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CONTEMPORARY INFLATION DYNAMICS: DIAGNOSIS AND FACTOR ANALYSIS IN DEVELOPING COUNTRIES

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ABSTRACT

In an international context full of ambiguities, the developing economies are suffering more and more from the relentless increase in the general level of prices, which constitutes a disruptive factor in their macroeconomic equilibrium. The signs of crisis are starting to appear, and cyclical measures are no longer needed to readjust the parameters. Faced with this continuing trend in prices worldwide over the period 2018-2023, it seems essential to look behind the scenes and detail the underlying explanations behind this phenomenon.

This article uses Morocco as an example to extract the determinants of inflation over the last decade, through a qualitative investigation of 30 observations. We use factor analysis (PCA) with Direct Oblimin Rotation, with a view to reducing the size of the data collected and deducing the real factors behind the new inflationary dynamic. The results obtained show that the rising inflation in Morocco is primarily driven by imported inflation affected by the COVID-19 pandemic and the Russian-Ukrainian war. Additionally, Internal factors such as economic freedom and the reform of the compensation fund influence in a second row the phenomenon analyzed.

Keywords: inflation, negative externalities, macroeconomics, factor analysis

JEL Classification: E31

INTRODUCTION

Nowadays, logic in life is no longer valid, planning, programming, developing strategies, and reasoning by cause and effect, but in the end and in a moment (t) everything is absorbed. This is what we have experienced and are currently experiencing, from the COVID-19 pandemic to the Russian-Ukrainian war of 2022 and the conflict between China and Taiwan, right through to the inflation crisis.

The last decade has had a major impact on the world's economies: health crises, political conflicts, climatic hazards and so on. As a result, we have seen countries affected to varying degrees, while others have lost their macroeconomic equilibrium. In this respect, Morocco is suffering in silence with the global economic crisis, while at the same time, the central bank (BANK AL-MAGHRIB) has tended to attach greater importance to controlling inflation and strengthening the credibility of their policy, noting that Morocco has shown real resilience in the face of a number of major shocks over the last few decades. This flexibility has mainly manifested itself in social support and monetary policy support measures.

Since the international financial crisis of 2007, Morocco has also experienced a prolonged period of moderate inflation, accompanied by sluggish economic activity and falling interest rates. But from 2022 onwards, this trend will begin to reverse, with inflation rising steadily against a backdrop of strong pressure on commodity prices and geopolitical tensions at the global level as we can see in Figures 1, 2 and 3.

As noted above, cyclical and structural factors are having a major impact on the price of energy products and imports in general, which are more expensive than before. The sirens are ringing, and Morocco, along with the rest of the world, is facing an inflation crisis.

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In the same vein, a number of articles have dealt with the subject of new price dynamics, namely (Mubasher & Atta, 2024),(Ada Tony & Umaru, 2024),(Bobeica & Hartwig, 2023),(Bonam & Samadu, 2021),(Harding, Lindé, & Trabandt, 2023) (Mai Chi, Pierre-Olivier, & Daniel, 2024). This coincidence has mainly been attributed to the shock effect felt at the global level. However, to our knowledge, no study has been carried out into the factors behind the rise in prices. For this reason, the aim of this article is to identify and analyse the underlying reasons for the inflation crisis, over a 5-year time series (2018 - 2023), using the method of factorial analysis of the results of exploratory studies. Hence, the problem of this work is to answer the following question: ***How can we explain the rapid rise in the general level of prices in Morocco?***

To answer this question, the remainder of this paper is organised as follows: The first section is devoted to the literature review through which an attempt has been made to explain and theoretically analyse each channel of inflation transmission; the second section deals with the working methodology and the hypotheses derived from the theories relating to the literature review; while the third section presents and discusses the results obtained.

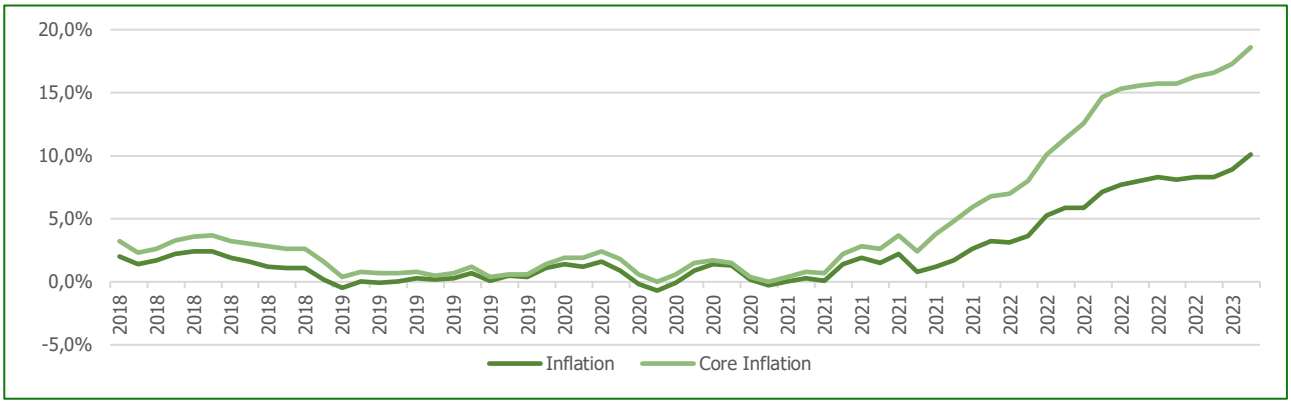

Figure 1. Evolution of the general and core inflation rate in Morocco over the period 2018 and 2023. *(Source: based on Central Bank of MOROCCO Data)*

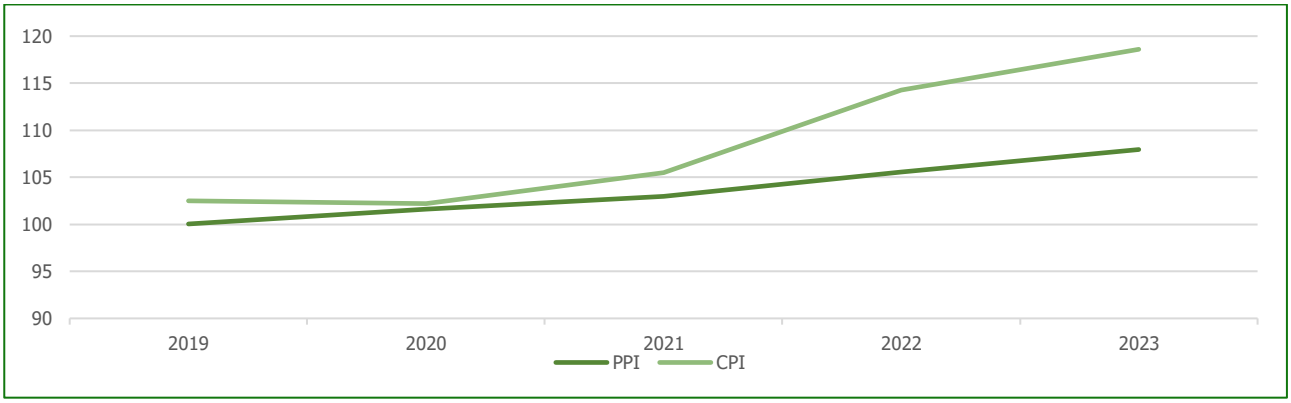

Figure 2. The reaction of the consumer price index to the industrial producer price index in Morocco. *(Source: based on Higher Planning Commission of MOROCCO Data)*

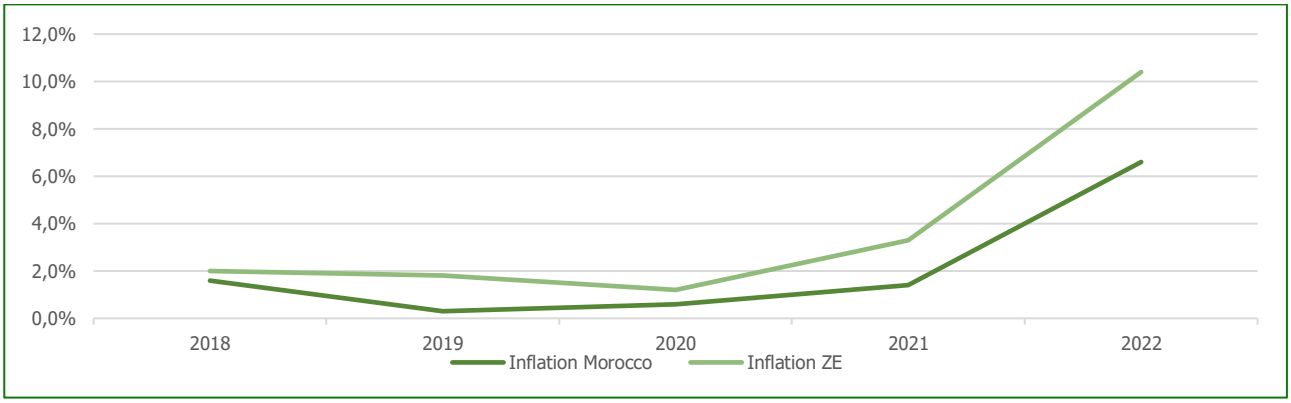

Figure 3. Inflation rates in Morocco and the Eurozone. *(Source: based on World Bank Group Data)*

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LITERATURE REVIEW

1. Inflation, conceptual framework

Definition

Inflation is an age-old phenomenon, and no country is immune to this scourge. A number of definitions have been developed to reflect the nature of this phenomenon.

The term inflation refers to a lasting, general and self-sustaining increase in the prices of goods and services, accompanied by a loss in the purchasing power of money.

"It is a global imbalance that results in a general increase in prices. Inflation involves all parts and mechanisms of the economy (production, income, prices)"(Jalladeau, 1998).

"Inflation is the generalised and continuous rise in the general level of prices of goods and services" (Beranrd & Simon, 2009).

Inflation is a macroeconomic phenomenon. It is a sustained rise in prices that is cumulative from year to year, accompanied by a loss in the purchasing power of money.

Measuring inflation

It is a quantitative phenomenon whose rate is evaluated as the change in the general level of prices from one period to another. It is most often measured using two tools: the gross domestic product (GDP) deflator and the price index (CPI).

The GDP deflator is an economic indicator used to measure inflation. It is calculated from changes in nominal GDP, which is expressed at current prices (value GDP), and real GDP, which is expressed at constant prices (volume GDP) and is used to calculate the economic growth rate (BEZBAKH, 2006).

$$GDP\ deflator\ = \frac{Nominal\ GDP}{Real\ GDP} * 100 \quad (1)$$

The second tool for measuring inflation is the Consumer Price Index (CPI), which is used to estimate changes in the average prices of products consumed by households from one period to the next. The calculation formula is as follows:

$$CPI = \frac{Cost\ of\ the\ CPI\ basket\ at\ current\ prices}{Real\ GDP\ Cost\ of\ the\ CPI\ at\ basic\ prices} * 100 \quad (2)$$

The inflation rate can also be used to measure inflation by calculating it using the following formula:

$$Inflation\ rate\ = \frac{CPI\ for\ the\ year - CPI\ for\ the\ previous\ year}{CPI\ for\ the\ preceding\ year} * 100 \quad (3)$$

Types and levels of inflation

After presenting the formulas used to measure inflation, it seems interesting to us to clarify the different types of inflation:

- *Disinflation:* By comparing the differences corresponding to points A and B, we can see that disinflation occurs mechanically since disinflation is most often defined as a reduction in the rate of price increases from one year to the next, rather than a fall in the price level.
- In the model, the maximum difference in the inflation rate occurs in the first and second years. Thereafter, disinflation occurs relative to the inflation rates that prevailed in the first two years.
- Symmetrically, in the opposite case, which corresponds to the oil counter-shock of 1986, the impact of disinflation is lasting. It was not limited to 1986. Inflation in France was lower in 1987 and will be lower in 1 988, even if the price of oil remains the same. It's simply that the disinflationary impact is stronger in the year of the shock and the following year, and then a little weaker thereafter (Pierre, 1988).
- *Deflation:* This is the opposite of inflation. It is characterised by a continuous, self-sustaining fall in the general level of prices. It makes it possible to gain in terms of the purchasing power of money (MEFSIN, 2015).

- *Stagflation:* The occurrence of high inflation in a low-growth environment – may be related to this threshold level, although the threshold level assumes that high inflation triggers low economic growth. This is not necessarily the case in a stagflationary environment in that inflation may accelerate in an already muted economy. This ties in with the fact that similar to inflation, stagflation is driven by either demand or supply factors (Chantal & Jean, 2015).
- *Imported Inflation:* This is inflation linked to foreign trade, which can be due to import surpluses. In other words, if there is an increase in the price of imported products, this can cause inflationary slippage in the importing country. Or, export surpluses can lead to an increase in the inflow of funds from abroad, which may coincide with a fall in the production of goods in the country concerned (Adamou Illou & Oumari, Modeling the impact of inflation on economic growth: Case of Morocco, 2022).
- *Core Inflation:* Core inflation is defined as "the rate that would occur on the economy's long-term growth path if that path were free of shocks. Underlying inflation reflects "price increases made necessary by increases in the trend costs of factors of production, which in turn depend on long-term inflation expectations, embodied in nominal interest rates, equity returns and underlying wage demands.
- The core inflation is based on the distinction between stable inflation or the persistent component of measured inflation and intermittent or transitory inflation. The definition of core inflation as persistence is reflected in a common tendency to describe core inflation and trend inflation as essentially anonymous systems, or to draw a distinction between shocks to the price level (having only a temporary impact on inflation) and more persistent inflationary shocks (Eckstein, 1984).
- *Hyperinflation:* Hyperinflation is linked to an excess of money in the economy in relation to its real needs, leading to a general rise in prices. This increase occurs when the state is no longer able to pay its expenditures because it does not have enough revenue. This is the case in Iraq, where the inflation rate exceeded 400% in 1994 (448.5%) (Macrotrends, 2023).
- *Creeping Inflation:* Slow inflation, with a reduced rate of no more than 5%, is kept under control by anti-inflationary measures, and it does not have harmful consequences for the economy, but it does run the risk of generating weak growth. Sometimes it is the only inflation that is compatible with the level of economic growth (FERROUD, BENJOUID, & DABNICHI, 2021).
- *Open Inflation:* This is when a country's government and monetary authorities take no action to control inflation. People spend their increased income freely. The result is a sharp rise in demand and prices. If people are allowed to spend their higher incomes freely on goods, prices will continue to rise sharply. It is characterised by an inflation rate of between 5 and 10% per year (Nipun, 2023).
- *Runaway Inflation:* It is characterised by an increase in prices reaching annual rates of between 10% and 30% in some industrialised countries and sometimes 100% in some third world countries. This inflation is linked to an excess of money in the economy in relation to its real needs, thus encouraging a general rise in prices. The Malawi inflation rate in 2016 was 20.06% (STAISTA, 2024).

Inflation theories

The first research into the causes of inflation in the 16th century dates back to the work of Malestroit and Jean Bodin.

According to Jean Bodin and in his reply to Malestroit (who, according to him, the rise in prices was fictitious due to the multiplication of means of payment, each representing a reduced weight of gold and silver). The cause of "the dearness of all things" is the abundance of the money supply due to the influx of precious metals (gold and silver) from America then the monopoly, famine and snobbery of the lords at the time are the main causes of inflation.

Other authors have examined the causes of price rises, notably William Petty, John Locke, David Hume and then David Ricardo, who all agreed that variations in nominal price levels are due to a variation in the money supply. Indeed, according to Hume, "if the quantity of money miraculously doubles overnight, all prices will double the next day." So, according to David Ricardo, the overall value of the goods to be exchanged is determined by the stock of metal available: the rise in prices can only come from an increase in this stock, which reduces the purchasing power of overabundant money.

As shown in Figure 5, these analyses give rise to several interpretations of inflation (inflation by money) by presenting one of the pillars of inflation theories, namely the quantitative theory of money, as well as the Keynesian vision of inflation (inflation by demand), followed by inflation by costs and by structures (Adamou Illou & Oumari, Modeling the impact of inflation on economic growth: Case of Morocco, 2022).

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The quantity theory of money

This theory is based on the accumulation of precious metals, and every country must accumulate gold to become rich. For mercantilists, the value of economic goods is measured and has an equivalence with the gold standard, since money is based on a system of parity with gold. During this period, as the quantity of gold continued to increase, hoarding and imports led to a devaluation of the currency, which manifested itself in higher commodity prices. As a result, goods could only be exchanged with two currency units. As a result, the rate of depreciation of the currency could reach 50% or the price could rise by 100%. This was the first discovery of inflation, according to Jean Baptiste SAY: "Money is only a veil." What we have here is a dichotomy between the real sphere (production Y) and the financial sphere (demand for money M). Money is just a veil, so it is always just a means of exchange on the market (Béraud, 2005).

The demand-pull theory of inflation

The link between money and excess demand becomes particularly close among those who accept the old "Say's law", according to which the supply of products creates their own demand: this means that aggregate demand is made up of all the income distributed at the time of production, which amounts to saying that it is rigorously equal to aggregate supply, in the absence of hoarding. Excess demand can therefore only come from an uncontrolled increase in the means of payment available to demanders, so it is the law of the market that determines these mechanisms. When there is an excess of demand over supply (Figure 4), prices will rise (BEZBAKH, 2006).

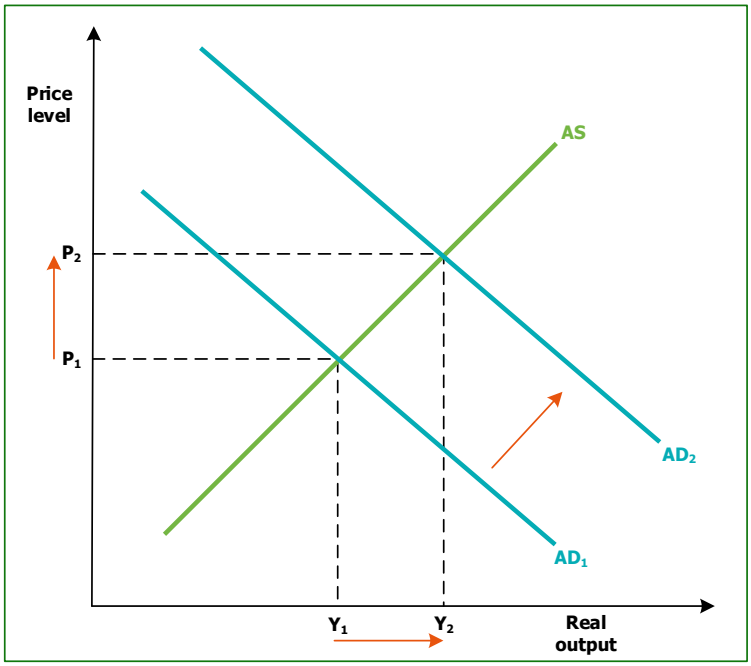

Figure 4. Demand behaviour in the face of rising prices. *(Source: constructed by the author from the article "People's understanding of inflation")*

The cost-push inflation

Caused by the search for profit maximisation on the part of certain companies. If the market is monopolistic or oligopolistic, the company can easily raise its prices. This has been the case with top-of-the-range products such as German luxury cars, which are in demand throughout the world regardless of their selling price. In such cases, the price increase only slightly depresses demand for the product, whereas the increase in the price of the product feeds inflation (BEZBAKH, 2006).

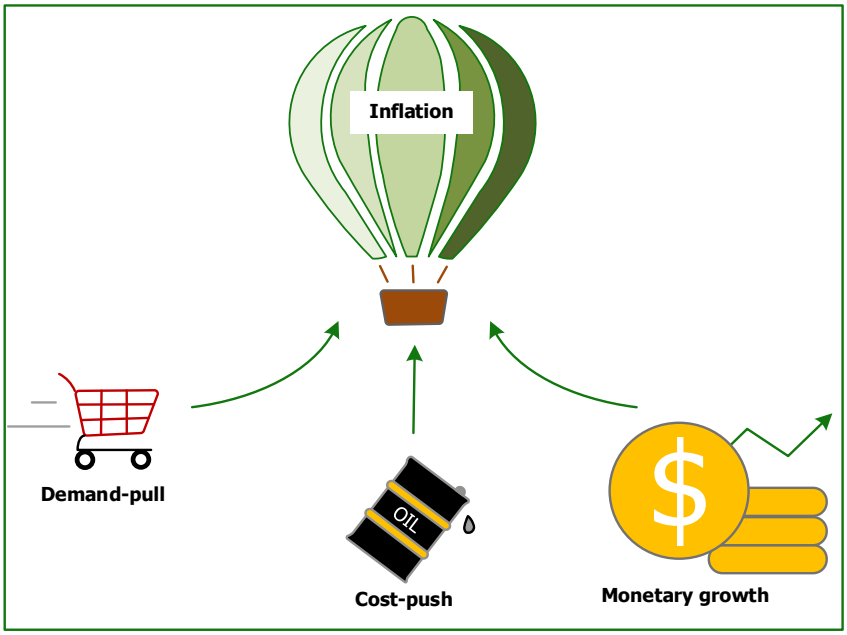

Figure 5. The main causes of inflation. *(Source: constructed by the author from the article "People's understanding of inflation")*

2. Inflation and macroeconomic equilibrium

Adjusting real and monetary flows, balancing global quantities, making behaviour compatible, realising the changing permanence of economic relationships - these are different ways of expressing the same thing: inflation serves a purpose.

At a stage of capitalism which is organised but not concerted, in an international situation of peaceful competition and, internally, of confrontation between groups in part economic, it maintains, thanks to a differential rise in the prices of goods and/or factors, the real growth of the income and consumption of wage-earners, entrepreneurs and the State within the limits required for additional investment to be able to cope with the practicable increase in this income and consumption.

The real feasible increase in these incomes and consumption is therefore the overall limit they come up against. This increase in output can come from three sources: an increase in employment, net investment, and an increase in labour productivity. If, for the sake of simplicity, we assume constant employment and full employment, we are left with net investment and productivity (André, 1962).

If we then assume that the increase in investment in value is greater than the increase in investment in volume (i.e., that the deflating effects of productivity on the value of a new investment and on that of the previous stock of capital are offset), we are confronted with the Marxist hypothesis of an increase in the organic composition of capital. The result is a narrow limitation of what can be achieved (Bettelheim, 1959).

If we give ourselves a maximum rate of growth of the real product by combining net investment and productivity, we widen the limits of what is at stake. Productivity, we widen the limits of what is at stake and we can also determine, by giving ourselves behavioural equations, the particular limits that cannot be crossed by employees, entrepreneurs and the State. If, finally, we make the growth of the real product depend on the state of income and consumption in the previous period, we define a third series of real limits, both global and specific, but moving. It is these three approaches that need to be supported by the beginnings of an argument (Charles, 1960).

Inflation as a regulatory tool

Low inflation, which is not the result of improved productivity, does not guarantee a favourable macroeconomic environment. The risks of the economy falling into a deflationary spiral increase considerably. Fears of rising unemployment are also heightened by the downward rigidity of wages, which are unable to keep pace with falling prices, reducing the profitability of investment (William, 2006).

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However, when inflation is at a high level, its volatility increases significantly, pointing to greater uncertainty surrounding future price trends (Ball, 1992). In such circumstances, savers and lenders demand an additional risk premium to compensate for the expected loss in the value of the money they hold and, ultimately, in their purchasing power, which considerably disrupts real activity through higher nominal interest rates and higher financing costs.

Sustained growth

On the other hand, when inflation is under control (moderate), it is easier to identify the sectors where the economy's resources need to be deployed. By way of illustration, if inflation is rising mainly because of soaring energy prices, the rise in this relative price contains important information for investors, who can focus on developing renewable energies or sectors that consume less energy, thereby increasing their profitability. On the other hand, if all prices were to rise at the same rate, it would be extremely difficult to identify the most important source of this increase, and therefore to identify the most profitable sectors of activity (Gulnihal, Don, Deirdre, & Stilianos, 2017).

Furthermore, when the rise in inflation is correctly anticipated, it provokes phenomena such as "menu costs" or additional charges for companies due to the rise in the price of intermediate products and wages, as well as "shoe-leather costs" which are linked to the increase in the time spent by households making purchases and the extra outlays required to compensate for the fall in the value of money. However, if the rise in inflation is not well anticipated, it creates an environment of uncertainty in which households find it difficult to make long-term commitments and businesses are reluctant to invest, fearing a fall in future returns.

In terms of financial stability, rising inflation is discouraging households from investing in financial instruments with a fixed nominal return, which puts the intermediated savings offered by banks at a disadvantage (Wright, 2011). This may force banks to rely on resources other than deposits, resulting in an increase in the short-term cost of financing their investment portfolios, which are generally medium to long-term. This should lead to an increase in the maturity risks inherent in the balance sheets of financial intermediaries, who hold long-term assets, often at fixed interest rates, against short-term liabilities whose cost is rising.

The above results of the research in the short-term period, the linear function clearly demonstrates statistically significant feedback between inflation and economic growth. Thus, with the acceleration of inflation, we observe a fall in production volumes, and, conversely, economic growth is possible when inflation is dropped. At the same time, the growth of inflation by 1% reduces GDP by 0,86%.

Consequently, the researched connection during 2012 and 2017 is much more closely and statistically significant (the coefficient of determination is 72%) than in previous researches, which confirms J. Keynes's view on the existence of a direct link between inflation and economic growth in the short-term period. This can be explained by the fact that in the current conditions of the domestic economy, there is a dominant inflation of demand (IM & TV, 2018).

AIMS AND OBJECTIVES

The purpose of this work is to investigate the determinants of inflation in Morocco and their impact on price dynamics through an exploratory study using the factor analysis method. The article examines internal and external factors that affect the dynamics of inflation, and establishes the weight and influence of such factors on the course of inflationary processes.

METHODS

According to the economic literature on the phenomenon of inflation, as well as the sources likely to produce this scourge, Morocco is a small globalised economy, which is aware of government reforms to readapt the redistribution system to budgetary constraints. This has been achieved by indexing compensated prices. Therefore, based on the theories developed above, the context of this research is with the aim of answering the following problem:

How can we explain the rapid rise in the general level of prices in Morocco?

With the aim of forecasting the determining factors of inflation in Morocco in the period (2018 to 2023), (30 observations), we will use a multivariate model as shown in Figure 6 in order to get closer to reality:

- COVID-19;

- the Russo-Ukrainian war;
- climate changes;
- the monopoly;
- the decompensation of supported prices (economic policy);
- a variety of intermediaries (distribution B2B);
- the commercial opening.

The main material of the study consists of primary data obtained by a qualitative investigation (22 questions) of a stratified sample composed of Professors of Higher Education, Management Executives and Supreme Audit Institutions (BANK AL MAGHRIB et Higher Planning Commission).

Figure 6. Inflation determinants in Morocco.

Assuming that the data collected is reliable and representative, the field study includes a total of 30 participants, with a Master's degree or higher, and with experience and in-depth knowledge in the field of economics and finance.

3. *Presentation model*

The data collected for this study was analysed using factor analysis. Factor analysis is a frequently used method of multi-variate statistical analysis that transforms a large number of related variables into a smaller number of independent factors.

Factor analysis explains the reason for the mutual dependence between the variables in the data set by reducing them to a smaller number of variables.

Three methods are used to test whether or not the data set to be analysed is suitable for factor analysis. These are the correlation matrix, the Barlett test and the Kaiser-Meyer-Olkin (KMO) test. The first step in checking whether or not the investigation data are suitable for factor analysis is to examine the correlation coefficients between the variables, which means that the higher the correlation values between the variables, the greater the probability that the variables form common factors (Yong, 2013).

$$X^2 = \frac{(N-K)In(S_P^2)-\sum_{i=1}^{k}(n_i-1)In(S_i^2)}{1+\frac{1}{3(k-1)}\left(\sum_{i=1}^{K}(\frac{1}{ni-1})-\frac{1}{N-K}\right)} \quad (4)$$

where: K*: statistical order;* n_i*: corresponding statistical size;* $N = \sum_{i=1}^{K} n_i$ *: total statistical size;* S_i^2*: empirique variance.*

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$$S_P^2 = \frac{1}{N-K}\sum_i (n_i - 1)S_i^2 (\mathbf{5})$$

The Kaiser-Meyer-Olkin (KMO) test is an index comparing the magnitude of the correlation coefficients observed. The Kaiser-Meyer-Olkin (KMO) ratio test must be greater than 0.5. Higher Kaiser-Meyer-Olkin (KMO) ratios indicate that the entire data set is suitable for factor analysis. Thus, a ratio of Kaiser-Meyer-Olkin (KMO).

$$KMO = \frac{\sum_{j\neq k}\sum r_{jk}^2}{\sum_{j\neq k}\sum r_{jk}^2 + \sum_{j\neq k}\sum P_{jk}^2} \quad (6)$$

where: r^2_{JK}: the correlation between the variable in question and another; P^2_{JK}: the partial correlation.

The eigenvalue test and the variance criterion are important criteria to consider when deciding how many factors to take into account. The eigenvalue indicates the total variance explained by each factor. Only factors with an eigenvalue greater than 1 were selected for implementation.

Method used

To optimize the factorial solution, EFA was performed using PAF and Direct Oblimin rotation (with δ = 0). This decision was based on the theoretical background that shows intercorrelations between the different factors that were extracted (Escola-Gascon, 2020). According to (Elazar & Liora Pedhazur, 1991), in the social sciences, and especially psychometrics, oblique rotations are recommended because they assume interdependence among latent factors. Moreover, absolute independence among the extracted factors themselves is not an insurable assumption.

Direct Oblimin rotation allowed for correlation between factors, if necessary (Costello & Osborne, 2005).

RESULTS

In this section, we present the results of the investigation carried out, followed by a numerical analysis of the various data collected.

Table 1 presents the results of the descriptive statistics.

Table 1. The Results of the Descriptive Statistics.

	Average	Standard deviation	Analyse N
COVID-19	1.23	.430	30
Russo-Ukrainian war	1.83	.379	30
Climate changes	1.40	.498	30
Monopoly	1.47	.507	30
Decompensation	1.83	.379	30
Distribution B2B	1.67	.479	30
Exporting impact (Developing export-oriented production)	1.53	.507	30

Table 2 shows the correlation between the different variables studied.

Table 2. The Value of the Correlation Between the Variables Studied.

		COVID-19	Russo-Ukrainian war	Climate changes	Monopoly	Decompen-sation	Distribu-tion B2B	Exporting impact (Develop-ing export-oriented production)
Correlation	COVID-19	1.000	.247	-.129	-.358	.247	.223	.042
	Russo-Ukrainian war	.247	1.000	.183	-.299	.040	-.126	.120
	Climate changes	-.129	.183	1.000	.191	.000	-.866	.082
	Monopoly	-.358	-.299	.191	1.000	-.120	-.189	-.196
	Decompensation	.247	.040	.000	-.120	1.000	.063	-.060
	Distribution B2B	.223	-.126	-.866	-.189	.063	1.000	-.094
	Exporting impact (De-veloping export-oriented production)	.042	.120	.082	-.196	-.060	-.094	1.000

According to Table 3, the KMO value is average because it is equal to 0.654 and greater than 0.6. The Chi-square value is high and Bartlett's test is significant at P = 0.000, which is well below 0.005. We can therefore reject the null hypothesis of the correlation coefficients, and confirm the possibility of factoring the data, which means that the application of the PCA is justified.

Table 3. The Kaiser-Meyer-Olkin Measure of Sampling Adequacy.

Kaiser-Meyer-Olkin Measure of Sampling Adequacy		.654
Bartlett's test of sphericity	Approx. Chi-Square	50.427
	df	21
	Signification	.000

Table 4 shows the variable extraction values. In our case, all the variables indicate extraction values greater than 0.5, so the external model is validated.

Table 4. Common representation qualities. Note: a - Extraction Method: Principal Component Analysis.

	Initial	Extraction(a)
COVID-19	1,000	.606
Russo-Ukrainian war	1,000	.530
Climate changes	1,000	.916
Monopoly	1,000	.633
Decompensation	1,000	.665
Distribution B2B	1,000	.905
Exporting impact (Developing export-oriented production)	1,000	.585

Table 5 indicates the number of factors to be extracted. In our case, we keep only the first 3 components because their eigenvalues are greater than 1. We can therefore deduce that these 3 variables explain 69.14% of the variance, as shown in Figure 7.

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Table 5. The Total Variance Calculation. Note: a. When the components are correlated, it is impossible to add the sum of the loading squares to obtain a total variance.

Components	Initial Eigenvalues			Extraction Sums of Squared Loading			Rotation Sums of Squared Loadingsa
	Total	% of variance	% of cumula-tive	Total	% of variance	% of cumula-tive	Total
1	2.084	29.765	29.765	2.084	29.765	29.765	2.010
2	1.663	23.763	53.529	1.663	23.763	53.529	1.716
3	1.093	15.609	69.137	1.093	15.609	69.137	1.165
4	.847	12.103	81.240				
5	.613	8.760	90.001				
6	.574	8.204	98.205				
7	.126	1.795	100.000				

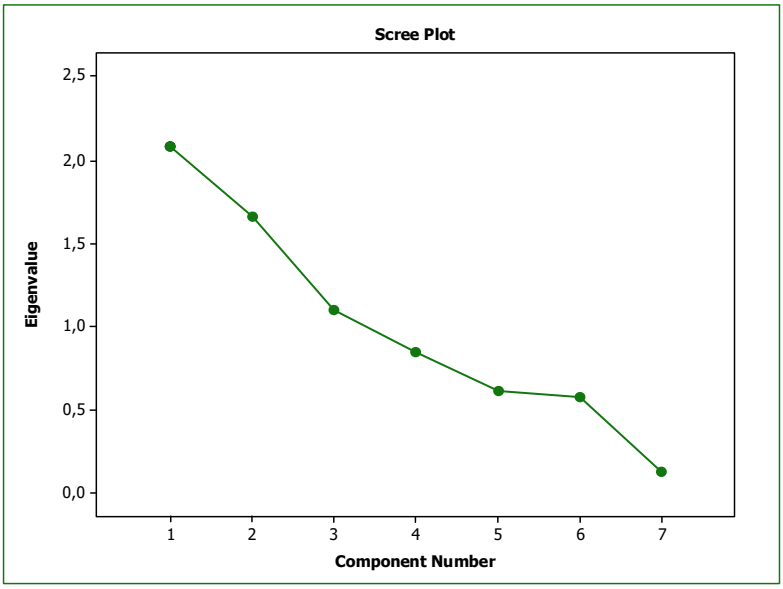

Figure 7. Plot showing the variance explained by each factor.

Table 6 shows the component matrix, we see that 2 variables load on the first component, 3 on the second component and 2 variables load on the other components.

Table 6. The Component Matrix. Note: a. 3 extracted components.

	Component(a)		
	1	2	3
Distribution B2B	.895		
Climate changes	-.864		
Russo-Ukrainian war		.725	
Monopoly		-.594	
COVID-19		.545	
Decompensation			.730
Exporting impact			-.646

Extraction method: Principal component analysis.

Table 7 corresponds to the shape matrix. It shows the classification of variables according to the components taken into consideration. Starting with the variables climate change and distribution channel (B2B), which saturate the first component. Subsequently, the variables: Monopoly, Russian-Ukrainian War, COVID-19 and Exports saturate on the same component. However, we have to eliminate the last variable because its correlation is shared with several components, and its correlation with the second component is the weakest. Then we have nothing to report for the two variables (Decompensation and Exports) linked to the third component while taking into account the shared correlation.

Table 7. The Rotation method: Oblimin with Kaiser Standardisation. Note: a. Rotation converges in 6 iterations.

	Component(a)		
	1	**2**	**3**
Climate changes	-.962		
Canal de Distribution	.945		
Monopoly		-.757	
Russo-Ukrainian war		.677	
COVID-19		.638	
Decompensation			.782
Exporting impact		.465	-.614

To check the internal consistency of the answers given in the investigation, we turn to the reliability of the measurement scale, through Cronbach's alpha coefficient which is defined as follows:

$$\alpha = \frac{k}{k-1}\left(1 - \frac{\sum_{i=1}^{k}\sigma_{Yi}^2}{\sigma_X^2}\right) \quad (7)$$

Where: k: The number of items; σ²x: The variance of the total score; σ²Yi: The variance of the item.

In Table 8 we measure reliability using Cronbach's Alpha tool, which is a reliability indicator that indicates the degree of homogeneity of the variables that make up the measurement scale. In our case, we are analysing the reliability of the scale of the second construct that forms the variables (Russian-Ukrainian War, COVID-19 and Monopoly).

Table 8. Data processing in observation. Note: a. Listwise deletion based on all variables in the procedure.

		N	**%**
Observations	Valid	30	100.0
	Excludeda	0	0.0
	Total	30	100.0

According to Table 9, Cronbach's Alpha is equal to - 0.724 which is greater than 0.7 which means that the scale is reliable, i.e., this scale has good internal consistency, so the variables are supposed to measure what this phenomenon actually does, and the second column shows the number of variables. If alpha is less than 0.7 the scale will be unreliable and will have poor internal consistency, because the variables measure different phenomena.

Table 9. The Calculation of Cronbach's Alpha. Note: a. The value is negative due to a negative average covariance among items. This violates reliability model assumptions. You may want to check item codings.

Cronbach Alphaa	**Number of items**	
-.724	3	

Table 10 indicates that if we eliminate the first variable, Cronbach's Alpha will be equal to -0.803, if we eliminate the third variable, Cronbach's Alpha will be equal to 0.393 and so on, but in our case, we are not deleting any variables.

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Table 10. Item total statistics. Note: a. The value is negative due to a negative average covariance among the elements. As a result, the assumptions of the reliability model are not respected. You can check the coding of the elements.

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Cronbach's Alpha if Item Deleted
COVID-19	3.30	.286	-.165	-.803a
Russo-Ukrainian war	2.70	.286	-.085	-1.092a
Monopoly	3.07	.409	-.418	.393

The analysis identified 3 significant factors that appear to correspond to distinct sets of variables. The results of the component and structure matrices suggest that these factors capture important dimensions of the data.

In conclusion, the variables designating climate change and the B2B distribution channel are correlated with the first component. The next 3 variables, which measure negative externalities (Russian-Ukrainian War, COVID-19 and Monopoly), are uncorrelated with the second component. The variables linked to Decompensation and Exports are correlated with the third component.

In our case, we have obtained only two variables for the first and third components, but it is better to have at least three variables for each construct so that the latter can be specified and so that we can calculate Cronbach's alpha reliability index.

DISCUSSION

In this work, we study the determinants of inflation in Morocco and their impact on price dynamics, through an exploratory investigation using the Factor Analysis method. This statistical method is the most widely used for identifying and assessing the underlying factors of inflation. The results concern the 2018-2023 period, which is marked by global upheavals. Thus, these results showed that the closure of factories during the pandemic and the recovery of demand postponed to the reopening after COVID-19 had effects on supply, the political conflict between Russia and Ukraine further aggravates the problem by increasing the costs of supplying imports, consequently, the domination of a monopolistic regime on the domestic markets of the Moroccan economy develops a penurious supply policy, and favoured the maximization of gains, leading to price increases.

(Mai Chi, Pierre-Olivier, & Daniel, 2024) find that the rises and falls in international inflation since 2020 largely reflect the direct and indirect effects of the main shocks. Macroeconomic conditions have generally played a secondary role. In the US, the estimated price pressures from strong macroeconomic conditions have been stronger than in other economies, but they have eased.

(Bonam & Samadu, 2021) conclude that the major negative externalities of the past have led to a significant fall in core inflation in Europe for more than a decade. However, the effects of the COVID-19 pandemic on core inflation could be different this time.

Although their analysis helps to support our own conclusions, some of their results differ from ours, which is probably due to the fact that (i) we use a different sample of countries and time series, (ii) we use a different definition of global shocks, (iii) we focus on headline inflation rather than core inflation, and (iv) we use a model-based approach rather than focusing on stylised facts.

CONCLUSIONS

Inflation is always a subject of debate within societies, as it directly affects company profits and profits, household wages and purchasing power, as well as the viability and balance of state budgets in countries that support the prices of certain consumer goods.

These debates are contributing to the emergence of a body of literature that focuses on the various determinants of inflation, in order to gain a deeper understanding of the factors involved and their sources.

Overall, the results obtained are consistent with economic theory. The inflation rate increase in Morocco is mainly due to the predominance of imported inflation in price formation, linked to the COVID-19 health crisis and the Russian-Ukrainian war. Internal factors also have an impact on economic freedom and the reform of the compensation fund.

However, after an in-depth analysis of the results obtained, it is clear that the rapid fluctuation in prices in Morocco is attributable not to cyclical inflation, but to structural inflation due to the inefficiency of certain mechanisms. It is a type of inflation which comes from the very foundations of the capitalist economy, resulting from the economic structure. This is the case of an oligopolistic market characterised by an absence of competition, in which only a few companies impose their prices.

Finally, this work has been limited to the analysis of internal and external cyclical factors, without taking into account all the structural determinants such as technology, globalisation, demographic changes and other institutional reforms which have certainly contributed to the dynamics of inflation observed in Morocco.

Limitations of Study

The article "Contemporary Inflation Dynamics: Diagnosis and Factor Analysis in Developing Countries" presents a promising approach to examining inflation-related variables in a macroeconomic context. However, it is important to highlight some specific limitations, particularly with regard to the unavailability of information and the difficulty of accessing data. The article relies on data collection and analysis to identify the various factors determining general price increases. However, in certain situations, the data required for an in-depth analysis may not be available or accessible, which could limit the scope and accuracy of the conclusions. Limited access to reliable and relevant data sources may hamper price factor analysis.

The ability to carry out complete analyses. The article may have to use a smaller sample of data, which could affect the representativeness of the results. When data is difficult to obtain, the reliability and quality of the information collected may pose problems. Errors or gaps in the data can lead to biased or incorrect analyses. If the article only has access to certain data sources or sample strata, there may be a selection bias that limits the generalisation of results to other contexts. Some participants may encounter technical obstacles in collecting and processing the massive data required. This may be due to overload or insufficient technical skills. Some respondents may be reluctant to share their data for reasons of confidentiality and security. This could make it difficult to obtain essential information for analysis. Unavailability or difficulty in accessing data may limit the generalisability of the results obtained in the article. The findings may not be applicable to all regions or sectors of the country. To overcome these limitations, it is essential that researchers recognise the potential constraints and take steps to mitigate their impact. This may involve efforts to obtain reliable data, diversify sources of information and carefully assess possible biases.

There are many opportunities for further study, practical experimentation and innovative applications, which could make a significant contribution to controlling inflationary trends in a constantly changing macroeconomic environment.

ADDITIONAL INFORMATION

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Formal Analysis: *Mohamed Aarab*
Methodology: *Mariam Lazrak*
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Validation: *Hamid El Amrani*
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CONFLICT OF INTEREST

The Authors declare that there is no conflict of interest.

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СУЧАСНА ДИНАМІКА ІНФЛЯЦІЇ: ДІАГНОСТИКА ТА ФАКТОРНИЙ АНАЛІЗ У КРАЇНАХ, ЩО РОЗВИВАЮТЬСЯ

У міжнародному контексті, повному неоднозначностей, країни, що розвиваються, все більше й більше страждають від невпинного зростання загального рівня цін, що є руйнівним фактором їхньої макроекономічної рівноваги. Лунають тривожні дзвіночки, оскільки циклічні заходи вже не потрібні для перегляду й зміни регулювання параметрів. Починають з'являтись ознаки кризи, і циклічні заходи для коригування параметрів вже не потрібні. Зіткнувшись із цією триваючою тенденцією цін у всьому світі протягом 2018-2023 років, автори вважають, що важливо детально розглянути основні пояснення цього явища.

У цій статті на прикладі Марокко можна визначити детермінанти інфляції за останнє десятиліття за допомогою якісного дослідження 30 спостережень. Ми використовуємо факторний аналіз (PCA) з прямою ротацією Обліміна з метою зменшення розміру зібраних даних та виведення реальних факторів, що стоять за новою інфляційною динамікою. Отримані результати свідчать, що зростання інфляції в Марокко насамперед зумовлене імпортованою інфляцією, на яку вплинули пандемія COVID-19 та російсько-українська війна. Крім того, внутрішні чинники, такі як економічна свобода та реформа компенсаційного фонду, мають другорядний вплив на динаміку проаналізованого явища.

Ключові слова: інфляція, негативні зовнішні ефекти, макроекономіка, факторний аналіз

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