INTEREST RATES, INFLATION, AND GROWTH: INSIGHTS FROM BRAZIL'S MONETARY POLICY

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ABSTRACT

This paper examines the impact of monetary policy instruments on Brazil's economic growth from 1999 to 2023. Using annual macroeconomic data and applying econometric techniques including Ordinary Least Squares (OLS), Augmented Dickey-Fuller (ADF) tests, Variance Inflation Factor (VIF) analysis, and Durbin-Watson statistics, the study evaluates the relationship between GDP growth and key policy variables such as money supply, interest rate, and inflation. Results indicate that while the money supply exhibits a positive correlation with GDP growth, high interest rates and inflation tend to exert a dampening effect. The findings contribute to the understanding of how monetary policy shapes economic performance in emerging markets, offering implications for policymakers seeking sustainable growth strategies.

Keywords: Monetary Policy, Economic Growth, Money Supply, Interest Rate, Inflation, Brazil, Emerging Markets

JEL Classifications: E52, E31, E43, O54, C22

INTRODUCTION

A country's economic direction depends heavily upon monetary policy because it shapes the development of inflation while controlling interest rates and investment levels and directly impacts GDP. The central banking institution deploys monetary policy instruments which cover regulation of money supply with adjustments to interest rates along with open market operations for sustaining economic stability and enhanced sustainable growth. Research studies on the monetary policy-GDP connection present opposing arguments to explain this link. Keynesian economists endorse expansionary monetary policy methods that reduce interest rates to fuel borrowing activities leading to more investment in the economy. The monetarist view demonstrates that money remains neutral during long periods while excessive monetary growth only produces inflation instead of genuine GDP expansion. History-based empirical research conducts an analysis of monetary policy effects on GDP through statistical methods and recorded data. A study investigates economic growth response to monetary policy through evaluation of money supply and inflation rates alongside interest levels and government spending metrics. The study will explore the effectiveness of monetary intervention approaches when building stable economic development frameworks.

LITERATURE REVIEW

Numerous economic researchers have studied the monetary policy and GDP relationship. This section evaluates five research studies exploring economic growth effects of the monetary policy instruments which include money supply alongside interest rates and inflation rates. 1. Friedman (1968) – The Role of Money Supply in Economic Growth Milton Friedman established in his monetary policy research that changes in money supply create immediate economic effects which later shift into price modifications. Utilising historical data from the U.S. economy his research demonstrated that monetary policy expansion at first stimulates GDP growth through rate decreases that drive investment up. When a surplus of money supply exists, it results in inflation while actual productive output remains unchanged. 2. Bernanke & Blinder (1992) – The Credit Channel of Monetary Policy Bernanke and Blinder studied what part the banking system played in forwarding monetary policy effects that affect GDP growth. According to their research monetary policy strengthens economic growth by managing the interest rate but also controls the availability of credit. The researchers established that monetary tightening by central banks leads banks to lower their lending activity which causes investment rates to decline, and economic growth decelerate. Financial systems that have reached advanced development stages enable monetary policy tools to generate better efficiency. 3. Taylor (1993) – Interest Rates and GDP. Stabilization John Taylor developed the well-known rule that central banks need to set interest rates based on combinations of inflation rate and gaps in output. His research proved that correctly adjusted monetary policies create stable economic output by stopping both demand-driven inflation and overheating. The research of Taylor continues to serve as a foundation through which global central banks make their interest rate choices. 4. Barro (1995) – Inflation and Economic Growth Using a large database of global countries Barro performed research to study the link between inflation rates and GDP growth trends. Research conducted by Barro showed that neither fast nor slow levels of inflation create growth problems yet excessive inflation rates over 10-15% directly reduce GDP through market uncertainty and discouraged extended project investments. His research demonstrates that monetary policy operators should maintain stable low inflation rates because this helps stimulate economic development. 5. Mishra & Montiel (2013) – Monetary Policy in Developing Economies Mishra and Montiel researched how monetary policy functions in emerging market economies that possess underdeveloped financial systems. The study established that interest rate adjustments along with other monetary transmission tools operate weaker in developing countries because banks have restricted growth, and governments exercise more authority over economic management. Central banks operating in emerging markets require multiple policy instruments to succeed in influencing GDP levels. Conclusion The five presented studies establish a solid base for exploring monetary policy connexons to GDP. The impact of monetary interventions on economic growth remains conditional to how developed the financial markets function alongside the performance of inflation and the general trust in monetary policy. The research follows previous studies by executing a statistical examination of monetary policy effects on GDP using historical economic data through econometric models.

METHODOLOGY

Time-series data from Brazil allows this study to examine how monetary policy affects GDP through quantitative econometric research methods. This research evaluates monetary policy through three significant variables which include money supply and interest rates and inflation together with government expenditure and exchange rate as external influences. The research utilizes official economic reports and financial institutions to obtain its data which ensures consistent and reliable data collection. The research uses a multiple linear regression model to analyses how monetary policy affects economic growth because of its research characteristics.

The necessary initial step prior to running regression analysis includes evaluating key dataset features using descriptive statistical methods. This section reviews the distribution of selected variables and their values in addition to displaying their variability along with their central tendencies. The variables in question are GDP and money supply and also include inflation and interest rates and government expenditure and exchange rates. The following table presents the descriptive statistics for all variables including mean values and standard deviations alongside the minimum and maximum points.

DESCRIPTIVE STATISTICS

Variable	Obs	Mean	Std. Dev.	Min	Max
Inflation	33	197.246	617.944	3.195	2947.733
money supply	33	69.765	24.304	30.395	111.483
GDP	33	1.465e+12	3.459e+11	9.172e+11	1.955e+12
Exp gov	33	19.169	.834	17.063	20.928
Landing int	27	49.172	15.426	27.392	86.363
loc us	33	2.355	1.494	0	5.394
Interest	27	38.754	14.51	15.011	77.617
To	33	24.803	5.948	15.156	38.816

Economic stability was unstable during certain periods based on the wide range of inflation shown by a high standard deviation. Economic conditions throughout time produce significant variations within GDP and money supply data points.

Correlation Matrix

The analysis of GDP relationships with monetary policy variables uses a created correlation matrix. The matrix reveals magnitude along with the orientation of the linkages between different variables.

Matrix of correlations

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) time	1.000									
(2) money_supply	0.990	1.000								
(3) GDP	0.945	0.921	1.000							
(4) Exp_gov	-0.065	-0.035	-0.153	1.000						
(5) Inflation	-0.119	-0.115	-0.144	-0.225	1.000					
(6) Landing_int	-0.810	-0.809	-0.872	0.268	0.153	1.000				
(7) loc_us	0.788	0.806	0.567	-0.041	0.148	-0.497	1.000			
(8) Interest	-0.768	-0.771	-0.831	0.326	-0.016	0.979	-0.505	1.000		
(9) To	0.692	0.705	0.534	-0.400	0.241	-0.583	0.886	-0.628	1.000	
(10) dummy	0.616	0.650	0.642	-0.190	0.118	-0.724	0.457	-0.758	0.604	1.000

The correlation matrix provides essential information about different variables. The statistical value of 0.921 indicates significant positive association between increasing money supply and economic growth. The negative correlation strength between interest rates and GDP stands at -0.831 and confirms economic theory since rising interest rates lead to declining economic growth. The economic connexion between GDP and inflation displays a weak yet negative pattern (-0.144) which demonstrates that inflation plays only a limited role in directly influencing national economic production levels. This dataset indicates that government spending changes demonstrate only weak negative effects (-0.153) on GDP alterations. The analysis indicates economic growth takes a significant downturn when lending interest rates increase since these variables exhibit a powerful negative correlation at -0.872.

The generalised format for the regression analysis includes:

$GDP_t = \beta_0 + \beta_1 \text{MoneySupply}_t + \beta_2 \text{InterestRate}_t + \beta_3 \text{Inflation}_t + \beta_4 \text{GovExp}_t + \beta_5 \text{ExchangeRate}_t + \varepsilon_t$

GDP_t = Gross domestic product at time t (dependent variable).

Broad money supply (M2) functions as the parameter for measuring the economic liquidity at time t.

The Central bank's policy interest rate serves as InterestRate_t and controls borrowing and investment activities.

The variable inflation rate measures price level fluctuations through inflation_t.

The inclusion of GovExp_t represents government expenditure for controlling fiscal policy effects.

The exchange rate variable called ExchangeRate_t records external economic forces affecting GDP. The error term (ε_t) contains unobservable variables which influence GDP.

The Ordinary Least Squares (OLS) estimation technique serves as the method to measure monetary policy effects on GDP. OLS serves the task of linear relationship estimation yet diagnostic tests are implemented to verify result reliability. The Variance Inflation Factor (VIF) serves as an assessment tool to detect multicollinearity conditions in independent variables. Strong correlations show up as high VIF values during cheques so researchers should either remove variables or make changes to those affected variables. Heteroskedasticity detection occurs through the Breusch-Pagan/Cook-Weisberg test which verifies irregular variations in residual variances. Robust standard errors substitute standard errors when the analysis detects this problem. The Durbin-Watson statistics provide an examination of serial correlation among residuals for testing purposes. Lagged variables or Generalized Least Squares (GLS) serves as a correction method when these variables exist. The Augmented Dickey-Fuller (ADF) test provides information about the stationary state of the variables. First-difference transformations of variables become necessary when data contains non-stationary behaviour to prevent spurious regression results.

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Empirical results

This part showcases the outcomes derived from conducting econometric studies on monetary policy and GDP connexons. The results contain regression estimates together with diagnostic tests and extensive interpretation of primary findings. The study relies on Ordinary Least Squares (OLS) regression as a modelling technique accompanied by robustness cheques for validation purposes.

Linear regression

Inflation	Coef.	St.Err.	t-value	p-value	[95% Conf	Interval]	Sig
L.money supply	3.849	.745	5.16	0	2.317	5.381	***
Landing int	0	0	-4.04	0	0	0	***
L.To	-131.316	17.485	-7.51	0	-167.258	-95.374	***
Exp gov	4.123	.948	4.35	0	2.174	6.072	***
D.GDP	-12.851	2.928	-4.39	0	-18.868	-6.833	***
Constant	2425.344	352.382	6.88	0	1701.012	3149.675	***

Mean dependent var	48.363	SD dependent var	126.092	
R-squared	0.810	Number of obs	32	
F-test	.	Prob > F	.	
Akaike crit. (AIC)	356.143	Bayesian crit. (BIC)	363.472	

*** p<.01, ** p<.05, * p<.1

According to the reported R-squared value of 0.810 GDP's 81% variation gets explained through the independent variables. The F-statistic data in the document confirms statistical significance based on the analysis p-values. Akaike Information Criterion (AIC): 356.143 Bayesian Information Criterion (BIC): 363.472

The most noticeable relationship discovered that money supply directly influences inflation rates. The research shows that increasing the money supply by one unit will generate 3.849 percentage points of inflationary change. The classical monetary theory proves correct since excessive economic liquidity drives up inflation through increased aggregate demand. The relationship between monetary expansion and inflation holds significant statistical value ($p < 0.01$) indicating the need for controlled money supply management to avoid excessive price rises. Inflation increases by 4.123 percentage points when the government spends one percentage point more of its budget. Analyzing public spending patterns reveals its impact on demand-driven inflation if productivity growth fails to keep pace with those increases. The research highlights the need for financial control systems because government spending without proper management creates dangerous inflation problems and weakens monetary systems. According to the model analysis more open trade policies produce 131.316 percentage points of decreased inflation for each unit of trade openness increase. Price stability appears to be a common outcome among economies which achieve high trade integration because it triggers market competition together with lower import prices. Previous studies confirm this negative link between openness in trade and inflation because international exchange strengthens operational supply networks to reduce inflationary pressure in domestic economies. The dynamic evolution of inflation depends heavily on the rate at which an economy grows. One percentage point increase in GDP growth results in a reduction of inflation by 12.851 percentage points. Higher economic growth levels produce reduction in inflationary pressure through their impact on supply capacity improvement and productivity gains. Sustainable economic growth demonstrates a direct connection to price level

stabilization according to the research findings because it naturally helps to manage inflation. The model establishes lending interest rate has no direct impact on inflation because its coefficient equals zero. The economy contains structural elements that stop interest rate changes from being directly transmitted to inflation measurements. The inflationary effects from interest rate policies seem to reach inflation through secondary methods that include credit availability and investment behavior. Added investigations need to study the intricate relationships which emerge between fiscal rates and price stability and economic performance. The Akaike Information Criterion (AIC) values together with the Bayesian Information Criterion (BIC) indicate a suitable model fit but additional model adjustment will lead to improved predictive abilities. Inflation depends on effective monetary-fiscal coordination because these elements combine to drive changes in both monetary expansion and government spending as well as trade dynamics and general economic performance.

Variance inflation factor

	VIF	1/VIF
L.money supply	3.501	.286
Landing int	2.619	.382
L.To	2.564	.39
Exp gov	1.352	.739
D.GDP	1.12	.893
Mean VIF	2.231	.

Breusch-Pagan / Cook-Weisberg test for heteroskedasticity
Ho: Constant variance
Variables: fitted values of Inflation
$chi2(1) = 5.80$
$Prob > chi2 = 0.0161$

Durbin-Watson d-statistic(9, 26) = 1.202161

The reliability of regression results required several diagnostic tests for verification. The Variance Inflation Factor analysis showed elevated values for money supply and lending interest rate which indicates significant variable correlations within the explanatory variables. The Breusch-Pagan/Cook-Weisberg test yielded a chi-square value of 5.80 (p = 0.0161) thus confirming the existence of heteroskedasticity which means the residuals have a non-uniform variance distribution. To solve this, we conducted a robust regression which made sifter possible problems with heteroscedasticity. The Durbin-Watson test inspection of autocorrelation revealed a 1.202 statistic indicating positive autocorrelation possibilities in residual values that suggest previous GDP measurements could impact current GDP results. Standard error accuracy and coefficient estimate precision were verified through robust error methods as well as various model modifications because these analytical issues existed.

Policy Recommendations

The economic growth and stability depends on a carefully planned understanding between monetary policies. The extensive connection between money supply and GDP demonstrates central banks should conduct liquidity expansion while avoiding inflationary consequences. The stability of prices gets affected by fast monetary supply increases yet rigorous monetary controls restrain economic development. A balanced strategy that builds investment and

consumption rates needs to be implemented to avoid economic overheating. The management of interest rates takes equal importance because increased borrowing expenses create negative effects on GDP. A flexible interest rate system enables businesses to invest when the economy declines without causing market-wide inflation during times of fast growth. Monetary policy rules driven by data including the Taylor Rule help policymakers adjust interest rates according to economic fundamentals during policy-making decisions. Inhibition of inflation stands as an essential objective for economic policy. Economic growth does not undergo big changes from inflation itself yet continuous price increases damage both consumer purchasing abilities and business investment assurance. Managing inflation requires both an inflation-targeting system supported by fiscal restrictions to stop economic volatility. Financial institutions need to be strengthened combined with better credit accessibility to transform monetary policy effects in real economic impacts. The relationship between fiscal policies and monetary policies needs to be organized and synchronized better. Public resources should be allocated to infrastructure development together with technological investments while maintaining inflation stability. The monetary policy needs to overcome structural barriers by decreasing external debt dependence and stabilizing exchange rates which will improve its resilience. Implementing a well-planned approach between fiscal discipline and monetary policies with financial sector reforms and economic stability will create favorable conditions for monetary interventions to support GDP growth.

CONCLUSION

This investigation demonstrates that monetary policy strongly affects Gross Domestic Product because three key components of money supply and interest rates and inflation control economic development patterns. The actual research tests demonstrate that proficient monetary intervention implementation creates economic growth, but inadequate policy management might cause economic breakdowns. Thoughtful application of expansionary monetary policies helps stimulate economic growth yet careless policy measures lead to price increase difficulties. The requirement for controlled policy shifts becomes evident because increased interest rates create obstacles to consumption and investment patterns. The impact that monetary policy has relies heavily on both active fiscal policy coordination and an efficient financial system for the policy to work effectively. An enhanced monetary policy transmission mechanism together with controlled inflation rates and developed financial sector will lead to maximum policy effects. Exchange rate volatility together with external debt dependence must receive attention because they ultimately strengthen policy effectiveness. Long-term economic growth requires both a monetary policy that uses accurate data and supportive fiscal management. Future studies need to examine the complete interactions between monetary and fiscal policies by studying broader economic conditions with a focus on specific characteristics of each nation.

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