peak.

The many stages of economic growth comprise an economic cycle (Figure 1). The economic cycle describes the fluctuations in national production, worldwide revenue, and global employment.
Indeed, it is characterized by an expansion or widespread contraction in a variety of economic sectors. GDP is one of the primary macroeconomic aggregates used to depict an economic cycle across time.

La dimension cyclique de l'économie



Source : Rouillot (2012).

Figure 1

Finally, it is critical to distinguish between economic expansion and economic development. Economic development is a series of structural changes that occur with economic growth. These structural and qualitative changes ensure that economic growth is consistent, irreversible, and has low fluctuations. Similarly, the concept of economic development includes social advancement.

In short, it is a qualitative, not quantitative, phenomenon. The primary factors of production are capital (infrastructure, industries, land, etc.) and labor (active population). The combination of these two parameters results in a production function. The aggregate function can be expressed as the following simplified equation:

Y = F (K, L)
With: Y is production, K is capital and L is labor.

Production growth is linked to increased capital stock. This necessitates investment and a growth in the worker pool. It is important to note that the quantity of capital investment varies based on savings levels. In
On the other hand, labor supply is determined by statistics on the active population's growth rate. Improving total factor productivity is key to increasing demand for both capital and labor. This theory considers all non-traditional production factors. He prioritizes efficiency and effectiveness when organizing work and output. Overall, economic growth modeling has evolved, but the fundamental structure remains.

3.3.2 The Harrod and Domar model (1939, 1948, 1947):

The work of economists Harrod (1939, 1948) and Domar (1947) represents a large contribution to economic and political debates on economic growth.

In falling in line with Keynesian analyses, they seek to identify the conditions under which an expansion phase can be sustainable.

In particular, the developed model is considered the first economic model that put more emphasis on the role of investment in the process of economic growth.

In this model, investments involve mobilizing local resources and foreign financial services.

Theoretically, the model is based on the General Theory of employment, interest and currency (1936) of economic growth. However, this theory is limited to the short term.

Indeed, they introduce the accumulation of capital as an engine of economic growth. However, like the General Theory (1936), the Harrod-Domar model (1939, 1948, 1947) emphasizes the unstable nature of economic growth and the need of the state intervention. Therefore, despite research efforts, nothing guarantees that a market economy is on a path of stable economic growth.

More specifically, the model is based on three hypotheses. Firstly, all economy must save a certain proportion of its national income to replace the depreciation of capital. Indeed, if an economy wants to increase the level of wealth creation, new investments are needed. These require new stocks of the capital. Practically, without a sufficient level of savings, there will be neither investment nor economic growth. Second, labor and capital are complementary. All

increase in production implies a proportional increase in capital and demand for labor. Third, the production function is in proportion of fixed factors. Thus, it only considers capital:

Y_0=f (K)=GDP.

Consequently, the equation takes the following form:

Y_0=K/v.

The average capital coefficient (v=K/Y) gives the quantity of capital necessary for produce a unit of goods and services.

At the theoretical and empirical levels, the Harrod model (1939, 1948) and the model of Domar (1947) are close, even if their problems are not identical. Domar (1947) only sought to emphasize the effects of investment on full employment, and this, beyond the short period. On the other hand, Harrod (1939, 1948) takes as principal objective of revitalizing the General Theory (1936) to create a growth model economic that goes beyond the short term.

For Domar (1947), investment exerts a double influence on the economy. On the side of demand in the short term, any investment generates an increase in overall demand. This implies a demand for production goods (income effect). On the side of demand and beyond the short period, the effect of the investment is analyzed through the investment multiplier.

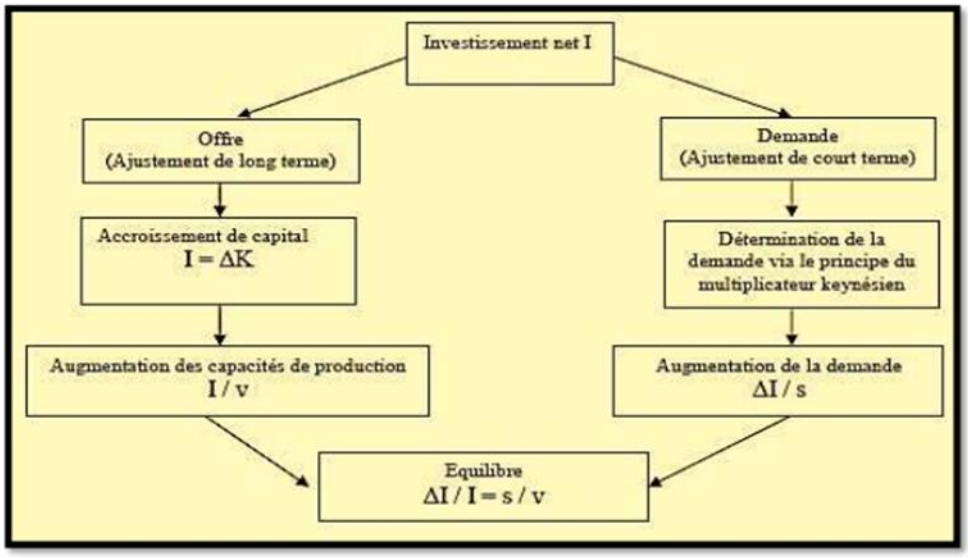
So, the investment is considered as an offer, it makes it possible to increase the production capacity in an economy and, subsequently, the volume of supply (capacity effect).

It is important to note that Keynes (1936) neglects the importance of the second effect. His

analysis is limited to the short term. Furthermore, investment only influences the global demand. However, Domar (1947) wants to determine the necessary conditions under which an increase in the aggregate demand resulting from the variation in investment will cause an increase in the production capacity. Thus, the additional income generated by the multiplier effect make it possible to absorb additional production

obtained, so that there is balanced economic growth. Otherwise, Domar (1947) supports the idea that there must be equality between the income effect and the capacity effect. This hypothesis is confirmed, if investment increases at a constant rate and equal to the ratio between the marginal proportion to save and the coefficient of capital, i.e. ΔI/I=s/v

Les deux principaux enjeux des investissements (Domar, 1947)



Source : Muet (1993).

(Figure 2)

More precisely, if we note:
- Y: is the overall demand. It is equal to the sum of quantities offered Y_o and of quantity requested Y_d .
- I: is the investment
- S: is savings
- s and c are respectively the marginal proportion to save and consume.
- With 0 < (c, s) < 1 and c+s =1
- m: is the investment multiplier. It measures the final impact on the activity economics of the initial modification of the investment.
- With m = [1/ (1 – c)] = 1/s
- v = K/Y is the average coefficient of capital. It is by hypothesis fixed.

So, like

ΔY_d =mΔI=ΔI/s and
ΔY_o=I/v

The effect of demand is proportional to the change in investment. Also, the supply is proportional to this investment. Therefore, there is no guarantee that the growth of demand is sufficient to confirm the growth in supply.
In balance
$\Delta Y_o = \Delta Y_d$
We will therefore have
$\Delta I/I = s/v \Rightarrow g = s/v$.

For Domar (1947), capital and production increase at a constant rate. Like the coefficient of capital v is constant, the investment growth rate is equal to economic growth rate.
However, g, s and v are, by hypothesis, independent variables. So, as it was mentioned several times, there is no guarantee that economic growth will be balanced. Otherwise, by introducing expectations of economic growth into the determination of investment, the rate of economic growth with a rate of savings as a function of the capital coefficient is fundamentally unstable. For this reason, the multiplier effect would be unrelated to the accelerator effect, except for a particular rate which corresponds to the regime of balanced economic growth.
In fact, Domar (1947) finds, in the long term, the conclusions put forward by Keynes (1936) for the short period. Underemployment equilibrium is most likely in an economy market. Most of the time, increasing investment is not enough to generate sufficient overall demand in the face of additional production capacity that it induces. In short, this model remains limited. In a few words, he is not a truly dynamic model.

In another vein, Harrod (1939, 1948) questions the stability of economic growth and the possibility of maintaining full employment from a comparison between the guaranteed economic growth rate (g_w), which balances supply and demand in the labor market, and the rate of natural economic growth (g_n), which balances supply and demand on the labor market. Overall, Harrod (1939, 1948) establishes a paradox based on the General Theory (1936). If g_w is greater than g_n, the high rate of economic growth will be able to reduce unemployment.
However, when the economy tends towards full employment, the rate of effective economic growth (g) will be limited by the natural rate of economic growth (g_n). So, the rate of real economic growth will become lower than the guaranteed rate.
Harrod (1939, 1948) concludes that the insufficiency of aggregate demand tends to contract gradually the economy. Thus, full employment remains relative to the savings rate. If g_w is below g_n, economic growth would be inherently unstable.

More precisely:

- K, Y and S: respectively represent the capital stock, GDP and savings.
- I= ΔK: investment is equal to the variation in the capital stock.
- V=K/Y represents the average coefficient of capital and s=S/Y (the savings rate);
- As K/Y=v, ΔK/ΔY=v.
- So ΔK=vΔY;
- In addition, if I=S, and S=sY;

- So, S=sY=vΔY=ΔK=I
- All in all, ΔY/Y=s/v.

Equilibrium implies that the guaranteed economic growth rate (g_w) is equal to the ratio s/v. However, there is insufficient evidence why the effective economic growth rate (g) respects this ratio. The latter depends on the decisions of entrepreneurs, the savings rate (determined by capital income) and the coefficient of average capital (fixed by hypothesis).
This last equation proves that the GDP growth rate is determined simultaneously by the national savings rate and the coefficient of average capital. Indeed, A country's economic growth depends on its ability to save. Furthermore, the equation shows that economic growth is determined by both investment and productivity. The productivity of additional capital is measured by the inverse of the coefficient of capital which is nothing other than the marginal efficiency of capital according to Keynes (1936).
The second problem put forward by Harrod (1939, 1948) is the possibility of full employment.
with a dynamic balance in the market for goods and services. Indeed, for economic balanced growth and without unemployment, the natural growth rate is equal to the guaranteed economic growth rate: $g_n = g_w$ = s/v. However, certain conditions can confront this equality. s, v and g_n are exogenous variables.
Thus, Harrod (1939, 1948) concludes that economic growth is obviously unstable and can be accompanied by unemployment.

Overall, we can clearly see that Harrod's model (1939, 1948) is very close to that of Domar (1947). As a result, researchers and analysts present frequently a so-called Harrod-Domar model (1939, 1948, 1947). The conclusions supported demonstrate that balanced economic growth is generally impossible ($g \neq g_w$), the same for full employment ($g \neq g_n$). Both models arrive at the same conclusion. Harrod and Domar (1939, 1948, 1947) demonstrate, based on different hypotheses, that the balanced economic growth is an exception. Imbalance remains the rule. Indeed, the conditions for regular economic growth are unlikely to be achieved.
Beyond the scientific contributions, the Harrod-Domar model (1939, 1948, 1947) has had several implications. In particular, the "big push" theory is based on the same fundamental. The poorest countries are also those with the least savings. Therefore, the Harrod-Domar model (1939, 1948, 1947) provides one of the bases, often implicit in the quantitative approach to development aid. Practically, the technical basis of what has become the norm of 0.7% of GDP devoted to this aid. (adopted by the United Nations in the 1970s) is based on the same logic.

Despite the theoretical and empirical contributions, the Harrod-Domar model (1939, 1948,
1947) is called into question. There are two main limitations. On the one hand, the insufficiency of national savings for investment is commonly covered by external financing.
The real obstacles are linked to the insufficiency of profitable projects and the absence of structural, institutional and cultural conditions to convert the external debt into an increase in production. On the other hand, an increase in interior savings, artificially, requires absorption capacity. However, some developing countries do not have this capacity, either due to a lack of infrastructure or resources. Overall, subsequent research attempted to partially resolve these limitations.

3.3.3 The Solow model (1956)

The main limitations of the Harrod-Domar economic growth model (1939, 1948,1947) were identified by Solow (1956). Practically, he tries to explain a link between the production growth and the production factors increase. Furthermore, in the Harrod and Domar model (1939, 1948, 1947), economic growth is unstable at long term. Moreover, it is an increasing function of the level of savings. As a result, Solow (1956) tries to carry out a comparison between the Keynesian approach and the neoclassical theory. Its starting point is the conclusion of Harrod and Domar (1939, 1948, 1947).
However, Solow (1956) puts forward an optimistic view of long-term economic growth.
term. It shows that economic growth can be stable if and only if capital coefficient is by hypothesis variable.
This model advances a neoclassical production function with two substitutable production factors, namely labor and capital. It takes the following form:
Yt = f (Kt, Lt).

Production results, exclusively, from the combination of a certain quantity of the capital (physical capital) and labor (labor).
On the other hand, Solow (1956) emphasizes the problem of production technique. He puts forward the hypothesis according to which scale returns are constant. So the production function takes the following form:
f (zK, zL) = zf (K, L).
If all production factors are multiplied by a certain given quantity, it is the same for production.
As a result, the production factors experience diminishing returns:
- f' k=df/dk > 0
- f ''kk=d2k/dk2 < 0
- f' L=df/dL > 0
- f ''LL=d2L/dk2 < 0

All in all, an increase in production factors with a certain proportion result in a less proportional increase in production. More specifically, all savings will be invested. Savings are assumed to be equal to investment. Furthermore, the savings rate is assumed to be exogenous. In addition, the population is experiencing a growth rate, economy described as "natural", with an inelastic labor supply. Thus, unemployment corresponds to the possible underutilization of production factors. So, it is not related to the analysis of economic growth itself, but to a cyclical analysis.

As a result, it is the self-regulating mechanisms of the market that play a crucial role in stability of growth:
- If economic growth is greater than demographic growth (s/v > g_n), there will be a labor shortage. Consequently, salaries increase. The entrepreneurs will substitute capital for labor. Since the coefficient of capital (v = K/Y) is by hypothesis variable, it increases. This increase makes decreases the s/v ratio. This tends towards n.

-If economic growth is lower than population growth (s/v < g_n), there will be unemployment. As a result, wages fall. Entrepreneurs will substitute labor for capital, the capital coefficient (v =K/Y) decreases and the s/v ratio increases. This tends towards n.

In the Solow model (1956), there is stable long-term economic growth. Its pace depends only on the evolution of the active population and technical progress. The latter will be integrated as an exogenous variable. It is defined as a "residual factor" and not the result of the economic behavior of agents. This reasoning depends on two conditions.

On the one hand, if the returns on production factors are decreasing, each economy will set a point where any increase in the factors of production will not generate an increase in production per capita. This point corresponds to the stationary state. Which is unrealistic for Solow (1956). An economy never reaches this level. Technical progress only increases productivity factor. However, on the long term, economic growth comes from the "residual factor". The latter is exogenous by hypothesis. So, it does not explain economic growth. It is considered as given.

On the other hand, the hypothesis of decreasing scale returns of capital indicates that economy, which has a lower initial level of capital stock per capita, may have scale returns and higher economic growth rates. The gain of productivity is derived from the efficiency of the combination of production factors. This process allows a developing country to converge in the long term towards developed countries. Furthermore, the economic growth is only maintained in the long term with the presence of exogenous factors. On the other hand, the accumulation of factors only contributes to medium-term economic growth. In short, a political action on variables such as population growth rate or progress, technology can contribute to economic stability with higher per capita income.

However, long-term growth is not necessarily guaranteed. Consequently, the catch-up of rich economies by developing countries, in the Solow model (1956), is based on a crucial assumption. The only difference between economies is based on the stock of initial capital.

Overall, savings do not have a big influence on the economic growth rate. The role of savings seems undervalued. The Solow model (1956), compared to that of Harrod and Domar (1939, 1948, 1947), allows us to practically valorize the whole hypotheses retained to analyze a production function aligned with the new market economy. Economic convergence would effectively strengthen confidence to the market mechanism. However, according to Barro and Salan-i-Martin (1995), the absence of convergence in Africa, convergence delays in Latin America and Europe the East, or more generally, the slowness of conditional convergence processes suggests that there are failures in the local market. More explicitly, the imperfections of the economic system in a country call into question the choices of economic policies.

3.3.4 Theories of endogenous economic growth:

Endogenous economic growth models combine a variety of economic ideas. They focus on emerging economic growth drivers such as research and development knowledge initiatives, agent behavior, and infrastructure spending. The primary goal of these models is to explain economic growth through processes and decisions, particularly microeconomic ones. They mostly rely on criticisms of the Solow model (1956). Economic agents' investments drive technological progress. It cannot have fallen from the sky. Additionally, these theories support the hypothesis of economic convergence.

However, they emphasize the heterogeneity of economic growth rates between countries. Thus, these theories support state intervention. It is negligible in the Solow model (1956). For example, Barro (1990) shows that a state intervention, in the form of appropriate structural measures, can stimulate economic growth by encouraging agents to invest more in activities generators of technical progress.

The first model of endogenous economic growth is put forward by Romer (1986). He tries to enrich the Solow model (1956). It introduces the notion of research and knowledge development. The advanced model makes it possible to endogenize part of the technical progress through the progressive diffusion of technological innovations. That passes through positive externalities between firms.

Along the same lines, Lucas (1988) emphasizes the role of human capital. This is the level of human resource skills available in an economy. In fact, it is human capital productivity. In a few words, the increase in the level of population education, through public or private means, can be positively correlated with the rate growth in GDP per capita.

Subsequently, Romer (1990) advances the factor in the production function as a stock of innovation resulting from voluntary research and development activity knowledge. Unlike the Solow model (1956), technical progress is no longer exogenous. It is introduced into the production function as an endogenous factor. In Indeed, it is the result of economic activity. Furthermore, it is interesting to emphasize the role of communications and transport infrastructure and research activities, fundamental actions carried out by the State. More specifically, Barro (1990) concludes that they facilitate the movement of goods and services, people and information. Furthermore, for him, the State should intervene by creating institutional structures, supporting of the profitability of private investments.

Overall, new economic growth theories have the undeniable advantage to consider the existence of new growth factors. The roles of human capital (Lucas), technical capital and physical capital (Romer) and public capital (Barro) are recognized not only as factors of production, but also as creators of positive externalities.

The rate of accumulation of this capital depends on the set of economic choices in a territory.

These models explain economic growth as a production function aggregated with constant or increasing scale returns., however, the latter factor compatible with the competitive balance of neoclassical models thanks to the introduction externalities.

However, increasing scale returns and positive externalities lead to situations where the perfect competitive equilibrium is not always achievable. Balance is suboptimal, increasing scale returns require a certain degree of monopoly to ensure positive effects. Consequently, positive externalities results lead to a gap between private returns and social returns (Ralle and Henin, 1993). In this case, the State must constantly intervene to improve the micro and macroeconomic performance which can guarantee a balance in the economy.

One of the models that empirically verifies endogenous economic growth is the “AK” model (Rebelo, 1991). Production is proportional to the stock of capital. In addition, the model integrates the externalities of technical progress. With a CobbDouglas function, the main goal is to make economic growth self-sustaining. In effect, the presence of research or technology in the production function implies increasing scale returns. However, the existence of these yields assumes imperfect competition. If labor and capital are remunerated at their marginal productivities, the sine qua non condition of perfect competition, there remains no product to reward the accumulation of knowledge.

One of the means to introduce increasing scale returns will be the knowledge development. It can gradually accumulate with positive externalities from other investments. However, the accumulation of knowledge can be involuntary. This is a consequence of other activities in the economy.
To better understand and explain Rebelo's (1991) reasoning, we consider a Cobb-Douglas production function for any firm:
$Y=B\ K\ \alpha\ L(1-\alpha)$ (1)
In this equation, returns are constant for labor and capital.
If B is accumulated endogenously, this would imply croissant scale returns. If each individual firm takes B, the accumulation of capital generates new knowledge in the economy. We therefore assume that:
$B=A\ K\ (1\ -\alpha)$ (2)
With: A is a constant.
The investment effort of each firm improves the level of knowledge of the labor force. Therefore, technical progress is external to individual firms. In on the other hand, it stimulates the economy. A priori, individual firms do not accumulate capital. Capital can be remunerated at its marginal productivity. However, his accumulation is the result of creating unanticipated profits. Overall, in combining equations (1) and (2), we obtain:
$Y=A\ K\ L\ (1\ -\alpha)$

To summarize, there are two postulates to account for increasing scale returns, if we want to endogenize the accumulation of knowledge. If we abandon the conditions of perfect competition, it will be possible to model the accumulation of knowledge as the result of effort deliberate by researchers to come up with new ideas. The resources devoted to research and knowledge development in industrial companies.

Modern studies demonstrate that the first mechanism is very important. For the second, he played, and it still plays a very crucial role in modern industries.
It is interesting to note that the State plays an important role in determining the long-term growth rate. A fundamental conclusion drawn from endogenous economic growth approaches is the fact that they give less weight to the mechanisms market. In addition, they encourage agents to invest in technical progress, to strengthen patent laws and to encourage cooperation between firms. Sum all, these models propose a review of public spending, not in a perspective of cyclical regulation (Solow, 1956), but in a long-term structural perspective.
Finally, an important scope of endogenous models consists of asserting an absence of
convergence. In addition, countries do not necessarily converge towards the same stationary state.
In the long term, neither the research and development effort nor the investment rate are necessarily capable of ensuring a reduction in development gaps between countries. This
Convergence remains linked to specific parameters and structures.

The challenges of economic convergence, and theoretical literature on the analysis of the determinants of economic convergence has well progressed. Gaps in technology and income are not being corrected automatically. According to Dervis (2012), cases of convergence are rare, but they carry information on the factors that explain this phenomenon.

More specifically, work on the convergence of economies or regions has been multiplied in the macroeconomic literature. However, with globalization and economies financialization, the concept of economic convergence has diversified and moves away from the initial definition.
Several empirical works attempt to analyze economic convergence. The evolution of
This debate is mainly related to the availability of GDP data. This macroeconomic indicator allows the comparison of different territories and the long-term economic growth evaluation and level of development.
Empirically, to measure a possible phenomenon of economic convergence, the method is simple. This involves observing whether the dispersion of income in an economy is reduced and to check whether the GDP per capita is close to the average level of countries or regions observed. If the average deviations (measured by the standard deviation) reduce over the course of the period studied, the results verify the existence of "sigma-convergence". On the
period considered; GDP per capita converges towards the average value of the sample.

This method can provide avenues for analysis and reflection on income inequalities.
between countries or regions. Also, the measurement of economic convergence aims to assess whether the standards of living of the different economies tend to become closer in the
time. Indeed, according to developed theories in a neoclassical framework, the elimination of trade barriers and the free movement of production factors not only enable the overall improvement of well-being in an economy, but also its real convergence.
On another note, it is interesting to emphasize the concept of "absolute convergence". The latter is based on the hypothesis according to which if an economy's GDP per capita growth rate is high, that economy had a low initial GDP per capita. More explicitly, it involves empirically testing the existence of a negative correlation between the growth rate of GDP per capita and the Initial GDP per capita.
In this regard, the most often cited study is that of Baumol (1986). It analyzes the data of OECD countries for the period between 1870 and 1979. It obtains a negative coefficient and significant for the initial income variable, based on a regression model classic of economic growth. In short, the results obtained verify the existence of absolute convergence.
However, further research conducted subsequently did not confirm these results. Has
As an example, DeLong et al. (1988) demonstrate that by expanding the sample to seven other countries convergence disappears. Countries with higher incomes in 1870 are also those which experienced the lowest rates of economic growth during the following century. All in all, they conclude that absolute convergence only seems relevant to within homogeneous regional groups.

It is interesting to note that absolute convergence is not a direct implication of Solow model (1956). Indeed, the concept of convergence attached to the Solow model (1956) can provide an explanation for the phenomenon observed on a global scale. The countries which do not have the same structural characteristics, and which have different balanced paths to verify the hypothesis of "conditional convergence". Empirical studies validate this hypothesis. They confirm that there is a negative correlation between the economic growth rate and initial GDP per capita. Indeed, considering the structural characteristics between countries provides strong evidence on the determinants of economic convergence.

Overall, the two concepts of economic convergence appear very fragile on the empirical level. They remain sensitive to a change in the estimation period or to the modification of the size of the observed countries sample.

As a result, the Convergence Clubs approach presents a more coherent analytical framework.
and more relevant. The concept of "Convergence Club" is defined as being a set of countries which have the same structural characteristics, and which can converge in the long term, if their initial conditions are similar. The initial conditions highlighted refer to human and physical capital. However, according to the neoclassical view, convergence is within the reach of all countries, whatever the initial conditions. In However, according to this approach, structural characteristics are added to the initial conditions to fulfill the definition of the club.
Empirically, the diversity of initial conditions which can be retained to define one Club led to a great diversity of Clubs. The disadvantage is the fact that two countries can be in the same club determined by an initial condition and in different clubs, if another initial condition is retained.

4. Empirical methods and procedures

4.1. Model specification.

Pesaran, Shin, and Smith (2001) introduced the Autoregressive Distributed Lag (ARDL) method in their publication "Bounds Testing Approaches to the Analysis of Level Relationships" which appeared in the Journal of Applied Econometrics. The authors proposed the ARDL approach as a versatile and powerful tool for studying long-run correlations between economic variables. The ARDL method can be used for both stationary and non-stationary time series, and it has gained popularity in the econometric literature due to its effectiveness in examining long-term correlations between economic variables.

The ARDL (Autoregressive Distributed Lag) approach is a commonly used method in econometrics to investigate correlations between economic variables. It is particularly useful when analyzing time series with non-stationary dynamics. The ARDL approach involves several steps, the first of which is identifying the variables to include in the model. These variables are typically economic factors that are believed to be related in some way. For instance, you could examine the relationship between GDP and debt, or population and trade openness.

Before beginning any economic analysis, it is essential to determine whether your time series data is stationary or not. Non-stationary data can lead to problems in econometric studies. Two commonly used stationarity tests are the augmented Dickey-Fuller (ADF) and Phillips-Perron tests. Once you have established the stationarity of your variables, you can define the ARDL model. This model is typically composed of autoregressions and distributed offset terms, and its exact specification will depend on your research question and the type of data you are working with.

After constructing an ARDL model, you can proceed to estimate it using appropriate techniques, such as OLS or GMM, to find coefficient estimates and evaluate certain economic assumptions. Once the model

has been estimated, you can check for the presence of cointegration between the variables to establish a consistent long-term link between time series. The Johansen and Bounds tests are two commonly used methods for cointegration testing.

Once you have conducted an ARDL (Autoregressive Distributed Lag) study, you can analyze its results to conclude whether a long-term relationship between your economic variables. To do so, you should examine the estimated coefficients, confirm statistical significance, and evaluate the model's overall fit. The ARDL approach is beneficial in exploring long-term correlations between economic variables, as it considers both short-run dynamics and potential cointegrations. It is frequently employed in empirical economic research and economic policy analysis.

This study examines the relationship between external debt and economic growth in Morocco using a multivariate approach. The analysis uses the econometric method of regression analysis. The real GDP growth rate is the dependent variable, expressed as an annual percentage. The independent variables include external debt stocks, service debt, openness to trade, and population growth. To facilitate estimate interpretation and achieve standard units of measurement, data for real exchange rates are changed to natural logarithms to be comparable to other variables in % of GDP. Furthermore, all data are sourced from the World Bank (2023).

The analysis begins with summary statistics and preliminary tests using the approaches of Dickey and Fuller (1979), Phillips and Perron (1988), Kwiatkowski et al. (1992), and Granger (1988). The study covers the period from 1975 to 2022 to determine the extent to which the rate of economic growth has been influenced. This is due to the increasing flood of external borrowing combined with the massive magnitude of the country's debt after 2020 because of the COVID crisis. The debt overhang theory serves as the theoretical foundation for the study, following the neoclassical paradigm. Thus, the basic functional connection is adjusted and represented following Krugman (1988) and the empirical research of Afonso and Alves (2014) and Kolawole (2020), among others.

4.2 Presentation of the estimation method and variables:

Variables:

LNGDP: GDP logarithm, Gross Domestic Product.

LNDEBT: External debt stocks logarithm.

LNGROSSCAPITAL: Gross capital formation logarithm.

LNPOPULATION: Population growth logarithm.

LNINFLATION: Inflation logarithm.

The basic functional relationship equation is modified and expressed as,

$$GRWT_t = f(DEBT_t + GROSSCAPITAL_t + POPULATION_t + INFLATION_t) \quad (1)$$

At time t, the equation for economic growth (GRWT) can be represented as a linear transformation of external debt (DEBT), gross capital formation (GROSSCAPITAL), and population growth (POPULATION), and inflation as (INFLATION).

The transformed equation (1) is represented as:

$$GRWT_t = \beta_0 + \beta_1 DEBT_t + \beta_2 GROSSCAPITAL_t + \beta_3 POPULATION_t + \beta_4 INFLATION_t + \varepsilon_0 \quad (2)$$

where, $\beta 0$ is the intercept, or the slope of the regression line, $\beta_{1\ldots4}$ are the coefficients of estimation, and ε is the error term. Equation (2) shows that the rate of economic growth is influenced by external debt and other independent variables. Based on prior expectations, openness is likely to have a positive impact on growth, while external debt and debt service may have negative effects.

4.3 Results of unit-root tests:

For Egypt:

Null Hypothesis: Unit root (individual unit root process)
Series: LNDGP, LNEXTERNALDEBT, LNGROSSCAPITAL, LNTRADE, POPULATION_GROWTH__ANNUAL___, INFLATION__CONSUMER_PRICES__ANNUAL___
Date: 10/17/24 Time: 13:28
Sample: 1970 2023
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 9
Total number of observations: 303
Cross-sections included: 6

Method	Statistic	Prob.**
ADF - Fisher Chi-square	85.2306	0.0000
ADF - Choi Z-stat	-7.05037	0.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results D(UNTITLED)

Series	Prob.	Lag	Max Lag	Obs
D(LNDGP)	0.0001	0	10	52
D(LNEXTERNA...	0.0003	0	10	52
D(LNGROSSC...	0.0001	0	10	52
D(LNTRADE)	0.0000	0	10	52
D(POPULATIO...	0.0519	0	10	52
D(INFLATION_...	0.3616	9	10	43

Null Hypothesis: Unit root (individual unit root process)
Series: LNDGP, LNEXTERNALDEBT, LNGROSSCAPITAL, LNTRADE, POPULATION_GROWTH__ANNUAL___, INFLATION__CONSUMER_PRICES__ANNUAL___
Date: 10/17/24 Time: 13:35
Sample: 1970 2023
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Total number of observations: 315
Cross-sections included: 6

Method	Statistic	Prob.**
ADF - Fisher Chi-square	16.7937	0.1575
ADF - Choi Z-stat	-1.30154	0.0965

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results UNTITLED

Series	Prob.	Lag	Max Lag	Obs
LNDGP	0.6973	1	10	52
LNEXTERNAL...	0.2692	1	10	52
LNGROSSCAPI...	0.2240	0	10	53
LNTRADE	0.2101	0	10	53
POPULATION_...	0.5679	1	10	52
INFLATION__C...	0.0450	0	10	53

For Morocco:

Null Hypothesis: Unit root (individual unit root process)
Series: LNDGP, LNEXTERNALDEBT, LNGROSSCAPITAL, POPULATION_GROWTH__ANNUAL___, INFLATION__CONSUMER_PRICES__ANNUAL___
Date: 10/17/24 Time: 13:38
Sample: 1970 2023
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 1
Total number of observations: 263
Cross-sections included: 5

Method	Statistic	Prob.**
ADF - Fisher Chi-square	24.5834	0.0062
ADF - Choi Z-stat	-2.71381	0.0033

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results UNTITLED

Series	Prob.	Lag	Max Lag	Obs
LNDGP	0.0772	0	10	53
LNEXTERNAL...	0.0467	1	10	52
LNGROSSCAPI...	0.0874	0	10	53
POPULATION_...	0.6556	1	10	52
INFLATION__C...	0.0222	0	10	53

Null Hypothesis: Unit root (individual unit root process)
Series: LNDGP, LNEXTERNALDEBT, LNGROSSCAPITAL, POPULATION_GROWTH__ANNUAL___, INFLATION__CONSUMER_PRICES__ANNUAL___
Date: 10/17/24 Time: 14:12
Sample: 1970 2023
Exogenous variables: Individual effects, individual linear trends
Newey-West automatic bandwidth selection and Bartlett k...
Total (balanced) observations: 260
Cross-sections included: 5

Method	Statistic	Prob.**
PP - Fisher Chi-square	112.088	0.0000
PP - Choi Z-stat	-8.47503	0.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Intermediate Phillips-Perron test results D(UNTITLED)

Series	Prob.	Bandwidth	Obs
D(LNDGP)	0.0000	2.0	52
D(LNEXTERNA...	0.0032	4.0	52
D(LNGROSSC...	0.0000	1.0	52
D(POPULATIO...	0.2123	3.0	52
D(INFLATION ...	0.0000	5.0	52

For Ecuador:

Null Hypothesis: Unit root (individual unit root process)
Series: LNDGP, LNEXTERNALDEBT, LNGROSSCAPITAL, LNTRADE, POPULATION_GROWTH__ANNUAL___, INFLATION__CONSUMER_PRICES__ANNUAL___
Date: 10/17/24 Time: 13:39
Sample: 1970 2023
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 5
Total number of observations: 311
Cross-sections included: 6

Method	Statistic	Prob.**
ADF - Fisher Chi-square	22.0972	0.0364
ADF - Choi Z-stat	-1.99130	0.0232

** Probabilities for Fisher tests are computed using an asymptotic Chi-square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results UNTITLED

Series	Prob.	Lag	Max Lag	Obs
LNDGP	0.3332	2	10	51
LNEXTERNAL...	0.0121	0	10	53
LNGROSSCAPI...	0.3425	0	10	53
LNTRADE	0.1380	0	10	53
POPULATION_...	0.6775	5	10	48
INFLATION__C...	0.1236	0	10	53

Null Hypothesis: Unit root (individual unit root process)
Series: LNDGP, LNEXTERNALDEBT, LNGROSSCAPITAL, LNTRADE, POPULATION_GROWTH__ANNUAL___, INFLATION__CONSUMER_PRICES__ANNUAL___
Date: 10/17/24 Time: 13:40
Sample: 1970 2023
Exogenous variables: Individual effects
Automatic selection of maximum lags
Automatic lag length selection based on SIC: 0 to 4
Total number of observations: 306
Cross-sections included: 6

Method	Statistic	Prob.**
ADF - Fisher Chi-square	110.533	0.0000
ADF - Choi Z-stat	-8.60346	0.0000

** Probabilities for Fisher tests are computed using an asymptotic Chi -square distribution. All other tests assume asymptotic normality.

Intermediate ADF test results D(UNTITLED)

Series	Prob.	Lag	Max Lag	Obs
D(LNDGP)	0.0014	1	10	51
D(LNEXTERNA...	0.0010	0	10	52
D(LNGROSSC...	0.0000	1	10	51
D(LNTRADE)	0.0000	0	10	52
D(POPULATIO...	0.1254	4	10	48
D(INFLATION_...	0.0000	0	10	52

We conducted a unit-root test using the Intermediate Phillips-Perron test and the Intermediate ADF. The results of the test indicate that the variables have mixed orders of integration, i.e., I (0) and I (1). Therefore, the most suitable technique for analyzing the cointegrating relationship among the variables is the ARDL. In our study, the ARDL technique is preferred over other techniques such as Engle and Granger (1987), Johansen (1988), and Johansen and Joselius (1990) as it estimates both the short- and long-run estimates simultaneously and assumes that all the variables in the model are endogenous. In essence, the process starts with a general vector autoregressive (VAR) model of order p, in which equation (2) is transformed into a long-run specification.

$$GRWT_t = \beta_0 + \beta_1 GRWT_{t-1} + \beta_2 DEBT_{t-1} + \beta_3 GROSSCAPITAL_{t-1} + \beta_4 POPULATION_{t-1} + \beta_5 INFLATION_{t-1} + \sum_{i=0}^{p} \beta_{1i} \Delta(GRWT_{t-1}) + \sum_{i=0}^{p} \beta_{2i} \Delta(DEBT_{t-1}) + \sum_{i=0}^{p} \beta_{3i} \Delta(GROSSCAPITAL_{t-1}) + \sum_{i=0}^{p} \beta_{4i} \Delta(POPULATION_{t-1}) + \sum_{i=0}^{p} \beta_{5i} \Delta(INFALATION_{t-1}) + u_t \quad (3)$$

where, in equation (3), Δ is the first difference operator, I range from 1 to 5, β_0 is the drift component, and u_t is the white noise error term.

Moreover, as the procedure follows the bound testing approach, it is based on the joint Wald-test (F statistic) with the null hypothesis of no cointegration among the variables. It states That,

H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = 0$

H_1: $\beta_1 \neq \beta_2 \neq \beta_3 \neq \beta_4 \neq \beta_5 \neq 0$

Furthermore, the short-run parameters can be estimated through the following error correction version of equation (3):

$$\Delta(GRWT_t) = \sum_{i=0}^{p} \beta_{1i}\, \Delta(GRWT_{t-1}) + \sum_{i=0}^{p} \beta_{2i}\, \Delta(DEBT_{t-1}) + \sum_{i=0}^{p} \beta_{3i}\, \Delta(GROSSCAPITAL_{t-1}) + \sum_{i=0}^{p} \beta_{4i}\, \Delta(POPULATION_{t-1}) + \sum_{i=0}^{p} \beta_{5i}\, \Delta(INFLALATION_{t-1}) + \gamma ECT_{t-1} + u_t \quad (4)$$

where γ is the speed of adjustment parameter and ECT is the residual from the estimation of equation (3).

4.4 Bounds test result:

For Morocco:

Null hypothesis: No levels relationship
Number of cointegrating variables: 5
Trend type: Rest. constant (Case 2)
Sample size: 51

Test Statistic	Value
F-statistic	8.936256588141345

	10%		5%		1%	
Sample Size	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
50	2.259	3.264	2.67	3.781	3.593	4.981
55	2.226	3.241	2.617	3.743	3.543	4.839000000000001
Asymptotic	2.08	3	2.39	3.38	3.06	4.15000000000001

	10%		5%		1%	
Sample Size	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
50	2.259	3.264	2.67	3.781	3.593	4.981
55	2.226	3.241	2.617	3.743	3.543	4.839000000000001
Asymptotic	2.08	3	2.39	3.38	3.06	4.15000000000001

* I(0) and I(1) are respectively the stationary and non-stationary bounds.

The results of the bounds test in Table 4 show that our critical value bounds F-statistics = 8.93 is higher than the higher I (1) value of 4.98.

So, in this case, we reject the Null hypothesis: No levels relationship, and we accept the assumption of the existence of cointegration among independent variables and the dependent variable.

For Egypt:

Null hypothesis: No levels relationship
Number of cointegrating variables: 4
Trend type: Rest. constant (Case 2)
Sample size: 50

Test Statistic	Value
F-statistic	5.199765725045951

	10%		5%		1%	
Sample Size	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
45	2.402	3.345	2.85	3.905	3.892	5.173
50	2.372	3.32	2.823	3.872	3.845	5.150000000000001
Asymptotic	2.2	3.09	2.56	3.49	3.29	4.37

* I(0) and I(1) are respectively the stationary and non-stationary bounds.

The results of the bounds test in Table 4 show that our critical value bounds F-statistics = 5.19 is higher than the higher I (1) value of 5.17.

So, in this case, we reject the Null hypothesis: No levels relationship, and we accept the assumption of the existence of cointegration among independent variables and the dependent variable.

For Ecuador:

Null hypothesis: No levels relationship
Number of cointegrating variables: 5
Trend type: Rest. constant (Case 2)
Sample size: 50

Test Statistic	Value
F-statistic	16.637558 1611587

	10%		5%		1%	
Sample Size	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
45	2.276	3.297	2.694	3.829	3.674	5.019
50	2.259	3.264	2.67	3.781	3.593	4.981
Asymptotic	2.08	3	2.39	3.38	3.06	4.1500000 00000001

* I(0) and I(1) are respectively the stationary and non-stationary bounds.

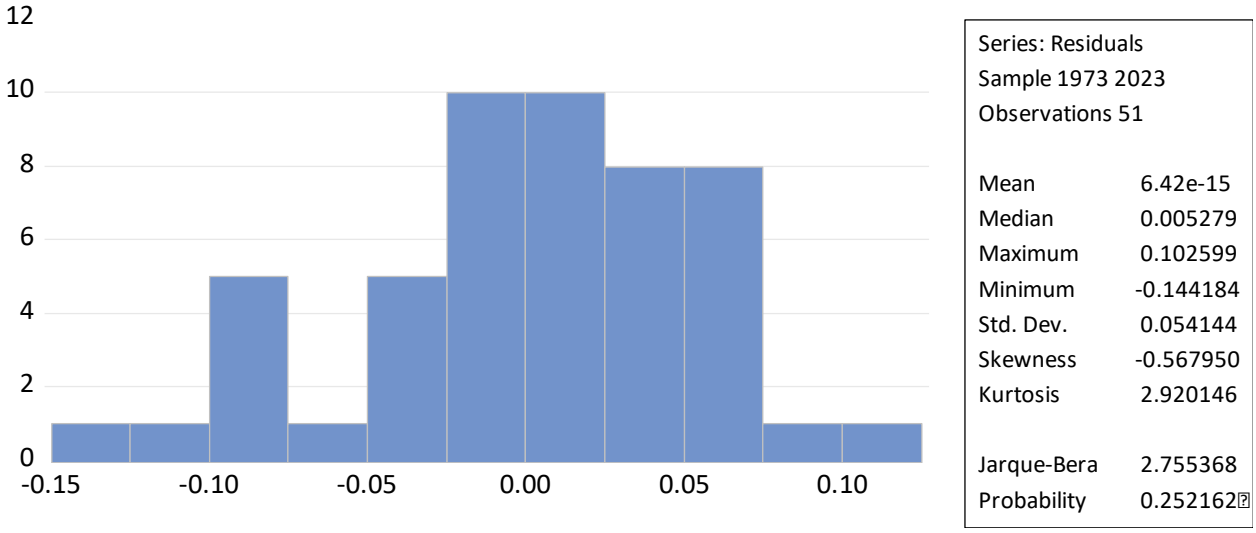
The results of the bounds test in Table 4 show that our critical value bounds F-statistics = 16.63 is higher than the higher I (1) value of 5.01.

So, in this case, we reject the Null hypothesis: No levels relationship, and we accept the assumption of the existence of cointegration among independent variables and the dependent variable.

4.5 Residual diagnostics:

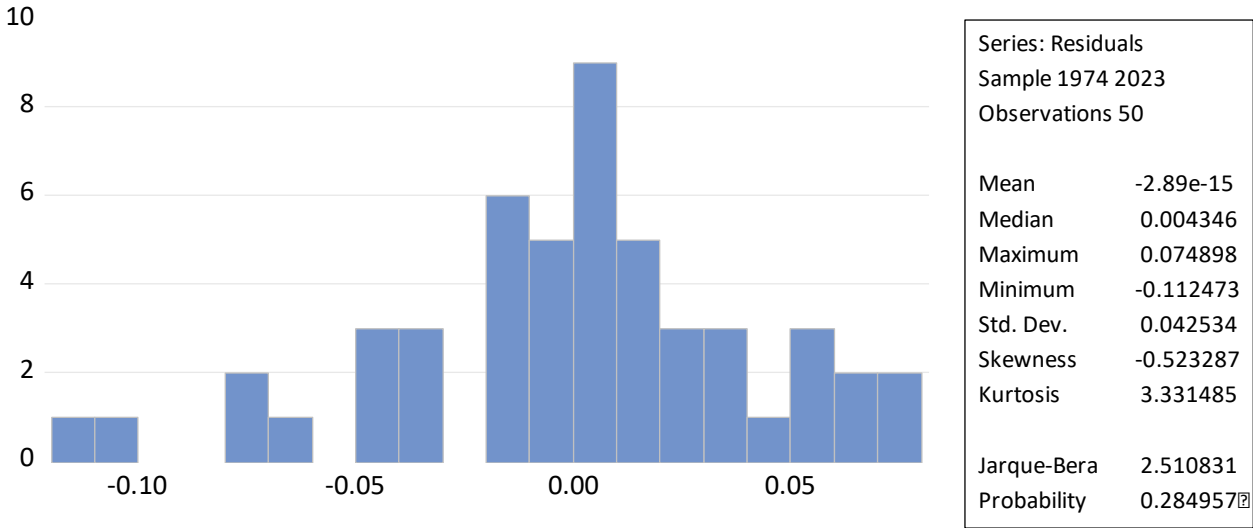
4.5.1 Test normality:

For Morocco:



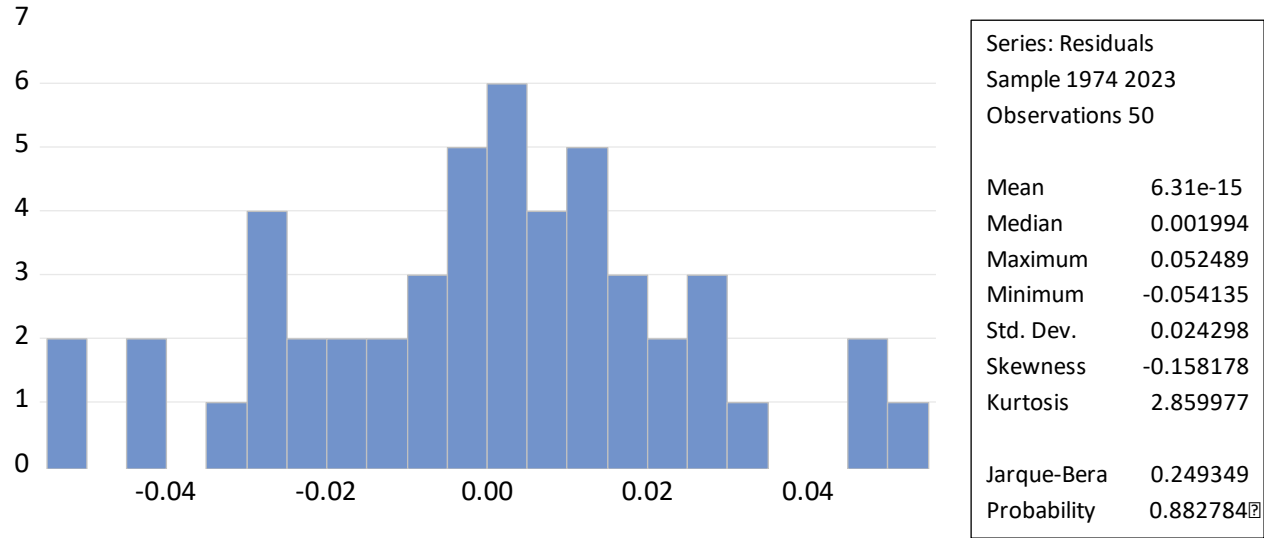
The residual data involved in the research are normally distributed and best represented by mean and standard deviation, as the probability is 0.25, which is higher than 0.05.

For Egypt:



The residual data involved in the research are normally distributed and best represented by mean and standard deviation, as the probability is 0.28, which is higher than 0.05.

For Ecuador:



The residual data involved in the research are normally distributed and best represented by mean and standard deviation, as the probability is 0.88, which is higher than 0.05.

4.5.2 Heteroskedasticity Test ARCH:

For Morocco:

Heteroskedasticity Test: ARCH

F-statistic	0.048877518507990 6	Prob. F(1,48)	0.825965897744974
Obs*R-squared	0.050862289643671 68	Prob. Chi-Square(1)	0.821569561506 7109

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 10/04/24 Time: 12:05
Sample (adjusted): 1974 2023
Included observations: 50 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.

C	0.002631151401125474	0.0006908006681133402	3.808843167371421	0.000396002161
RESID^2(-1)	0.030794117537478451	0.1392878352009426	0.221082608977449562061	0.825965645

R-squared	0.001017245792873434	Mean dependent var	0.002721053132397071
Adjusted R-squared	-0.019794894919775	S.D. dependent var	0.003910202945612132
S.E. of regression	0.003948714325561798	Akaike info criterion	-8.191675408613124
Sum squared resid	0.000748432551595 0541	Schwarz criterion	-8.115194488395998
Log likelihood	206.7918852153281	Hannan-Quinn criter.	-8.162551037982049
F-statistic	0.048877518507990 6	Durbin-Watson stat	2.056407895257782
Prob(F-statistic)	0.825965897744974		

We conducted the ARCH test to check for the presence of heteroscedasticity in the residuals of our model. The Chi-Square (1) probability is 0.82, which is greater than 0.05, indicating the absence of heteroscedasticity in our model.

For Egypt:

Heteroskedasticity Test: Harvey
Null hypothesis: Homoskedasticity

F-statistic	1.096571005631116	Prob. F(14,35)	0.393785826080610 4
Obs*R-squared	15.24467338353985	Prob. Chi-Square(14)	0.361636327246627 3
Scaled explained SS	18.52927890914931	Prob. Chi-Square(14)	0.183726614218742 3

Test Equation:
Dependent Variable: LRESID2
Method: Least Squares
Date: 10/04/24 Time: 12:28
Sample (adjusted): 1974 2023
Included observations: 50 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-2.441017929354454	55.50603303985083	-0.043977522681739452606211	0.965172037
LNDGP(-1)	1.961467358234038	7.251955382231699	0.270474270311494 27788848	0.588384452
LNDGP(-2)	7.280652388906751	7.751727342254214	0.939229678794909 97154279	0.354049901
LNDGP(-3)	-3.377907720597903	3.873776394095938	-0.871993476680662 01822765	0.389154539
LNEXTERNALDEBT	3.092645586946598	5.156475892461095	0.599759538579956 56681738	0.552529731
LNEXTERNALDEBT(-1)	-1.231750234974255	6.611936922054838	-0.186291894390438 13920091	0.853291382
LNEXTERNALDEBT(-2)	-0.256626812419847 7	6.447775147854859	-0.039800830843748 153259867	0.968478796

LNEXTERNALDEBT(-3)	-3.811384616927385	6.259887795739769	-0.60885829760738149	0.54655019483444700
LNEXTERNALDEBT(-4)	2.187446286212324	4.214628261665316	0.51901286243393103	0.60701882821862520
LNGROSSCAPITAL	-4.920241078855167	3.111717029046886	-1.581198107966208	0.12282875852122470
LNGROSSCAPITAL(-1)	-6.351594445663924	5.397455430697427	-1.176775049816877	0.24722641569192250
LNGROSSCAPITAL(-2)	4.870352833717473	4.985117518567441	0.976978535761104	0.33528497390296671
POPULATION_GROWTH__ANNUAL___	0.609381913566584 1	2.855703044005506	0.213391200495940 79	0.83226000985255100
INFLATION__CONSUMER_PRICES__ANNUAL___	-0.038673772630069 28	0.159124534793928	-0.243040914760355 53	0.80939247329821480
INFLATION__CONSUMER_PRICES__ANNUAL___(-1)	-0.105966435949194 2	0.179160490952521 39	-0.591460937156701 19	0.55801271886265500

R-squared	0.304893467670797	Mean dependent var	-7.954333730758041
Adjusted R-squared	0.026850854739115 86	S.D. dependent var	2.473956358361955
S.E. of regression	2.440516436943057	Akaike info criterion	4.865621465259251
Sum squared resid	208.4642167646233	Schwarz criterion	5.439228366887696
Log likelihood	-106.6405366314813	Hannan-Quinn criter.	5.084054244992319

F-statistic	1.096571005631116	Durbin-Watson stat	2.061074278085408
Prob(F-statistic)	0.393785826080610 4		

We conducted the ARCH test to check for the presence of heteroscedasticity in the residuals of our model. The Chi-Square (1) probability is 0.39, which is greater than 0.05, indicating the absence of heteroscedasticity in our model.

For Ecuador:

Heteroskedasticity Test: ARCH

F-statistic	0.028088523467024 58	Prob. F(1,47)	0.867619938582404 4
Obs*R-squared	0.029266289426104 32	Prob. Chi-Square(1)	0.864165634740173 9

Test Equation:
Dependent Variable: RESID^2
Method: Least Squares
Date: 10/04/24 Time: 12:41
Sample (adjusted): 1975 2023
Included observations: 49 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.000575346421122 66	0.000143889529880332 6	3.998528748400484 3551761	0.000223726866
RESID^2(-1)	0.024402037320581 69	0.145600806137191	0.167596319385823 10185868	0.867619679

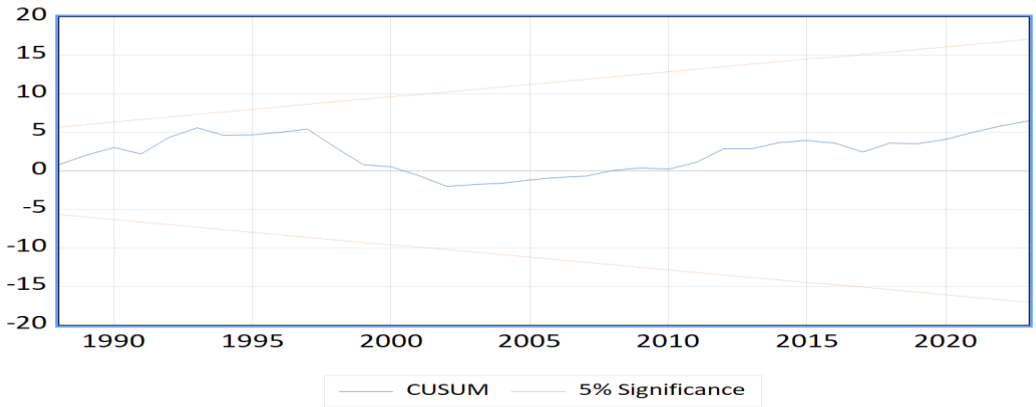
R-squared	0.000597271212777 6391	Mean dependent var	0.000589690055 7354104

Adjusted R-squared	-0.020666616633759 02	S.D. dependent var	0.000801449318494467
S.E. of regression	0.000809688589636 2294	Akaike info criterion	-11.359884659849 29
Sum squared resid	3.0812993772794e-05	Schwarz criterion	-11.282667504824 36
Log likelihood	280.3171741663076	Hannan-Quinn criter.	-11.330588578940 04
F-statistic	0.028088523467024 58	Durbin-Watson stat	1.996883098465998
Prob(F-statistic)	0.867619938582404 4		

We conducted the ARCH test to check for the presence of heteroscedasticity in the residuals of our model. The Chi-Square (1) probability is 0.86, which is greater than 0.05, indicating the absence of heteroscedasticity in our model.

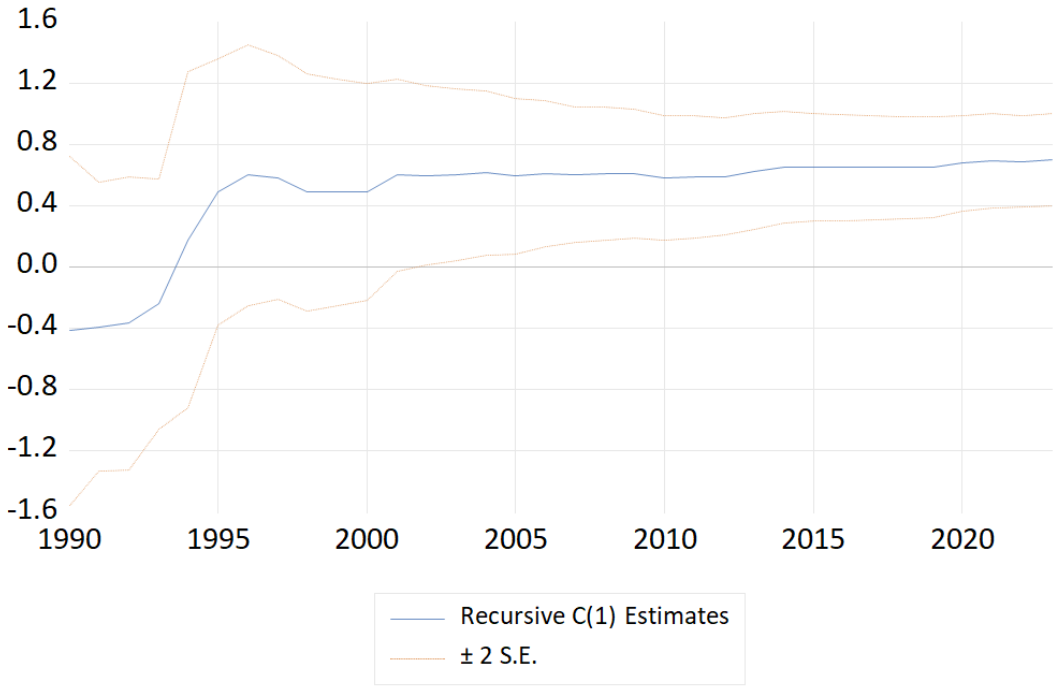
4.5.3 CUSUM TEST & STABILITY SYSTEM:

For Morocco:



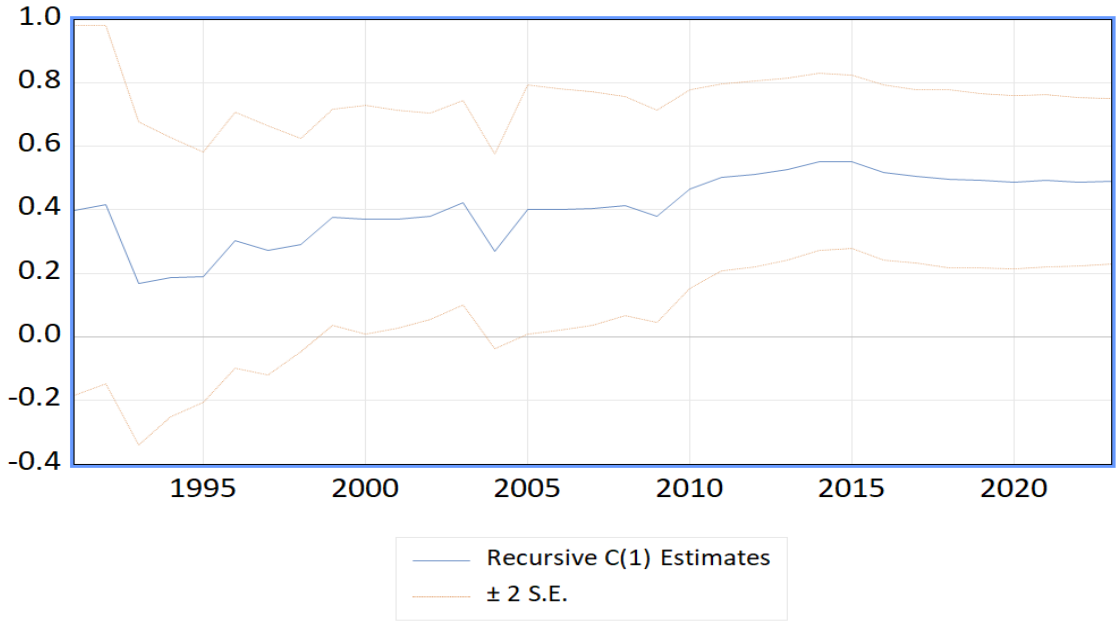
We conducted the CUSUM test and stability analysis. Based on the chart, our model appears to be stable.

For Egypt:



We conducted the CUSUM test and stability analysis. Based on the chart, our model appears to be stable.

For Ecuador:



We conducted the CUSUM test and stability analysis. Based on the chart, our model appears to be stable.

5. Results and discussion

For Morocco:

Conditional error correction

Dependent Variable: D(LNDGP)
Method: ARDL
Date: 09/07/24 Time: 23:44
Sample: 1974 2023
Included observations: 50
Dependent lags: 4 (Automatic)
Automatic-lag linear regressors (4 max. lags): LNEXTERNALDEBT LNGROSSCAPITAL POPULATION_GROWTH__ANNUAL___ INFLATION__CONSUMER_PRICES__ANNUAL___
Deterministics: Restricted constant and no trend (Case 2)
Model selection method: Akaike info criterion (AIC)
Number of models evaluated: 2500
Selected model: ARDL(3,4,2,0,1)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNDGP(-1)*	-0.595893929374131	0.138049015596473	-4.316538700806291	0.000123787957208896333
LNEXTERNALDEBT(-1)	-0.143484685855824	0.028317681624608855	-1.535601906252784	0.053627749
LNGROSSCAPITAL(-1)	0.462754611259668	0.119628120380586	3.868276201999116	0.000456325042
POPULATION_GROWTH__ANNUAL___**	-0.263412401049770	0.058888804929687	-4.473047149866326	7.789411755097 78e-05

INFLATION__CONSUMER_PRICES__ANNUAL___(-1)	0.003762240648628295	0.004785293370409128	0.786208960347756	0.437035989320823451
C	5.304385744685787	1.144616194945662	4.634204695083491	4.81830891168389e-05
D(LNDGP(-1))	0.295269478319803	0.14580763288362015	2.025061915259238	0.050541303936768
D(LNDGP(-2))	-0.116440546443472	0.079882971763988598	-1.457639035044341	0.153855324495105
D(LNEXTERNALDEBT)	-0.135385817794820 6	0.106334131482596 5	-1.273211300145701	0.211334090462888942
D(LNEXTERNALDEBT(-1))	0.066055981780313 69	0.086104510936439596	0.767160445950862	0.448130211638204
D(LNEXTERNALDEBT(-2))	-0.046935296701838 3	0.094319580392428856	-0.497619846710051	0.621864149358275
D(LNEXTERNALDEBT(-3))	0.249774147119492 6	0.086911842542883588	2.873879226555024	0.006850211669151294 2
D(LNGROSSCAPITAL)	0.648796731637119 5	0.064168190563235 61	10.11087777202868	6.34812682268774 1e-12
D(LNGROSSCAPITAL(-1))	-0.251934286803744 4	0.102800462930029 78	-2.450711446343705	0.019396480235847348
D(INFLATION__CONSUMER_PRICES__ANNUAL___)	-0.002006286331302 22	0.003281382366164155	-0.611414979244712	0.544875992359865 3

R-squared	0.830490601133727 6	Mean dependent var	0.062364225437951

Adjusted R-squared	0.762686841587218	S.D. dependent var	0.1033095628363166
S.E. of regression	0.050327045273973 19	Akaike info criterion	-2.89722321147173 37
Sum squared resid	0.088648402010299 14	Schwarz criterion	-2.32361630984329 3
Log likelihood	87.43058028679342	Hannan-Quinn criter.	-2.67879043173867
F-statistic	12.24844472767126	Durbin-Watson stat	2.19843247941515 2
Prob(F-statistic)	1.328985027298475 e-09		

* p-values are incompatible with t-bounds distribution.
** Zero-lag variable.

After confirming the cointegrating relationship, Table 6 displays the long-term estimation results. The study has found that economic growth from the immediate past has a positive impact on the current year's economic growth. This implies that the economic growth of the previous year has a favorable effect on the current growth. In other words, a 10-percentage-point increase in growth in the last period leads to a 5.9% increase in economic growth for the current year.

The ARDL technique is dynamic and relies on the significant lagged value of the dependent variable. Furthermore, it has been observed that external debt has a considerable negative impact on long-term economic growth. According to Table 6, the current year's economic growth is influenced by the stock of external debt from the previous three years. A 10% increase in external debt from the previous year can slow economic development by 1.4% in the current year. These results indicate that the country's external debt has increased significantly and has become unbearable.

Also, we noticed that a 10% increase in gross capital formation from the previous year can increase economic development by 4.6% in the current year.

Also, we noticed that a 10% increase in population growth from the previous year can increase economic development by 2.6% in the current year.

For Egypt:

Dependent Variable: D(LNDGP)
Method: ARDL
Date: 09/07/24 Time: 23:10
Sample: 1973 2023
Included observations: 51
Dependent lags: 3 (Automatic)
Automatic-lag linear regressors (3 max. lags): LNEXTERNALDEBT LNGROSSCAPITAL LNTRADE POPULATION_GROWTH__ANNUAL___ INFLATION__CONSUMER_PRICES__ANNUAL___
Deterministics: Restricted constant and no trend (Case 2)
Model selection method: Akaike info criterion (AIC)
Number of models evaluated: 3072
Selected model: ARDL(1,0,1,1,3,3)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNDGP(-1)*	-0.2812735914218476	0.06264206451264230	-4.490171154115483	7.050809476947696e-05
LNEXTERNALDEBT**	-0.1364391844512712	0.03559103760411669	-1.023830342166636	0.127463638993715
LNGROSSCAPITAL(-1)	0.1541233209651063	0.09461300549029245	1.628986717736318	0.112036035047033
LNTRADE(-1)	0.1497433349871625	0.05521463500514014	2.712022541033158	0.010188325475711329
POPULATION_GROWTH__ANNUAL___(1)	-0.2011596640347807	0.07214352299102382	-2.788325775086565	0.008410900186200106
INFLATION__CONSUMER_PRICES__ANNUAL___(-1)	0.0036774593965773874	0.00342435434018208	1.073913223323232	0.290007933

C	1.135230211740124	0.54526084 76229603	2.081994 0942279	0.044511 35950099 6398
D(LNGROSSCAPITAL)	0.391841352557043 6	0.08149058 790497011	4.808424 1434368	6.694074 66482608784e-05
D(LNTRADE)	-0.065118387696141 61	0.09322995 16043847	-0.698470 0028531	0.489370 6412699 863
D(POPULATION_GROWTH__ANNUAL___)	-0.372216407149652 1	0.23369006 3092977	-1.592778 7767307	0.119953 67197841 346
D(POPULATION_GROWTH__ANNUAL___(-1))	0.086513445287684 18	0.27822793 30264999	0.310944 91615712	0.757636 91897343 458
D(POPULATION_GROWTH__ANNUAL___(-2))	0.470029533721930 3	0.23932890 12071366	1.963948 042182	0.057294 71245432 7371
D(INFLATION__CONSUMER_PRICES__ANNUAL___)	-0.002284418651720 653	0.00182913 211758600 3	-1.248908 1336423	0.219758 50957190 2938
D(INFLATION__CONSUMER_PRICES__ANNUAL___(-1))	-0.007834040264087 238	0.00274716 247897879 6	-2.851684 5779127	0.007158 58376844 353
D(INFLATION__CONSUMER_PRICES__ANNUAL___(-2))	-0.005837705653214 992	0.00218088 940786737 3	-2.676754 351196	0.011122 53421795 2665

R-squared	0.865107399566023 8	Mean dependent var	0.073553 96145629 866
Adjusted R-squared	0.673760277175032 9	S.D. dependent var	0.111716 30017273 45
S.E. of regression	0.063809444523822 58	Akaike info criterion	-2.425902 46633819

Sum squared resid	0.146579227575796	Schwarz criterion	-1.857718456713388
Log likelihood	76.86051289162385	Hannan-Quinn criter.	-2.208782551275911
F-statistic	8.375823775719542	Durbin-Watson stat	2.442048120004805
Prob(F-statistic)	1.413564473977334e-07		

* p-values are incompatible with t-bounds distribution.
** Zero-lag variable.

A 10-percentage-point increase in growth in the last period leads to a 2.8% increase in economic growth for the current year.

A 10% increase in external debt from the previous year can slow economic development by 1.3% in the current year. These results indicate that the country's external debt has increased significantly and has become unbearable.

Also, we noticed that a 10% increase in gross capital formation from the previous year can increase economic development by 1.5% in the current year.

Also, we noticed that a 10% increase in population growth from the previous year can increase economic development by 2% in the current year.

For Ecuador:

Dependent Variable: D(LNDGP)
Method: ARDL
Date: 09/07/24 Time: 23:15
Sample: 1974 2023
Included observations: 50
Dependent lags: 4 (Automatic)
Automatic-lag linear regressors (4 max. lags): LNEXTERNALDEBT

LNGROSSCAPITAL LNTRADE POPULATION_GROWTH__ANNUAL___ INFLATION__CONSUMER_PRICES__ANNUAL___
Deterministics: Restricted constant and no trend (Case 2)
Model selection method: Akaike info criterion (AIC)
Number of models evaluated: 12500
Selected model: ARDL(3,0,4,0,2,2)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
LNDGP(-1)*	-0.017209315534428	0.105850429 08221797	-9.609875 5846692	4.34360624271494 75e-11
LNEXTERNALDEBT**	0.048674507532105 78	0.015130183 475121355	3.217046 5800749	0.002899 49504942 8085
LNGROSSCAPITAL(-1)	0.537729731346571 3	0.068587807 790586664	7.840019 6978866	4.89460320931292 572e-09
LNTRADE**	0.290368431769332 5	0.035473678 310423833	8.185462 5503491	1.88704941992516 1e-09
POPULATION_GROWTH__ANNUAL___(-1)	-0.057444283650817 05	0.03611271 520967335	-1.590694 7495483	0.121214 09625999 19
INFLATION__CONSUMER_PRICES__ANNUAL___(-1)	-0.004655712548676 135	0.00070697- 501031324 56	-6.585399 2157142	1.74081812975400 4e-07
C	4.725327930709016	0.710595386 36611102	6.649815 5962836	1.44393212441293 72e-07
D(LNDGP(-1))	0.506677104631458 9	0.097076005 981228376	5.219385 2163344	9.65823363011670 82e-06
D(LNDGP(-2))	0.351299405534095 8	0.103901333 21275519	3.381086 6144682	0.001871 63772292 2092
D(LNGROSSCAPITAL)	0.215778191636178 1	0.044191424 089713544	4.882807 9232907	2.60439839399752 4e-05

D(LNGROSSCAPITAL(-1))	-0.522254652381183	0.06793437745825528	-7.687634656098151	7.486186130601 49e-09
D(LNGROSSCAPITAL(-2))	-0.343727659220613	0.07386601426528541	-4.653939837114298328893	5.103459 72e-05
D(LNGROSSCAPITAL(-3))	-0.086276689087402 88	0.03343592289658125 6	-2.580358663262572 6738966	0.014507 5024
D(POPULATION_GROWTH__ANNUAL___)	-0.020714327020500 67	0.05558090057321364 3	-0.372687828588019 77286478	0.711763 366
D(POPULATION_GROWTH__ANNUAL___(-1))	0.114663639451025 4	0.05848414367217581	1.960593628443491 8484251	0.058412 5668
D(INFLATION__CONSUMER_PRICES__ANNUAL___)	-0.003261681501620 706	0.00047765187677113 39	-6.828574650807118 9162358	8.609270 66e-08
D(INFLATION__CONSUMER_PRICES__ANNUAL___(-1))	0.001296675838994 269	0.00044463219888561 48	2.916288659178109 8905355	0.006324 51465

R-squared	0.966465739796874 9	Mean dependent var	0.068379 1732927 9279
Adjusted R-squared	0.950206704546874 9	S.D. dependent var	0.132687 1773076 283
S.E. of regression	0.029608362571984 9	Akaike info criterion	-3.937035 2540110 75
Sum squared resid	0.028929619428405 84	Schwarz criterion	-3.286947 4321655 05
Log likelihood	115.42588 13502769	Hannan-Quinn criter.	-3.689478

			1036469 32
			2.208764
	59.441764		1002368
F-statistic	22133479	Durbin-Watson stat	98
	1.0918915		
	86113628		
Prob(F-statistic)	e-19		

* p-values are incompatible with t-bounds distribution.
** Zero-lag variable.

A 10-percentage-point increase in growth in the last period leads to a 0.1% increase in economic growth for the current year.

A 10% increase in external debt from the previous year can slow economic development by 0.4% in the current year. These results indicate that the country's external debt has increased significantly and has become unbearable.

Also, we noticed that a 10% increase in gross capital formation from the previous year can increase economic development by 5.3% in the current year.

Also, we noticed that a 10% increase in population growth from the previous year can increase economic development by 0.5% in the current year.

If a country fails to pay its external debt for three years, the interest rate will be compounded over time, leading to a negative impact on economic growth. Various studies, including Pattillo et al.'s (2004) and Ehikioya et al.'s (2020), suggest that a country's external debt must be sustainable to prevent delays in economic reform and slow growth with low productivity (Moss, 2006; Vamvakidis, 2007; Kolawole, 2021). Furthermore, the IMF emphasizes that increasing debt can hinder economic growth and worsen the country's financial situation.
The R-squared value of 0.84 indicates that these variables can explain 84% of the economic growth, which is a significant explanation.

6. Conclusion and recommendations:

6.1 Conclusion

For Morocco, Egypt and Ecuador, the commercial balance deficit is continuously increasing, resulting in a significant funding requirement, Unfortunately, this funding requirement has not been met by other funding sources.

Foreign deficits have caused the tree countries to rely on external debt. To maintain a specific level of currency reserves, these countries has borrowed money from the international financial market. Various factors such as economic growth, debt, population growth, and capital formation play a significant role in explaining the dependent variable, both in the short and long term. The dependent variable is negatively correlated with the country's external debt. This aligns with the theory that continuous economic growth can generate sufficient tax revenues to increase public spending while simultaneously reducing the need for financing.

When there is strong economic growth, it usually leads to an increase in exports. This consequently reduces the necessity for currency reserves and external lending. According to a popular theory, growth and external debt should have a positive relationship. However, in our case, it is the opposite. This means that as the government's external debt increases, growth decreases. Our hypothesis suggests that this outcome can be attributed to two opposing factors.

In general, investments in these countries have low returns, as measured by the marginal capital coefficient.
When analyzing the nature of externally funded projects, they are significant investments with long-term profitability. The selection criteria for completed projects are sometimes controversial. The concept of "white elephants" refers to the low impact of governmental investments on economic growth (Akesbi, 2017).

On the other hand, the economy is heavily impacted by short-term capital transfers to foreign countries through debt service, amortization, and interest, and capital flight.

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The variable debt service is significant and has a negative coefficient, as predicted by economic theory. This implies that if a country’s external debt servicing increases in proportion to its currency reserves, the government is less likely to borrow further from external sources.

6.2 Why these three countries can’t converge to developed countries?

One major drawback of debt is that it requires payment of interest on foreign currency. This means that these governments may have to resort to increasing taxes or redirecting funds from productive projects to pay off foreign debt, which could negatively impact economic growth (Lin & Sosin, 2001). Although foreign debt is considered an important source of finance for the Moroccan, Egypt and Ecuador

governments, it may also pose significant challenges in terms of external debt burden (Forgha, Mbella, and Ngangnchi, 2014).

One of the main disadvantages of using international debt, especially when it is denominated in foreign currency and not hedged, is that it exposes the borrower to fluctuations in exchange rates. This is because if the government borrows in foreign currency while collecting taxes in its native currency, its local currency may weaken. This depreciation is often a result of foreign investors selling off their government bonds or creditors suddenly recalling their loans, which puts downward pressure on the domestic currency.

Developing countries frequently fail to achieve developed country status due to a mix of structural, historical, economic, and institutional issues. While convergence theory predicts that poorer countries should expand faster than richer countries (owing to higher returns on capital and technology investment), many developing countries encounter obstacles to long-term economic growth and development. Here are some of the main reasons why many emerging countries struggle to catch up with affluent nations:

➢ Low Levels of Human Capital: Developing countries frequently have lower levels of education, health, and skill development. A poorly educated workforce stifles innovation and productivity, which are critical for long-term prosperity. Poor health outcomes, such as high infant mortality and short life expectancy, lower the population's productive capacity.

➢ Poor Governance and Corruption: Many developing countries face significant growth challenges due to weak institutions and governance, such as high levels of corruption, political instability, and inefficient bureaucracy. Corruption diverts resources from productive use, erodes investor trust, and impedes the execution of growth-promoting policies:

For example:

The Moroccan kingdom ranks 97th in the 2023 index published by the NGO, which assesses the perception of corruption in the public sector in 180 countries, down three places from the previous year and 24 in five years.

Systemic and endemic corruption threatens the social, economic and political stability of our country and encourages the rent-seeking economy and the protection of illicit activities, according to a release from Transparency International. This ranking's release comes amid a slew of corruption scandals rocking Morocco's political landscape.

Between 2000 and 2008, corruption cost Egyptians more than 57 billion pounds. This number, which equals over 20% of Egyptian GDP (2011 value), was proposed by Global Financial Integrity. According to its annual assessment, Egypt is the third most corrupt country in Africa. Transparency International made the same negative observation. The survey, issued in 2012, ranks Egypt 118th, with the first representing the least corrupt country and the 176th being the most corrupt.

In 2023, Ecuador's public sector corruption perception index was 66 points on a scale of 0 to 100, with 0 representing a high level of corruption and 100 indicating no corruption. This represents a relatively troubling scenario in terms of corruption, despite ongoing efforts to promote openness and accountability.

➢ Developing countries may suffer limited access to international financial markets or high borrowing prices because of perceived risk. Without sufficient capital, it is difficult to invest in infrastructure, education, and industrial development, all of which are essential for growth. High debt levels can limit fiscal headroom, requiring governments to prioritize debt repayment above development spending.

➢ Dependence on Primary Commodities: Many developing countries rely substantially on primary commodity exports (such as oil, minerals, and agriculture). This exposes companies to price volatility in global markets, causing economic instability and limiting their capacity to invest in diverse, high-value businesses. Furthermore, primary sectors tend to experience slower productivity development than manufacturing and services.

➢ technology Backwardness: Developing countries frequently experience considerable disparities in technology capability. Although globalization has encouraged technology transfer, developing countries may lack the absorptive capacity (skills, infrastructure, and institutions) to effectively embrace and innovate with modern technologies. This reduces productivity growth and prevents convergence with developed economies.

➢ Limited Research and Development (R&D): Developing countries often invest far less in R&D than developed countries. Without innovation and technical advancements, economies struggle to progress up the value chain and remain trapped in low-productivity industries.

➢ The "Middle-Income Trap"

Stagnation After Initial Growth: Some developing countries experience relatively high growth rates for a period but then stagnate before reaching developed country status. This is known as the middle-income trap. After achieving middle-income status through industrialization or commodity exports, these countries struggle to move into high-value, innovative industries and face slowing productivity growth. Factors contributing to the middle-income trap include poor governance, inadequate education systems, and weak institutions that fail to support the transition to a knowledge-based economy.

➢ **External Debt and Financial Crises:**

➢ Debt Overhang: Developing countries often accumulate high levels of external debt, which can lead to a debt overhang. When a large portion of national income is used to service debt, there is less available for public investment in development, infrastructure, and social programs. Debt crises, like those seen in Latin America in the 1980s or in Sub-Saharan Africa, can set back growth for decades.

➢ Capital Flight and Volatility: Developing countries often face capital flight during times of financial instability, as investors move their money to safer markets. Currency crises, inflation, and unstable financial systems can lead to economic collapses, making it difficult for developing countries to maintain stable growth.

➢ Law and Property Rule Rights: In many developing countries, the rule of law is weak, and property rights are poorly safeguarded. This hinders investment, particularly in capital-intensive businesses and long-term projects, because investors are concerned whether their investments will be protected.

Conclusion:

➢ While some developing countries have achieved significant growth and development (e.g., South Korea, Singapore), many continue to face significant barriers to converge to developed nations. The key to successful convergence lies in addressing the structural, institutional, and economic challenges that hinder sustained growth. This includes investing in human capital, building strong institutions, diversifying the economy, and promoting innovation and last but not least managing debt. However, the complexity of global trade dynamics, historical legacies, and external factors means that convergence remains a difficult and uneven process for many developing nations.

Bibliographie

1. Bailly, Jean.-Luc., Caire, Gilles., Lavialle, Christophe et Jean-José, Quilès. (2006). Macroéconomie. 2e édition, Édition Bréal-Collection Grand Amphi-Économie.
2. Barro, Robert.-J. (1997). Les facteurs de la croissance économique : Une analyse transversale par pays. Édition Economica.
3. Barro, Robert.-J. et Sala-i-Martin, Xavier. (1995). « Technological diffusion, convergence and growth ». NBER Working Papers, No. 5151.
4. Baumol, William.-J. (1986). « Productivity growth, convergence, and welfare: What the long-run data show ». The American Economic Review, Vol. 76, No. 5, pp 1072- 1085.
5. Branson, William.-H. (1972). « Macroeconomic equilibrum with portfolio balance in open economies ». Seminar paper No. 22, Stockholm, Institue for international economic studies, November, 1972.
6. Cohen, Daniel. (1992). « Growth and external debt ». CEPREMAP, No. 9302.
7. Cordella, Tito., Ricci, Luca.-A. et Ruiz.-Arranz, Marta. (2005). « Debt overhang or debt irrelevance? Revisiting the debt-growth link ». IMF working paper, No. 05/223.
8. DeLong, Elisabeth.-R., DeLong, David.-M. et Clarkal-Pearson, Daniel-L. (1988). « Comparing the areas under tow or more correlated receiver operating characteristic curves: a nonparametric approach ». International biometric society, Vol. 44, No. 3, pp. 837-845.
9. Dervis, Kemal. (2012). « Le village planétaire ». FMI, Finance et développement, septembre 2012, Vol. 49, No. 3.
10. Flores.-Prieto, Pedro., Fullerton, Thomas. M. Jr. et Cesar, Andrade.-Olivas. (2007). « Evidencia empírica sobre deuda externa, inversión y crecimiento en México, 1980-2003 ». MPRA Paper, No. 9497.
11. Krugman, Paul. (1988). « Financing versus forgiving a debt overhang ». Journal of development economics, Vol. 29, No. 3, pp. 253-268.
12. Nurkse, Ragnar. (1953). Problems of capital formation in underdeveloped countries. Oxford University press.

13. Pattillo, Catherine., Poirson, Hélène et Ricci, Luca. (2004). « What are the channels through which external debt affects growth? ». IMF Working paper, No. 04/15.
14. Raffinot, Marc. (1998). « Soutenabilité de la dette extérieure : De la théorie aux modèles d'évaluation pour les pays à faible revenu ». Document de travail du DIAL, No.1.
15. Ralle, Pierre et Hénin, Pierre-Yves. (1993). « Les nouvelles théories de la croissance : Quelques apports pour la politique économique ». Revue économique, 1993/1, No. 44
16. Rostow, Walt.-Whitman. (1960). The stages of economic growth: A non-communist Manifesto. Cambridge University press.
17. Sachs, Jeffrey.-D. (1989). « The debt overhang of developping countries ». In : BragaJorge, de Macedo et Findlay, Ronald (eds). Studies in : debt, growth and stabilization: Essays in memory of Carlos Dias Alejandro. Oxford Blackwell.
18. Pesaran, H. M., & Shin, Y. (1999). An autoregressive distributed lag modelling approach to cointegration analysis. In Storm, S. (Ed.), Econometric and Economic Theory in the 20th Century (Chapter 11). The Ragner Frisch Centennial Symposium. Cambridge: Cambridge University Press. https://doi.org/10.1017/CCOL521633230.011
19. Engle, R. F., & Granger, C. W. J. (1987). Co-integration and error-correction: Representation, estimation and testing. Econometrica, 55(2), 251-276. https://doi.org/10.2307/1913236
20. Johansen, S. (1988). Statistical analysis of cointegration vectors. Journal of Economics, Dynamics and Control, 12(2-3), 231-54. https://doi.org/10.1016/0165-1889(88)90041-3
21. Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and interference on cointegration with application to the demand for money. Oxford Bulletin of Economics and Statistics, 52(2), 169-210. https://doi.org/10.1111/j.1468- 0084.1990.mp52002003.x
22. Pattillo, C., Poirson, H., & Ricci, L. A. (2004). What are the channels through which external debts affect growth? IMF Working Paper, 2004/15, 1-33. https://doi.org/10.5089/9781451843293.001
23. Pesaran, H. M., & Shin, Y. (1999). An autoregressive distributed lag modelling approach to cointegration analysis. In Storm, S. (Ed.), Econometric and Economic Theory in the 20th Century (Chapter 11). The Ragner Frisch Centennial Symposium. Cambridge: Cambridge University Press. https://doi.org/10.1017/CCOL521633230.011
24. Pesaran, M. H., Shin, Y., & Smith, R. J. (2001). Bounds testing approaches to the analysis of level relationship. Journal of Applied Economics, 16(3), 289-326. https://doi.org/10.1002/jae.616
25. Phillips, P. C. B., & Perron, P. (1988). Testing for a unit root in time series regression. Biometrika, 75(2), 335-346. https://doi.org/10.1093/biomet/75.2.335
26. Pattillo, C., Poirson, H., & Ricci, L. A. (2004). What are the channels through which external debts affect growth? IMF Working Paper, 2004/15, 1-33. https://doi.org/10.5089/9781451843293.001
27. Moss, T. (2006). Will debt relief make a difference? Impact and expectations of the multilateral debt relief initiative. Centre for Global Development Working Paper, 88. Retrieved July 10, 2023 from https://www.cgdev.org/publication/will-debt-relief-make-difference-impact-and-expectations-multilateral-debt-relief National Bureau of Statistics [NBS] (2023). Real GDP and Unemployment. https://www.nigerianstat.gov.ng/ Ndubuisi, P. (2017). Analysis of the impact of external debt on economic growth in an emerging economy: Evidence from Nigeria. African Research Review, 11(4), 156-173. http://dx.doi.org/10.4314/afrrev.v11i4.13
28. Vamvakidis, A. (2007). External debt and economic reform: Does a pain reliever delay the necessary treatment? IMF Working Paper, 2007/050, 1-27. https://doi.org/10.5089/9781451866148.001

29. Kolawole, B. O. (2020). Foreign debt and economic growth dynamics: Further evidence from Nigeria. Journal of Economics and Allied Research, 3(3), 49-60. Kolawole, B. O. (2021). Fiscal stability and macroeconomic environment in Nigeria: A further assessment. Theory, Methodology, Practice - Review of Business & Management, 17(2), 53-66. http://doi.org/10.18096/TMP.2021.03.05