

Factors Affecting Inflation in the Arab Maghreb Countries During 2002-2021

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<i>Received : 29/09/2024</i>	<i>Accepted : 31/10/2024</i>	<i>Published : 21/12/2024</i>
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Abstract:

This study analyzes the key determinants of inflation in Arab Maghreb countries, including FDI, money supply, economic growth, and political stability. FDI increases inflation by boosting demand, while economic growth helps control it by enhancing productivity. Excessive money supply is a primary inflation driver, emphasizing the need for strict monetary control. Political stability reduces inflation volatility, supporting effective economic management. The findings highlight the importance of coordinated economic and political strategies for managing inflation, using data from 2002 to 2021 from the World Bank.

Keywords: Inflation; Economic Growth; Panel Data Analysis; Economic Determinants.

JEL Classification Codes: E31; E58; O55.

Résumé :

Cette étude analyse les principaux déterminants de l'inflation dans les pays du Maghreb arabe, notamment les IDE, la masse monétaire, la croissance économique et la stabilité politique. L'IDE augmente l'inflation en stimulant la demande, tandis que la croissance économique contribue à la contrôler en améliorant la productivité. La masse monétaire excessive est le principal moteur de l'inflation, ce qui souligne la nécessité d'un contrôle monétaire strict. La stabilité politique réduit la volatilité de l'inflation, favorisant ainsi une

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gestion économique efficace. Les résultats soulignent l'importance de stratégies économiques et politiques coordonnées pour gérer l'inflation, en utilisant les données de 2002 à 2021 de la Banque mondiale.

Mots-clés : Inflation ; Croissance économique ; Analyse des données du panel ; Déterminants économiques.

Codes de classification JEL : E31 ; E58 ; O55.

1- Introduction:

One of the main concerns that decision-makers have throughout time is economic growth, particularly in light of the risks associated with the Fourth Industrial Revolution and the massive technical advancements that are taking place worldwide. Consequently, governments endeavor to maintain a pace with the advancements in digital transformation and bridge the gap before it increases, impeding the attainment of consistent progress.

Numerous factors contribute to economic growth, primarily the variety and caliber of monetary, fiscal, and other policies implemented by the government; yet, all of these policies share the same goal of achieving growth that ensures that people's economic and living conditions will improve.

Owing to the current global information avalanche and the widespread availability of technology, nations are racing to keep up with these advancements and develop new applications and innovations. These include artificial intelligence applications and techniques that have the potential to improve human lives, improve living conditions, and raise the bar for economic growth, in addition to the facilities and services they offer in a variety of fields, including trade, education, health care, and others. They have scarcely been without one of these technologies in one form or another, without recognizing the difficulties and issues they present.

a. The Problem of The Research:

In the context of our work, a key question deserves to be asked:

What are the key factors influencing inflation in the Arab Maghreb countries?

b. Study Hypothesis:

- The growing amount of the money supply exerts a positive and considerable influence on the inflation rate in Arab Maghreb nations.
- Foreign Direct Investment (FDI) contributes to inflation by increasing the demand for goods and services.
- Political stability plays a crucial role in controlling inflation by creating an environment conducive to effective economic management and price stability.

c. Research Aims: The objective of this study is to:

- comprehend the effects of inflation on the economy of the Arab Maghreb nations.
- Examine how economic variables can affect the inflation rate.

d. The Importance of the Research:

This topic is pertinent due to the economic and political events central to the news that have precipitated inflation.

The comprehension of the influence of many factors on the inflation rate.

e. Research Methodology and Tools Used:

All scientific work requires the use of methods and techniques to better understand the subject of study. As part of our study, we utilized the following methods and techniques:

- **Historical Method:** It allowed us to consult financial documents from previous years and to leverage facts through situations related to the past of the World Bank.
- **Analytical method:** We conducted a processing of data and information on each variable.
- **Documentary Technique:** We gathered existing data from libraries,

the works of our predecessors, financial literature, and certain websites. This technique allowed us to enrich our theoretical knowledge and the definition of the main concepts.

2- Theoretical Rooting of Inflation:

Inflation is a well-known phenomenon and has become the main variable affecting public or private economic life. Several definitions have been attributed to it. Etymologically, the word inflation comes from the Latin "inflatio," meaning swelling, and originally referred to an excessive increase in the amount of paper money. In other words, inflation is the swelling of all means of payment that can lead to a rise in prices and a depreciation of the currency. (Goux, 1998)

2-1. The Concept of Inflation:

Inflation is a global imbalance that results in a general increase in prices. Inflation involves all parties and all mechanisms of the economy. In this sense, the inflationary process is based on macroeconomic mechanisms; moreover, it is a self-sustaining phenomenon.

2-2. Types of Inflation:

Inflation has been classified into numerous classifications, among which the following can be identified:

2-2-1. Open Inflation:

Declared or open inflation is characterized by a rapid, general, permanent, and cumulative increase in prices, typically ranging between 5 and 10%, with peaks that can reach 20%. This inflation primarily stems from the scarcity of certain items in specific economic sectors, resulting in heightened production costs and, subsequently, increased prices. This situation can lead to social demands, forcing the state to raise wages.

However, if the wage bill increases more rapidly than the value of products in the market, this leads to a further rise in prices, thus fueling the inflationary cycle. (Laval, 1952)

2-2-2. Creeping Inflation:

Creeping inflation is a form of inflation that is structurally embedded in the economy, characterized by a low rate of evolution over the long term, typically between 2.5% and 4% per year. This chronic inflation is common in industrialized countries and is characterized by a slow but steady increase in prices and wages. It occurs when market demand slightly exceeds supply due to a gradual improvement in the standard of living, insufficient production, an increase in population, a resurgence in consumption, and excess wealth and liquidity among consumers and businesses. Although persistent, this type of inflation does not pose a serious threat to the economy and can even stimulate economic growth by encouraging consumption and investment. (Robinson & Eatwell, 1976)

2-2-3. Hyperinflation:

The existence of hyperinflation is linked to an excess of money in the economy compared to its actual needs, thereby promoting a general rise in prices. This increase stems from the fact that the state is no longer able to cover its expenses because it does not have enough revenue. This catastrophic budget situation will lead to a lack of confidence from lenders, which will push the state to resort to monetary issuance.

2-2-4. Galloping Inflation:

Galloping inflation is significant inflation, reaching double-digit rates. It is a very high inflation. It is manifested by a very strong acceleration of prices. It is a type of inflation that is completely out of control, exceeding 30% and, in some cases, can surpass 100%. This kind of inflation generally leads to a total loss of confidence in the national currency due to a depreciation of its value. It may result in the disintegration of the entire economic and monetary framework, or maybe the eradication of the national currency, supplanted by a new currency. (Dagut, 2005)

2-2-5. Imported Inflation:

Imported inflation, most shown by the rise in raw material prices, most especially oil. A change in the price of an imported good will cause inflation in the importing nation.

Inflation may originate from external factors, such as a devaluation of the national currency resulting in heightened prices for imported goods; however, these external factors rapidly influence internal mechanisms, causing imported inflation to evolve into traditional inflation. (Clerc, 1997)

2-3. The Indicators of Inflation:

2-3-1. Consumer Price Index (CPI):

The consumer price index measures the variation in the cost of a selected array of goods over time, based on the premise that the quantities acquired remain unchanged between two successive survey intervals. It delineates the market for consumer goods and services intended for domestic consumption.

The price he refers to in the national price index is an overall selling price, whether it is paid by the consumer or not.

Analyzers often use the CPI as a proximal indicator of the total inflation index for the whole country. Consumer pricing index determines the inflation rate. Computed as the percentage change in the general price level, the inflation rate is:

$$\text{Inflation rate} = (\text{CPI (N)} - \text{CPI (N-1)}) / (\text{CPI (N-1)}) \times 100$$

In general, inflation is measured using the consumer price index (CPI). (OCDE, 2002)

2-3-2. GDP deflator:

The GDP deflator represents the ratio of nominal GDP to real GDP. It establishes the pricing of all goods and services generated within the

economy, excluding imported commodities. It is feasible to assess how prices have affected the time period under examination using the GDP deflator.

It should be emphasized that a larger difference between nominal and real GDP suggests a more important impact of prices on the economy. We figure it out like this (Mankiw, 2003):

$$\text{GDP deflator} = (\text{Nominal GDP}) / (\text{Real GDP}) \times 100$$

- Nominal GDP: The monetary value of final products and services produced within a specific year, assessed at the prevailing market prices of that year.

- Real GDP: The monetary value of final products and services generated throughout a year, assessed at constant prices.

2-3-3. Other indicators:

- The wholesale price index shows changes in the prices paid at different levels of distribution;
- Intermediate products price indices indicate fluctuations in the prices incurred by producers for acquiring intermediate goods and raw materials;
- The price indices for manufactured products indicate variations in the ex-factory costs of goods assessed at base prices;
- At the production level, the agricultural product price index tracks the change in prices that farmers receive for their products.

3- Empirical Study:

Our study is based on prior research that identifies key causes of inflation, including money supply growth, exchange rate fluctuations, and economic activity levels. Previous findings highlight the significant roles of monetary policy, political stability, and external factors in influencing inflation, especially in developing countries and regions like CEMAC. These studies emphasize the complex interplay between economic and monetary variables in determining inflation.

3-1. Previous Studies:

- A number of real-world studies have been used to try to figure out what causes inflation, which can be related to money or the economy. In addition to pursuing shared goals like price stability and economic growth, central banks are essential to maintaining economic stability, (Bikai et Essaine, 2017).
- Jayati (2007) emphasizes that monetary policy should be part of the broader framework of overall macroeconomic policy, aimed at achieving objectives of monetary stability, economic growth, full employment, and balance of current accounts, rather than being limited to controlling monetary variables.
- According to Nupukpo (2002), monetary stability mainly depends on the level of development and economic activity. He indicates that monetary policy primarily relies on the key interest rates set by central banks.
- According to Asenmacher-Wesche and Gerlach (2006), inflation in Japan, the UK, the US, and the eurozone is mostly determined by the increase of the money supply.
- Using a sample of 53 developing nations, Loungani and Swagel (2001) use a VAR approach to show that monetary growth and exchange rate fluctuations, especially in those with flexible exchange rate regimes, account for a sizable amount of inflation variations in developing nations.
- Moreover, Barnichon and Peiris (2007) find that the difference between the money supply and demand is a more important driver of inflation than the production gap after applying an error correction model to a panel of 16 African nations. Thus, over time, monetary factors have a significant impact on inflation.
- Diouf (2007) conducts a study on Mali and finds that, in addition to monetary creation, climatic conditions significantly explain inflation.
- Ntita et al. (2017) employ a fixed effects model on a panel of six nations from the Central African Economic and Monetary Community (CEMAC) for the period from 1996 to 2016. Econometric analysis demonstrates that the money supply and political stability exert a substantial influence on inflation in this region.
- Nkwenka Nyanda (2019) conducts a study on the Central African Economic and Monetary Community (CEMAC) and finds that inflation primarily arises from trade, and that external inflation does not support economic activity.

These empirical studies reveal several elements causing inflation that support each other. Among these problems are changes in exchange rates, the growth of the money supply, and the mismatch between the accessible and sought amounts of money.

3-2. Presentation of Data:

The World Bank database provided the data utilised for this investigation. For a panel of Arab Maghreb nations, they span the years 2002–2021, and they are yearly in scope.

The selection of this timeframe is warranted by the accessibility of data.

The explained variable:

- The inflation rate: is quantified by the Consumer Price Index (CPI).

The explanatory variables:

- The investment rate: This metric quantifies the proportion of gross fixed capital formation relative to GDP. Investments facilitate the provision of goods and services and generate value, hence mitigating inflation.
- Foreign direct investment: Denotes the net inflows of foreign direct investments within a nation as a percentage of GDP. This ratio facilitates export promotion and job generation, hence supporting economic growth.
- The real interest rate: is adjusted for inflation using the GDP deflator as the measurement tool in order to arrive at the real interest rate. This variable is used for the purpose of determining the economic situation.

We do not have enough data on the real interest rate in the Arab Maghreb countries, so we choose to ignore the variable.

- The money supply: indicates, as a percentage of GDP, the various forms of payment that are now in circulation. Any monetary creation can either encourage or hinder inflation and economic growth.
- The GDP growth rate: it is an economic indicator used to measure a country's economic activity.
- Government effectiveness: it is an indicator that measures the effectiveness of public action and the quality of regulation. This indicator is assessed on a scale from -2.5 to 2.5.

2.5 is the highest degree of government effectiveness, while -2.5 represents the lowest degree of effectiveness.

- Political Stability: it is an indicator that measures the degree of political stability in a country. This indicator is assessed on a scale of -2.5 to 2.5. -2.5 represents the highest degree of political instability, while 2.5 indicates the highest degree of political stability. This variable was introduced to examine the effect that the political environment could have on the control and management of inflation.

3-3. Methodology:

The panel data allows us to conduct an analysis in two dimensions: the individual dimension and the temporal dimension. They are generally indicated by the indices i and t respectively. It is often interesting to identify the effect associated with each individual.

To estimate our model, we selected three estimation methods:

- The first is the ordinary least squares (OLS) technique applied to panel data. Using this method, which is known as the Pooled Model, assumes that the sample is completely homogenous. Both the N constants $\alpha_i = \alpha$ and the N parameter vectors $\beta_i = \beta$ are comparable to one another.
- The second technique involves applying the OLS method to the model with variables, which allows for controlling the characteristics of each country. We will implement a distinct model for each nation. A model with fixed effects is referred to as a model with fixed effects. In order to simplify the elimination of time-invariant features for each country, the fixed effects model is utilized. This allows for the examination of the overall impact that the explanatory variables have on the dependent variable.
- The third option entails utilising the generalised least squares method. The random effects model assumes that there are individual components that follow a random distribution. The random effects model is distinguished by the fact that it assumes that the variation that exists between countries is random and does not have any correlation with the variables that are being used to explain the phenomenon. These techniques will be subject to a model estimation.

3-4. Descriptive Statistics:

We will start by describing our variables using descriptive statistics. The results of our explanatory factors' descriptive statistics are shown in the following table.

Table 1: Results of descriptive statistics

	RT inf	RT inv	FDI	RTc GDP	MM	Gov	PS	Corrup
Observation	100	100	100	100	100	100	100	100
Mean	3.32	29.43	3.15	3.51	67.72	-0.52	-0.70	-0.59
Std.Dev	3.11	11.62	4.59	12.33	34.33	0.55	0.74	0.44
Max	15.51	57.16	27.65	86.82	183.65	0.69	0.83	0.283
Min	-9.79	0.16	-10.95	-50.33	16.82	-1.840	-2.5	-1.56

Source: Output STATA

The primary descriptive statistics of the variables for our model are presented in Table 1, which provides an overview of these data. Over the course of the five countries, the average inflation rate is 3.32 percent. The peak inflation rate in Libya was 15.51% in 2011, while the lowest figure was -9.79% in 2002. The standard deviation of the same variable is 3.11%, which shows that the inflation rate is volatile among the Arab Maghreb countries.

We can notice that the variable GDP growth rate differs from one country to another; it is significant for some countries and low for others, resulting in a huge difference between the maximum and minimum values. The GDP growth rates exhibit a minimum of -50.33% and a maximum of 86.82%, with an average of 3.51% and a standard deviation

of 12.33%. This indicates that the GDP growth rate is very volatile among the Arab Maghreb countries.

With a mean of 29.43% and a standard deviation of 11.62%, the five countries' investment rates span 0.16% to 57.16%. With an average of 3.15% and a standard deviation of 4.59%, the variable FDI—that is, the net flows of foreign direct investment as a percentage of GDP—ranges from -10.95% to 27.65%. The outflows of investment flows help to justify the negative sign of the variable FDI.

Moreover, the money supply variable—which shows the percentage of GDP in circulation as a method of payment—varies between about 16.82% and 183.65% with an average of 67.72% and a standard deviation of 34.33%.

- The correlation between the variables:

We utilise the correlation matrix to evaluate the interdependence among the explanatory variables.

Table 2: Variables in the model and their correlation matrix

	RT inf		RT inv	FDI	RTc GDP	MM	Gov	PS	Corrup
RT inf	1.00								
RT inv	0.19		1.00						
FDI	0.33		0.32	1.00					
RTC GDP	-0.10		-0.002	0.06	1.00				
MM	-0.29		-0.13	-0.43	-0.18	1.00			
Gov	0.12		0.19	0.02	0.002	0.04	1.00		
PS	0.07		0.02	0.23	0.048	-0.37	0.51	1.00	
Corrup	0.17		0.17	0.08	-0.001	-0.04	0.94	0.52	1.00

Source: developed by ourselves

According to this correlation matrix, there is a strong positive correlation between the two variables, government effectiveness (GOV) and control of corruption (CORRUP).

Also, on average, there is a favourable association between political stability and corruption control.

At 0.32, the investment rate and FDI variables are positively associated with one another. Similarly, foreign direct investments are negatively correlated with the money supply at 0.43.

We put the explanatory variables through the multicollinearity test to make sure they weren't dependent on each other. The existence of this problem leads to an increase in the variance of these variables, making them unstable and difficult to interpret.

In our work, there is multicollinearity with a relatively high VIF, and to resolve this issue, we eliminated certain variables from the model, which are: government effectiveness (GOV) and control of corruption (CORRUP), which reduced the VIF to an acceptable threshold of 1.22.

3-5. Model Presentation:

The estimated econometric model in this chapter is the inflation equation, inspired by Nubukpo's work (2002). It is presented as follows:

$$RTinf_{it} = \alpha_i + \beta_1 RTinv_{it} + \beta_2 FDI_{it} + \beta_3 RTGDP_{it} + \beta_4 Sup_{it} + \beta_5 Gov_{it} + \beta_6 PS_{it} + \beta_7 Corr_{it} + \alpha_8 RTint_{it} + \varepsilon_{it}$$

Where:

i: refers to the country, indicated as 1, ..., 5 (1: Tunisia; 2: Algeria; 3:

Libya; 4: Morocco; 5: Mauritania);

t: represents the time period from 2002 to 2021 (annual period);

α_i : denotes the fixed effects associated with the nation;

β_j : denotes the coefficients of the variables $j=1, \dots, 8$;

$RTinf_{it}$: Rate of Inflation;

$RTGDP_{it}$: Rate of GDP growth;

$RTinv_{it}$: Investment ratio (as a percentage of GDP);

FDI_{it} : Foreign direct investment (as % of GDP);

$RTint_{it}$: Real interest rate;

Sup_{it} : Money supply (as % of GDP);

Gov_{it} : Indicator of government effectiveness;

PS_{it} : Indicator of political stability;
 $Corr_{it}$: Indicator of corruption control;
 ε_{it} : Error term.

3-6. Econometric Tests:

First thing to look for when evaluating a panel data sample is if the data producing process's specification is homogeneous or heterogeneous. This is like econometrically assessing the model's coefficients' equality at the individual level.

3-6-1. Fisher's Specification Test:

It allows for a comparison between the completely homogeneous model and a model with individual effects.

This test allows us to check whether the model specification is homogeneous or heterogeneous; in other words, it examines whether the model is the same for all countries or if there are specific characteristics unique to each country.

H0: pooled model $\alpha_i = \alpha$ for all $i=1, \dots, N$

H1: Individual effects model $\alpha_i \neq \alpha$

If the probability is greater than 5%: we accept **H0**, meaning we should retain the completely homogeneous model.

To determine whether to employ fixed or random effects. First, we checked for random effects.

Table 3: Fisher specification test result

	RT inf
Prob > F	0.02

Source: developed by ourselves

We can conclude that Prob > F is less than the 5% threshold. We reject the totally homogeneous model and retain the individual effects model.

We therefore have a specific effect by country, and the test results compel us to move to a model with individual effects.

3-6-2. Breush-Pagan Test (Lagrange Multiplier):

It is the Breusch-Pagan statistic that is produced when a random effects model is estimated. It examines the significance of the random effects model.

H0: No random effects $\sigma_u^2 = 0$

H1: Presence of random effects $\sigma_u^2 \neq 0$

If the probability is greater than 5%: we accept **H0**, meaning the absence of random effects.

Table 4: Lagrange multiplier test result

	RT inf
Prob > chibar2	1.00

Source: developed by ourselves

The Lagrange Multiplier test shows that Prob > Chi2 is more than 5%, hence we must accept the null hypothesis of no random effects.

3-6-3. Hausman Test:

The Hausman specification test is a useful tool that can be utilized when deciding between a model with fixed effects and one with random effects.

Individual effects and their link to explanatory variables is the focus of the hypothesis under examination:

H0: $COV(\alpha_i ; X) = 0$: Model of random effects

H1: $COV(\alpha_i ; X) \neq 0$: Model of fixed effects

If the probability is greater than 5%: we accept **H0**, meaning we should retain the random effects model.

Table 5: Results for the Hausman specification test

	RT inf
Prob>chi2	0.01

Source: developed by ourselves

According to the results of the Hausman test, we can conclude that the Prob > Chi2 is less than 5%, and therefore we must accept the hypothesis **H1** and retain the fixed effects model.

3-6-4. Test of Autocorrelation of Errors:

It is necessary to study whether the errors are autocorrelated in the estimated model or if there is no autocorrelation, as the OLS estimation method requires that the errors be non-autocorrelated for the results and estimation to be relevant. We are going to test autocorrelation using the Woodbridge test.

The hypotheses of the test are as follows:

H0: Absence of autocorrelation of the residuals.

H1: Presence of autocorrelation in the residuals.

The decision criterion: If Prob > F is less than 5%, then we reject the null hypothesis **H0** and accept the alternative hypothesis H1, which indicates that there is autocorrelation among the residuals.

Table 6: Woodbridge test results

	RT inf
Prob> F	0.004

Source: developed by ourselves

The test results indicate that the Prob > F is below 5%, necessitating the acceptance of hypothesis H1 on the existence of autocorrelation in the residuals.

3-6-5. Test For Heteroscedasticity:

A heteroscedastic econometric model is defined by a residual variance that varies over time, violating one of the estimate assumptions of the ordinary least squares approach. An estimation of a heteroscedastic model using the OLS method will yield unbiased estimators, but they will not have minimal variance, and thus the model may be unreliable. We will test for heteroscedasticity by following the steps of Breusch-Pagan, which are:

- Conduct regression analysis;
- Extract the residuals from the regression;
- Compute the squares of the residuals;
- Conduct a regression analysis of the squared residuals against the independent variables.

The hypotheses of the test are as follows:

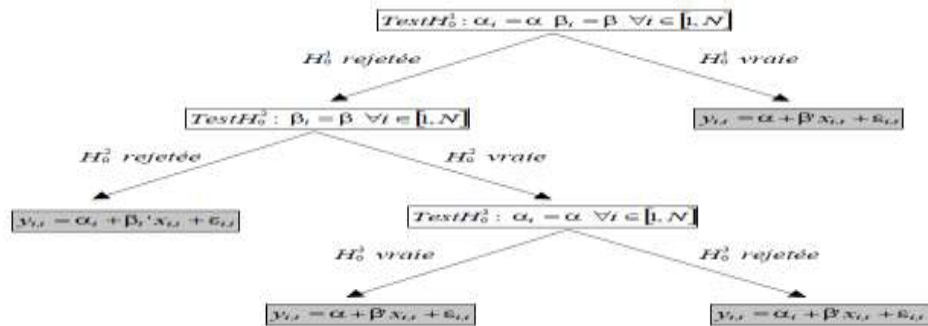
H0: The variance of the errors remains constant (The residuals exhibit homoscedasticity).

H1: The variance of the errors is non-constant (the residuals exhibit heteroscedasticity).

The decision criterion: If the test statistic $n \cdot R^2 > \chi^2(k)$, we reject **H0**, meaning the residuals are heteroscedastic.

According to the findings of our research, the test statistic $n \cdot R^2$ is higher than the critical value of the model, which indicates that the residuals exhibit heteroscedasticity.

Figure 1: General procedure for homogeneity testing



Source: Hsiao, C. (1986). Analysis Panel Data. Econometric Society Monographs, n° 11, Cambridge: Cambridge University Press.

4- Results and Interpretations:

We are going to be evaluating the inflation model using three different methods: the pooling model, the fixed effects model, and the random effects model. These are the three techniques that we need to apply.

Here is the breakdown of the research that was conducted to determine what causes inflation in the Arab Maghreb countries:

$$RTinf_{it} = \alpha_i + \beta_1 RTinv_{it} + \beta_2 FDI_{it} + \beta_3 RTGDP_{it} + \beta_4 Sup + \beta_5 PS_{it} + \varepsilon_{it}$$

Both heteroscedasticity and autocorrelation of mistakes are issues that arise as a result of the fact that the model that is being maintained is a fixed effects model. We have regressed with the MCG method to obtain more relevant results.

Our econometric study using the STATA software has yielded the following results:

Table 7: Coefficients of the inflation variables

<i>RTinf</i>	
Variables	Coefficients
<i>RTinv</i>	0,015
<i>FDI</i>	0,108**
<i>RTGDP</i>	-0,038*
<i>Sup</i>	0,028***
<i>PS</i>	-0,969*
Const	4,233***
Observation	100

Source: Output STATA

*** Statistically significant at the 1% level

** Statistically significant at the 5% level

* Statistically significant at the 10% level.

The data we have presented indicate that managing inflation necessitates regulation of additional variables. Consequently, we have

analysed several variables regarded as conventional predictors of inflation, including the investment rate, foreign direct investment, money supply, economic growth rate, and political stability.

All factors, except for the investment rate, which exerts no substantial influence on inflation in the Arab Maghreb countries, are statistically significant according to our econometric research findings.

The variable "FDI" represents the net flows of foreign direct investments located in a country as a percentage of GDP. This variable has a positive and statistically significant effect on inflation with a coefficient of 0.108. Any increase in FDI of 1% leads to a rise in the inflation rate of 0.108%. FDI can lead to an increase in inflation. When a foreign company invests in a country, it often creates new job opportunities and stimulates the demand for goods and services. If national production fails to meet this increased demand, it may lead to a rise in prices, which in turn causes inflation.

The variable "GDP growth rate" represents an economic indicator used to measure a country's economic activity. This variable has a negative and statistically significant effect on inflation with a coefficient of -0.038. If there is a one percent increase in the rate of growth of the GDP, there will be a 0.038 percent decrease in the rate of inflation. A high economic growth rate can have beneficial effects on controlling inflation. When the economy grows, businesses can achieve economies of scale, invest in new technologies, and improve their productivity. This can help reduce production costs and contain inflation.

Strong economic development can also result in rising investments, employment, and income, therefore fostering the demand for goods and services. Supply can meet this higher demand, therefore regulating inflationary pressures.

The variable "money supply" shows the fraction of GDP in current circulation means of payment. The inflation rate in the Arab Maghreb nations is positively and quite significantly affected by this variable.

"A rise in the money supply faster than the rate of production is the only way to cause inflation, which is a monetary phenomenon that occurs everywhere and everywhere," Milton Friedman said famously in

1970. Prices rise then whenever the money supply exceeds the necessary actual balances.

With an excessive amount of money generated as its origin, inflation is clearly a monetary phenomenon, accepted as such (Friedman). Many central banks have chosen to control the change of the money supply in order to reach price stability using the monetarist viewpoint. This is carried out hoping to boost the economy.

In a nation, the variable "political stability" gauges the degree of political stability. With a value of -0.969, this variable has a negative and considerable impact on the inflation rate of Arab Maghreb nations. Should the political stability index show a one percent increase, the inflation rate would drop seven-point nine percent.

The mastery of political stability has a negative effect on the volatility of inflation in that a politically stable environment allows public authorities to better control price developments and strive for their stability. In a politically unstable environment, despite the established norm, inflation is very volatile and has a negative effect on economic growth. Hence the necessity to ensure political stability within the Arab Maghreb countries in order to achieve sustained growth and control inflation.

5- Conclusion:

As part of this work, we pursued two main objectives. The first was to present a literature review on the phenomenon of inflation, focusing on the main theories explaining this phenomenon that has attracted the interest of many researchers across various fields.

The second purpose was to ascertain the origins of inflation in the Arab Maghreb nations from 2002 to 2021. Utilising a fixed effects panel model, our empirical study's findings verified that the money supply exerts a positive and highly significant influence on inflation in the Arab Maghreb countries, whereas political stability negatively affects inflation in this region. Therefore, effective management of the money supply and the preservation of political stability are crucial for containing

and controlling inflation in the Arab Maghreb. Economic expansion somewhat mitigates inflation. The results have been inconsistent and at times unclear.

Research indicates a favourable correlation between inflation and economic growth following an analysis of inflation's impact on economic development. Others have endorsed the presence of an inverse link. Additional research has been undertaken that corroborates the notion of the super neutrality of money over the long run. They illustrate that inflation does not affect economic growth in the long term, despite a negative association in the short term. The impact of inflation on economic growth is uncertain and diverse. Numerous studies have empirically examined the impact of inflation on economic growth, although a consensus has not been achieved.

The causes of inflation are numerous. They can be financial, real, and even structural. Otherwise, inflation is a cumulative and worsening process. It is developing, even though the underlying causes have already disappeared. This can have consequences and even costs in various political areas, institutions, and also for certain economic aggregates, as well as on economic growth.

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7- Appendices:

1- Declaration of panel data:

```
xtset id Année
      panel variable:  id (unbalanced)
      time variable:  Année, 2002 to 2021
                  delta:  1 unit
```

2- Homogeneous regression:

```
. reg TXINF TXINV Ide tXCPIB Mm SPOL
```

Source	SS	df	MS	Number of obs	=	99
Model	186.886313	5	37.3772626	F(5, 93)	=	5.58
Residual	623.234622	93	6.70144755	Prob > F	=	0.0002
Total	810.120935	98	8.26654016	R-squared	=	0.2307
				Adj R-squared	=	0.1893
				Root MSE	=	2.5887

TXINF	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TXINV	.0553351	.0238084	2.32	0.022	.0080563	.1026139
Ide	.7095274	.3681526	1.93	0.057	-.0215507	1.440605
tXCPIB	.0138121	.024015	0.58	0.567	-.0338769	.0615011
Mm	.020682	.009021	2.29	0.024	.038596	.0027681
SPOL	-.2417565	.3927456	-0.62	0.540	-1.021671	.5381584
_cons	2.172124	1.062805	2.04	0.044	.0616029	4.282645

3- Fixed effects model:

```
. xtreg TXINF TXINV IDE tXCPIB Mm SPOL , fe
```

Fixed-effects (within) regression
Group variable: id

R-sq:

within = 0.0945
between = 0.0681
overall = 0.0873

Number of obs = 100
Number of groups = 5

Obs per group: min = 20
avg = 20.0
max = 20

corr(u_i, Xb) = -0.0619

F(5,90) = 1.88
Prob > F = 0.1057

TXINF	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TXINV	-.0246535	.0429696	-0.57	0.568	-.1100201	.0607131
IDE	.2176867	.0799363	2.72	0.008	.0588792	.3764942
tXCPIB	-.0264038	.0245246	-1.08	0.285	-.0751262	.0223186
Mm	.0032758	.019492	0.17	0.867	-.0354485	.0420001
SPOL	.2881372	.5833615	0.49	0.623	-.8708122	1.447087
_cons	3.437199	1.661742	2.07	0.041	.1358591	6.738538

sigma_u	1.5095512
sigma_e	2.7786331
rho	.22788481 (fraction of variance due to u_i)

F test that all u_i=0: F(4, 90) = 3.01

Prob > F = 0.0221

4- Random effects model:

```
. xtreg TXINF TXINV IDE tXCPIB Mm SPOL , re
```

```
Random-effects GLS regression           Number of obs   =       100
Group variable: id                     Number of groups  =        5

R-sq:                                Obs per group:
    within = 0.0661                      min =         20
    between = 0.6443                     avg =        20.0
    overall = 0.1795                      max =         20

corr(u_i, X)  = 0 (assumed)             Wald chi2(5)     =       20.57
                                           Prob > chi2      =       0.0010
```

TXINF	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
TXINV	.0244763	.0265511	0.92	0.357	-.027563	.0765155
IDE	.1552909	.0739715	2.10	0.036	.0103094	.3002725
tXCPIB	-.0401697	.0239924	-1.67	0.094	-.087194	.0068546
Mm	.0218841	.0100474	2.18	0.029	.0415766	.0021917
SPOL	-.2649276	.4231472	-0.63	0.531	-1.094281	.5644256
_cons	3.550405	1.098594	3.23	0.001	1.397199	5.70361
sigma_u	0					
sigma_e	2.7786331					
rho	0	(fraction of variance due to u_i)				

5- Test for Multicollinearity:

```
. vif
```

Variable	VIF	1/VIF
Mm	1.41	0.711456
IDE	1.36	0.734383
SPOL	1.18	0.849590
TXINV	1.12	0.888926
tXCPIB	1.04	0.966086
Mean VIF	1.22	

6- Lagrange multiplier test (Breush-Pagan):

Breusch and Pagan Lagrangian multiplier test for random effects

$$TXINF[id,t] = Xb + u[id] + e[id,t]$$

Estimated results:

	Var	sd = sqrt(Var)
TXINF	9.700143	3.114505
e	7.35955	2.712849
u	0	0

Test: $Var(u) = 0$

chibar2(01) = 0.00
Prob > chibar2 = 1.0000

7- Hausman specification test:

	---- Coefficients ----			
	(b)	(B)	(b-B)	sqrt(diag(V_b-V_B))
	e	.	Difference	S.E.
TXINV	-.0246535	.0244763	-.0491298	.0345984
IDE	.2176867	.1552909	.0623958	.0367396
tXCPIB	-.0264038	-.0401697	.0137659	.0084405
Mm	.0032758	-.0218841	.0251599	.0169397
SPOL	.2881372	-.2649276	.5530649	.4187909

b = consistent under H_0 and H_a ; obtained from xtreg
B = inconsistent under H_a , efficient under H_0 ; obtained from xtreg

Test: H_0 : difference in coefficients not systematic

chi2(4) = $(b-B)'[(V_b-V_B)^{-1}](b-B)$
= 12.05
Prob>chi2 = 0.0170

8- Homoscedasticity test (Breusch-Pagan):

```
. reg r12 TXINV IDE tXCPIB Mm SPOL
```

Source	SS	df	MS	Number of obs	=	100
Model	5966.68685	5	1193.33737	F(5, 94)	=	208.14
Residual	538.923054	94	5.73322397	Prob > F	=	0.0000
				R-squared	=	0.9172
				Adj R-squared	=	0.9128
Total	6505.6099	99	65.7132313	Root MSE	=	2.3944

r12	Coef.	Std. Err.	t	P> t	[95% Conf. Interval]	
TXINV	-.1331625	.0219585	-6.06	0.000	-.1767616	-.0895634
IDE	1.732577	.0611765	28.32	0.000	1.611109	1.854044
tXCPIB	-.1401748	.0198424	-7.06	0.000	-.1795723	-.1007772
Mm	.0129996	.0083094	1.56	0.121	-.003499	.0294982
SPOL	1.31756	.3499542	3.76	0.000	.6227172	2.012402
_cons	11.0434	.9085674	12.15	0.000	9.239422	12.84739

9- Autocorrelation test:

```
. xtserial TXINF TXINV IDE tXCPIB Mm SPOL
```

Wooldridge test for autocorrelation in panel data

H0: no first order autocorrelation

F(1, 4) = 34.097
 Prob > F = 0.0043

10- Final estimation after correcting for heteroscedasticity and autocorrelation of errors:

```
. xtgls TXINF TXINV IDE tXCPIB Mm SPOL, panels(h) corr(ar1)
```

Cross-sectional time-series FGLS regression

Coefficients: generalized least squares
 Panels: heteroskedastic
 Correlation: common AR(1) coefficient for all panels (0.5541)

Estimated covariances = 5 Number of obs = 100
 Estimated autocorrelations = 1 Number of groups = 5
 Estimated coefficients = 6 Time periods = 20
 Wald chi2(5) = 24.23
 Prob > chi2 = 0.0002

TXINF	Coef.	Std. Err.	z	P> z	[95% Conf. Interval]	
TXINV	.0152279	.0321462	0.47	0.636	-.0477775	.0782332
IDE	.1089169	.0476978	2.28	0.022	.015431	.2024027
tXCPIB	-.0380009	.0216872	-1.75	0.080	-.080507	.0045052
Mm	.0288173	.0100105	2.88	0.004	.0484376	.009197
SPOL	-.9696037	.602011	-1.61	0.107	-2.149524	.2103163
_cons	4.233977	1.157992	3.66	0.000	1.964354	6.5036