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Golden Insights: Analyzing the Influence of Economic Indicators on Sovereign Gold Bond Performance in India

Sathish Pachiyappan[1], Chandrakala G[2], Arya Mishra[1], Keerthana K[1], Samiksha Kumari[1], Tanvi Verma[1]

[1]School of Business and Management, Christ University, Bangalore, India, [2]School of Commerce and Management studies, Dayananda Sagar University, Bangalore, India. *Corresponding Author's Email: chandrakala-socm@dsu.edu.in

Abstract

India has been the leading consumers of gold with the consumption of around 774 metric tons in 2022. The demand for gold in India is majorly associated with its culture, tradition, attractiveness, and the source for financial security (GJC,n.d.)The gold market in India plays a vital role in the economy as a stable asset and hedge against inflation due to its ability to hold value over time. In order to limit the import of gold and reduce the country's current deficit, the Indian Government introduced Sovereign Gold Bonds in 2015 as a substitute to physical gold. As SGBs export-import values are backed by Reserve Bank of India (RBI) they are considered as an inflation hedging tool. The study aims to examine the effectiveness of SGBs, in the changing economy by understanding the impact of key economic indicators – Inflation Rate, Exchange Rate, Per Capita Income, Gold Prices, and GDP Growth Rate—on the performance of Sovereign Gold Bonds (SGBs) in India. 36 months observations of the selected macroeconomic variables and series wise released prices are collected for a period starting from September 2021 till August 2024 for the analysis. Descriptive statistics is applied to understand the characteristics of the variables. Further, correlation and ordinary least square method is used to check the existing relationship and impact level of macroeconomic variables on SGBs. Lastly, both long run and short run relationships of these variables are analyzed using the Autoregressive Distributed Lag Model (ARDL).

Keywords: ARDL, Exchange Rate, GDP, Gold Prices, Inflation Rate, Sovereign Gold Bonds.

Introduction

The Indian government introduced sovereign gold bonds (SGBs) in 2015 as an alternative to physical gold investment, with the goal of reducing demand for gold imports while still providing a secure, interest-bearing investment option tied to gold's market value. The allure of SGBs comes from their dual benefit: investors receive periodic interest payments, and the principal amount grows incrementally with gold prices. This process provides SGBs with a practical inflation hedge, particularly for an economy like India, where inflation, volatility is a constant concern. The rationale for this investment is that whenever inflation rises, it will also raise the price of gold, conserving the purchasing power of the bondholder's investment. Gold has always been perceived as one of the safest assets, especially during periods of economic uncertainty. Studyfound that gold could serve as a long-term inflation hedge; however, its short-term volatility complicates its role (1). Sovereign gold bonds that are linked to gold have been marketed as offering equivalent to inflation protection. While international research on gold's inflation-hedging abilities is largely studied, the value of SGBs in the Indian economy has relatively less study. Unique inflation dynamics, fluctuating gold prices, and macroeconomic volatility, provides an unusual backdrop for analyzing SGBs as an inflation hedge. It is important to understand that inflation can scrape the real returns of investments, which makes it essential for investors to entreat assets that preserve their purchasing power. There are significant barriers to maintaining investment value when there is inflation, which makes gold and SGBs appealing during inflationary times (2). Yet, the complex connection in India between gold prices, inflation, and other macroeconomic indicators is influenced by both domestic factors and global market conditions. Over the last ten years, the Indian economy has experienced significant macroeconomic shifts and despite

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policy interventions, inflationary pressures continue to exist. Moreover, foreign monetary policies, changes in currency rates, and movements in commodity prices all contribute to global variables that increase uncertainty. It is crucial to comprehend how SGBs respond to different inflationary scenarios and whether or not these changes in dynamic factors allow them to provide the same level of inflation protection as actual gold. Earlier studies have emphasized the multiple factors influencing gold prices and their relation to inflation. Researchers studied the performance of gold, which brought attention to gold's dual role as a long-term stable asset and a short-term volatility commodity (3). The focus of this work is to fill a research requirement brought by the unique characteristics of inflation, exchange rates, and investor behavior in the Indian context. It is more challenging to assess sovereign gold bonds' effectiveness as a hedging instrument because, unlike real gold, SGB's contain an interest component. In this backdrop, the study presents the effect of macroeconomic variables on SGB. The study is planned as follows: First phase reviews the literature on inflation hedging and the role of gold and SGBs. The second phase consists of the methodology of the study, outlining the econometric models used. Finally, discusses the empirical results, and provides concluding remarks on the effectiveness of SGBs as an inflation hedge in India. Macroeconomic theory studies the overall structure of the economy, with an emphasis on inflation and national income. Both the Inflation Hedge Theory, which holds that some assets, including gold and Sovereign Gold Bonds (SGBs), can guard against inflation by retaining or increasing value, and an understanding of inflation—a general rise in prices and reduction in purchasing power—are essential. This theory is crucial to our research as it offers a framework for examining the ways in which macroeconomic variables—interest rates and inflation in particular—affect the performance of SGBs as means of investment. This study explores the positive impact of SGBs on the Indian economy and analyses how their returns are correlated with key macroeconomic variables. Besides, the study intends to provide insights for traders and policymakers, strengthening the knowledge of SGBs as prudent investments in an inflation-prone climate by examining them besides other financial assets. This literature study provides a thorough explanation of how gold, especially in the form of SGBs, belongs into larger inflation protection plans. It also evaluates how well SGBs mitigate inflationary risks in comparison to other assets. Earlier studies indicated correlation between inflation and security returns and laid foundations for subsequent research on inflation and asset pricing also provided the framework for examination of inflation hedging (4). Based on that, Camba-Mendez (n.d.) investigated the relationship between sovereign bond yields and inflation risk, an area that is directly related to apply gold as an inflation hedge. Introduced in India, Sovereign Gold Bonds offer an original application for inflation hedging products by addressing the cultural and financial value of gold, in addition to providing inflation protection. Studies have shown that gold has two characteristics: it is stable over the long run, but it is volatile over the short term. Augmented Dickey-Fuller (ADF) test was used which showed how diverse gold performs as an inflation hedge (5). The findings on gold's efficiency as an inflation hedge, however, continue to be contradictory. According to several studies, there appears to be a regime-dependent relationship between gold prices and inflation, with gold showing distinct characteristics before and after the global financial crisis of 2008 (6, 7). As an illustration, gold demonstrated some hedging potential prior to the financial crisis, but its enactment following the crisis was less steady, casting doubt on its suitability as a long-term hedge. The significance of considering time-varying models to precisely evaluate gold's hedging qualities has also been highlighted in research and also reflected examination of time-dependent parameter VAR models (8, 9). Additionally, regional research offers different perspectives regarding the efficacy of gold. Gold has been found to be a partial inflation hedge with stronger long-term correlations in states like the UK and the USA (10). Conversely, research conducted in India emphasizedthe cultural and economic function that gold plays, where the metal acts as a hedge against rising inflation as well as an investment (11). This conversation is further enhanced by Jakobsson's (n.d.) research on the Swedish stock market that focuses on the connection between macroeconomic variables and gold prices during periods of financial instability,

including the COVID-19 epidemic and the 2008 financial crisis. According to these studies, gold is still an asset in a variety of economic situations even though its hedging function varies depending on the region. Several studies have used advanced techniques to evaluate the prospective for gold to hedge against inflation. For example, a Fractional Co-integrated Vector Autoregressive (FCVAR) model was utilized to assess the long-term correlations between inflation and asset values (12). By capturing the persistence and structure fractures in financial data, this method offers deeper insights into the long-term responses of gold, stock markets, and real estate prices to inflation. The gold-inflation relationship was investigated in two studies using the Nonlinear ARDL (NARDL) model. According to analysis of data from six nations, gold is a reliable long-term inflation hedge in the US and the UK, while the evidence is less clear in China and India. Investigation in Vietnam discovered an asymmetry link between gold and inflation, concluding that the metal is not a trustworthy inflation hedge there (13, 14). New research is progressively focusing on gold in non-traditional forms, including Sovereign Gold Bonds (SGBs). In addition to the appreciation in value of gold, these bonds, which are insured by the Indian government, give an additional interest rate, making them possibly a more reliable investment during periods of inflation. The effect of SGBs on liquidity in the markets and physical gold demand, especially during Indian festivals are examined (15). The value of SGBs as a hedge against inflation is largely due to their ability to stabilize market conditions and lessen the need for actual gold, as demonstrated by this research. Scholars have also employed sophisticated techniques like mean-variance optimization and Monte Carlo simulations to assess performance of SGBs in diversified portfolios (16). These techniques assist in striking a balance between risk and return, proving the effectiveness of SGBs in boosting portfolio stability, especially for investors who are risk adverse. Studies on other financial assets compare the performance of gold against other financial assets in different economic environments by examining how US equities, bonds, and T-bills perform as inflation hedges (17). These studies demonstrate that although gold and SGBs can operate as reliable hedges, the selection of assets should reflect sector-specific characteristics and the overall economic situation. From the review of numerous studies, it is clear that there are still gaps in the literature regardless of the progress that has been made in our understanding of gold's hedging potential. Numerous studies do not fully explore the influence of SGBs on market behavior and inflationary control, instead focusing solely on comparing them to actual gold (18). Further investigation is also required on the relationship between SGBs and more general macroeconomic factors like GDP growth, exchange rates, and income levels, particularly in the Indian context where gold is significant both culturally and economically. The fluctuations in inflation pose difficulties for investors looking for maintaining their purchasing power. The effectiveness of Sovereign Gold Bonds (SGBs), which are touted as a safe investment correlated with gold prices and a potential hedge towards inflation, is yet neglected given India's distinct economic environment. The objective of this study is to assess Sovereign Gold Bonds' (SGBs) effectiveness in protecting against inflation in India. To examine the connections between SGB returns and a range of economic variables, such as GDP growth, inflation rates, and gold prices, rates of interest, financial status, and exchange rates in the short run as well as long run. The Hypotheses of the study are framed as follows:

H_1: Inflation Rates have significant influence on returns on Sovereign Gold Bonds (SGBs) in the long run.

H_2: Per Capita Income have significant influence on returns on Sovereign Gold Bonds (SGBs) in the long run.

H_3: Exchange Rates have significant influence on returns on Sovereign Gold Bonds (SGBs) in the long run.

H_4: Gross Domestic Product has significant influence on returns on Sovereign Gold Bonds (SGBs) in the long run.

H_5: Gold Prices/ Rates have significant influence on returns on Sovereign Gold Bonds (SGBs) in the long run.

H_6: Inflation Rates have significant influence on returns on Sovereign Gold Bonds (SGBs) in the short run.

H_7: Per Capita Income have significant influence on returns on Sovereign Gold Bonds (SGBs) in the short run.

H_8: Exchange Rates have significant influence on returns on Sovereign Gold Bonds (SGBs) in the short run.
H_9: Gross Domestic Product have significant influence on returns on Sovereign Gold Bonds (SGBs) in the short run.
H_{10}: Gold Prices/ Rates have significant influence on returns on Sovereign Gold Bonds (SGBs) in the short run.

Methodology

The details of the variables can be found in Table 1. This research analyses the influence of economic indicators on the performance of Sovereign Gold Bonds in the Indian Economy for the period of 2021-2024. The analysis is conducted within the time frame defined by the data availability for Sovereign Gold Bonds in India. Also, the time period captures the post-pandemic economic recovery phase, significant global inflation trends and other economic indicators that directly impacted the investor behaviour and gold-related financial instruments like Sovereign Gold Bonds in India. The study incorporates monthly data sourced from Bloomberg terminal and other recognized databases and applies the statistical software EViews for conducting our research. The study did not compare other gold investment avenues to maintain a focused analysis on Sovereign Gold Bonds, which are unique due to their government backing, fixed interest component, and policy-driven nature. Including other avenues could dilute the depth of analysis specific to SGBs.

Table 1: Variable Description

Endogenous Variable	**Variable Definition**	**Unit of Measurement**	**Reference Period**	**Source**
SGB	Sovereign Gold Bonds	INR	2021-2024	BSE
Exogenous Variables	Variable Definition	Unit of Measurement	Reference Period	Source
IR	Inflation Rates	%	2021-2024	Bloomberg
PCI	Per Capita Income	INR	2021-2024	Statista
ER	Exchange Rates	%	2021-2024	Bloomberg
GDP	Gross Domestic Product	%	2021-2024	Bloomberg
GR	Gold Prices/ Rates	INR	2021-2024	Rupee rates database

The selected macroeconomic indicators were chosen based on their direct and historically observed impact on gold investment behavior. Factors like inflation, income levels, exchange rates, GDP, and gold prices are closely linked to investor sentiment, purchasing power, and the attractiveness of gold as a hedge, making them highly relevant for analyzing SGB performance. The model includes Sovereign Gold Bonds as endogenous variables, while Inflation rates, Gold rates, per capita income, GDP Growth and Exchange rates as exogenous variables. To investigate whether economic indicators affect Sovereign Gold Bonds, the hypotheses are determined as follows: The Autoregressive Distributed Lag (ARDL) bounds testing approach has been used in this paper to observe the impact of economic indicators on the performance of Sovereign Gold Bonds in India. The ARDL Modeling Approach was originally introduced and further extended (19, 20). This model estimates the short run and long run components of the data concurrently. This method has the ability to hold the variables that are integrated of different orders, especially I(0) and I(1). The ARDL model also has the ability to be effective for small sample sizes, providing reliable estimates even when data points are limited. This procedure also provides unbiased estimates of the long run model and valid t-statistic even when some of the regressors are endogenous. Considering the above advantages, ARDL-UECM employed in this study has the following form as expressed in Equation [1].

$$\Delta \ln SGB_t = \boldsymbol{\beta}_0 + \sum_{i=1}^{n} \delta_1 \Delta \ln IR_{t-i} + \sum_{i=1}^{n} \delta_2 \Delta \ln GR_{t-I} + \sum_{i=1}^{n} \delta_3 \Delta \ln PCI_{t-i} + \sum_{i=1}^{n} \delta_4 \Delta \ln GDP_{t-i} + \sum_{i=1}^{n} \delta_5 \Delta \ln ER_{t-I} + \boldsymbol{\beta}_1 \ln SGB_{t-I} + \boldsymbol{\beta}_2 \ln IR_{t-I} + \boldsymbol{\beta}_3 \ln GR_{t-I} + \boldsymbol{\beta}_4 \ln PCI_{t-I} + \boldsymbol{\beta}_5 \ln GDP_{t-I} + \boldsymbol{\beta}_6 \ln ER_{t-i} + \varepsilon_t \quad \text{.....[1]}$$

SGB represents the historical trade prices of Sovereign Gold Bonds. IR is inflation rates. GR and PCI represent physical gold rates and per capita income respectively. GDP reflects the GDP Growth of the country and ER is the Exchange rates. t is the time dimension; Δ denotes a first difference operators and $\boldsymbol{\beta}$ is an intercept. At first, in the ARDL bounds testing approach, estimate Equation [1] by Ordinary Least Squares in order to identify the existence of a long run relationship among the variables by conducting an F-test to test the joint significance of the variables. Two sets of critical bound values for the F-statistic are generated (21). If the calculated F-statistic falls below the lower bound critical value, the null hypothesis of cointegration cannot be rejected. Contrary, if the computed F- statistic lies above the upper bound critical value; the null hypothesis is rejected, implying that there is a long-run cointegration relationship amongst the variables in the model. Further, once cointegration is established, the conditional ARDL long-run model for EXP_t can be estimated as expressed in Equation [2]. All variables are previously defined. This involves selecting the orders of the ARDL (p, q) model using Akaike Information Criterion (AIC). Finally, we obtain the short-run dynamic parameters by estimating an error correction model associated with the long-run estimates. This is specified as follows in Equation [3].

$$\Delta \ln SGB_t = \boldsymbol{\beta}_0 + \sum_{i=1}^{n} \delta_1 \Delta \ln IR_{t-I} + + \sum_{i=1}^{n} \delta_2 \Delta \ln GR_{t-I} + + \sum_{i=1}^{n} \delta_3 \Delta \ln PCI_{t-I} + + \sum_{i=1}^{n} \delta_4 \Delta \ln GDP_{t-I} + + \sum_{i=1}^{n} \delta_5 \Delta \ln ER_{t-I} + \varepsilon_t \quad \text{.....[2]}$$

$$\Delta \ln SGB_t = \boldsymbol{\beta}_0 + \sum_{i=1}^{n} \delta_1 \Delta \ln IR_{t-I} + + \sum_{i=1}^{n} \delta_2 \Delta \ln GR_{t-I} + + \sum_{i=1}^{n} \delta_3 \Delta \ln PCI_{t-I} + + \sum_{i=1}^{n} \delta_4 \Delta \ln GDP_{t-I} + + \sum_{i=1}^{n} \delta_5 \Delta \ln ER_{t-I} + \phi ECM_{t-1} + \varepsilon_t \quad \text{.....[3]}$$

Where:

- δ_1, δ_2, δ_3, δ_4, and δ_5 are the short-run dynamic coefficients.
- ϕ is the speed of adjustment parameter.
- ECM_{t-1} is the error correction term from the long-run relationship.

Results and Discussion

Descriptive Statistics

The effectiveness of Sovereign Gold Bonds in hedging against inflation was analyzed by examining the relationship between the historical data of Sovereign Gold Bonds from BSE (Bombay Stock Exchange) and various economic factors such as Inflation rates, Gold prices, GDP Growth, Per Capita Income (in Rs.), and exchange rates in India by considering 36 monthly observations for the period of 2021-2024. This empirical study encompasses static and dynamic forecasting to accurately identify the implications of inflation rates and other economic indicators on the performance of sovereign gold bonds to hedge against rising prices and to study its efficiency as a safe investment. Firstly, this research segment includes descriptive statistics, Unit root tests, Correlation Analysis, ARDL Bound F Test, ARDL Long run and Short run co-efficient estimation, Residual diagnostics and Stability test. The Autoregressive Distributed Lag (ARDL) bounds testing approach has been employed in this study to understand the performance of sovereign gold bonds to hedge against inflation. The ARDL model approach was initially introduced and further extended (19, 20).

Table 2: Descriptive Statistics

Frequencies	SGB	IR	GR	PCI	GDP	ER
Mean	5630.619	3.515	5076.932	174597.3	0.386	80.528
Median	5381.375	3.770	5008.870	168565.5	0.300	82.250
Maximum	7749.000	9.940	6779.080	210013.0	1.400	83.890

Minimum	4652.500	-1.05	4119.100	151520.0	-0.100	73.640
Std. Dev	952.353	2.050	696.836	16394.91	0.382	3.348
Skewness	0.809	0.198	0.804	0.623	0.884	-0.890
Kurtosis	2.603	4.602	2.790	2.372	3.161	2.186
JB Test (P Value)	0.124	0.129	0.139	0.232	0.094	0.056
Observation	36	36	36	36	36	36

Table 2 depicts the summary of descriptive statistics. With sovereign gold bonds signaling the performance of safe investments, inflation rates, gold rates, per capita income, GDP growth and Exchange rates reflecting the performance of the Indian economy, mean value shows the average level of each variable during the study period. The highest mean score is per capita income, and the lowest standard deviation is found in GDP. Further minimum and maximum values have been identified through each variable. All the variables are positively skewed, indicating that the data is not normally distributed. The kurtosis value of IR and GDP is greater than three which means the peak-ness of the curve. The other variable, such as SGB, GR, PCI and ER, shows less than three, indicating flatness than the normal distribution curve. Finally, the p-value of the JB Test is greater than 5%, which suggests that the data is expected to follow a normal distribution at a 5% significance level.

Unit Root Test

Before employing the ARDL model, all the variables are tested for stationarity. Stationarity explains whether the mean and variance are constant over a period of time. Table 3 shows the Unit Root test results using the Augmented Dickey-Fuller test and Philips perron test (22, 23).

Table 3: Augmented Dickey-Fuller Test and Phillips Perron Test Results

Variables	**ADF Test**		**PP Test**		**Result**
	At level	First Difference	At level	First Difference	
SGB	2.03	-8.18*	1.00	-18.95*	I(1)
IR	-3.43*	-	-3.34*	-	I(0)
GR	1.20	-6.76*	3.13	-19.58*	I(1)
PCI	1.53	-4.46*	0.27	-50.73*	I(1)
GDP	-3.27*	-	-3.65*	-	I(0)
ER	-2.14	-8.18*	-2.43	-25.35*	I(1)

Note: *,**,*** indicate one, five and ten per cent significance levels, respectively

The ADF test is used to check for the unit root in each variable and determine the order of integration (24). The unit root test results in Table 3 confirm that all the variables are I(1), except inflation rates and Gross Domestic Product which is I(0). Since the variables are either I(1) or I(0), the ARDL process is applied.

Correlation Analysis

Table 4 depicts the correlation analysis to establish the relationship between SGB and other variables

Table 4: Correlation Analysis

Variables	SGB	IR	GR	PCI	GDP	ER
SGB	1	-	-	-	-	-
IR	0.127	1	-	-	-	-
GR	0.453*	-0.047	1	-	-	-
PCI	0.366**	-0.001	0.148	1	-	-
GDP	-0.303***	0.271	-0.068	0.042	1	-
ER	-0.161	-0.055	-0.157	-0.022	0.277	1

Note: *, **, *** indicate one, five and ten per cent significance levels, respectively

The table 4 results show a positive and significant relationship between SGB and gold rates (r = 0.453, P< 0.01). It could be inferred that as gold rates increase, the performance of sovereign gold bonds also tends to increase. Similarly, a positive and significant relationship exists between SGB and PCI (r = 0.366, P<0.05). It can be concluded that, when the Per capita Income increases, the performance of SGBs also increases, indicating that individuals invest in SGBs with an increase in their income. On the other hand, we identify an inverse and significant relationship between GDP and SGB (r = -0.303, P<0.10). It implies that higher GDP growth is associated with lower SGB performance. However, Inflation rates and Exchange rates do not have a significant relationship with SGBs.

Bounds F-test for Co integration

Table 5 depicts the results of the ARDL Bounds F-test for the Co integration relationship. The appropriate lag length taken is 3 which were selected on the basis of automatic selection.

Table 5: Results of Bound Test Approach to Cointegration

F statistics	1%		5%		10%	
	I(0)	I(1)	I(0)	I(1)	I(0)	I(1)
4.342***	3.06	4.15	2.39	3.38	2.08	3

*** indicates that computed statistic falls above the value of the upper bond at ten per cent significance level

The ARDL Bound F-test results expressa long-run association between IR, GR, PCI, GDP, ER and SGB has been established through the ARDL Bound F-Test in the above table. The Bound F-test for co-integration compares F statistics and critical values (21). To make a conclusive decision about long-run association among the chosen variables, the study considers a 1% level of significance as the critical value, which is consistent (21, 25). The variables are co -integrated if F statistics is greater than the lower bound and upper bound value of the critical value. Conversely, no co-integration is implied if the computed F statistics are lesser than the lower bound and upper bound value of the critical value. The findings are not inclusive, though, if the computed F statistic falls between upper and lower bound values. All the evaluated models have a co-integration (long-run association), according to the study findings therefore, the analysis may draw the conclusion that, over time, SGB and other exogenous variables move in tandem.

Long Run Estimates

After the existence of co-integration relationship among the variables is confirmed, the long run coefficients of the selected ARDL (1, 1, 3, 1, 2, 0) model is estimated and the results are shown in Table 6.

Table 6: Estimated Long Run Coefficients using the ARDL (1, 1, 3, 1, 2, 0) model.

Variable	Co-efficient	t-stats
IR	28.825	2.045***
DGR	0.883	3.365*
DPCI	-0.009	-1.324
GDP	29.271	0.322
DER	-3.514	-0.099
C	-76.820	-1.008

The above table presents the ARDL long run coefficients of the chosen variables. It is observed that the Inflation Rate (IR) has a positive and significant impact (β = 28.825, p<0.10) on the dependent variable, indicating that a 1% change in the inflation rate leads to a 28.825% change in the dependent variable in the long run. Gold rates, on the other hand, also have a positive and significant influence (β = 0.883, p<0.01), indicating that, in the long run, a 1% change in DGR will translate into a 0.883% change in Sovereign Gold Bonds. On the other hand, other variables such as DPCI, Per Capita Income (β = -0.009, t-stat = -1.324), GDP (β = 29.271, t-stat = 0.322), and DER, Exchange Rates (β = -3.514, t-stat = -0.099) does not have a significant influence on the dependent variable, as their t-statistics do not meet the thresholds for significance. Hence, H_1 and H_5 are accepted.

Short Run Dynamics

The results of short run dynamic coefficients associated with the long run relationships are shown in Table 7. The optimal lag length for the selected error correction representation of the ARDL (1, 1, 3, 1, 2, 0) model is taken as 3.

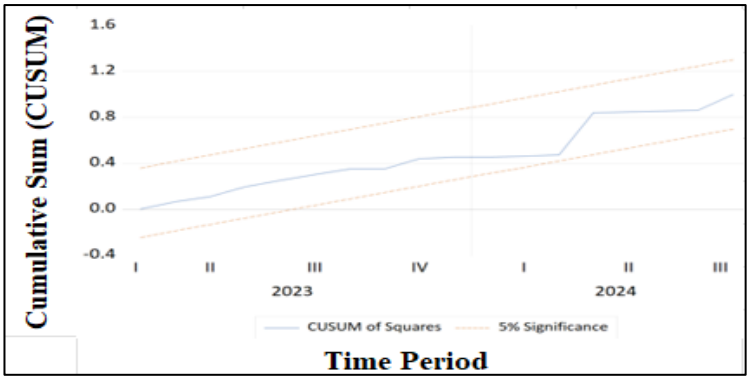
Table 7: Error Correction Representation for the Selected ARDL (1, 1, 3, 1, 2, 0) model.

Variable	Co-efficient	t-stats
IR	-0.539	0.069
DGR	0.400	6.018*
DGR(-1)	0.010	0.114
DGR(-2)	0.147	2.134**
DPCI	0.001	0.878
GDP	-78.699	-2.109**
GDP(-1)	-111.058	-2.795**
ECT(-1)	-0.881	-6.366*
R^2	0.863	
DW Test	1.850	
Residual Diagnostic	0.075	
Presence of Heteroskedasticity	YES (P<0.10)	
Presence of Autocorrelation	0.842 NO (P>0.10)	

Note: *, **, *** indicate one, five and ten per cent significance levels, respectively

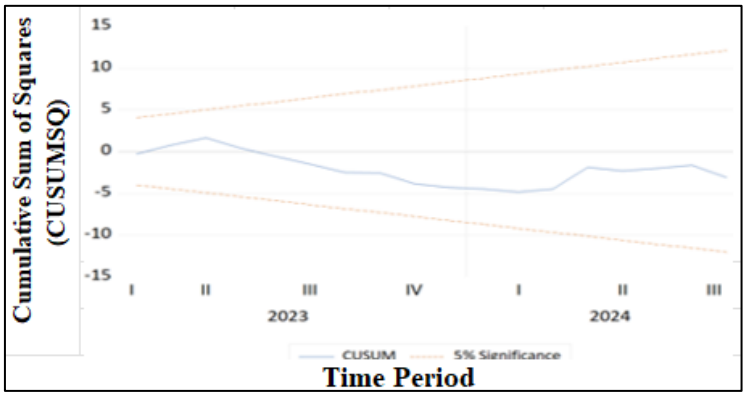
The above table presents the ARDL Short Run Coefficients (1, 1, 3, 1, 2, 0), indicating the immediate impact of several regressors on the SGB. It is observed that the coefficient for the Inflation Rate is negative (-0.539) but statistically insignificant (t-stat = 0.069) which implies that changes in the inflation rate do not have a significant short-run effect on the sovereign gold

bonds. In contrast, the immediate value of Gold Rate has a positive and highly significant impact on the dependent variable, as indicated by a coefficient of 0.400 and a t-statistic of 6.018*. However, the lagged value (DGR(-1)) is not significant (t-stat = 0.114), suggesting that past values of DGR do not affect the dependent variable, whereas the two-period lag (DGR(-2)) shows a statistically significant positive impact (t-stat = 2.134**), indicating that the dependent variable responds to changes in the growth rate after a two-period lag. The DPCI has a positive (0.001) coefficient but is statistically insignificant (t-stat = 0.878), indicating that it has no short-term significant impact on the dependent variable. The DPCI has a positive (0.001) coefficient but is statistically insignificant (t-stat = 0.878), indicating that it has no short-term significant impact on the dependent variable. The co-efficient of Sovereign Gold Bonds is significantly impacted negatively by GDP, with a coefficient of -78.699 (t-stat = -2.109**). The lagged GDP value (GDP(-1)) similarly exhibits a significant negative effect (-111.058, t-stat = -2.795**), suggesting that the short run effects of both the current and past GDP levels are detrimental to the dependent variable. As per the ARDL short run co-efficient model, the co-efficient (β) of Error correction term should be negative and significant. It is observed that the co-efficient of the error correction term shows -0.881 and significant at 1% significance level which is noted as a robust adjustment mechanism that guarantees from correction of any short-term deviations from the long run equilibrium. (or the speed of adjustments gets corrected by 0.88% towards long run equilibrium). The overall model explains 86.3% (R^2) observed that, over the short-term period, variations in the Sovereign Gold Bonds the model shows that some variables, like GDP and DGR, significantly influence the dependent variable, and the presence of a significant error correction term suggests a strong mechanism for adjusting to long-run equilibrium. Finally, the study tested residual diagnostics with the estimated ARDL long run and short run with evidence that there is no presence of auto-correlation and presence of heteroskedasticity. Hence, H_9 and H_{10} are accepted.



The straight line represents critical bounds at 5% significance level

Figure 1: Cumulative Sum of Recursive Residuals



The straight line represents critical bounds at 5% significance level

Figure 2: Cumulative Sum of Squares of Recursive Residuals

Stability of the ARDL Model

The stability of the long-run coefficients and the short-run dynamics by applying the CUSUM (Cumulative Sum of Recursive Residuals) and CUSUMSQ (Cumulative Sum of Squares of Recursive Residuals) plots are examined (26). The CUSUM and CUSUMQ plots for the estimated model are presented in Figure 1 and 2 respectively. X-axis represents the time period and Y-axis represents cumulative sum as well as cumulative sum of squares. In the plots of the CUSUM and CUSUMSQ statistics, the blue lines are positioned between two red lines that are dotted. This implies that all of the predicted co-efficient in the provided regression results are stable, given that both tests remain within the critical bound test at the 5% significance level, the ARDL – ECM model long run and short run dynamic co-efficient are stable. As a result, the model is fitted and taken into the account when determining the policy. The study underscores the significance of Sovereign Gold Bonds (SGBs) as a hedge against inflation, confirming their reliability for long-term investors seeking to maintain purchasing power. SGBs align with prior research, which suggests that gold-based instruments are less volatile compared to equity markets during inflationary periods, making them attractive for preserving wealth (27). However, the analysis also reveals that the inflation-hedging benefits are more evident in the long term, whereas short-term volatility and negative correlations suggest SGBs do not respond immediately to inflation spikes. This lag may occur because investors tend to react cautiously during inflationary surges, leading to temporary misalignment between inflation trends and SGB performance. In both short and long terms, gold prices are key drivers of SGB performance, reflecting the intrinsic value of these bonds, which are tied to gold's market behavior. Consistent with previous findings, rising gold prices positively impact SGB returns, reaffirming gold's traditional role as a store of value and inflationary hedge (27). The short-term lag in gold's effect on SGB returns suggests that investor responses to market fluctuations and speculative movements also influence these returns. This dynamic demonstrates that while SGBs benefit from long-term gold price stability, they may be subject to market sentiment in the short run. Interestingly, the study shows that exchange rates and per capita income have no significant influence on SGB performance, indicating that SGBs are primarily governed by domestic inflation and gold prices rather than broader economic indicators. This aligns with the understanding that SGBs act as a currency-neutral investment vehicle tied directly to gold rather than exchange rate volatility. However, GDP growth negatively impacts SGB returns in the short run, reflecting that during economic expansions, investor preferences shift toward equities and other higher-yield assets, diminishing demand for gold-backed investments (27). This outcome highlights that SGBs, similar to other gold-linked instruments, are more attractive during periods of economic uncertainty, when investors seek stability over high returns The error correction mechanism (ECT) further supports the view that SGBs provide long-term stability, even in the face of short-term market fluctuations. The significant ECT coefficient confirms that deviations from long-run equilibrium are efficiently corrected, ensuring that SGBs maintain their intrinsic value over time. This finding aligns with earlier studies, which highlight that gold-based instruments tend to return to their long-term equilibrium despite temporary shocks or speculative trends. These findings emphasize that SGBs offer significant advantages as a long-term investment option, particularly for conservative investors looking to hedge against inflation. However, their limited short-term responsiveness to inflation and sensitivity to GDP growth suggest that SGBs should be used as part of a diversified investment strategy rather than a stand-alone short-term instrument (27). Policymakers could encourage greater adoption of SGBs during periods of rising inflation and gold prices, while also promoting investor education about the importance of holding these bonds over a longer horizon. Additionally, offering incentives during economic expansions could help maintain demand, ensuring that SGBs remain an integral part of investor portfolios even when other asset classes, such as equities, perform well.

The findings of the study have evaluated how different key economic variables significantly impact the performance of Sovereign gold bonds in both long run and the short run. The implications of the work will impact the various stakeholders which include retail investors, institutional Investors, Governments and regulators, Banks and

other financial institutions, financial analysts and gold traders. The finding that Inflation Rate has long run relationship and GDP has a short run negative relationship with Sovereign Gold Bonds suggests that the price of SGB is very responsive to the economic uncertainty acts as an addition to the study on impact of inflation on SGBs (28). Therefore, to utilize the benefit of understanding this relation, policymakers can support Sovereign Gold Bonds (SGBs), which will protect purchasing power and act as an inflation hedge, during inflationary times. In order to stimulate public investment, policymakers can support SGBs during periods of rising inflation and can also put educational programs into place to educate investors about the advantages of SGBs. This proactive approach can help in stabilizing the financial ecosystem and enhance overall economic resilience, aligning with broader fiscal strategies aimed at managing inflation and economic growth.

Conclusion

This study evaluates the effectiveness of Sovereign Gold Bonds (SGBs) as an inflation hedge in India using ARDL bounds testing approach with 36 monthly observations from 2021 to 2024. The results show that SGBs are significantly correlated with inflation, gold prices, and other macroeconomic variables, helping preserve purchasing power during inflationary periods. While inflation and gold prices positively impact SGB performance in both the short and long run, inflation rates have a strong long-term effect, and GDP growth negatively affects performance in the short run. The presence of a self-correcting mechanism through error correction terms further indicates that SGBs can stabilize and recover from short-term volatility, making them suitable for long-term portfolio strategies. This stabilization reinforces SGBs' role not just as a hedge against inflation but also as a dependable component of diversified investment portfolios during uncertain economic conditions. The results of the paper also recommend that policymakers should promote SGBs during periods of rising inflation rates and gold prices and address the impact of economic growth on investor behavior. By carefully managing these dynamics, policymakers can ensure that SGBs remain a viable instrument for wealth preservation and capital growth across varying economic conditions. The methodology of the study has several limitations. First, the use of a small sample size, with only 36 months of data, may not capture the full range of economic fluctuations, especially given the long-term nature of bonds. Second, the focus is primarily on a limited set of macroeconomic variables, including inflation rate, exchange rate, per capita income, gold prices, and GDP growth rate. This excludes other significant factors like global economic trends, investor sentiment, and fiscal policies, which could affect the accuracy of the results. Additionally, the ARDL model presumes linear relationships between variables, potentially oversimplifying the complex dynamics of financial markets, where non-linear relationships often exist. The model also faces potential endogeneity issues, as there may be unobserved factors or reverse causality that could bias the results, and these are not comprehensively addressed. Another limitation is the reliance on unit root tests to ensure stationarity, and the presence of variables with mixed orders of integration may limit the generalizability of the ARDL model. Lastly, the limited time horizon of the data, covering 2021 to 2024, includes unusual economic conditions such as the aftermath of the COVID-19 pandemic, which may affect the robustness of the results in more stable periods. Therefore, the study still has a lot of potential in the following areas: Future research on Sovereign Gold Bonds (SGBs) could focus on assessing their performance over longer periods to capture a broader range of economic cycles and evaluate their consistency as an inflation hedge. Comparative studies with other gold-related financial products, such as gold ETFs or physical gold, would provide deeper insights into their relative advantages. Incorporating additional relevant variables, such as interest rates, fiscal deficits, global commodity prices, and investor confidence indices, would further enrich the analysis. Additionally, future studies could examine the behavioral aspects of investors, including financial literacy, investment preferences, and market sentiment, to better understand factors influencing SGB adoption. Research on portfolio optimization would also be valuable, evaluating how SGBs perform in diversified investment strategies. Future research could explore the performance of Sovereign Gold Bonds in other emerging markets to identify cross-country trends. Additionally, applying machine

learning techniques could enhance predictive accuracy and provide deeper insights into the factors influencing SGB performance.

Abbreviations

None.

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Author Contributions

Chandrakala. G: Introduction, Literature Review, Arya Mishra: Introduction, Literature Review, Sathish P: Methodology, Analysis, Keerthana K: Methodology, Analysis, Samiksha Kumari: Conclusion, Implications, Tanvi Verma: Conclusion, Implications.

Conflict of Interest

The authors declare that there are no conflicts of interest regarding the publication of this manuscript. We confirm that the research was conducted with utmost integrity and without any undue influence.

Ethics Approval

This research adhered to ethical guidelines and prepared the manuscript as per the journal requirements.

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