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The Impact of Monetary Shocks on Economic Growth in Algeria: An SVAR Analysis (1990-2020)

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Abstract:
This study examines the impact of monetary policy on economic growth in Algeria using a structural vector autoregression (SVAR) approach. The results show that monetary policy shocks have a significant impact on the Algerian economy, with a positive effect on output in the short term. However, the effect fades away in the long term, suggesting that other factors, such as structural reforms, may be needed to sustain growth. These findings have important implications for policymakers in Algeria and other developing countries, as they highlight the need for a balanced approach to monetary policy to support economic growth and stability.

Keywords: Svar, Economic growth, Monetary Policy, Shock.
Jel Classification Codes:

Introduction:

Monetary policy plays a critical role in achieving macroeconomic stability and promoting economic growth, especially in developing nations such as Algeria. The country's heavy reliance on oil and gas exports has resulted in significant economic fluctuations in recent times due to global commodity price variations. In response, the Algerian government has implemented various monetary policies geared towards fostering growth and stability. Nevertheless, the extent of the impact of these policies on Algeria's economic growth remains uncertain.

In effect, Despite being one of Africa's largest economies, Algeria has experienced unstable economic growth due to external shocks, including political instability and changes in global commodity prices (World Bank, 2020)[2]. And according (IMF) in

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[2] World Bank. (2020). Algeria economic update: Diversification for economic stability. Retrieved from https://openknowledge.worldbank.org/handle/10986/33970

2022 Algeria's GDP is projected to grow by around 3.9%, and for inflation 3.8% for the unemployment rate 12.5% .These economic indicators suggest that Algeria's economy is expected to see modest growth in the coming years, but still faces challenges related to high unemployment, a weak non-oil sector, and dependence on oil exports.

Hence, comprehending the effect of monetary policy on economic growth is critical for policymakers to make informed decisions and promote sustainable economic development.

That is why , **We ask the crucial question**: what is the impact of monetary shocks on economic growth in Algeria?

To answer this question we hypothesize that monetary policy shocks have a significant impact on economic growth in Algeria. Specifically, we expect that expansionary monetary policy will lead to an increase in output in the short term, but this effect will fade away over time as the economy adjusts to the shock.

On the methodological side, we use structural vector automatic regression (SVARs) to analyze differences in the effects of monetary policy on economic growth. VARs have been a popular tool for studying monetary shocks. The SVAR methodology is commonly utilized in previous studies to gauge the dynamic impact of monetary policy on various macroeconomic indicators, such as output, inflation, among others (Kwiatkowski et al., 1992)[3]; (Lütkepohl, 2005)[4]. It requires only minimal constraints in order to separate movements in endogenous variables such as: production, prices, and interest rates into parts due to fundamental shocks, such as shifts in aggregate supply and demand schedules and changes in monetary policy stance. The transparency of the definition constraints is of particular importance in a cross-country study. , because it facilitates the assessment of whether the results are driven by different or unreasonable selection assumptions. Moreover, once an identification scheme is adopted, SVAR is easy to estimate, making it particularly suitable for studying a country like Algeria.

This study aims to explore the correlation between monetary shocks and economic growth in Algeria through the utilization of a structural vector autoregression (SVAR) approach.

By applying this approach, we seek to evaluate the short- and long-term effects of monetary policy shocks on Algeria's economic growth.

The remainder of this paper is structured as follows: Section 1 provides a brief overview of the policy monetary and economic growth in Algeria, followed in Section 2 reviews the corresponding academic literature, Section 3 gives a description of the data, Section 4 details the structural vector Autoregression (SVAR), Section 5 discusses the results, Section 6 concludes.

The objective of the study: is to investigate the impact of monetary policy shocks on the economic growth of Algeria, using a Structural Vector Autoregression (SVAR) model and to analyze the dynamic interactions between monetary policy variables and Gdp in short run and long run.

[3] Kwiatkowski, D., Phillips, P. C. B., Schmidt, P., & Shin, Y. (1992). Testing the null hypothesis of stationarity against the alternative of a unit root: How sure are we that economic time series have a unit root? Journal of Econometrics, 54(1-3), 159-178.

[4] Lütkepohl, H. (2005). New introduction to multiple time series analysis. Springer.

2.Conceptual Literature : In this part, we will try to give a quick overview of economic growth and monetary policy, and to highlight the relationship between them, in order to show their great importance in the economy, and this is in order to evaluate the standard study that we will do later.

2.1.Monetary Policy: Monetary policy is a crucial tool for achieving macroeconomic stability and growth. It involves managing the money supply, influencing interest rates, and ensuring financial stability. One of the key objectives of monetary policy is to maintain price stability by keeping inflation under control. Central banks use an inflation targeting framework to set a specific inflation target and adjust monetary policy as needed to achieve it. This approach has been successful in many countries, including the United States, Canada, and Australia (Bernanke & Gertler, 1995)[5]; (Mishkin, 2018)[6]. Monetary policy also plays a critical role in promoting economic growth by supporting aggregate demand and fostering a favorable business environment. Central banks can use their policy tools to influence interest rates, which can have a significant impact on investment and consumption decisions (Blanchard, 2019)[7]; (Taylor, 1993)[8]. Additionally, central banks are responsible for ensuring financial stability by providing liquidity to financial institutions and preventing runs on the banks. During the global financial crisis of 2008-2009, central banks played a crucial role in stabilizing financial markets and preventing a systemic collapse (IMF, 2021). Monetary policy is also closely linked to exchange rate policy, as changes in interest rates can affect the value of a country's currency. Central banks can use exchange rate policy to influence the competitiveness of the economy and support the balance of payments (Svensson, 2017)[9]. Overall, the effectiveness of monetary policy depends on a range of factors, including the state of the economy, the credibility of the central bank, and the presence of other macroeconomic policies such as fiscal policy. As such, central banks must continually monitor and adjust their policy stance in response to changing economic conditions.

Monetary policy in Algeria has traditionally focused on maintaining price stability through exchange rate management and controlling money supply growth. The exchange rate policy is characterized by a fixed exchange rate regime, where the Algerian dinar (DZD) is pegged to the US dollar (USD). The central bank intervenes in the foreign exchange market to maintain the peg, and controls the money supply through the use of reserve requirements and open market operations (Ghachem, 2017)[10]. The monetary policy framework has evolved over time, with the central bank adopting more market-oriented policies and gradually liberalizing

[5] Bernanke, B. S., & Gertler, M. (1995). Inside the black box: The credit channel of monetary policy transmission. Journal of Economic Perspectives, 9(4), 27-48.
[6] Mishkin, F. S. (2018). The economics of money, banking and financial markets (12th ed.). Pearson Education.
[7] Blanchard, O. (2019). The future of macroeconomic policy: Seven tentative conclusions. Peterson Institute for International Economics.
[8] Taylor, J. B. (1993). Discretion versus policy rules in practice. Carnegie-Rochester Conference Series on Public Policy, 39, 195-214.
[9] Svensson, L. E. (2017). Monetary policy and macroprudential policy: Different and separate? Journal of Monetary Economics, 90, 50-66.
[10] Ghachem, R. (2017). Algeria: Monetary policy challenges in a changing economic environment. The Journal of North African Studies, 22(4), 652-670.

the financial sector. However, the lack of a well-developed money market and limited access to financing have limited the effectiveness of monetary policy (Ouahrani, 2019)[11].

In recent years, the central bank has implemented several measures to modernize and strengthen the monetary policy framework. These include the adoption of inflation targeting as the primary objective of monetary policy, the introduction of a new monetary policy rate, and the establishment of a new committee to oversee monetary policy. Additionally, the central bank has taken steps to improve financial sector supervision and promote financial inclusion, such as developing a credit registry and strengthening the legal framework for collateral and credit reporting. While these efforts have helped to improve the effectiveness of monetary policy, significant challenges remain, including the need to diversify the economy and promote private sector development (IMF,2021)[12].

2.2.Economic Growth: Economic growth refers to the sustained increase in the production of goods and services in an economy over a given period of time. It is measured by the increase in real GDP (gross domestic product) or per capita income, and is usually accompanied by improvements in living standards, employment opportunities, and the overall well-being of the population. Economic growth is considered a key objective of economic policy, as it can lead to higher levels of investment, innovation, and technological progress, which in turn can fuel further growth.

The concept of economic growth has been the subject of extensive research and analysis by economists, policymakers, and scholars. Theories of economic growth attempt to explain the factors that contribute to growth, such as investment, human capital, technological progress, and institutions, and how they interact with each other. The seminal works of economists such as Robert Solow, Paul Romer, and Robert Barro have greatly influenced the understanding of economic growth and its determinants

One of the challenges of economic growth is to achieve sustained and inclusive growth, which benefits the entire population and avoids widening income disparities. This requires policies that promote access to education, health care, and finance, as well as investments in infrastructure and innovation. However, economic growth can also have negative impacts on the environment and social cohesion if it is not managed properly.

Economic growth is complex and multidimensional, involving several interdependent factors. One important framework is the endogenous growth theory, which posits that sustained economic growth is primarily driven by innovation, technological progress, and human capital accumulation (Romer, 1990)[13]. This theory highlights the importance of investments in research and development, education, and infrastructure for long-term economic growth. In addition, the Solow-Swan model highlights the role of capital accumulation, arguing that

[11] Ouahrani, D. (2019). The effectiveness of monetary policy in Algeria. Journal of Economics and Political Economy, 6(3), 290-301.

[12] International Monetary Fund. (2021). Algeria: Staff report for the 2021 Article IV consultation. IMF Country Report No. 2021/253.

[13] Romer, P. M. (1990). Endogenous technological change. Journal of Political Economy, 98(5), S71-S102.

investment in physical capital, such as machinery and equipment, can increase productivity and output (Solow, 1956)[14]. The Harrod-Domar model, on the other hand, emphasizes the role of investment in generating economic growth (Domar, 1946)[15]. These frameworks provide different perspectives on the drivers of economic growth and highlight the importance of investment, human capital, and technological progress in promoting sustainable economic development.

Moreover, the role of institutions in promoting economic growth cannot be ignored. Good governance, strong property rights, and a stable legal and regulatory framework are crucial factors that enable economic growth (Acemoglu & Robinson, 2012)[16]. Institutions can also promote innovation and entrepreneurship by providing a supportive environment for research and development, protecting intellectual property rights, and reducing barriers to entry for new firms. On the other hand, weak institutions, corruption, and political instability can hinder economic growth by creating an unfavorable business climate and reducing investors' confidence (Gupta, Davoodi, & Alonso-Terme, 1998)[17]. Thus, promoting institutional quality is a critical component of any comprehensive approach to economic growth.

Furthermore, international trade and globalization can also be important drivers of economic growth. Trade liberalization can increase competition, promote innovation, and enhance productivity, leading to economic growth (Rodrik, 2018)[18]. However, the benefits of trade are not evenly distributed, and some industries and regions may be negatively affected. Therefore, policies aimed at promoting trade should be designed carefully to ensure that the benefits are shared widely.

Finally, social and cultural factors can also influence economic growth. Gender equality, education, and healthcare are all critical determinants of economic growth and development. Investments in education and healthcare can improve human capital, leading to higher productivity and economic growth. Gender equality can promote inclusive growth by enabling women to participate fully in the economy, increasing labor force participation and reducing income inequality. Therefore, social policies that promote human development and gender equality can be important drivers of economic growth.

And after we showed the relationship between economic growth and monetary policy in the economy and how they are considered among the most important basic concepts. Now we will move on to studying the standard and introducing our model.

3.The Empirical Review:

[14] Solow, R. M. (1956). A contribution to the theory of economic growth. The Quarterly Journal of Economics, 70(1), 65-94.

[15] Domar, E. D. (1946). Capital expansion, rate of growth, and employment. Econometrica, 14(2), 137-147.

[16] Acemoglu, D., & Robinson, J. A. (2012). Why nations fail: The origins of power, prosperity, and poverty. Crown Business.

[17] Gupta, S., Davoodi, H., & Alonso-Terme, R. (1998). Does corruption affect income inequality and poverty? Economics of Governance, 1(1), 23-45.

[18] Rodrik, D. (2018). Straight talk on trade: Ideas for a sane world economy. Princeton University Press.

There is not much literature related to monetary shocks and their impact on economic growth in Algeria, or even at the level of various countries, especially developing ones. But we tried to review and find some of these studies to expand the framework of knowledge as well as to help us analyze and draw different conclusions.

The first empirical study (Musa, Ibrahim, Sule Magaji, and Ali Salisu, 2022)[19] The aim of the study was to study the effect of monetary policy on economic growth in Nigeria. SVAR analysis was used to assess the effects of monetary policy following the framework of inflation targeting (IT) on economic growth in Nigeria. Quarterly time series data were used from 1986 from the first quarter to the fourth quarter of 2017. The results revealed that monetary policy has a positive shock on economic growth and The monetary policy rate (MPR) positively affects growth. However, its effect was only negligible at a maximum of 3 percent. Also, the broad money supply (M2) had a positive shock but only accounted for 7 percent max. The study concluded that the inflation targeting (IT) framework is a good tool for monetary policy but it is not sufficient and other complementary tools are needed. The second study (Sousa, J. M., & Zaghini, A. 2007)[20] the paper analyzed the sum of the main monetary aggregates for the economies of the Group of Five countries (the United States, the eurozone, Japan, the United Kingdom and Canada), and also analyzes the characteristics of their index of global output and inflation. Using a structural VAR approach over the period from 1980 Q1 to 2001 Q4, they found that after a monetary policy shock, output declined temporarily, with the downward effect peaking during year two, and the global monetary aggregate falling significantly. In addition, the price level rises permanently in response to a positive shock to global aggregate liquidity. The similarity of our results to those of country studies may support the use of a global monetary aggregate as a summary measure of global monetary trends. The Third study (Herve, D. B. G. 2017)[21] This paper studied and tried to predict the effects of monetary policy on economic growth by studying the case of Côte d'Ivoire through the SVAR model. A time series used monthly data starting from 1990 Q1 to 2014Q12. The empirical results concluded that monetary policy shocks are not the main determinant of business cycle movements in Côte d'Ivoire. The real interest rate and sum of money respond significantly to changes in the industrial production index, while Other variables respond sparingly. This means that the industrial sector in Côte d'Ivoire is constrained due to the high cost of credit in the production process. And that the global oil price shock captured real activities and negatively affected the growth of GDP. The study recommends the gradual diversification of the economic GDP and the optimal fiscal policy that can be relied upon because it play a dominant role.

[19] Musa, I., Magaji, S., & Salisu, A. (2022). The Monetary Policy Shocks and Economic Growth: Evidence From SVAR Modelling. International Journal of Indonesian Business Review, 1(1), 1-11.
[20] Sousa, J. M., & Zaghini, A. (2007). Global monetary policy shocks in the G5: A SVAR approach. Journal of International Financial Markets, Institutions and Money, 17(5), 403-419.
[21] Herve, D. B. G. (2017). Estimation of the Impact of Monetary Policy on Economic Growth: The Case of Cote d Ivoire in Line with SVAR Methodology. Applied Economics and Finance, 4(4), 66-83.

The next study (Forhad, A. R., Homaifar, G. A., & Salimullah, A. S. M. 2017)[22] studied the transmission effectiveness of monetary policy for Bangladesh using a structural vector autoregressive (SVAR) model for the period from 1972 to 2014. It was investigated how a monetary policy shock defined as an unexpected rise in interest rate affects real and nominal macro variables; They are real output, prices, real effective exchange rates, and money supply. And the results were the monetary policy shock has a short-term impact on real production, the price level, and exchange rates and the monetary policy shock generates inflationary pressures that lead to a devaluation of the Bangladeshi taka. The next was about algerian economy (Benazza ,I.,& Bensaad , W.2021)[23] The aim of the study was to investigate the transmission mechanism of monetary policy in Algeria, and the data were in the form of a quarterly series, covering the period from 2000 to 2018 using the vector autoregressive (SVAR) model. The results indicated that monetary policy shocks are transmitted to the Algerian economy mainly Through broad money supply (m2) and exchange rate channels. Second study is (Sirine, S., & Bentayeb, H. 2021)[24] The aim of the study was to measure the effects of monetary shocks on the real economy sector through internal variables (money supply, the volume of loans directed to the economy), and external variables (exchange rate) that have an impact on the transmission of monetary shocks, using the SVAR model and annual data from 1990 to 2019. The result was that there is a real response between economic variables and monetary shocks, because they affect real economic activity and prices, through a mechanical relationship that begins with its impact on the monetary mass and then the channels of monetary policy, and the return to balance in the short term, and is considered The exchange rate channel of long-term shocks is an effective tool for policy criticism in Algeria.

In this review of the empirical economic literature, we presented a panorama of studies and research related to the Algerian economy and other economies such as: the Nigerian economy and others, which enabled us to better understand our topic and the method of applied econometrics. Based on all this, we will proceed with our standard model based on all these empirical studies in Section 4.

4.Study Methodology:

The identified VAR model The choice of variables in the VAR reflects the theoretical set up of a Keynesian small open economy model, IS-LM such as that described in Svensson (2000)[25] and Clarida et al. (2001)[26]. In particular, the VAR model comprises the quarterly data changes of the log of the inflation (TINF), log of the Discont rate (DR), the log of the real exchange rate against a basket of

[22] Forhad, A. R., Homaifar, G. A., & Salimullah, A. S. M. (2017). Monetary Policy Transmission Effect On The Realsector Of The Bangladesh Economy: An Svar Approach. Economia Internazionale/International Economics, 70(1), 25-46.

[23] Benazza , I., & Bensaad , W. (2021). The monetary policy transmission mechanism evidence from the Algeria An SVAR approach. Recherchers Economiques Manageriales, 15(1), 517-536.

[24] Sirine, S., & Bentayeb, H. (2021). The impact of monetary shocks on the real economy in Algeria using the SVAR model (the period between 1990 and 2019), (4)9, 70-88.

[25] Svensson, G. (2000). A conceptual framework for the analysis of vulnerability in supply chains. International journal of physical distribution & logistics management, 30(9), 731-750.

[26] Clarida, R., Gali, J., & Gertler, M. (2001). Optimal monetary policy in open versus closed economies: an integrated approach. American Economic Review, 91(2), 248-252.

trading partners (REER) and the log of Total loans directed to the economy (DLOANS),the log of supply money (M2), and log of (GDP).

-We first define Zt as the (6 × 1) vector of the macroeconomic variables Assuming Zt to be invertible, it can be written in terms of its moving average (ignoring any deterministic terms) B(L) υt where vt is a (6 × 1) vector of reduced form residuals assumed to be identically and independently distributed,υt~iid (0,Ω) with positive definite covariance matrix . B(L) is the (6 × 6) convergent matrix polynomial in the lag operator . L,B(L)=Bj Lj Following the literature, the innovations (υt), are assumed to be written as linear combinations of the underlying orthogonal structural disturbances.

- (εt)i.e ,υt= sεt .The VAR can then be written in terms of the structural shocks as ,Zt=C(L)εt (Bjørnland.H.& Jacobsen.d 2010)[27].

-We follow the approach initially developed by (Siami 2018)[28] ,and implemented by (Starr, M. 2005)[29] And We estimate a reduced form VAR and identify monetary-policy innovations through specification about variable ordering. Specifically, the reduced form VAR is thus:

$$X_t = \sum_{i=0}^{m} A_i \, X_{t-1} + U_t$$

In order to examine the effect of Monetary policy on economic growth, we estimate the following equation:

$$X_t = LGDP_t . LM2_t . LREER_t . LDLOANS_t . LTINF_t . LDR_t$$

$$U_t = [U_t^{LGDP} . U_t^{LM2} . U_t^{LREER} . U_t^{LDLOANS} . U_t^{LTINF} . U_t^{LDR}]$$

-Where X_t is the vector of endogenous variables.

-U_t represents the vector of the structural residues.

-A is a square matrix (n*n) of main diameter elements are equal to 1.

-m is the vector of lags that determines the number of delays in the model.

-In order to identify structural shocks, a transition matrix P should be formed which achieves the following relationship $U_t = p.e_t$.

By specifying the transition matrix parameters by:

Write the equal: $U_t = p.e_t$ as follows: $A_0 U_t = B.e_t$ where: $P = A^{-1} + B$

The restrictions placed on the contemporaneous relationships Confirmation of some non-diagonal elements for matrices A and B, depending on some economic indications, to assume that one of the residues does not affect the other in the same year (that is, this element will take a value of 0 On the other hand, when measuring the effect, the value of the element αij is given as economic constraints by giving it a value of 1 (Chibi , Benbouziane 2010),[30]Taking into consideration the state of the Algerian economy, the distinction between the short and long term.

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[27] Bjørnland, H. C., & Jacobsen, D. H. (2010). The role of house prices in the monetary policy transmission mechanism in small open economies. Journal of financial stability, 6(4), 218-229.

[28] Siami-Namini, S. (2018). The effect of monetary policy shocks on the real economy: A FAVAR approach. Research Journal of Economics, 2(1), 1-9.

[29] Starr, M. A. (2005). Does money matter in the CIS? Effects of monetary policy on output and prices. Journal of Comparative Economics, 33(3), 441-461.

[30] Chibi, A., Benbouziane, M., & Chekouri, S. M. (2010, August). The macroeconomic effects of fiscal policy shocks in Algeria: an empirical study. In Economic Research Forum (Vol. 536, pp. 1-26).

4.1.Description of data:

The data sets used for this analysis is the quarterly series of the selected relevant macroeconomic variables from1990 to 2020. The choice of this period is to enable us focus strictly on the monetary reforms of market-regime in Algeria. The data for reel exchange rate (REER) and the inflation rate (TINF), supply money M2 and total loans directed to the economy (dloans), discount rate (DR), will be used as monetary policy variables. Data for GDP gross domestic product will be used as economic growth variable. The data were obtained from The World Bank, are used. Log transformation to minimize the hetroskedasticity problem (Gujarati ,Sangeetha, 2007)[31]. All the empirical tests have been carried out by using Eviews 12 Software.

4.2. Model specification:

Following the previous empirical studies,it is possible to specify our empirical model in the following manner.

The main steps of an SVAR model are:

* Unit root test variables must be I(0), I(1) or a mixture of both.
* Estimating the VAR model after determining the lag lengths.
* Estimating the SVAR model after placing structural matrix Constraints.
* Extraction of structural impulse response functions and variance decomposition.

4.3.Model Estimations:

Before estimating SVAR model we must estimate structural matrices to transform VAR errors into uncorrelated structural shocks.

Restrictions on A and B (short run matrices) and F (long run matrices) take the form of assumptions about the structure of contemporaneous feedback of variables in the SVAR and assumptions about the correlation structure of the errors, we estimate the SVAR model including five popular measures of monetary policy.

-We order the policy variables in the SVAR after the non-policy variables with GDP.Coming first, based on the assumption that it adjusts most sluggishly.

-Specifically, our assumption of short run implies that monetary policy shocks affect GDP Through the broad money and reel exchange rate tool.

- The reel exchange rate is affected and responds to all possible shocks It occurs in study variables.

$-U_t^{LGDP} = b_{11} + a_{12}e_t^{LM2} + a_{13}e_t^{LREER}.U_t^{LGDP\ Schok}$

$-U_t^{LM2} = a_{21}e_t^{LGDP} + b_{22} + a_{25}e_t^{LTINF}.U_t^{LM2\ Shock}$

$-U_t^{LREER} = a_{31}e_t^{LGDP} + a_{32}e_t^{LM2} + b_{33} + a_{34}e_t^{LDLOANS} + a_{35}e_t^{LTINF} + a_{36}e_t^{LDR}.U_t^{LREER\ Shock}$

$-U_t^{LDLOANS} = a_{42}e_t^{LM2} + b_{44}.U_t^{LDLOANS\ Shock}$

$-U_t^{LTINF} = a_{51}e_t^{LGDP} + b_{55}.U_t^{LTINF\ Shock}$

$-U_t^{LDR} = a_{65}e_t^{LREER} + b_{66}.U_t^{LDR\ Shock}$

MATRIX A

[31] Gujarati, D. N., & Sangeetha, N. (2007). Basic econometrics, 4/e Tata McGraw-Hill.

$$\begin{vmatrix} e_{1t}^{LGDP} \\ e_{1t}^{LM2} \\ e_{1t}^{LREER} \\ e_{1t}^{LDLOANS} \\ e_{1t}^{LTINF} \\ e_{1t}^{LDR} \end{vmatrix} \begin{vmatrix} LGDP & LM2 & LREER & LDLOANS & LTINF & LDR \\ 1 & a_{12} & a_{13} & 0 & 0 & 0 \\ a_{21} & 1 & 0 & 0 & a_{25} & 0 \\ a_{31} & a_{32} & 1 & a_{34} & a_{35} & a_{36} \\ 0 & a_{42} & 0 & 1 & 0 & 0 \\ a_{51} & 0 & 0 & 0 & 1 & 0 \\ 0 & 0 & a_{63} & 0 & 0 & 1 \end{vmatrix} \begin{vmatrix} \mu_{1t}^{LGDP} \\ \mu_{2t}^{LM2} \\ \mu_{3t}^{LREER} \\ \mu_{4t}^{LDLOANS} \\ \mu_{5t}^{LTINF} \\ \mu_{6t}^{LDR} \end{vmatrix}$$

To determine the impact of monetary policy shocks in the long run, we can write the matrix f, which determines shocks between variables within the model in the long run. we estimate the following equations:

$$y_t = A^{-1}C(L)y_{t+}A^{-1}B\mu_t$$
$$y_t = [I - A^{-1}\,C(L)]^{-1}\,A^{-1}B\mu_t$$

$-U_t^{LGDP} = a_{11} + a_{12}e_t^{LM2} + a_{13}e_t^{LREER}.U_t^{LGDP\ Schok}$
$-U_t^{LM2} = a_{21}e_t^{LGDP} + a_{22} + a_{25}e_t^{LTINF}.U_t^{LM2\ Shock}$
$-U_t^{LREER} = a_{31}e_t^{LGDP} + a_{32}e_t^{LM2} + a_{33} + a_{34}e_t^{LDLOANS} + a_{35}e_t^{LTINF} + a_{36}e_t^{LDR}.U_t^{LREER\ Shock}$
$-U_t^{LDLOANS} = a_{42}e_t^{LM2} + a.U_t^{LDLOANS\ Shock}$
$-U_t^{LTINF} = a_{51}e_t^{LGDP} + a_{55}.U_t^{LTINF\ Shock}$
$-U_t^{LDR} = a_{65}e_t^{LREER} + a_{66}.U_t^{LDR\ Shock}$

MATRIX F

$$\begin{vmatrix} LGDP & LM2 & LREER & LDLOANS & LTINF & LDR \\ a_{11} & a_{12} & a_{13} & 0 & 0 & 0 \\ a_{21} & a_{22} & 0 & 0 & a_{25} & 0 \\ a_{31} & a_{32} & a_{33} & a_{34} & a_{35} & a_{36} \\ 0 & a_{42} & 0 & a_{44} & 0 & 0 \\ a_{51} & 0 & 0 & 0 & a_{55} & 0 \\ 0 & 0 & a_{63} & 0 & 0 & a_{66} \end{vmatrix}$$

Source: Prepared by researchers

We assume in the long run that the money supply (M2) and the real exchange rate (REER) and the inflation rate (TINF) can affect the (GDP), because the hyperinflation will cause the value of currency to diminish quickly in short periods In such cases people attempt not to hold or use the currency or attempt to exchange it for something else immediately after receiving it exactly because the store of value function has broken down (hyperinflation causes the price level to rise and the value of a currency unit to fall appreciably. This leads to a decline in domestic demand, and consequently, domestic production decreases.

The second assumption, in the long run, the discount rate response to a structural shock of the exchange rate, where we assume that the central bank adjusts the discount rate depending on the price level to achieve the goal of price stability, taking into account the exchange rate, which is a final goal and at the same time an intermediate goal in Algeria According to Article 35 of the Money and Credit Law This formulation framework is relatively close to the framework of Bank Algeria.

Because the annelle reports (ex: considering that of 2010,2015) explain well the objective of the monetary policy.

Note: We have developed Restrictions, taking into account the theoretical aspects of monetary policy and the surrounding economic conditions in the Algerian economy and its structural changes, with the commitment of the central bank clarified by adopting a simple and predictable monetary policy rule.The results of the matrix long-and short run are shown in the table (4).

5.Study Results:

5.1.Stationarity of time series (Unit Root test): In order to examine the stationarity of time series, we have used the ADF and PP test , The results of the ADF and PP tests in the table (01) indicate the probability of calculated values is greater than the critical value (0.05) for all variables and therefore we accept null hypothesis h0, which states the existence of a unit root in all time series. After the same test all variables possess unit roots and became stationary only after we transformed them to their first differences. so they are integrated of order 1.

Table 1 .Unit Root Test

Variables	Test Techniques				Results Stationary
	ADF test (Prob)		P-P test (Prob)		
	Level	1st dif	Level	1st dif	
LGDP	0.1266	0.0034	0.0007	0.0000	1st diff
LM2	0.2777	0.0069	0.0847	0.0000	1st diff
LREER	0.0073	0.0126	0.0065	0.0000	1st diff
LDLOANS	0.3890	0.0000	0.0304	0.0000	1st diff
LTINF	0.1669	0.0000	0.2125	0.0000	1st diff
LDR	0.7901	0.0000	0.7832	0.0000	1st diff

Source: Eviews:12 output

5.2.Lag Selection of VAR : the table (2) determine the lag lenght order obtained throught unrestricted vector autoregressive (VAR) via:Schwartz Creteria (SC),Akaike Information Creteria (AIC) and Hannan Quinn Creteria (HQ), and throught the creterion values,the lag lenght order is (1).

Table 2 .Optimum lags length results

Lag	LogL	LR	FPE	AIC	SC	HQ
1	685.2236	1591.016*	9.73e-13*	-10.63179*	-9.661355*	-10.23766*

Source: Eviews:12 output

5.3.Cointegration test: According to Granger, the cointegration test is used to test the long equilibrium relationships between several variables (Regis Bournonnais, 2003)[32] so we will test the equilibrium relationship between GDP, TINF, DR, REER, DLOANS, M2. This presence equilibrium relationship between these variables is often verified through statistical procedures, the most used are those which Engle and Granger (1987) and Johansen (1988, 1991). According to the Dickey Fuller stationarity test performed on our various pre-selected variables, they are all integrated of order 1 that's mean, they are all I (1). This justifies the use of cointegration test Engle and Granger. The estimates are presented in the tables 03:

Table 3 .Johansen Cointegration Test

[32] Bourbonnais, R. (2003). Econometrics. Dunod: Paris, France.

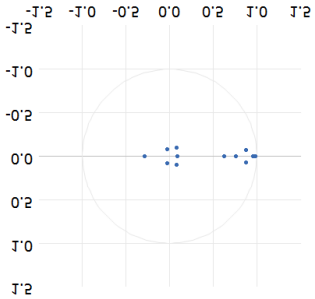
Hypot No. of	None *	At most 1*	At most 2*	At most 3	At most 4
Trace Sta	149.8157	92.08113	54.48664	32.37032	11.60346
Critical	95.75366	69.81889	47.85613	29.79707	15.49471
Prob.**	0.0000	0.0003	0.0105	0.0247	0.1770

Source: Eviews:12 output

The test results, we show that all variables are cointegrated at the 5% level. The null hypothesis of no cointegration is rejected because he trace test five (5) cointegration equation r=4 .

5.4. Model Stability Test: The Figure 1 presents the inverse roots of the AR characteristic polynomial associated with the different lag orders specified by the selection criteria.

Fig.1.Inverse Roots of AR Characteristic Polynomial



Source: Eviews:12 output

The results indicate that the estimated model fulfilled the conditions of stability as all Coefficients are smaller than one (VAR satisfies the stability condition) and all the roots lie inside the circle, Which means, the model not suffering of Serial Correlation and Heteroskedasticity problems. See Table 4, which shows the LM with 10 lag test value is less than the critical value, which leads us to accept the null hypothesis, that is, the model does not have Serial Correlation problem table no shows probability of Chi-sq 0.28, is greater than the significance level 0.05, which leads us to accept the null hypothesis, which mean that the model does not have Residual Heteroskedasticity problem.

Table 4. Heteroskedasticity Tests and Serial Correlation LM Tests

Lag	Prob.	Prob.
1	0.0881	0.0886
6	0.0718	0.0722
10	0.3359	0.3368
Chi-Sq	df	Prob.
527.0932	504	0.2304

Source: Eviews:12 output

5.5. Impulse responses and variance decomposition:

Figure 2 : shows panels of impulse response graphs indicating how innovations in respective monetary policy variables affect gdp in Algeria over a 10 period Each

panel illustrates the response of the non- policy variable to a one standard deviation innovation (corresponding to a positive shock) in the policy variable.

Graph 2: reveals that the response of GDP to an expansionary shock in the money supply measured by M2. has negative effect on GDP of up to - 0.012% This evidence rules out the ikely existence of the liquidity puzzle in Algeria in meduim run As if These shocks are expected by economic agents This response is consistent with our a priori expectation as presented in the theory of rational expectations Lucas 1972 model, developed in the United States from the 1970's, no action of economic policy (monetary and fiscal) is able to act effectively on economic activity, unless contains an element of surprise.the results are similar to that of Siami VAR Model (2018).)Hamdan (2017، we conclude A expansionary monetary policy generally is expected to increase the gdp level, not reduce it. Results indicate the existence of liquidity puzzle in algeria over the period studied. It is also suggested that monetary policy shocks are not only the dominant sources of gdp .

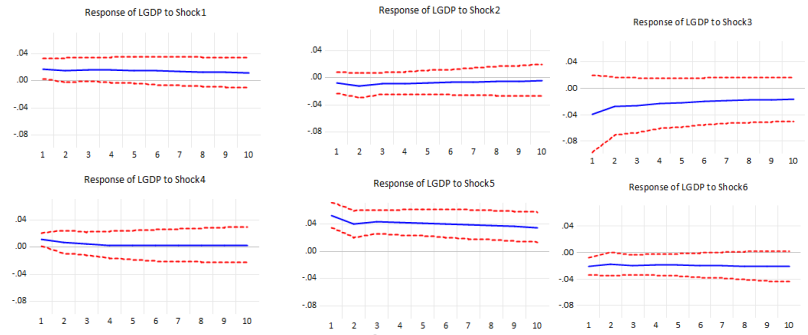
Graph 3: we observe that a negative innovation in the real exchange rate of up to 0.039% in the short run, this response is not consistent with theoretical expectations. Because, the real exchange rate (i.e. a real depreciation) increases gdp with the positive effects. This response is theoretically consistent especially for an open economy with many trading partners like Algeria and practically, this is startling because depreciation of the real exchange rate should make local tradable goods more competitive globally and hence increase the demand for the local commodities.

Graph 4: we note that positive innovation in loans to the economy reaches 0.011% in the short term, and then in the long run it decreases to 0.03%. This response is somewhat in line with economic theory. Because loans directed to the economy increase the gross domestic product because they increase development projects, especially investments within the country, especially in the situation in Algeria, which leads to improving some incomes and raising them.

Graph 5: shows the response of GDP to an expansionary shock in inflation (one standard deviation). Has negative effect on GDP of up to 0.035 % for long period it has an insignificant effect because inflation led to a decrease of domestic currency value due to increases prices and consequently a decrease in domestic demand and it is what matches with monetary Theories.

Graph 6: Shows the response of GDP to a deflationary shock at the first standard deviation. Here, the GDP rises slowly over the first three period, but declines rapidly by -0.002% over the long term and then stabilizes at the new level. This response is consistent with our a priori expectations as presented by the traditional Keynesian IS-LM model. From a practical point of view, we note that there is no immediate response to the discount rate shock on economic growth in Algeria. It is an affirmation of the functioning of the banking system in Algeria and its limits, which gives us an explanation for the relative effectiveness of the tool and it is limited to liquidity management. The GDP is simply an affirmation of the thin and relatively inaccessible nature of the credit markets in the economy.

Fig.2.panels of impulse response graph



Source: Eviews:12 output

5.6.Variance decomposition: In this section, we conduct an analysis of variance analysis that aims to gain insight into the impact of monetary policy changes in Algeria on economic growth as a policy objective in investigating the mechanism.

Table 5 shows that, along with its own changes, changes in the inflation index (consumer price index) are largely explained by changes in GDP. The results reveal that the changes in inflation represent 56.54 percent of the fluctuations in the GDP. This indicates that the monetary authorities respond to a large extent to fluctuations in GDP by adjusting prices without forgetting the impact of the real exchange rate, which also represents 28.94 percent of fluctuations in GDP in the short and even long term, and this is due to the many and permanent changes that occur. It is carried out by the monetary authority in Algeria represented by the Central Bank, without forgetting its fluctuations due to what is happening in the country and abroad.

Table 5. Variance decomposition of GDP

Period	LGDP	LM2	LREER	LDLOANS	LTINF	LDR
1	6.195101	1.061841	28.94323*	2.475087*	52.99767	8.327072
2	6.703568	2.259093*	27.15316	2.250176	52.67621	8.957797
4	7.558223	2.235240	23.82819	1.540032	54.88041	9.957903
6	7.799282*	2.083762	21.54384	1.182922	56.54773*	10.84247
10	7.603828	1.763532	18.95025	0.929554	57.68433*	13.06850*

Source: Eviews:12 output

Conclusion:

This paper allowed us to study the macroeconomic effects of monetary policy shocks in Algeria using the SVAR structural autoregressive vector models approach. In addition, using quarterly data from the period 1990-2020, the results of the study were as follows:

-The occurrence of one positive structural shock in the total loans directed to the economy and the inflation rate estimated at 1% will have a significant negative impact on the real GDP in the short, medium and long term and will generate a negative impact.

As for the impact of the shock on the monetary mass, the real exchange rate, and the discount rate, it was positive. With regard to the response of the real GDP components, there is a significant positive effect in the short term, but in --the long term it remains constant. This means that the variables have a strong relationship with economic growth as explained by economic theory, especially since we knew

that monetary stability is absent in Algeria, and these variables are the ones that control it. .

These results show us that the expansionary monetary policies pursued in Algeria confer the characteristic of the relative ability of monetary policy in Algeria to influence economic variables, as indicated by the analysis of variance, as the monetary policy pursued by the state is unfortunately ineffective and has visible effects in the short and long term, and that the shocks Cash is transmitted through monetary policy channels.

In order to address the previous imbalances, we decided to make some suggestions through which monetary policy can play a role in economic development and support growth, as the public authorities should take into account the following aspects:

The independence of the Central Bank of Algeria and its formulation of monetary policy in line with the prevailing global economic conditions.

The monetary authority followed a strong plan in the area of the exchange rate, especially in the parallel exchange market, which has become a threat to the national economy.

- Mainstreaming financial inclusion and the necessity of imposing the electronic exchange of money in order to control the excessive liquidity that hinders the task of the monetary authority in controlling the volume of money circulating in the money market.

- Coordination between monetary and financial policies and the necessity of economic diversification and the promotion of foreign trade and thus improving the value of the Algerian dinar.

Modeling monetary policy tools and macroeconomic variables to access a future outlook in economic forecasting.

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