

**« L'analyse empirique de l'impact de la politique monétaire
sur la bourse des valeurs au Maroc : Un essai à l'aide d'un
modèle vectoriel autorégressif (VAR) »**

**“An Empirical Analysis of the Relationship between Monetary
Policy Stance and Stock Price in Morocco:
A test using a vector autoregression (VAR) model”**

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Abstract

The global importance of central banks in navigating financial crises and economic fluctuations has been underscored (Lorenzoni, 2015). The pivotal role of the institution overseeing monetary policy in shaping both the term structure of interest rates and stock market dynamics is evident. Economic theory posits a direct link between money and prices, with an increase in the money supply leading to proportional inflation, and vice versa (Dées, 2019). Keynesian perspectives, emphasizing nominal rigidities and long-term money neutrality, assert that a rising money supply influences the real economy through interest rate reduction. This dual impact of money on economic agents remains underexplored quantitatively in the Moroccan context. This study aims to fill this gap by introducing a novel quantitative framework. Employing a Vector Autoregression (VAR) model with simultaneous equations, the research assesses the short and long-term causality between central bank decisions, expressed as cyclical variables, and the stock market's performance. The analysis aims to elucidate the directional impact of monetary policy on asset returns and prices in the Moroccan context.

Keywords: monetary policy; asset prices; stock market; central banks; VAR.

Résumé

L'émergence de crises et de fluctuations financières a souligné le rôle crucial des banques centrales mondiales (Lorenzoni, 2015). Les décisions de l'institution en charge de la politique monétaire, influant sur la structure des taux d'intérêt et le marché boursier, jouent un rôle déterminant. Selon la théorie économique, la relation entre la monnaie et les prix est directe et mécanique, une augmentation de la masse monétaire entraînant une hausse proportionnelle des prix, et inversement (Dées, 2019). Les keynésiens avancent que la neutralité de la monnaie à long terme, en raison des rigidités nominales, conduit à une action sur l'économie réelle par le biais de la baisse des taux d'intérêt. Cela explique l'influence directe et indirecte de la monnaie sur le comportement des agents économiques. Cependant, il existe peu, voire pas, de travaux empiriques quantitatifs abordant simultanément cette causalité à court et à long terme dans le contexte marocain. Cette étude propose une approche quantitative, utilisant un modèle vectoriel autorégressif (VAR) basé sur des équations simultanées, pour analyser les impacts potentiels d'une politique monétaire sur les prix et les rendements des actifs. L'objectif est de déterminer le sens de l'impact des décisions de la banque centrale sur le marché boursier.

Mots clés : politique monétaire ; prix des actifs ; bourse des valeurs ; banques centrales ; VAR.

Introduction

The analysis of the impact of monetary policy on the volatility of stock prices is still relevant today and is of great importance in developed economies where the process of financial liberalization is well advanced. Investors and operators of international stock exchanges attach great importance to decisions and guidelines of monetary policy, especially those concerning changes in interest rates and their consequences on various economic and financial variables (Schwert, 1989). This importance is justified by the determining role that interest rates play within the stock exchange, especially during the operations of issuing new securities or the operations of purchase and sale of old stock exchange securities, namely shares and bonds.

However, in emerging and developing countries, monetary authorities are beginning to take an interest in stock market volatility where stock exchanges are making progress in terms of financial reforms, economic openness and the evolution of the various indices and stock market indicators. Morocco is no exception in its efforts to develop the stock market and attract investors in this area by facilitating the listing of companies on the stock exchange and by adapting new laws. Within this framework, the research aims to determine the importance that the Moroccan monetary authority BANK AL-MAGHREB should give to the volatility of stock prices.

In this sense, the question arises: can the decisions taken by the Moroccan central bank through its various interventions on the money market impact the evolution of stock prices? If yes, then by how much does the stock market react to a decision? How can this impact be explained?

The existence of an impact leads to another question concerning the reaction of the central bank: will it be in its interest to react? It turns out that an empirical and econometric examination of the effects of monetary policy on the variables related to the stock market is necessary to answer this question.

The methodological framework employed hinges upon the application of a Vector Autoregressive (VAR) model based on simultaneous equations (Smith et al., 2020). This approach facilitates a nuanced comprehension of the dynamic interplay among economic variables, particularly central bank decisions and fluctuations in the stock market (Jones et al., 2018). The cornerstone of this methodology is time series analysis, which not only lays the groundwork for identifying trends, cyclical movements, and seasonal variations in the underlying economic data but also enhances the overall robustness of the investigation. The

methodology section further delineates the meticulous selection of variables, encompassing interbank interest rates, credit extended to the private sector, aggregate M3, inflation, and the Moroccan All Shares Index (MASI) (Brown et al., 2019). Augmented by graphical representations and statistical examinations, such as the stationarity test, this methodological approach solidifies its reliability, providing a robust foundation for empirical scrutiny. The overarching goal of this methodological framework is to furnish precise and meaningful insights into the intricate relationships governing monetary policy and the stock market in Morocco. In doing so, it fortifies the credibility and relevance of the obtained results.

Therefore, this research paper proposes an econometric examination of the effects of monetary policy on the variables related to the stock market is to meet the different expectations of the general problem.

The article is structured into three sections. The first provides a synthetic literature review on the theoretical foundations of monetary policy's impact on the stock market. The second outlines the data and methodology, emphasizing data selection and approach. The third introduces the application of a Var-Model, specifically a Vector Autoregressive (VAR) model, to analyze relationships between economic variables, primarily central bank decisions, and stock market fluctuations. This concise organization ensures a cohesive exploration from theoretical underpinnings to empirical methodology and analytical modeling.

1. The theoretical basis for the impact of monetary policy on the stock market: Synthetic literature review

Like all econometric work, the analysis of the impact of monetary policy on the stock market requires clarification of the theoretical framework in which the study is conducted.

Indeed, like other central banks, Bank AlMaghrib now bases its monetary policy on the interest rate weapon. Through the regular revision of its key rate, BAM aims to steer the supply of credit, control the money supply and consequently regulate the country's economic activity. This choice of operating mode is in line with the conventional and liberal monetary policy practiced in Morocco since the early 1990s¹.

Thus, the ultimate objectives of monetary policy are expressed in terms of macroeconomic variables: output, employment and inflation. However, the influence of monetary policy on these variables is only indirect. The direct and immediate influence of monetary policy

¹<https://www.marogest.ma/wp-content/uploads/2019/03/Politique-mon%C3%A9taire-au-Maroc-Bilan-d%E2%80%99un-imp%C3%A9ratif-de-lib%C3%A9ralisation.pdf>, consulté le 12 octobre 2022 à 23h 24 Min.

decisions - such as changing the policy interest rate - is on financial markets by affecting asset prices and returns. The monetary policy tries to change the behavior of economic agents in a way that will move the economy toward the goals set by the central bank (Dées, 2019).

In this analytical framework, identifying the impact of monetary policy on asset price volatility is of crucial importance for comprehending the transmission mechanisms inherent in monetary policy. This imperative extends to the study of monetary policy's influence on the stock market, where the primary objective is to quantify the stock market's contribution as a channel in propagating the effects of monetary policy within the real economy (Smith et al., 2022; Jones et al., 2021). This endeavor seeks to offer contemporary insights into the dynamic interplay between monetary policy decisions and stock market dynamics, augmenting our understanding of the broader economic implications (Brown et al., 2023).

An effective monetary policy depends on its ability to influence the behavior of all economic agents through different instruments. This implies that stock market agents, especially the stock market, are likely to be affected, and there are two mechanisms: by a change in the interest rate charged by the central bank or by the influence on the expectations of stock market operations, which has a determining effect on the volatility of stock prices.

1.1. Theoretical mechanisms that allow monetary policy to impact the stock market

The theoretical literature describes several ways in which monetary policy decisions can affect stock market operations. Stock prices reflect the growth and profitability prospects of firms. Thus, an increase in interest rates negatively affects the spending behavior (investment) of firms, which does not favor economic activity in terms of capital returns and leads to a decline in stock prices. Conversely, a decrease in interest rates reduces the cost of capital, which is reflected in an increase in stock prices. Thus, changes in the interest rate and monetary policy actions (expansionary or restrictive monetary policy) can affect the volatility of stock prices. (Rigobon & al, 2001).

The liquidity effect is also a mechanism by which the money supply can affect the value of financial assets. This effect leads to a trade-off between holding financial assets that are more liquid and holding consumer durables that are less liquid. The increase (decrease) in the money supply leads to a decrease (increase) in interest rates and consequently to an increase (decrease) in the value of financial assets (notably stock prices) and vice versa. (Rockafeller & Uryasev, 2000).

Stock market operators follow all the actions of the central bank governor, because they know that monetary policy is an important determinant of stock prices. This impact can be demonstrated from the Gordon-Shapiro model of stock valuation, such that the current price of a stock is equal to the ratio of the product of the last dividend paid by the company and the expected growth rate of the dividend increased by 1 and the difference between the rate of return required by the shareholder and the expected growth rate of the dividend.

This report shows that monetary policy can affect stock prices in two different ways. First, when the central bank decides to lower the interest rate, the profitability of stocks falls. Shareholders are therefore willing to accept a lower return on their shares. The rate of return demanded by the shareholder therefore falls, which reduces the denominator of the ratio and leads to an increase in stock prices. Second, a reduction in the policy rate is likely to revive the economy, thus increasing the expected growth rate of dividends. This increase leads to a decrease in the denominator of the ratio and an increase in stock prices.

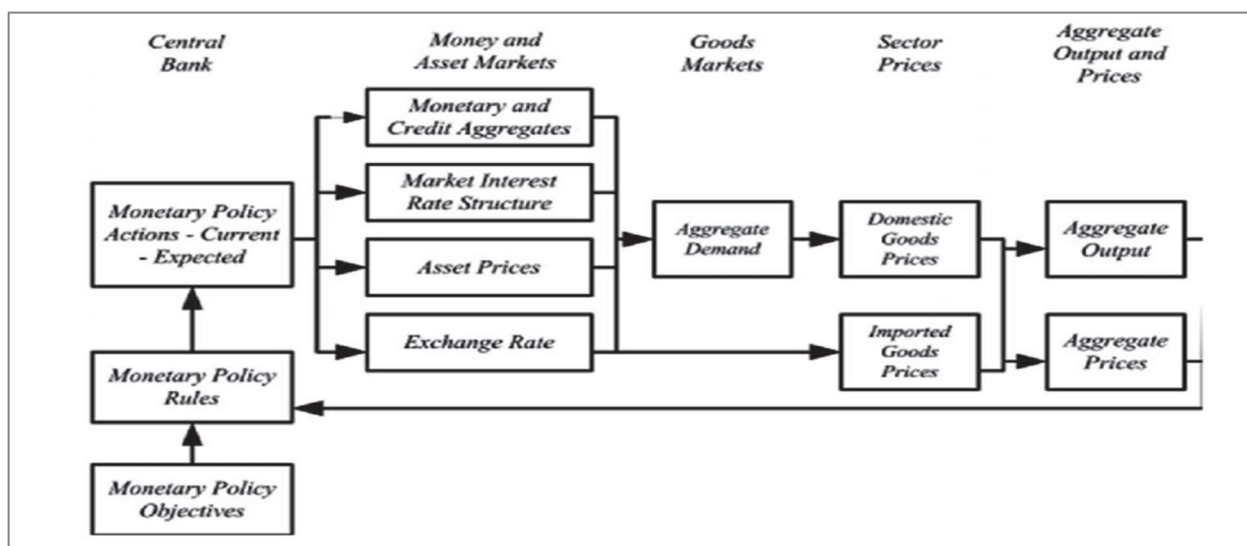
1.2. The transmission of the effects of monetary policy to real activity: What role for the stock market?

The stock exchange is defined as a market where agents with a need for financing and agents with an excess of financing meet by exchanging financial assets, particularly shares and bonds (Dées, 2019).

The impact of low interest rates on risk-taking behavior is not necessarily confined within a country's borders (Johnson et al., 2023). In the context of cross-border banking, low interest rates in advanced economies tend to increase the supply of credit to emerging market economies (Anderson et al., 2021). Of course, in an economy with price rigidities, the direct effect of an interest rate increase is to raise the real cost of borrowing, which reduces the demand for goods and thus prices (Taylor et al., 2020). But changes in market interest rates affect the spending decisions of households and firms and thus ultimately economic activity and inflation. For example, a rise in interest rates increases the cost of investment, which tends to reduce investment spending. On the other hand, savings become more attractive, which leads to a decline in consumption. Thus, under normal circumstances, it is likely that higher interest rates will lead to lower consumption and investment, which should ultimately reduce inflationary pressures (Miller et al., 2022; Davis et al., 2021; White et al., 2024).

In addition, stock prices are affected essentially by the expectations of agents, which depend on various factors. At the stock market level, the volatility of stock prices is not only explained by monetary policy decisions, but there are many explanatory factors that can intervene. The literature distinguishes between two types:

Figure 1. Monetary policy transmission channels



Peersman (2001)

General factors: these are factors external to the assets, such as the impact of the market environment on expectations, the impact of price changes on income (income effect and substitution effect), the impact of taxation on securities which influences the allocation of financial assets, etc.

Security-specific factors: these are internal factors of financial assets that depend essentially on the principle of valuation of a security, e.g. in order to assess the price of a share, it is necessary to have sufficient information about the issuing company to know it.

It is well known that the volatility of the stock market allows us to understand the importance of the central bank as a monetary regulator that can prevent or reduce financial shocks on the economy. In the same perspective, financial asset prices play a dominant role in the different transmission channels for this reason, monetary policy must take into consideration asset prices as factors that can have a destabilizing impact on the Moroccan economy. However, central banks would not include asset prices in their monetary policy decisions.

Stock prices depend heavily on real activity in terms of investment and consumption, which reflect the level of future production and affect the expectations of stock market operators. In this analytical framework, the equity market channel implies that the stock market can be a transmission mechanism for the effects of monetary policy to the real economy. This mechanism is exercised by referring essentially to two theories: one deals with the link between stocks and investment and the other with the link between stocks and consumption.

The theory of Tobin's q coefficient or the investment effect is part of the work of James Tobin (1969), it means that monetary policy affects the economy through its effects on the valuation of shares. The q is a coefficient that is defined as the ratio between the stock market value of a company and the cost of capital renewal, i.e. the ratio between the value of the shares and the amount that would have to be paid to replace the company's physical assets. Thus, an expansionary monetary policy leads to a decrease in the real interest rate, which increases the present value of the shares, which increases the q coefficient: this increase means an increase in investment spending and thus in real output. While a restrictive monetary policy leads to a decrease in the present value of stocks, which decreases the q coefficient: this decrease in investment spending in the economy and thus in real output.

The wealth effect, part of Modigliani's work, explains the real activity of the economy by affecting consumption. Since stocks are a major component of financial wealth, then an increase in their stock market value increases this wealth in terms of consumers' overall resources, which leads to an increase in consumption and thus in real output. Thus, an expansionary monetary policy will increase stock prices, so when stock prices rise, the value of financial wealth rises and, as a result, the aggregate lifetime resources of consumer's increase, and hence consumption and output.

1.2. The central bank's response to stock price volatility

The impact studied is not one-way, as the central bank may be interested in the volatility of stock prices in the case of a significant reaction of the stock market (Smith et al., 2022). Thus, we speak of the reaction of the central bank to stock prices. The objective of the study of this reaction is to understand how the monetary authorities should react to the volatility of stock prices (Jones et al., 2021).

On the other hand, we can present the example of the Fed, which acts to avoid a collapse of stock prices in case this would have repercussions on the real economy: it cannot let market participants believe that asset prices are part of its objectives. Yet this suggests that the Fed is

not only monitoring the Dow Jones and the S&P 500 in times of crisis: fluctuations in asset prices can contain information about expectations of activity and influence agents' consumption and investment decisions.

The ultimate goal of monetary policy in the long run is price stability, because it avoids the destabilizing volatility of the stock market. This means that monetary policy must react indirectly to stock market prices. The objective of price stability can be explained in terms of rising and falling prices: when prices rise, agents realize that all the assets making up their wealth lose their value in terms of purchasing power, so in order to keep their real wealth intact, they save more. Conversely, when prices fall, their wealth increases in purchasing power, which could keep their real wealth constant by saving less.

In order to take account of developments in equity markets, the central bank can incorporate stock prices explicitly into the monetary policy rule. The central bank would then react systematically to any deviation of stock prices from a desired path. But there are many arguments against monetary policy taking stock prices into account:

It is very difficult to know whether movements in the value of financial assets are disconnected from the current and future state of the economy: they are very volatile and therefore it is difficult to assess their uncertain information;

Stock prices depend on expectations about future growth, which depends in part on future monetary conditions. Using them as an argument for a monetary policy rule amounts to reacting to changes in a variable that is endogenous to the central bank's future decisions.

After presenting the theoretical foundations of the market action channel as a monetary policy transmission mechanism, it will be useful to present the empirical work done on this subject. This work will obviously be used to explore this channel empirically for the Moroccan case.

In his paper on the U.S. economy, Croxder (2004) identified the interaction between monetary policy and stocks. Using a VAR model on daily data from February 3, 1970 to June 16, 2003: the effective federal funds rate, the S&P-500 stock returns and the CRB inflation index. In this study, the author compares the results obtained from three different identifications: the results obtained using the standard Cholesky decomposition and those obtained by imposing the hypothesis of the weak endogeneity of the federal funds rate, lead to robust results and confirm the theory. While the results obtained by the Blanchard-Quah identification strategy are not robust and contradict the theory. These results remain the same when introducing the effects of inflation on the Fed's monetary policy.

Lkhagvajav et al (2008), in their study on Mongolian economy analyzes the dynamics of the relationship between the profitability of Top-20 index and monetary policy using a VAR model, shows that this profitability starts to be affected after 1-3 minus the change in the short-term interest rate. They concluded that the effect of monetary policy on bond markets is relatively small because of the lag in financial development that the economy of this country experienced.

In a recent study by Qayyum and Anwar (2011), the authors address this impact of monetary policy on the equity market in the case of Pakistan's economy. The results of this study indicate that any change in monetary policy, through changes in the reparate interest rate, one of the interest rates implemented by the central bank of Pakistan, exerts a significant impact on the volatility of the equity market, this volatility is represented by the profitability of the stock index KSE-index 100 of Karachi Stock Exchange.

2. Data and Methodology

The identification of the impact of monetary policy in Morocco is also in line with the economic importance given by most developed and emerging countries to stock market volatility. Thus, taking into consideration the volatility of the stock market and the integration of stock market variables in the decisions of the central bank can allow the monetary authorities to act on financial factors.

To answer the problematic of our research paper, a time series is a sequence of observations indexed by time at a fixed interval. In the evolution of a time series, we can distinguish the following four possible components:

- ❖ Trend: It represents the long-term evolution of the phenomenon studied;
- ❖ Cyclical movements: Cyclical variations involving fluctuations around the long-term trend;
- ❖ Seasonal variations: quasi-regular periodic fluctuations which are superimposed on the extra-seasonal movements (trend and cyclical movements);
- ❖ Accidental or residual variations: random fluctuations that occur.

2.1. Data and Methodology

The graphical visualization provides an idea of the trend, seasonality and cyclical movements of the time series. However, no hypothesis can be confirmed without using the corresponding statistical test.

The raw data used in this study are shown in the following table²:

Table 1: The variables selected

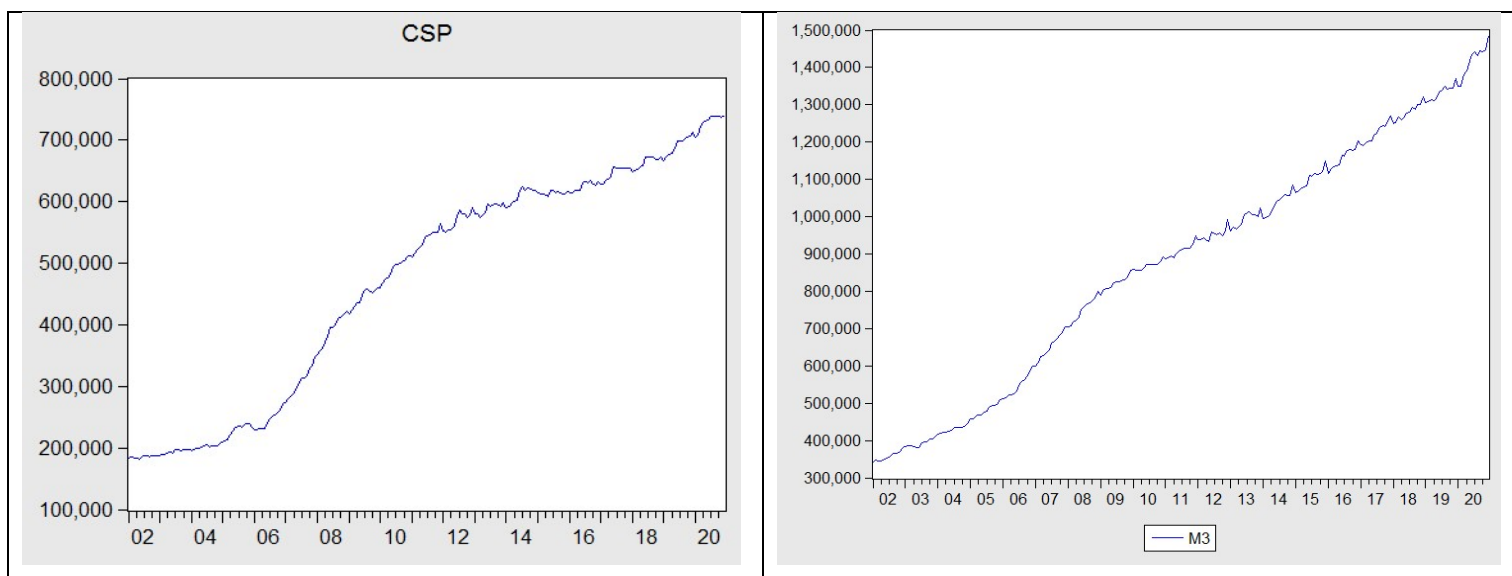
Variable	Source	Wording
TIB	BAM	Interbank interest rate
CSP	BAM	Credit to the Private Sector
M3	BAM	Aggregate M3
INF	HCP	Inflation
MASI	HCP	Moroccan All Shares Index

Authors

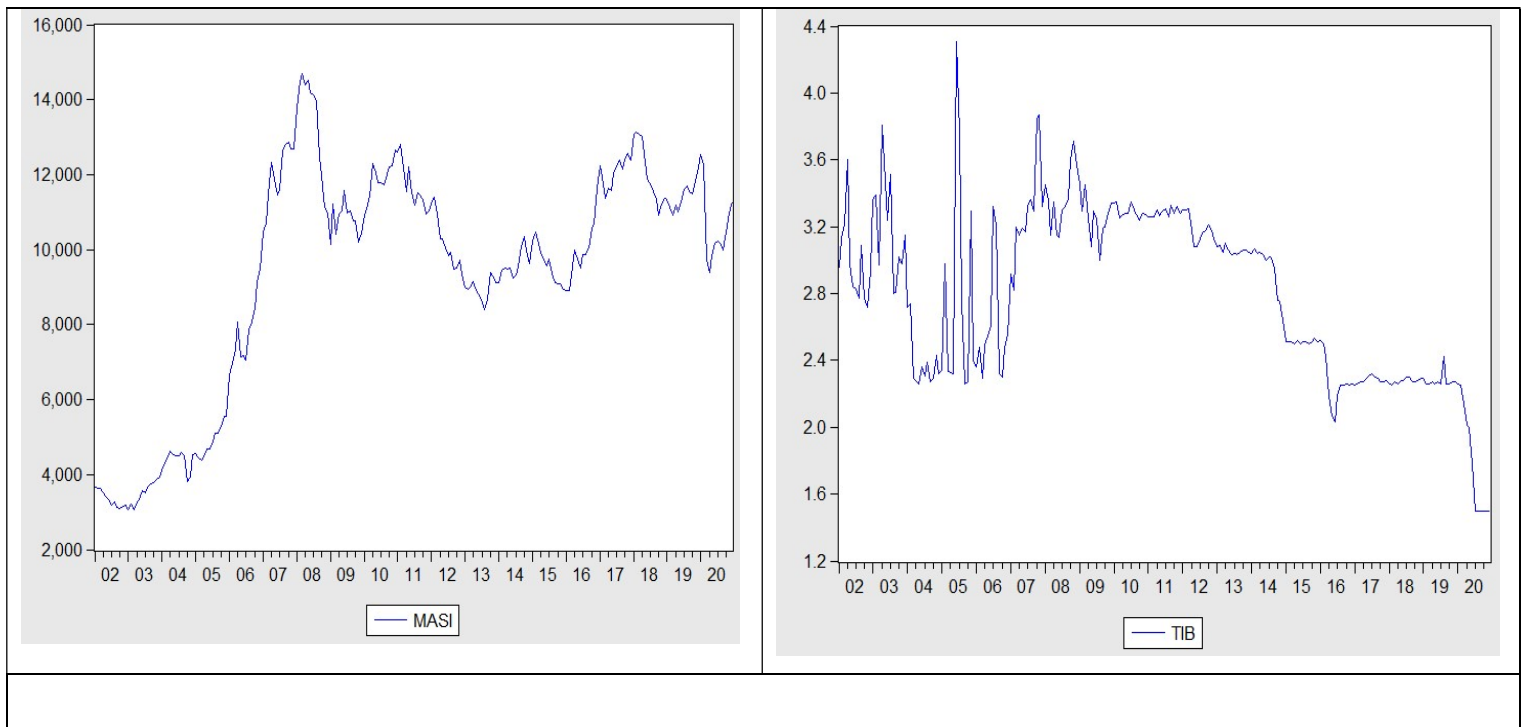
After reviewing the description of the variables and the relevant data for conducting our empirical study, the next step will be the primary focus of data processing and statistical analysis.

❖ **Variables description:**

The raw data used in the context of this study are represented as follows.



² Log-linearization of the variables: we keep only the TIB variables.

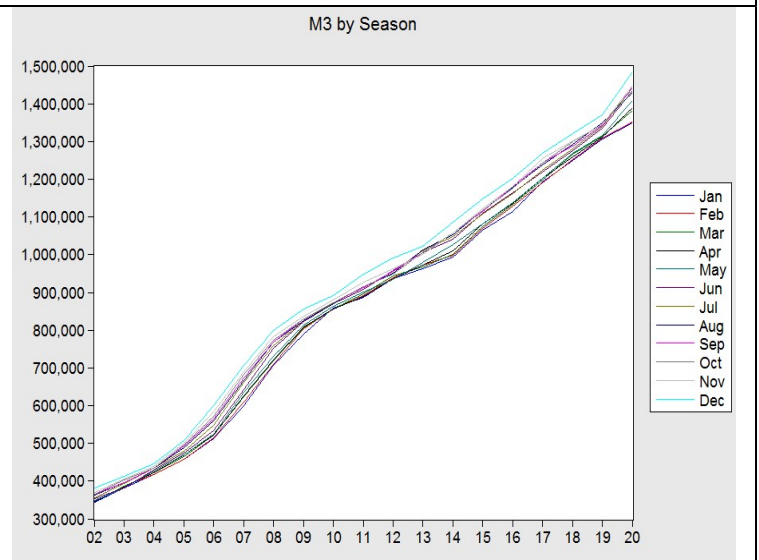
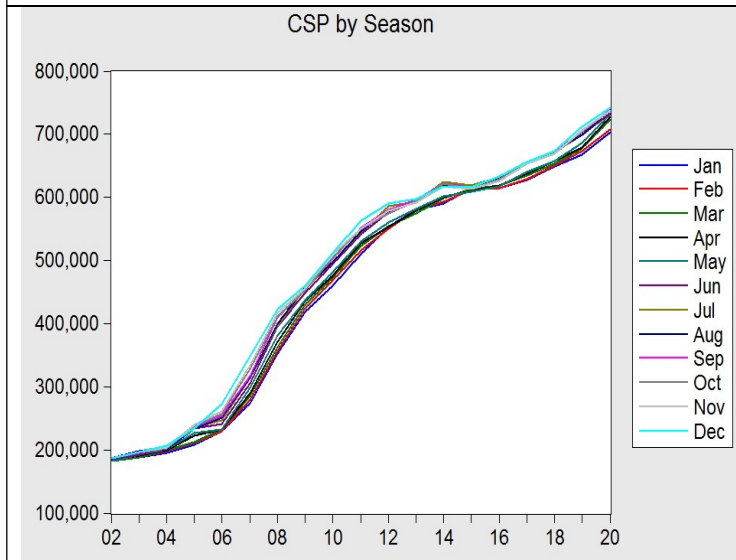
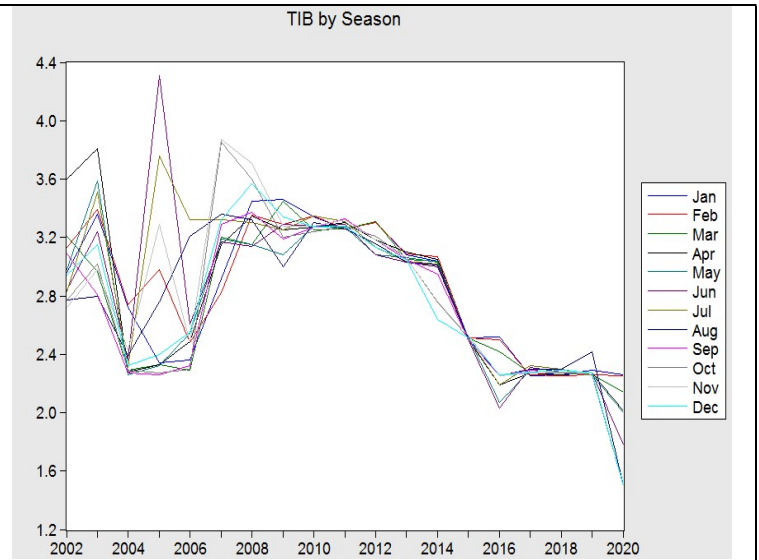
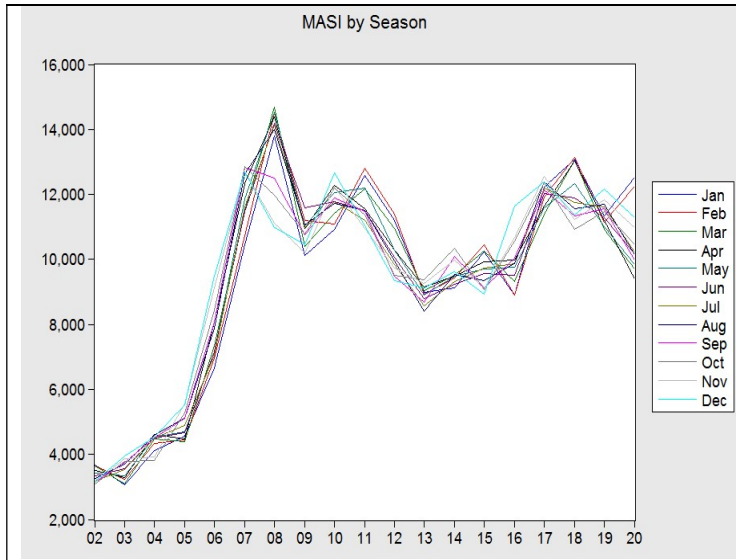


The graphs above show that the curve for both variables, CSP and M3, is increasing. This is, therefore, a powerful visual representation of the variable's trend over time. When the curve is ascending, it suggests an upward trend or a regular increase in the variable over the specified period at the top.

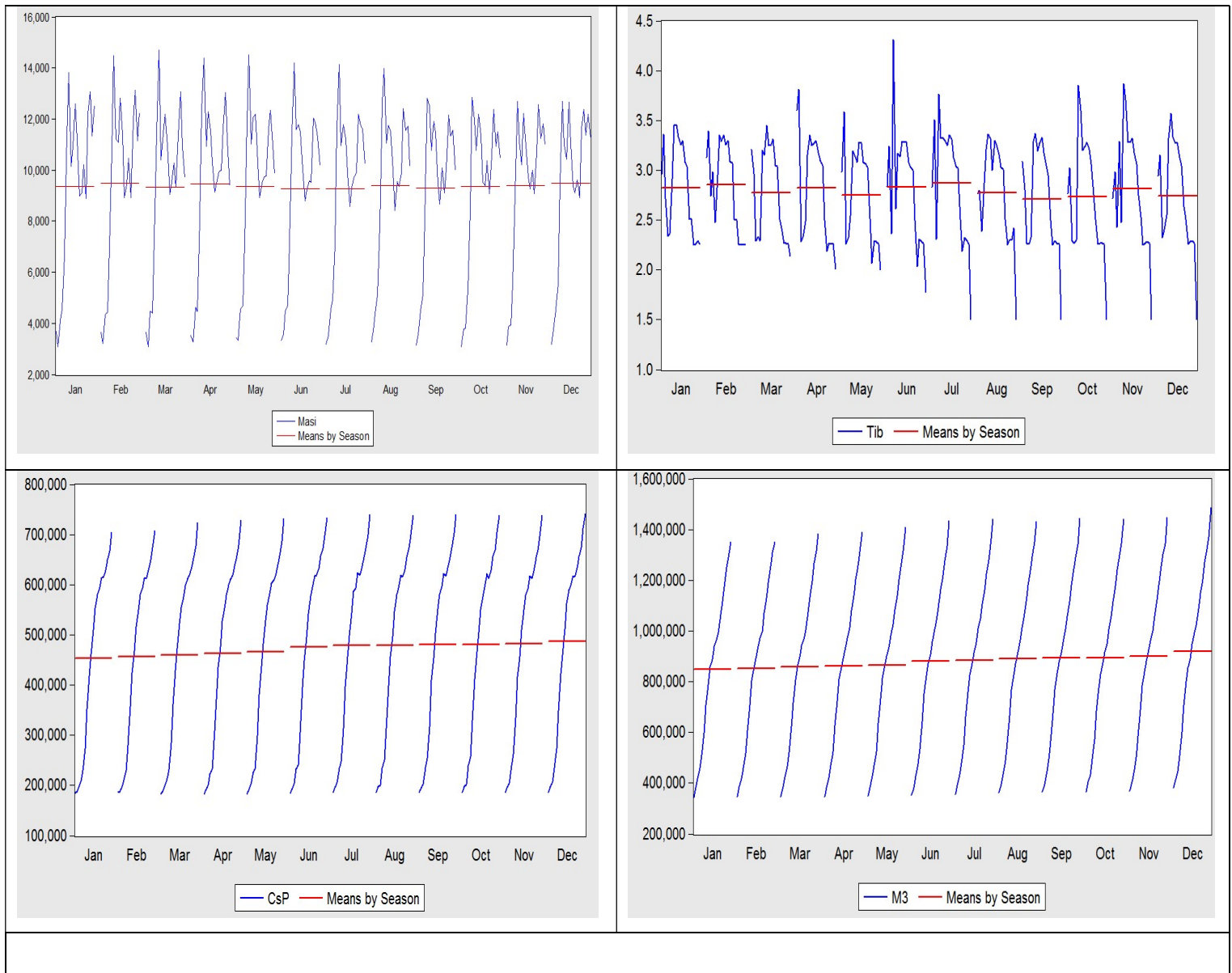
As for the other two variables in our study, the Masi has shown some fluctuations before trending towards a stagnant decline with periodic fluctuations. Meanwhile, the TIB variable is also decreasing, remaining low at the end of the study period.

❖ **Seasonality test:**

Classification of variables by year:



❖ Classification of variables by month:



The graphical visualization shows that none of the variables is affected by seasonality. However, the variables CSP and M3 are affected by a trend, as is the case for the variable MASI at the beginning of the period and for the variable TIB at the end of the period.

2.2. Descriptive statistics

Following this first graphical and descriptive analysis of the variables, and in order to deepen

Variable	Obs	Mean	Std. Dev.	Min	Max
LnMasi	228	9.067346	.4328245	8.029436	9.594523
TIB	228	2.791301	.5198521	1.5	4.31
LnCSP	228	12.96449	.4759867	12.11262	13.51624
INF	228	1.489958	1.254637	-1.574074	5.226824
LnM3	228	13.60478	.4243485	12.74504	14.211

our statistical analysis on the different differentials observed between these variables, we are going to analyze some of the characteristics of position, dispersion, distribution and correlation.

The reading of the above table reveals important facts that would undoubtedly constitute partial partial answers to our problem³.

Results of Results obtained by the STATA software

Another observation can be revealed concerning the dispersions; it is that almost all the variables have a low dispersion around their means. In other words, the variables maintain their evolution over time.

In the context of the descriptive analysis, we still have to read the results of the correlations between the variables selected. In Indeed, the following table summarizes these correlations:

³except inflation.

Table 3: Table of correlation between variables

	LnMasi	TIB	LnCSP	INF	LnM3
LnMasi	1.0000				
TIB	-0.0364	1.0000			
LnCSP	0.8043	-0.2879	1.0000		
INF	-0.0144	0.2050	-0.2755	1.0000	
LnM3	0.8201	-0.3759	0.9884	-0.2681	1.0000

Results of Results obtained by the STATA software

Based on the results of the correlations between the variables in the study, we find positive correlations between the variables (except TIB and INF).

2.3. Stationarity test

The results of this test applied to our variables are summarized in the following table:

Table 4: The result of the stationarity test

Variables	Tests	P-Values	Decisions
LnMasi	Dickey-Fuller test for unit root	0.03142	We accept H_0
	Dickey-Fuller test for unit root first difference	0.0000	On rejette H_0
TIB	Dickey-Fuller test for unit root	0.0110	On rejette H_0
	Dickey-Fuller test for unit root first difference	0.0000	On rejette H_0
LnSCP	Dickey-Fuller test for unit root	0.0682	On retient H_0
	Dickey-Fuller test for unit root first difference	0.0000	On rejette H_0
INF	Dickey-Fuller test for unit root	0.0000	On rejette H_0
	Dickey-Fuller test for unit root first difference	0.0000	On rejette H_0
LnM3	Dickey-Fuller test for unit root	0.0000	On rejette H_0
	Dickey-Fuller test for unit root first difference	0.0000	On rejette H_0

Results of Results obtained by the STATA software

The table above gives a quick look at the stationarity test of our variables. Indeed, the two variables LnMasi and Ln CSP are the only ones that are stationary at the first difference. On the other hand, all the other variables are stationary in their raw state.

3. A Var-Model

A VAR is a form of linear dynamic model that has several equations. Each of these denotes a linear relationship where a variable is expressed as a combination of its past eigenvalues and the past values of the other variables.

3.1. The specification of the analysis model

The VAR model was introduced by C. Sims (1980) as an alternative to simultaneous equation models. This model does not require a framework of economic theory, but a modeling of the different econometric relationships between the variables, which does not allow an obvious interpretation of the coefficients of the model. The model is presented as a generalization of the following Autoregressive AR model:

$$x_t = \alpha_1 x_{t-1} + \dots + \alpha_q x_{t-q} + \varepsilon_t \text{ avec } \varepsilon_t \sim iid(0; \sigma^2)$$

$$x_t = \sum_{i=1}^q \alpha_i x_{t-i} + \varepsilon_t$$

For a VAR(q) model, taking the case of two variables x and y considering (q=3)

$$\begin{cases} x_t = \alpha_{11}^1 x_{t-1} + \alpha_{12}^1 x_{t-2} + \alpha_{13}^1 x_{t-3} + \alpha_{11}^2 y_{t-1} + \alpha_{12}^2 y_{t-2} + \alpha_{13}^2 y_{t-3} + \varepsilon_t \\ y_t = \alpha_{21}^1 x_{t-1} + \alpha_{22}^1 x_{t-2} + \alpha_{23}^1 x_{t-3} + \alpha_{21}^2 y_{t-1} + \alpha_{22}^2 y_{t-2} + \alpha_{23}^2 y_{t-3} + \varepsilon_t \end{cases}$$

In matrix form:

$$Z_t = \alpha_1 Z_{t-1} + \alpha_2 Z_{t-2} + \alpha_3 Z_{t-3} + \varepsilon_t$$

We can write the model in the canonical form:

$$Z_t = \alpha_1 Z_{t-1} + \alpha_2 Z_{t-2} + \alpha_3 Z_{t-3} + \varepsilon_t$$

$$Z_t - \alpha_1 Z_{t-1} - \alpha_2 Z_{t-2} - \alpha_3 Z_{t-3} = \varepsilon_t$$

$$Z_t - \alpha_1 L Z_t - \alpha_2 L^2 Z_t - \alpha_3 L^3 Z_t = \varepsilon_t$$

$$Z_t - \alpha_1 L Z_t - \alpha_2 L^2 Z_t - \alpha_3 L^3 Z_t = \varepsilon_t$$

$$A(L)Z_t = \epsilon_t$$

A VAR with delay q, the polynomial A(L) is of degree q.

3.2. Econometric results

In order to evaluate the impact of monetary policy on stock price volatility, we mobilized the Stata software which gave us the following results:

first, it is necessary to estimate the optimal delay of the Var model fixed in Lag 1 (see table 6).

Table 5: Results of A VAR model

Vector autoregression					
Sample: 3 - 228				Number of obs	= 226
Log likelihood = 1663.531				AIC	= -14.23478
FPE = 4.53e-13				HQIC	= -13.89885
Det(Sigma_ml) = 2.78e-13				SBIC	= -13.40235
Equation	Parms	RMSE	R-sq	chi2	P>chi2
LnMasi	11	.043048	0.9903	23042.56	0.0000
TIB	11	.232794	0.8096	961.1095	0.0000
LnCSP	11	.009974	0.9996	528297.2	0.0000
INF	11	.751322	0.6593	437.3667	0.0000
LnM3	11	.009705	0.9995	439564.5	0.0000

Results of Results obtained by the STATA software

Then, we tested the significance of lags in the VAR (Wald restriction test).

Table 6 : Lag optimal results

Selection-order criteria								
Sample: 5 - 228						Number of obs	=	224
lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
0	-220.993				5.2e-06	2.0178	2.04854	2.09395
1	1638.89	3719.8	25	0.000	4.0e-13*	-14.3651*	-14.1806*	-13.9082*
2	1660.92	44.063	25	0.011	4.1e-13	-14.3386	-14.0004	-13.5009
3	1683.77	45.707*	25	0.007	4.2e-13	-14.3194	-13.8276	-13.101
4	1698.41	29.273	25	0.253	4.6e-13	-14.2269	-13.5814	-12.6277
Endogenous: LnMasi TIB LnCSP INF LnM3								
Exogenous: _cons								

Results of Results obtained by the STATA software

According to the results obtained, we observe in this equation system that the MASI index responds negatively to changes in the money supply. Indeed, the coefficient of the M3 aggregate and the constant are statistically significant at the 5% threshold. This means that the stock market is significantly influenced by the money supply with a negative sign. This result is consistent with the findings of the previously mentioned empirical studies.

In this sense, if the money supply increases, it can stimulate demand for stocks because investors have more money to invest and may be willing to pay higher prices for stocks. This can also encourage companies to invest more, which can boost economic growth and consequently increase the profits of publicly traded companies (El Moutaoukil & Oumane, 2021).

However, in our case, an increase in the money supply can also lead to higher inflation, which can have a negative impact on the stock market. If inflation rises, it can increase costs for companies, reduce profit margins, and discourage investors from putting their money into stocks.

Thus, the impact of the money supply on the stock market depends on many factors, such as economic growth, inflation, monetary and fiscal policies, and geopolitical events. It is important to monitor these factors and understand how they can influence the stock market."

In a similar vein of thought, the impact of the money supply on the stock market can be complex and multifaceted, but a significant increase in the money supply may have a negative long-term impact on the stock market.

When the money supply increases rapidly, it can lead to asset price inflation, including the prices of publicly traded stocks. Investors may be incentivized to buy stocks to avoid losing value due to currency devaluation. This can create a speculative bubble, where stock prices are artificially high compared to their true value.

However, this speculative bubble cannot last indefinitely. If the actual value of publicly traded companies does not match their market prices, it can lead to a market correction, where stock prices sharply decline. Investors can then incur significant losses, and the overall economy may suffer as a result.

Furthermore, a rapid increase in the money supply can also lead to higher interest rates, which can make stock investments less attractive to investors. Companies may also have more difficulty raising funds in the stock market if interest rates are high.

3.3. Robustness tests

As for the robustness test of our VAR model, we have adopted three tests, namely⁴:

- Test of absence of autocorrelation of errors in the estimated VAR (LM test):

These results indicate that all probabilities associated with the LM statistic are greater than the 5% threshold ($p > 0.05$). This implies that the residuals are autocorrelated. In other words, the errors are not independent.

- Test “Stationarity of the VAR Model Residuals”:

P value is lower than the significance level of 5%.

- Test of the stability of the estimated VAR:

all the eigenvalues lie inside the unit circle VAR satisfies stability condition.

Conclusion

This paper proposed an econometric approach to deal with the transmission channels of the effects of monetary policy on stock market volatility, while mobilizing a vector autoregression (VAR) model based on simultaneous equations, in order to determine the direction of impact of central bank decisions on the stock market.

The results obtained show the degree of the effects of the decisions of the Moroccan central bank on the stock exchange prices. This relationship is formally linked to the general and cyclical situations of the Moroccan economy.

This study aims to deepen our understanding of the interaction between monetary policy and the stock market in Morocco. By using VAR models and analyzing various variables representing monetary policy, we seek to identify transmission mechanisms and assess the impact of monetary policy on stock price volatility. The findings of this study will contribute to a better understanding of the relationships between monetary policy and the stock market in Morocco, which could have significant implications for economic policymakers and investors.

These results also suggest that the level of interest rates plays a central role in the dynamics of the stock market. Changes in this rate influence corporate investment decisions, which in turn

⁴ Appendix A

affect profitability and stock prices. Therefore, it is essential to closely monitor interest rate developments to better understand stock market fluctuations and anticipate future movements. These results suggest that the stock market in Morocco may potentially serve as a channel for transmitting the effects of monetary policy. The growing significance of market capitalization relative to the overall economy indicates that fluctuations in the stock market can influence the overall economic activity.

In addition to the observed insights, this research opens avenues for further exploration and presents several perspectives. Firstly, future research could delve deeper into the specific mechanisms through which interest rates influence stock market dynamics, offering a more nuanced understanding of this relationship. Additionally, exploring the impact of external factors, such as global economic conditions or geopolitical events, on the transmission channels identified in the Moroccan context could enhance the comprehensiveness of the study.

Addressing other related questions, such as the potential non-linearities in the relationship between monetary policy and the stock market or the role of investor sentiment in amplifying or mitigating the effects, would contribute to a more comprehensive understanding of the complex dynamics at play. Moreover, investigating the impact of unconventional monetary policy measures, beyond interest rate changes, on stock market volatility could provide valuable insights in the evolving landscape of central banking.

While the findings shed light on the relationship between monetary policy and the stock market in Morocco, it is crucial to acknowledge the study's limitations. For instance, the analysis primarily focuses on a specific time period, and results may be subject to changing economic conditions. Future research could extend the time horizon to capture longer-term trends and potential shifts in the relationship.

Despite these limitations, the current study provides valuable contributions to the literature on monetary policy and stock market dynamics in the Moroccan context. The insights gained can inform economic policymakers and investors about the potential implications of monetary policy decisions on stock market behavior, fostering more informed decision-making in both realms. The study also contributes to the broader body of knowledge on the transmission channels of monetary policy, with implications that extend beyond the specific context of Morocco.

Appendix A

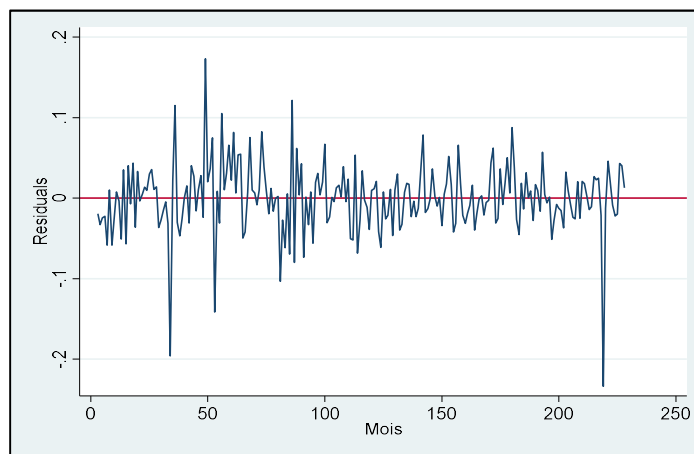
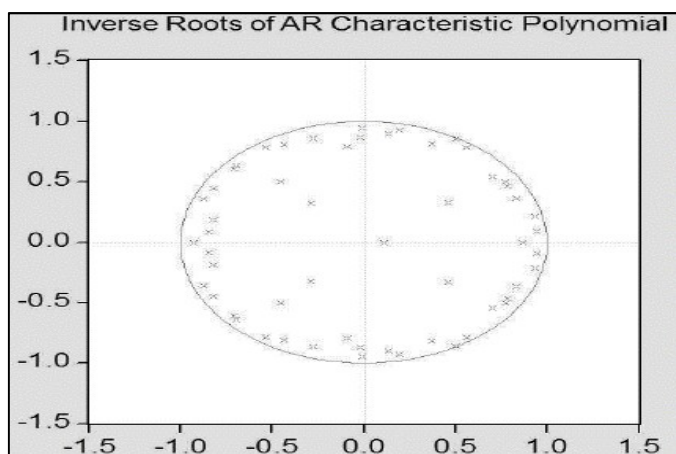
Stability condition

Eigenvalue stability condition

Eigenvalue	Modulus
.9949907	.994991
.8729674	.872967
.7640819	.764082
.2123419	.212342
.08216522	.082165

All the eigenvalues lie inside the unit circle.
VAR satisfies stability condition.

Stationarity of the VAR Model Residuals



Lagrange-multiplier test

```

+-----+
| lag |  chi2  df  Prob > chi2 |
+-----+
|  1  | 52.3107  25  0.06109 |
|  2  | 46.8380  25  0.07512 |
+-----+
    
```

H0: no autocorrelation at lag orde

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