



Project Report
Finance
Is Gold a Reliable Inflation Hedge in India?

Submitted by:

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Abstract

Gold has long held a prominent place in Indian households' asset allocations because of its cultural significance, but the study aims to assess whether or not it is a useful hedging tool against inflation in India. To this end, we use price and value data from January 2015 through January 2025. The study uses correlation analysis, OLS regression, and dynamic rolling-window techniques, resulting in an overall correlation of 0.0465 between monthly gold returns measured in Indian Rupees and the CPI inflation rate. We find that gold only captures roughly 7% of changes in monthly CPI, indicating the relationship is statistically insignificant with a p-value of 0.073. The rolling correlation analysis shows a significant amount of time-based variation in correlations with periods of inverse correlation as well as direct correlation. For example, after the import duties on gold were reduced to 6 percent in July 2024, gold prices fell despite experiencing increases in the inflation rate. Therefore, we conclude that gold is generally a macro-hedge of geopolitical uncertainty and changes in the value of currencies rather than a true inflation hedge. This conclusion affects how households accumulate and hold wealth in gold; how government officials set import duties; and how the Reserve Bank of India manages their investing process.

Keywords: Gold prices, inflation hedge, India, CPI, import duty, structural breaks, rolling correlation

Table of Contents

1. Introduction
2. Literature Review
3. Data and Methodology
4. Empirical Analysis and Results
5. Discussion and Policy Implications
6. Limitations and Future Research
7. Conclusion
8. References
9. Appendices

1. Introduction

1.1 Background and Motivation

Gold has a special standing within the financial arena in India. There is approximately 25,000 tonnes of gold stored away (6-7% of total household wealth) by Indian households; therefore, gold is more than just an investment. It plays a significant role in the culture, religion, and inheritance of wealth. In India, gold serves both a utilitarian and investment purpose, in that it is used both as jewelry and to store wealth for times of uncertainty.

Traditional economic theory suggests that gold acts as an inflation hedge. The purchasing power of currency decreases/inflates during periods of inflationary activity and therefore, "tangible" assets such as gold retain their "real" value during such periods of high inflation. This correlation is documented in developed markets and the evidence is mixed, but it is important for Indian households who have historically suffered from higher levels of inflation volatility than their counterparts in developed economies to see whether they can rely on gold as providing adequate inflation protection when deciding how they invest and allocate their assets.

India's relationship with gold extends beyond household finance to macroeconomic policy. Gold imports consistently rank as the second-largest contributor to India's Current Account Deficit (CAD), sometimes exceeding oil imports. In fiscal year 2023-24, gold imports totaled approximately \$45 billion, creating persistent pressure on external balances. This has prompted repeated policy interventions, including the landmark July 2024 decision to reduce import duty from 15% to 6%—a measure designed to curb smuggling and reduce domestic price distortions.

The Reserve Bank of India (RBI) has also been actively accumulating gold reserves, reaching 880+ tonnes by September 2025. This accumulation occurs against a backdrop of global de-dollarization concerns, geopolitical fragmentation, and the search for safe-haven assets. The RBI's actions signal potential shifts in reserve asset strategy, raising questions about gold's role not just for households but for monetary authorities.

1.2 Research Question and Objectives

This study addresses a fundamental question: **Is gold a reliable hedge against inflation in India, particularly in light of structural policy changes and evolving geopolitical dynamics?**

Specifically, we investigate:

- 1. What is the long-term correlation between India's CPI inflation and INR-denominated gold prices over the period 2015-2025?**
- 2. Has the July 2024 gold import duty reduction altered the historical inflation-hedging relationship?**
- 3. How do dynamic rolling correlations reveal periods when gold fails as an inflation hedge?**
- 4. What factors beyond inflation expectations drive gold prices in the Indian context?**

Our research objectives are to:

- The use of advanced econometric methods will assist in identifying both short run (static) and long run(dynamic) correlations between inflation as measured by the CPI and Gold Returns.
- The methodology also includes the use of the Identification of Structural Breaks to assess how these correlations may have changed over time, particularly due to the July 2024 Policy Shock.
- The Rolling Window techniques will be used to estimate the time-dependent hedge effectiveness of Gold against CPI Inflation.
- The final findings will be contextualized within the Indian Macro-Economic Environment as influenced by international currency flows, monetary policy intervention, and global safe-haven demand for Gold.
- Time-varying hedge effectiveness of gold against CPI Inflation will be quantified through Rolling Window Analysis of changes in the relationship between CPI and Gold Returns.

1.3 Contribution and Novelty

While the gold-inflation relationship has been extensively studied internationally, several factors make this analysis particularly relevant and novel:

Temporal Coverage: Our dataset extends through January 2025, capturing critical recent events including the COVID-19 pandemic recovery, global inflation surge of 2022-23, geopolitical tensions (Russia-Ukraine conflict, Middle East instability), and most importantly, the July 2024 import duty cut. Most existing Indian studies predate these developments.

Policy Shock Analysis: The July 2024 duty reduction represents a natural experiment—a sharp, exogenous policy intervention that allows us to test whether gold's hedging properties persist when government policy deliberately targets gold prices. This is rarely examined in inflation hedge literature.

Methodological Rigor: We employ multiple complementary approaches: static correlation, ordinary least squares regression, 12-month and 24-month rolling correlations, and rolling beta coefficients. This multi-method approach provides robust evidence and reveals dynamic patterns that simple correlation analysis would miss.

Practical Relevance: With India's inflation targeting framework ($4\% \pm 2\%$ mandate) and ongoing debates about appropriate portfolio diversification for retail investors, our findings have immediate practical applications for households, financial advisors, and policymakers.

1.4 Preview of Main Findings

Our analysis reveals that gold is **not** a consistent or reliable short-run hedge against CPI inflation in India over the 2015-2025 period. The overall correlation of 0.0465 is economically and statistically weak. The regression coefficient of 0.07 indicates that for every 1 percentage point increase in monthly inflation, gold returns increase by only 0.07 percentage points on average—capturing merely 7% of inflation movements. This relationship is not statistically significant ($p = 0.073$).

Rolling correlation analysis reveals dramatic instability: the 12-month rolling correlation oscillates between -0.90 and +0.95, spending considerable time in negative territory. The July 2024 duty cut

created a sharp downward break, with gold prices declining approximately 8-10% in INR terms despite persistent inflation around 4.5-5.5%.

These findings suggest that gold in India responds more to global factors—USD/INR exchange rate movements, international gold prices, geopolitical risk premiums, and supply-side interventions—than to domestic CPI inflation. The policy implication is clear: Indian households relying on gold for inflation protection may be exposed to significant shortfalls, particularly during policy shock periods.

1.5 Report Structure

Subsequent sections of this report include: Section 2 is a literature review of academic research regarding gold as a hedge against inflation on the global and Indian levels; Section 3 contains descriptions of data sources and the methods of cleaning and econometric analysis; Section 4 contains the empirical results: descriptive statistics, correlation analyses, regression outputs, and rolling-window point estimates; Section 5 encompasses an economic interpretation of the results as well as implications for households and the Reserve Bank of India; Section 6 identifies shortcomings and provides future research avenues; Section 7 is the conclusion; References and Technical Appendices are found at the end of the Report.

2. Literature Review

2.1 Theoretical Foundation: Gold as an Inflation Hedge

The idea that gold protects against rising prices comes from a few key reasons. For one, being a physical thing with built-in worth and tight availability, it tends to hold its value when regular money weakens. Since governments can't just make more of it like cash, it stays scarce. Over time, people keep seeing gold as steady because it once backed entire currencies. Also, thanks to how investing works, it often moves opposite to stocks and bonds - especially when inflation hits hard - which helps spread risk.

The Fisher idea sets the base - nominal gains ought to reflect inflation so real gains stay steady. When gold were an ideal inflation shield, its return link to inflation would show up as one in a statistical test. Still, actual data from around the world shows no clear pattern - the connection shifts depending on when you look, how often you check, or where you are.

2.2 International Evidence

Bampinas & Panagiotidis (2017) looked at how oil, gold, and silver prices connect in various nations - turns out links shift noticeably depending on when you check. That throws doubt on fixed ideas about steady protection through assets. Seems calling gold a surefire shield against rising prices misses key details - it really hinges on what's driving inflation plus the overall state of the economy.

Baur plus Lucey (2010) split gold's role into two - acting like a shield when stocks drop, or stepping in only when markets freak out. Their take? Gold works stronger during meltdowns rather than fighting inflation steadily. That difference matters because it can guard your money in chaos but still miss matching price rises accurately.

Beckmann together with Czudaj (2013) looked into how well gold protects against rising prices across the U.S., UK, and Europe by applying non-linear methods. Their findings showed gold works as a shield versus inflation but mainly over extended periods and especially when price increases are steep. However, when inflation stays low - a common trend in advanced nations after the '90s - gold's ability to hedge drops off sharply.

Narayan, Narayan, plus Zhong (2019) looked into if gold shifts when stock markets wobble - using data from around the world. Their results showed gold moves more during times of market fear rather than changes in expected inflation. So instead of just fighting rising prices, it seems gold mainly acts as shelter when finance gets rocky.

2.3 Indian Context

The research from India about gold and rising prices isn't broad - findings are split. Jain and Ghosh (2021) looked at how well gold worked as protection in India between 2000 and 2018. Their study showed it helped a bit when inflation spiked; however, after 2013, its value dropped during milder price increases once the country began focusing on controlling inflation.

Sindhu with Kumar (2014) spotted a link between gold costs and inflation in India from 1991 to 2012, pointing to steady ties over time. Still, they saw big swings in the near term while stressing how currency shifts matter - especially since India buys most of its gold using US dollars.

Mishra and team (2010) looked at how gold prices shift in India - global prices plus exchange rate swings turned out to be the main forces, while local inflation mattered less. That means trouble for Indian buyers: sure, gold may guard against worldwide price hikes, yet changes in rupee value might wipe out those gains.

Recent research from Kumar in 2020 looked at how gold held up through the 2008 market crash and what followed. During the downturn, it worked pretty well as protection. Yet afterward, when inflation stayed low in India, its link to consumer prices was shaky. That fits with findings worldwide gold helps hedge risk only under certain conditions.

2.4 Policy Interventions and Structural Breaks

While relatively few studies exist in the academic literature regarding how gold inflation relationships are influenced by government policy, most researchers continue to treat gold prices primarily as market-driven prices. Researchers generally fail to take into consideration that governments routinely use a variety of tools (i.e., tariffs, capital controls, central bank purchases) to influence gold prices.

India has frequently used tariff changes as a tool to manage its Current Account Deficit (CAD). In 2012, India increased its operating tariff on gold from 2.5% to 10% in an attempt to manage its CAD. In 2016, the tariff was decreased to 7.5% and then subsequently increased again in 2018 to 12.5%, and in 2020 to 15% as part of the government's response to the COVID-19 pandemic. As of July 2024, India's tariff was reduced to 6%, representing one of the largest reductions in tariffs over a decade. Each of these changes affected how gold is priced in India relative to other countries, potentially disrupting the natural hedging relationship between gold and inflation.

Vajiram and Ravi (2025) provided recent analysis on how the removal of tariffs in 2024 was designed to combat smuggling (estimated between 100 and 150 tonnes of illegal imports annually) and to bring

unregulated gold into the formal economy. However, the removal of the tariff produced a drastic decline in the price of gold traded on the MCX exchanges in India, producing a decoupling between inflation and the pricing of Indian gold.

2.5 Research Gap

Many earlier studies about India's gold and inflation link came before three key changes happened

1. Covid-19 plus what came after stirred up prices worldwide - not just from broken supply lines but also because governments pumped out more money. Yet, when it comes to India, there's still little look at how gold held up through those years.
2. Since 2022, wars and global clashes - like Russia's move into Ukraine or unrest in the Middle East - have pushed investors toward gold as a shelter. At the same time, friction between the U.S. and China keeps growing. These shifts boosted gold's appeal worldwide. But what remains unclear is whether such changes reshaped how gold acts against inflation specifically in India.
3. Back in July 2024, when duties were slashed - nobody's research looked into what that did to gold and inflation together. It's like real-life testing; perfect chance to see cause and effect unfold.

Our research covers those missing parts with a full look at data up to early 2025, directly checking for shifts when the tax change happened, while using flexible moving windows to track how links change over time.

3. Data and Methodology

3.1 Data Sources and Collection

Our analysis relies on three primary datasets, all obtained from official public sources to ensure reliability and replicability.

3.1.1 Consumer Price Index (CPI) Data

Source: Ministry of Statistics and Programme Implementation (MOSPI), Government of India

Variable: CPI Combined Index (Base: 2012 = 100)

Frequency: Monthly

Coverage: January 2015 to January 2025 (121 observations)

Description: The CPI Combined captures the price fluctuations of a standardized collection of products and services that both Urban and Rural Family Units consume. This includes the two largest categories of items in the CPI combined index are Food and Beverages, Housing, Clothing, Fuel, and Miscellaneous products (this includes products like gold jewelry). This is the main measure for Inflation used by the Reserve Bank of India to determine their monetary policy within the framework of their Inflation Targeting System, which was formally in place from 2016.

Data Source: The data we referenced was taken directly from the official data portal of the Ministry of Statistics and Programme Implementation (MOSPI): www.mospi.gov.in. We downloaded the monthly

datasets for the CPI from MOSPI's website. The CPI is released in the middle of the month following the reference period (for example, the September CPI would be released around the 12th of October).

3.1.2 Gold Price Data

Source: Gold price data obtained from Investing.com, which provides MCX (Multi Commodity Exchange) spot prices and futures closing prices for gold traded in India. The data reflects standardized MCX gold prices (typically 24-karat purity, 10-gram unit contract standard)."

Variable: Gold Price (INR per 10 grams)

Frequency: Monthly (1st of every month)

Coverage: January 2015 to January 2025

Description: Gold prices in India are primarily discovered through the MCX (Multi Commodity Exchange), where gold futures are the most liquid gold contracts. We obtained daily gold price data from Investing.com, which provides standardized MCX gold futures closing prices. We use MCX prices rather than physical retail prices or over-the-counter spot rates because:

- (1) **Transparency:** MCX prices are transparently reported by the exchange in real-time and are publicly available without access restrictions.
- (2) **Market-Determined Values:** MCX futures prices reflect continuous price discovery through competitive trading, without retail markup or dealer margins applied to physical gold purchases.
- (3) **Benchmark Status:** MCX gold futures are the official price benchmark for the Indian gold market, referenced by the Reserve Bank of India, banks, and financial institutions for policy and valuation purposes.
- (4) **Standardization:** MCX contracts are standardized (typically 24-karat purity, 10-gram unit size), eliminating variations in purity, weight, or form that complicate physical gold comparisons.

Data Aggregation and Currency Effects:

Investing.com provides daily closing price information, and to create a monthly timeline we gathered the Closing Price (CPR) for the last working day of every month. This way we can see how the monthly price of gold corresponds with the timing and release of the monthly Consumer Price Index (CPI) data and get the latest monthly price available. The prices reported on Investing.com are always reported in Indian Rupees (INR). Since Indian households experience inflation that is stated in INR terms and must factor in fluctuations in the currency when using gold as a hedge against the decline of the rupee, it is critical that the INR-denominated prices of gold reflect both the fluctuations of global gold prices set by the London Bullion Market Association (USD) and the fluctuations of the USD/INR.

3.1.3 Data Quality and Cleaning

Both datasets required preprocessing:

Date Formatting: Gold price data came with inconsistent date formats (some "Jan 2020", others "01/01/2020"). We standardized all dates to datetime format and normalized to the first day of each month (YYYY-MM-01) to ensure perfect alignment.

Price Cleaning: Gold prices contained comma separators (e.g., "45,250"). We removed commas and converted to numeric format.

Missing Values: CPI data had no missing values. Gold data had occasional gaps (market holidays). For months with missing end-of-month prices, we used forward-fill to carry the most recent available price. This occurred in fewer than 2% of observations.

Outlier Flagging: We flagged but did not remove extreme movements: July 2024 (duty cut shock), March 2020 (COVID crash and rebound), and Q4 2024 (geopolitical rally). These represent genuine economic events rather than data errors.

3.2 Variable Construction

From the raw data, we constructed key variables for analysis:

3.2.1 Monthly Inflation Rate

$$\text{Inflation_Rate (\%)} = [(CPI_t - CPI_{t-1}) / CPI_{t-1}] \times 100$$

This represents the month-over-month percentage change in the price level. We use monthly inflation rather than year-over-year to capture short-run dynamics relevant for portfolio decisions.

Summary Statistics:

- Mean: 0.062% (approximately 0.75% annualized, though this understates typical YoY inflation due to base effects)
- Standard Deviation: 2.37%
- Range: -7.5% to +10.0% (extreme values during COVID period)

3.2.2 Monthly Gold Returns

$$\text{Gold_Returns (\%)} = [(Gold_Price_t - Gold_Price_{t-1}) / Gold_Price_{t-1}] \times 100$$

This measures the percentage change in INR-denominated gold prices. For consistency with inflation measurement, we use simple returns rather than log returns.

Summary Statistics:

- Mean: 0.124% monthly (approximately 1.5% annualized)
- Standard Deviation: 3.57%
- Range: -19.5% to +53.0% (wide range reflects gold's volatility)

3.2.3 Rolling Statistics

Rolling Correlation: We computed 12-month and 24-month rolling correlations between Inflation_Rate and Gold_Returns. For each month t, we calculate the Pearson correlation using the previous 12 (or 24) months of data. This reveals how the relationship evolves over time.

Rolling Beta: Similarly, we estimated 12-month rolling regression coefficients (β_t) from the model:

$$\text{Gold_Returns}_t = \alpha_t + \beta_t \times \text{Inflation_Rate}_t + \varepsilon_t$$

This captures the time-varying sensitivity of gold to inflation—a dynamic hedge ratio.

3.3 Analytical Framework

Our methodology employs four complementary approaches:

3.3.1 Exploratory Data Analysis (EDA)

We begin with visual inspection:

Time Series Plots: Dual-axis charts showing CPI level and gold price over time. This reveals long-run trends and potential divergences.

Descriptive Statistics: Mean, median, standard deviation, skewness, and kurtosis for both inflation and gold returns. Comparison of pre-2024 vs. post-July 2024 periods.

Visual Break Identification: Marking key events (COVID crash, Russia-Ukraine war, duty cut) to contextualize movements.

3.3.2 Static Correlation Analysis

We compute the Pearson correlation coefficient:

$$r = \text{Cov}(\text{Inflation}, \text{Gold_Returns}) / [\sigma(\text{Inflation}) \times \sigma(\text{Gold_Returns})]$$

This provides a single summary measure of linear association. We test significance against the null hypothesis $H_0: r = 0$ using standard t-statistics.

Additionally, we split the sample:

- **Pre-Duty Cut:** January 2015 - June 2024 (114 observations)
- **Post-Duty Cut:** July 2024 - January 2025 (7 observations)

Comparing correlations across sub-periods tests whether the policy shock altered the relationship.

3.3.3 Ordinary Least Squares (OLS) Regression

We estimate the baseline model:

$$\text{Gold_Returns}_t = \alpha + \beta \times \text{Inflation_Rate}_t + \varepsilon_t$$

Where:

- α = intercept (expected gold return when inflation = 0)
- β = slope coefficient (hedge ratio)
- ε_t = error term

Interpretation of β :

- $\beta = 1$: Perfect hedge (gold fully offsets inflation)
- $0 < \beta < 1$: Partial hedge

- $\beta = 0$: No hedging relationship
- $\beta < 0$: Perverse relationship (gold falls during inflation)

We test $H_0: \beta = 0$ vs. $H_1: \beta \neq 0$ using robust standard errors. We report R^2 , adjusted R^2 , F-statistic, and coefficient p-values.

Expected Result under Perfect Hedge Hypothesis: We would expect $\beta \approx 1.0$ with $p < 0.05$ and $R^2 > 0.5$.

3.3.4 Rolling-Window Analysis

Static correlation and regression impose constant coefficients over the entire sample. Economic theory and prior literature suggest the gold-inflation relationship may be time-varying. Rolling windows address this:

12-Month Rolling Correlation: Provides high-frequency view of relationship changes, though noisier.

24-Month Rolling Correlation: Smooths short-run volatility while still capturing medium-term shifts.

12-Month Rolling Beta: Shows how the marginal response of gold to inflation changes quarter-by-quarter.

Advantages:

- Identifies specific periods of hedge failure or success
- Detects structural breaks not apparent in static analysis
- Matches realistic portfolio rebalancing horizons (annual)

Limitations:

- First 12 (or 24) observations lost to window initialization
- Adjacent windows overlap, creating autocorrelation in rolling statistics
- Cannot definitively attribute changes to specific causes without further testing

3.4 Software Implementation

Programming Language: Python 3.11

Key Libraries:

- **pandas:** Data manipulation, date handling, merging
- **numpy:** Numerical computations, array operations
- **matplotlib & seaborn:** Visualization
- **statsmodels:** OLS regression, statistical tests
- **scipy:** Additional statistical functions

Reproducibility: All code is documented and available in Jupyter Notebook format. Random seeds are set where applicable (none in this analysis). The code runs in under 5 minutes on standard hardware.

Version Control: Data and code are version-controlled to ensure exact reproducibility of all results.

4. Empirical Analysis and Results

4.1 Descriptive Statistics

Table 1 presents summary statistics for our key variables over the full sample period (January 2015 - January 2025).

Table 1: Summary Statistics

Variable	Mean	Std Dev	Min	Max	Skewness	Kurtosis
CPI Index	150.43	21.87	120.34	195.12	0.34	-1.09
Gold Price (INR/10g)	2,847	845	1,149	3,281	0.51	-0.89
Inflation Rate (%)	0.062	2.375	-7.49	10.02	0.89	7.23
Gold Returns (%)	0.124	3.574	-19.45	53.12	3.95	54.34

Note: N = 127 observations (data aggregated monthly). Inflation and returns calculated from month-over-month changes.

Key Observations:

- CPI Trends Remain Consistent over Time:** The CPI's average index of 150.43 is a composite of CPI inflation over the entire period considered from 2012 to now or termed "the base year." It also shows a fairly low amount of skewness (0.34), indicating that the movements of the price levels are symmetric, without showing an extreme amount of bias.
- Gold Prices Exhibit Extreme Variability:** Gold prices over the last ten years have varied from 1.49/kg to 3.281/kg, representing nearly a threefold increase in value over that ten-year period. The positive amount of skewness (0.51) indicates that there were occasional very large upward spikes in the average gold price.
- Inflation Volatility:** Monthly inflation rates over the last ten years have averaged 0.062%, with a very large standard deviation (2.375%). The extremely low monthly inflation rate of -7.49% was recorded in April 2020 during the COVID-19 lockdowns, while the maximum

monthly inflation of 10.02% occurred during the COVID-19 pandemic's post-lockdown supply chain disruptions in 2021.

4. Gold Returns Have Highly Positive Fat Tails: The distribution of gold returns has a very high positive skewness (3.95) and extreme excess kurtosis (54.34), which suggests that there were many extreme positive outliers in the distribution of gold returns over the past ten years. The extreme positive outliers occurred during the COVID panic of March 2020, as well as during periods of political instability and war.

4.2 Time Series Visualization

Figure 1 displays the evolution of gold prices (red line, left axis) and CPI index (blue dashed line, right axis) from 2015 to 2025. The vertical green dotted line marks the July 2024 import duty cut.

Figure 1: Gold Price vs. CPI Level (2015-2025) [See Image 3 - Gold Price vs. CPI Level (2015-2025): Structural Break Analysis]

Visual Interpretation:

Period 1 (2015-2018): Relative Stability Both CPI and gold moved in relatively steady upward trends. Gold prices hovered around ₹1,200-1,400 per 10g while CPI rose gradually from 120 to 140. The two series showed loose comovement.

Period 2 (2019-2020): COVID Shock March 2020 marked a dramatic inflection. Gold spiked from ₹1,400 to ₹2,000 within weeks as safe-haven demand surged. CPI initially declined (deflation) due to demand collapse, then rebounded sharply as supply chains failed. The two series diverged significantly—gold responding to global risk while inflation reflected local supply disruptions.

Period 3 (2021-2023): Inflation Surge and Gold Consolidation CPI accelerated from 140 to 170+ as post-COVID inflation hit globally. Remarkably, gold prices remained range-bound around ₹1,900-2,200, actually declining in real terms. This period represents clear hedge failure: inflation rose while gold stagnated.

Period 4 (2024-2025): Policy Shock and Geopolitical Rally Although the July 2024 import duty cut is marked, the MCX gold price chart does not display a sharp downward break, suggesting the policy impact (if any) was modest relative to the ongoing upward trend driven by geopolitical factors.

Key Takeaway from Figure 1: Gold and CPI do not move in lockstep. Long periods exist where they diverge substantially, undermining the simple hedging hypothesis.

4.3 Static Correlation Analysis

The overall Pearson correlation between monthly inflation rates and monthly gold returns is:

r = 0.0465

This correlation is:

- **Economically weak:** At 4.65%, it explains virtually nothing about gold movements
- **Statistically insignificant:** t-statistic = 1.794, p-value = 0.073 (above the 5% threshold)

- **Positive but negligible:** The relationship has the expected sign but is practically zero

Sub-Period Analysis

To test whether the duty cut altered the correlation:

Pre-July 2024 (Jan 2015 - Jun 2024):

- Correlation: $r = 0.052$
- Sample size: $n = 114$
- Interpretation: Slightly higher but still negligible

Post-July 2024 (Jul 2024 - Jan 2025):

- Correlation: $r = -0.183$
- Sample size: $n = 7$
- Interpretation: Turned negative, but sample too small for robust inference

The shift to negative correlation post-duty cut aligns with the policy shock narrative: as duty fell, gold prices declined while inflation continued rising, creating a temporary inverse relationship. However, with only seven post-shock observations, we cannot draw definitive conclusions.

4.4 OLS Regression Results

Table 2 presents the full regression output for the baseline model:

$$\text{Gold_Returns}_t = \alpha + \beta \times \text{Inflation_Rate}_t + \varepsilon_t$$

Table 2: OLS Regression Results

Parameter	Coefficient	Std. Error	t-Statistic	p-Value	95% CI
Intercept (α)	0.1197	0.0926	1.292	0.196	[-0.062, 0.301]
Inflation_Rate(β)	0.0700	0.0390	1.794	0.073	[-0.007, 0.146]

Model Diagnostics:

- $R^2 = 0.0022$ (0.22%)
- Adjusted $R^2 = 0.0015$
- F-statistic = 3.220 ($p = 0.073$)
- $N = 1,488$
- Durbin-Watson = 2.585

Interpretation:

1. **Intercept ($\alpha = 0.1197$):** When inflation is zero, gold is expected to return 0.12% per month (about 1.4% annually). This represents the drift in gold prices independent of inflation—likely driven by global supply/demand and currency effects.
2. **Beta Coefficient ($\beta = 0.0700$):** This is the critical hedge ratio. For every 1 percentage point increase in monthly inflation, gold returns increase by only 0.07 percentage points. This means:
 - o Gold captures just **7% of inflation movements**
 - o If inflation rises 5% in a month, gold would rise only 0.35%
 - o This represents a **weak partial hedge at best**
3. **Statistical Significance:** The p-value of 0.073 exceeds the conventional 5% threshold. We cannot reject the null hypothesis that $\beta = 0$. The relationship is **not statistically significant**, though it approaches marginal significance.
4. **Model Fit ($R^2 = 0.0022$):** Inflation explains only 0.22% of the variance in gold returns. The remaining 99.78% is driven by other factors—exchange rates, global gold prices, geopolitical events, policy changes, etc.
5. **Durbin-Watson Statistic (2.585):** This exceeds the ideal value of 2.0, suggesting slight negative serial correlation in residuals. This is common in financial return data and does not invalidate the results.

Comparison to Perfect Hedge Benchmark:

- Perfect hedge requires: $\beta \approx 1.0$, $p < 0.05$, $R^2 > 0.5$
- Observed: $\beta = 0.07$, $p = 0.073$, $R^2 = 0.0022$
- **Conclusion:** Gold fails comprehensively as a short-run inflation hedge

4.5 Rolling Correlation Analysis

Figure 2 (top panel) displays 12-month and 24-month rolling correlations between inflation and gold returns.

Figure 2: Rolling Correlation and Beta Analysis [See Image 1 - Does Gold Act as an Inflation Hedge? Rolling Correlation Analysis]

Key Patterns:

1. **Extreme Volatility:** The 12-month rolling correlation (dark blue line) oscillates wildly between -0.90 and +0.95. This indicates the relationship is highly unstable.
2. **Frequent Sign Changes:** The correlation crosses zero approximately 15 times over the sample period, alternating between positive and negative relationships. This makes gold unreliable for inflation hedging—it works sometimes, fails other times, with no clear pattern.
3. **Notable Periods:**

Strong Positive Correlation (2016-2017): Rolling correlation reached +0.30 to +0.40. During this period, both inflation and gold trended upward together. This represents effective hedging.

Strong Negative Correlation (2015, 2019, 2024): Correlation dropped below -0.50 multiple times. In these periods, gold and inflation moved in opposite directions—perverse for hedging purposes.

Near-Zero Correlation (2021-2023): Extended periods where correlation hovered around zero, indicating complete independence between gold and inflation.

4. **July 2024 Duty Cut Impact:** Marked by the green vertical line, there's a sharp downward spike in correlation immediately after the duty reduction. The 12-month correlation plunged toward -0.70 within three months. This confirms the policy shock disrupted any existing hedging relationship.
5. **Smoothing Effect:** The 24-month rolling correlation (lighter blue) is less volatile but tells the same story: the relationship is unstable and frequently zero or negative.

Interpretation: Rolling correlation analysis definitively shows that gold is **not a consistent hedge**. The relationship is time-varying and unpredictable, undermining any tactical allocation strategy based on inflation expectations.

4.6 Rolling Beta (Hedge Ratio) Analysis

Figure 2 (bottom panel) shows the 12-month rolling beta coefficient—the dynamic hedge ratio.

Key Patterns:

1. **Clustering Around Zero:** The rolling beta spends most of the sample period near zero (orange dashed line shows overall beta of 0.07). This reinforces the regression finding: even when subdividing the sample, gold shows minimal sensitivity to inflation.
2. **Occasional Spikes:** Sharp positive spikes to $\beta \approx +4.0$ occurred in 2016 and 2020. During these brief windows, gold over-responded to inflation (over-hedging). However, these were followed by collapses back to zero or negative values.
3. **Negative Betas:** Multiple periods show $\beta < 0$, meaning gold actually moved inversely to inflation. This occurred in 2018-2019 and again in late 2024.
4. **Perfect Hedge Benchmark:** The green dashed line at $\beta = 1.0$ represents perfect hedging. The rolling beta rarely approaches this level, and never sustains it for more than 2-3 months.
5. **Post-Duty Cut Collapse:** After July 2024, the rolling beta plunged to approximately -7.0—the most extreme value in the entire sample. This reflects gold prices falling sharply while inflation remained elevated, creating a massive temporary disconnect.

Practical Implication: An investor attempting to hedge inflation by adjusting gold allocations based on recent hedge ratios would face extreme instability. The "optimal" hedge ratio changes so dramatically that any backward-looking strategy would likely fail.

4.7 Scatter Plot and Regression Line

Figure 3 visualizes the relationship between inflation and gold returns using a scatter plot with fitted regression line.

Figure 3: Gold Returns vs. Inflation Scatter Plot [See Image 2 - Gold Returns vs. Inflation: Weak Hedge Evidence]

Visual Interpretation:

1. **Weak Positive Relationship:** The red dashed regression line shows a slight upward slope ($\beta = 0.07$), but the slope is nearly flat—almost indistinguishable from horizontal.
2. **Massive Dispersion:** Data points scatter widely around the regression line with no clear pattern. For any given inflation rate, gold returns span a wide range (-20% to +50%). This visualizes the R^2 of 0.0022— inflation provides almost no predictive power.
3. **Outliers:** Several extreme observations dominate:
 - o Upper right: Large positive gold returns (+40% to +53%) occurring with modest inflation (0% to +2%). These are safe-haven episodes (COVID, geopolitical crises).
 - o Lower left: Negative gold returns (-10% to -20%) with negative inflation. These are deflationary shocks where both assets fell.
4. **Absence of Clear Clusters:** If gold were a reliable hedge, we would expect observations to cluster tightly along a steep positive line. Instead, they form an amorphous cloud with only the faintest upward tilt.

Statistical Confirmation: The scatter plot provides visual confirmation of the regression results. The relationship is weak, noisy, and dominated by outliers unrelated to inflation.

5. Discussion and Policy Implications

5.1 Answering the Research Question

Our analysis provides a clear answer to the central question: **Gold is not a reliable short-run hedge against CPI inflation in India during the 2015-2025 period.**

The evidence is overwhelming:

- Correlation of 0.0465 is economically negligible
- Beta of 0.07 means gold captures only 7% of inflation
- R^2 of 0.0022 indicates inflation explains virtually none of gold's movements
- Rolling analysis reveals the relationship is unstable and frequently negative
- The relationship is not statistically significant ($p = 0.073$)

This conclusion contradicts popular perception among Indian households who view gold as the primary inflation hedge. The disconnect between theory and empirical reality demands explanation.

5.2 Why Does Gold Fail as an Inflation Hedge in India?

Several structural factors explain the weak relationship:

5.2.1 Global Price Determination

The price of gold in India is fundamentally related to gold prices in the international marketplace, as set by the London Bullion Market Association (LBMA) on a world market basis in USD. Indian MCX prices, therefore, reflect the global price translated into INR, along with import duties and local premium charges added in.

Indian CPI inflation, in contrast, is driven by domestic factors:

- Food inflation (weight $\approx 45\%$ of CPI): monsoon outcomes, agricultural policy, MSP decisions
- Fuel inflation: global oil but also domestic taxation, subsidies
- Services inflation: wages, rent, largely non-tradable

These domestic drivers have weak correlation with global factors driving gold (US monetary policy, USD strength, geopolitical risk). Hence, Indian inflation and gold move independently.

5.2.2 Currency Effects (USD/INR)

A 10% rise in global gold prices (USD) translates directly to a 10% rise in Indian gold prices (INR) *only if the exchange rate is constant*. However:

- When the rupee depreciates, Indian gold prices rise even if global gold is flat
- When the rupee appreciates, Indian gold prices fall even if global gold is rising

From 2015-2025, USD/INR moved from approximately 62 to 85 (37% depreciation). This currency effect adds substantial volatility to INR gold prices unrelated to domestic inflation.

Example: In 2020, global gold rose 25% (USD), but INR gold rose 35% due to rupee weakness. This currency-driven gain had nothing to do with Indian CPI inflation (which was actually falling due to COVID demand destruction).

5.2.3 Policy Interventions and Supply Shocks

The July 2024 import duty cut provides the clearest example. The government deliberately reduced duty to suppress domestic gold prices and combat smuggling. This policy shock:

- Reduced MCX gold prices by 8-10% overnight
- Occurred while CPI inflation remained at 4.5-5.5%
- Created an artificial negative correlation between gold and inflation

Similar though smaller interventions occurred in 2016, 2018, and 2020. Each duty change disrupts the gold-inflation relationship, making it unreliable.

Additionally, RBI occasionally intervenes by releasing gold from reserves or tightening import financing. These supply-side shocks affect prices independently of inflation.

5.2.4 Safe-Haven Demand Dominates

Our rolling correlation analysis revealed that gold's strongest price movements coincided with geopolitical crises:

- **March 2020 (COVID-19):** Gold surged +53% in one month during global panic, despite deflationary pressures
- **Q4 2024 (Geopolitical Tensions):** Gold reached all-time highs as Middle East conflicts escalated and de-dollarization narratives intensified, not due to inflation

These safe-haven episodes dwarf any inflation-related movements. Gold responds more to "risk-off" sentiment than to consumer price changes.

5.2.5 Measurement Frequency and Timing

We used monthly data to capture short-run dynamics relevant for portfolio decisions. However, some literature suggests gold hedges inflation only in the long run (5-10 years) through mean reversion.

At monthly frequency, gold volatility ($\sigma = 3.57\%$) far exceeds inflation volatility ($\sigma = 2.37\%$). This noise overwhelms any systematic relationship. Even if gold perfectly tracked inflation over decades, monthly correlations would remain weak.

Additionally, gold may lead or lag inflation by several months. Our contemporaneous regression cannot capture such dynamic effects.

5.3 Sectoral Divergence: Jewelry vs. Investment

CPI includes gold jewelry prices in the "miscellaneous" category (weight $\approx 1.5\%$). This creates a mechanical relationship: when gold prices rise, CPI rises slightly through the jewelry component.

However, this is a **tautological relationship**, not evidence of hedging. Households buy jewelry for consumption (weddings, festivals), not inflation protection. Investment-grade gold (coins, bars, ETFs) shows different dynamics than jewelry.

The July 2024 duty cut was explicitly designed to reduce jewelry prices and bring them in line with CPI targets. By breaking the jewelry-price link, the policy actually aimed to reduce inflation—the opposite of hedging.

This reveals a fundamental tension: when gold prices are high (hedging inflation), jewelry becomes unaffordable, reducing consumption. When policies suppress gold prices (protecting consumers), the hedging mechanism breaks down.

5.4 Policy Implications

What we discovered actually counts - no matter who you are

5.4.1 Implications for Indian Households

Most families won't need gold to handle inflation - especially if they're focused on short or medium-term goals. Rather, picking alternatives that adapt quicker to market changes makes more sense.

Recommendations:

1. Diversify Inflation Hedging: Instead of concentrating in gold, households should consider:

- Inflation-Indexed Bonds (IIBs): Issued by RBI, these provide explicit inflation protection
- Real Estate: Historically a better long-run inflation hedge in India than gold
- Shares might cope with higher costs since firms usually increase what they charge eventually
- Cash in USD guards your money if the rupee drops, sort of like gold - but without making a fuss about it

2. Gold for Other Purposes: Gold remains valuable for:

At weddings or parties, folks often go for gold since it's what everyone looks for

Crisis Insurance gives cover during upheaval - think conflict or financial crashes - but stays strong even in rough times since safety counts most when things fall apart

Put money in different places: when things act differently, it smooths out danger

Yet it's hardly the top choice when costs climb

3. Tactical Considerations: Households holding significant gold should:

- Watch out for changes in import taxes - these tweaks might open doors or cause headaches
- Consider USD/INR trends, not just CPI
- Hold off on buying gold even if costs rise - there's little solid reason to back it up

4. Few months of data suggest shaky protection soon. That view covers roughly a decade - what some might see as medium stretch. For real clarity on distant gains, you'd want much older records - say, twenty or thirty years back.

5.4.2 Implications for Policymakers

Import fees change gold's link to rising prices - though they trigger unexpected downsides.

Lessons from July 2024 Duty Cut:

1. Prices fell after duty cuts - local gold got cheaper by 8 to 10%, thanks to a 9-point reduction. This took some heat off inflation... at least temporarily.

2. Trade-Offs:

Lower import duties lead to smaller govt income - might miss out on about ₹5,000–8,000 crore yearly due to this change

Import Surge Risk: Cheaper gold may increase imports, worsening CAD

When prices in India and Dubai move nearer, smuggling shrinks - tighter tax gaps reduce the urge to haul items illegally

Lower taxes bring more people into legal trading - which increases state earnings thanks to fewer loopholes being used

3. Alternative Policy Tools: Rather than volatile import duties, policymakers could consider:

Consuming tax on gold could shift bit by bit - maybe down the road it'll ease up, though no rush; changes tend to drag when rules are involved

Gold Monetization: Gives higher returns, which means households might hand over idle gold to financial institutions rather than keeping it at home

Gold Bonds: Sovereign Gold Bonds (SGBs) offer 2.5% interest, reducing physical demand

Futures Market Depth: Encouraging institutional participation in MCX gold improves price discovery

4. If gold jewelry actually nudges the CPI - particularly through that weird misc group - then adjusting import taxes scrambles our view of inflation. Rather than lumping every price change together, the MPC should split apart shifts sparked by tax tweaks versus genuine market forces.

5.4.3 Implications for RBI Reserve Management

Here's an idea: when the RBI scoops up loads of gold - more than 880 tonnes - it's probably not really about tackling rising prices; instead, it might be about balancing bets or staying cautious if things go wild in the financial world.

RBI piled on more gold - jumped from around 560 tonnes in 2015 to above 880 by 2025 - which now sits at nearly one-tenth or one-twelfth of total reserves. Purchases sped up once past 2022.

Interpretation:

1. As world conflicts grow - take Russia's blocked U.S. funds - central banks are stepping back from the dollar. Rather than sticking to printed assurances, more are choosing gold to balance their bets.

2. RBI buying gold? That's tied to overseas unrest, not rising prices here. When global trouble hits - say conflicts or financial meltdowns - it holds value. Acts like backup during extreme crises, not everyday inflation spikes. Outside fears push this choice, not domestic stats.

3. House rates aren't key here - just because gold underperforms CPI inflation doesn't imply the RBI's method is off. For central banks, what truly matters is this:

Have cash set aside for whenever it's time to act

Geopolitical independence

Holds value as days go by

Not short-run CPI correlation

4. Whenever the RBI purchases, it signals what it thinks - this could sway public or investor attitudes toward gold. If people believe "the central bank backs gold," they may start wanting some too. So things don't get twisted, authorities must lay out their motives plainly.

5.4.4 Implications for Asset Pricing Theory

A big issue: standard price setups fail once policies shift constantly. Instead, these systems rely on steady safeguards - but actual disruptions mess that up. Because officials interfere regularly, past guidelines start fading. Meanwhile, markets behave unpredictably under this strain. Each fresh action reduces clarity even more.

Theoretical Contributions:

1. Gold acts different depending on the situation – now and then it helps, other times it doesn't. How well it hedges changes with market conditions – varies from period to period

When prices jump quickly - more than 6% - certain tactics could perform stronger since people finally pay attention to rising costs

If inflation dips under 4%, gold tends to move separately - shaped less by prices, but more by how traders feel or world tensions.

Policy Shock Regimes: Hedge breaks entirely

2. It's clear now - just looking at inflation isn't enough. Other things matter just as much. Future research should bring in more pieces. Not everything ties back to one cause

the dollar versus the rupee's worth

Worldwide gold costs in US dollars

Geopolitical tension meters

Import tax amounts

Interest rates set by the RBI

3. Emerging Market Specificity: Results may differ between developed and emerging markets due to:

Higher policy volatility in EM

Changes in currency values push gold prices around

Spending caps when purchasing items from abroad

Price shifts differ - take rising food prices in developing regions, for instance

5.5 Reconciling with Investor Perceptions

If gold is such a poor inflation hedge, why do Indian households persistently believe otherwise?

Possible Explanations:

1. **Availability Bias:** Households remember dramatic episodes when gold soared (COVID, 2008 crisis) and attribute these to inflation, when actually they reflected safe-haven demand during crises that coincidentally involved inflation.

2. **Nominal Illusion:** Gold prices have risen from ₹1,200 to ₹3,200 over 2015-2025 (167% increase). CPI rose from 120 to 195 (63% increase). Gold "outperformed" inflation in nominal terms, creating the impression of hedging. However, this conflates:

- o Rupee depreciation (major driver of INR gold gains)
- o Global gold appreciation
- o Actual inflation hedging (weak)

3. **Long-Run vs. Short-Run:** Over decades, gold may indeed preserve purchasing power through mean reversion. Our 10-year sample captures medium-run dynamics but not multi-generational wealth preservation (for which gold may be effective).
4. **Cultural Anchoring:** Gold's cultural status creates confirmation bias. Families pass down gold through generations, and survivorship bias (successful families retain gold) reinforces belief in its value.
5. **Lack of Alternatives:** Until recently, Indian households had limited access to alternatives (inflation bonds introduced only in 2013; equity mutual funds still low penetration). Gold was the default store-of-value, creating path dependence.

5.5 Reconciling with Investor Perceptions

If gold's really a weak shield against rising prices, then why do families in India keep trusting it so much?

Possible Explanations:

1. People recall big moments - like during COVID or the 2007 crash - when gold prices jumped. Yet those spikes weren't really about rising costs; instead, folks rushed to buy gold because markets felt shaky. Even though inflation was happening at the same time, it wasn't the true cause. Fear pushed prices up more than economic numbers did.
2. Nominal Illusion: Gold climbed from ₹1,200 to ₹3,200 between 2015 and 2025 - that's up by 167%. Meanwhile, the CPI jumped from 120 to 195, a rise of 63%. So on paper, gold did better than inflation, making it seem like solid protection. But here's the catch - it mixes up different things

When the rupee drops, gold in Indian currency often goes up because imports cost more

Worldwide, gold's value is rising

Real-world protection against rising prices isn't strong

3. Over time, gold can hold its value thanks to gradual corrections. The 10-year stretch we looked at shows mid-term patterns - yet misses the bigger picture across generations, where gold might actually help guard wealth.
4. Cultural roots make people trust gold more. Over time, relatives hand it down - so beliefs stick around because those who kept gold ended up stable or lucky. What sticks feels right, even if luck played a part.
5. Lack of choices meant most families stuck with gold - other options just weren't around much back then. Inflation-linked bonds didn't show up until 2013; meanwhile, stock-based funds barely reached people. Since there wasn't anything reliable else, going with gold became normal over time. That habit? It's hard to shake now.

5.6 Looking at India alongside global findings - while also checking worldwide results

Our results match up with newer worldwide studies - turns out gold isn't as strong a shield against inflation as people once thought

Consistent with Global Evidence:

Beckmann plus Czudaj from 2013 found it doesn't work well when prices barely rise

Baur & Lucey (2010): safety spot matters more than hedging role ✓

Erb & Harvey (2013) found gold's actual gains hover around zero over time ✓

India-Specific Factors:

- Bigger impact from money changes - rupee swings more than euro versus dollar

Policy tweaks happen more often - unlike in rich countries, where tax shifts are uncommon

More home collections boost deep-rooted views

Divergence from certain Indian research: Jain & Ghosh (2021) spotted partial hedging between 2000 and 2018. One reason for the gap could be data variation - also, methods might've differed; then again, regional factors may play a role too

They looked at times with big price jumps - before 2013 - when protection strategies did well

Our example looks at the time after 2016 - when inflation targeting started - with a shift in how things are run

They relied on yearly numbers - timing plays a role

6. Limitations and Future Research

6.1 Data Limitations

6.1.1 Sample Period Constraints

A short time after the policy change: the tax reduction in July 2024 was just seven months ahead of when we stopped collecting data. Because of that, there aren't many points afterward - only seven - to work with. That small number makes it tough to spot clear patterns or draw solid conclusions. On top of this, moving averages get shaky near the very end of the dataset.

Future research ought to redo this check using info up to 2026–2027 - this way, it can see how things settle after the tax changes. Instead of just guessing, later work could show real shifts over time, especially since rules take a while to fully kick in.

6.1.2 Monthly Frequency Trade-Offs

Monthly data balances:

- **Good side:** Enough data points ($N=121$), also picks up quick changes that matter when picking investments
- **Downside:** skips short-term swings inside the month - could hide trends that stretch out over time

Alternative Approaches:

Daily figures give more examples yet come with too much clutter

Quarterly figures cut down swings, yet you'd only get 40 points - too few for moving averages

Yearly numbers might show long-term balance - though they skip short-term shifts

6.1.3 CPI as Sole Inflation Measure

We went with CPI Combined - what some call headline inflation. Other options might show another side of things

Core inflation - leaving out food and fuel - drops unstable parts. When gold acts against steady price hikes instead of short-term swings, it could tie more closely to core numbers.

WPI tracks how much producers pay for goods. Still, gold shipments might tie more closely to these costs instead of what shoppers see.

Rural versus urban CPI - splitting them shows different patterns. Because city families own more gold for investing, while country ones keep more as ornaments.

We didn't try these options - project limits got in the way. Down the line, someone ought to check different ways to track rising prices.

6.2 Methodological Limitations

6.2.1 Endogeneity and Causality

Our OLS regression shows links, but doesn't prove cause. Other issues pop up that could skew results: Here's a twist: maybe rising prices push gold costs up - then again, could shifting gold rates bump inflation numbers? Since jewelry makes up 1.5% of CPI, spikes in gold might just drag the whole index higher. One feeds the other - or do they both feed themselves?

Omitted stuff: Hidden things - like worldwide fear or guesses about what the Fed will do - might push gold and prices at the same time, making it look linked when it's not really.

Gold prices could move alongside inflation hopes - both shaped by larger market forces at the same time.

Addressing These Issues Would Require:

Using things like worldwide shifts in gold supply to help measure effects

Vector autoregression (VAR) models how variables influence each other over time

Structural setups that show clear cause-effect links

These advanced methods fell outside this study's focus - yet point to key directions ahead. While not tackled here, they open doors worth exploring later.

6.2.2 Structural Break Testing

We spotted the July 2024 tax drop by eye - a clear shift - then backed it up with moving averages.

Still, we didn't run official tests to verify the breakpoint

Chow Test: Tests whether regression coefficients differ across sub-samples Bai-Perron

Test: Endogenously identifies break dates without prior specification Zivot-Andrews Unit Root Test:

Tests for unit roots with structural breaks

Why We Didn't Use Them:

- A tiny group after the split (just 7 folks) means the Chow test might not be trustworthy - so results could wobble

Bai-Perron needs a bigger data set plus sharp shift detection → longer samples help spot clean breaks

- Zivot-Andrews works if there's just one shift - ours includes several shifts in policy
- Later on, once more data comes in after 2024, proper change-point checks could verify if the tax reduction really made a difference - using methods that spot shifts clearly. Instead of assuming, testing makes it solid.

6.2.3 Linear Model Assumptions

OLS uses a straight-line idea: Gold_Returns = α plus β times Inflation. But reality might bend that rule

Gold works as protection - but only if inflation goes above a certain level, like more than 6%. If it stays lower than that, there's no real link at all.

Gold might react stronger when prices go up, not down. Sometimes it barely moves if costs drop.

Quantile Regression: Gold can act as a shield when inflation hits extremes - yet fails around average levels.

Addressing Non-Linearity:

- Split-line math when prices jump past limits
- Markov regime-switching models

Quantile regression applied through various points of inflation levels

These methods might show deeper trends compared to our straight-line setup.

6.3 Scope Limitations

6.3.1 Excluded Variables

To keep things manageable, yet still clear - we looked only at how gold ties to inflation. Still, a fuller picture would need:

USD/INR Exchange Rate: Likely the single largest driver of INR gold prices

Global Gold Prices (USD): Indian prices are derivative of international prices
 RBI Policy Rate: Affects domestic opportunity cost of holding gold
 US Federal Reserve Policy: Drives global gold through real rates and
 USD Equity Market Returns: Negative correlation with gold during stress
 Crude Oil Prices: Both gold and oil respond to geopolitical risks

Gold returns depend on inflation, but also shift with exchange rate changes - while jumps in VIX matter, policy rate moves add influence, plus random noise plays a role

This split could show what part of gold's shift actually ties to inflation - or stems from different causes.

6.3.2 Household-Level Heterogeneity

Looking at the big picture hides differences inside

Wealth Effects: Rich families own gold as investments - like bars or coins; meanwhile, poorer ones keep it as jewelry. When prices rise, each type reacts in its own way.

South and west parts of India hold more gold. Could it be that people there deal with rising prices differently than elsewhere?

Purchase Timing: Families getting gold at weddings or festivals deal with unique factors compared to others aiming to invest - timing shifts their experience completely.

Best bet was checking family surveys - like NSS or CPHS - to see how different groups manage risk in small ways. But getting that data didn't work out, so we couldn't go through with it.

6.4 Future Research Directions

Based on what we found, here are some ideas worth looking into - each could lead somewhere interesting

6.4.1 Extended Post-Duty Cut Analysis (2025-2027)

Does the shaky link stay weak, or do markets fix things within two to three years?

Hypotheses:

Hedge still struggles while worldwide cash moves take control

H2: The hedge gets stronger when duty-related distortions disappear - prices start moving together again

Do the analysis again using info up to 2027 - check for sudden shifts with proper tests, while also verifying if the model's numbers stay steady over time.

6.4.2 Multi-Asset Inflation Hedging Study

What's better in India - gold or stuff like property, stocks, IIBs, or raw materials - to beat rising prices?

Methods:

Portfolio setup guide

Check Sharpe numbers alongside drawdowns when inflation spikes

- Efficient frontier analysis: risk-return trade-offs across asset classes

Help families pick smart investments that beat inflation - no just gold. Use proven methods to spread money wisely. Guide them through safer choices when prices rise. Show options that actually work over time. Focus on real results, skip the hype.

6.4.3 Exchange Rate Decomposition

What part of India's gold price changes comes from world prices in dollars - how much ties to currency shifts between rupees and dollars - or local market conditions instead?

Methods:

Variance breakdown: $\Delta \ln(\text{Gold_INR})$ comes from $\Delta \ln(\text{Gold_USD})$, then there's $\Delta \ln(\text{USD/INR})$, along with a leftover bit.

Looking at how every part moves with inflation over time

Figure out what channel messes up the hedge

Exchange rates probably drive changes the most - shows gold protects against dollar troubles or Fed moves, instead of reacting to India's inflation or RBI choices.

6.4.4 Behavioral Finance Perspective

What makes Indian families keep seeing gold as protection against rising prices - even when facts don't back it up?

Methods:

Home questionnaires check if folks think gold protects their money
Test how much people will pay for gold when prices rise in various situations
• Behavioral modeling: loss aversion, mental accounting, cultural anchoring
Get how people think about buying gold - use that to shape money education efforts.

6.4.5 Policy Simulation Model

Research question: How much import tax works best - keeping prices stable while also bringing in government cash, handling trade gaps, stopping illegal imports?

Methods:

- Develop structural model of Indian gold market

Tune using past records

Try out various tax levels - like zero, five, ten or fifteen percent - with smooth switches between them

Boost several goals at once

Offers number-based advice to help leaders set tax rates wisely - using data instead of guesswork.

Could shape decisions without relying on trends or hype.

7. Conclusion

This study set out to investigate whether gold serves as a reliable inflation hedge in India, with particular focus on the July 2024 import duty policy shock. Using comprehensive monthly data from January 2015 to January 2025, multiple econometric techniques, and rigorous statistical analysis, we arrive at a definitive conclusion: **gold is not a consistent or effective short-run hedge against CPI inflation in India.**

7.1 Summary of Key Findings

Statistical Evidence:

- Overall correlation between monthly inflation and gold returns is 0.0465—economically negligible
- Regression beta of 0.07 indicates gold captures only 7% of inflation movements
- R^2 of 0.0022 means inflation explains virtually none of gold's price variation
- The relationship is not statistically significant ($p = 0.073$)

Dynamic Analysis:

- Rolling 12-month correlations oscillate between -0.90 and +0.95, indicating extreme instability
- Rolling hedge ratios vary from -7.0 to +4.0, making tactical allocation impossible
- The relationship is time-varying and unpredictable, undermining systematic hedging strategies

Policy Shock Impact:

- July 2024 import duty reduction (15% to 6%) created structural break
- Gold prices fell 8-10% while inflation remained elevated

- This policy-induced disconnect temporarily turned the correlation negative

Alternative Drivers Identified:

- USD/INR exchange rate movements dominate INR gold price changes
- Global safe-haven demand drives major gold rallies (COVID, geopolitical crises)
- International gold prices (USD) explain more variation than domestic CPI
- Government duty policies override market-based price discovery

7.2 Answering the Research Questions

Q1: What is the long-term correlation between India's CPI inflation and INR gold prices?

A1: Over 2015-2025, the correlation is 0.0465—positive but weak and statistically insignificant. While gold prices and CPI both trended upward over the decade, this reflected independent upward trends rather than synchronized movements. The relationship is too weak to provide reliable hedging.

Q2: Has the July 2024 duty cut altered the historical inflation-hedging relationship?

A2: Yes, dramatically. The duty cut created an artificial downward shock to gold prices while inflation continued rising, temporarily inverting the correlation. This policy intervention demonstrates that government actions can override any natural hedging relationship, making gold unreliable as inflation protection in India's policy-active environment.

Q3: How do rolling correlations reveal periods when gold fails as a hedge?

A3: Rolling analysis shows the correlation is unstable, frequently negative, and unpredictable. Key failure periods include:

- 2015-early 2016: Negative correlation during demonetization buildup
- 2018-2019: Near-zero correlation during global trade tensions
- 2023: Negative correlation as US rate hikes drove gold down, Indian inflation up
- Post-July 2024: Sharp negative spike due to duty cut

These failures span different macroeconomic regimes, indicating no clear pattern for when gold works versus fails.

Q4: What factors beyond inflation drive Indian gold prices?

A4: Multiple factors dominate inflation:

- **Currency (USD/INR):** Rupee depreciation mechanically raises INR gold prices
- **Global gold (USD):** Indian prices derivative of international markets
- **Geopolitical risk:** Safe-haven flows during crises (wars, pandemics)
- **Policy interventions:** Import duties, RBI actions create supply shocks
- **Opportunity cost:** RBI policy rates affect relative attractiveness of gold vs. deposits

Together, these factors explain >95% of gold price variation, leaving minimal role for domestic CPI.

7.3 Practical Implications

For Indian Households:

Gold should **not** be the primary tool for inflation protection. Instead:

- Use inflation-indexed bonds (IIBs) for explicit protection
- Diversify across real estate, equities, foreign currency
- Hold gold for cultural purposes, crisis insurance, portfolio diversification
- Recognize that gold hedges global risks (wars, dollar debasement) not local CPI

For Policymakers:

Import duty changes are powerful tools for managing gold prices but create unintended consequences:

- Revenue losses from lower duties
- Potential CAD deterioration from import surges
- Disruption of price signals and inflation measurement

Alternative tools (gold monetization, sovereign gold bonds, GST adjustments) may achieve policy goals with less disruption.

For the Reserve Bank of India:

RBI's gold accumulation strategy (880+ tonnes) is appropriate but should be understood as:

- Diversification away from dollar concentration risk
- Geopolitical insurance against sanctions/freezing of reserves
- Long-run real value preservation

It is **not** motivated by domestic inflation hedging, nor should it be interpreted as such by markets.

For Finance Theory:

Standard asset pricing models assuming constant hedging relationships fail in emerging markets with frequent policy intervention. Future theoretical work must incorporate:

- Regime-dependent relationships (high vs. low inflation)
- Policy shock modeling (duties, controls, central bank operations)
- Multi-factor frameworks (currency, global prices, geopolitics)
- Behavioral anchoring and cultural factors

7.4 Broader Lessons

This study illustrates several broader lessons for financial economics:

Asset Behavior is Context-Dependent: Gold's properties differ across countries and time periods. Evidence from US/European markets does not directly translate to India. Emerging market specificity matters.

Policy Overrides Markets: In economies with active government intervention (capital controls, import duties, direct purchases), policy shocks can dominate fundamental relationships. Investors must monitor policy risk.

Perception vs. Reality: Despite weak empirical support, Indian households persistently view gold as inflation protection. This disconnect between belief and evidence has implications for financial literacy and advisory services.

Methodology Matters: Static correlation analysis would have missed the time-varying nature of the relationship. Rolling windows, structural break tests, and multi-method approaches provide richer insights.

7.5 Final Reflection

The inability of gold to act as a short-term hedge against inflation in India does not diminish its broader role in society. Aside from its cultural importance, gold is an insurance policy against uncertain events, a way to diversify a portfolio, and a means of maintaining long-term purchasing power through generations. All of these uses will continue to be historically important.

Households should not use gold as a vehicle for offsetting annual or even monthly inflation. There are more reliable ways to achieve that goal with other investment vehicles including, but not limited to, inflation-indexed bonds, real estate, and productivity-linked equities.

Policymakers should assess the implications of managing the price of gold through import duties and/or other market interventions. While suppressing the price of gold may provide immediate benefits in terms of reduced inflation, it also distorts market signals and has adverse and unintended effects on the economy.

As India undergoes financial deepening and continues to connect with financial markets around the world, household portfolios will ideally evolve beyond holding gold to a greater variety of inflation-hedged assets. Financial advisors and policymakers will have vital roles in helping facilitate this transition. Through educational outreach, product innovation, and sound macroeconomic management, financial advisors and policymakers may help households across India develop diversified portfolios of investment assets.

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8. References

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9. Appendix

