

Hedging properties of Gold in an Emerging Market Economy: An Application of Intertemporal Capital Asset Pricing Model

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Background

- there has been enormous growth in the global financial markets including emerging market economies (EMEs), in terms of trading of a variety of financial instruments as well as volume of trade.
- However, **adverse economic events** in global financial markets, higher **interconnectedness** → exposed to the risks of higher volatility.
- **Indian financial market** is no exception: witnessed substantial growth domestically and also achieved greater international integration, reinforced by the process of liberalisation and globalisation.
- It also led the Indian financial market to be more susceptible to external shocks.
- Increasing interconnectedness of Indian markets and rising uncertainties across markets → need and significance of **portfolio diversification**.

Contd..

- Investors are primarily motivated to allocate funds to safe assets as a means of mitigating the risk exposure.
- It underscore the need for a hedge or safe haven to safeguard investors from adverse economic events and potential losses.

Gold

- Gold receives significant attention due to its remarkable performance during GFC
- Gold acts as a **hedge** amidst economic uncertainties.
- gold is considered a **safe haven** since it acts as a stabilizing force.
- gold prices remained relatively high, while those of other risky assets experienced a decline.
- Gold prices experienced a consistent rise until 2016, with occasional declines in 2013 and 2015.
- global stock market volatility, surge in inflation, geopolitical and economic uncertainties etc. contribute to increased demand for gold for investments.
- Gold as a **risk diversifier, inflation hedge, low transaction costs, and equity-like returns** reaffirmed in existing literature.

Literature Review

Study	Findings
Merton (1973)	ICAPM is consistent with the expected utility of lifetime consumption and time varying investment opportunity set.
Bali and Engle (2010)	The risk-aversion coefficient is highly significant and positive confirming the application of ICAPM to different risky assets.
Baur and Lucey (2010)	Gold acts as a hedge and safe-haven in the USA and the UK, not for Germany and the BRICS
Kang et al., 2019	Test the ICAPM for G7 countries and find that the intertemporal risk-return relation is positive conditional on bad market news, but negative conditional on good market news.
Chelikani et al., 2023	Findings suggest a positive intertemporal risk-return relationship subject to distortion due to trading by informed investors to exploit mispricing.
Sikiru and Salisu (2023)	Gold acts as a hedge against risks caused by COVID-19 for stocks in the tourism sector
Cui et al., 2023	Empirical findings suggest that gold acts as a safe haven asset during the time of COVID-19.

Objective

- To assess the **hedging effectiveness** of gold against stock prices in Indian stock market in a multi-period setting of intertemporal risk-return relationship.
- we examine the cross-sectional intertemporal risk-return relationship using **gold prices** and **treasury bill rates** as the hedging variables.
- assess whether it generates adequate risk premium in the Indian financial market, given that these attributes of gold are not homogeneous across all stock markets.

ICPAM

- **Capital Asset Pricing Model (CAPM):** widely used models for describing prices of financial assets in a risk-return setting.
- CAPM faces theoretical and empirical challenges: based on mean-variance criterion of investor's choice of portfolios, homogeneous expectations, and is a single-period model.

Intertemporal Capital Asset Pricing Model (ICAPM, Merton 1973) :

- multivariate asset pricing model → positive relationship between expected return and risk
- continuous-time framework: captures investors' needs and preferences better.
- equilibrium model that maximises expected utility of lifetime consumption
- investors are compensated by additional risk premium for bearing risk associated with variation in the **investment opportunity set**
- **hedging** occupies a predominant position in the ICAPM framework

Underlying Model

- Merton's (1973) ICAPM entails the following equilibrium relationship between risk and return:

$$\mu = A \cdot Cov_m + B \cdot Cov_x$$

where μ = expected excess return on a vector of ' n ' risky assets,

A = average relative risk aversion slope coefficient,

Cov_m = covariance between returns on a vector of ' n ' risky assets and the market
' m '

B = $k \times 1$ vector that reflects reactions of the market to shifts in the investment
opportunity set

Cov_x = covariance between ' n ' risky assets and the state variables, ' x '

For a single risky asset, the ICAPM relation can be depicted as:

$$\mu_i - r_f = A \cdot \sigma_{im} + B \cdot \sigma_{ix}$$

- The ICAPM is said to be valid if two conditions are satisfied:
 - (i) positive common slope coefficient ($A > 0$), and
 - (ii) zero intercepts ($C_i = 0$)

Empirical Framework and Methodology

➤ First, we employ the GARCH techniques to parameterize the conditional covariances between stock 'i' (portfolios) and the market portfolio and the same with hedging variables.

- The mean equation for a multivariate GARCH (MGARCH) model can be written as:

$$r_t = \mu_t + \epsilon_t$$

$$\epsilon_t | \tau_{t-1} \sim N(0, H_t)$$

where r_t is the vector of returns,

μ_t is the $k \times 1$ vector of parameters,

ϵ_t is the error vector,

H_t is the conditional covariance matrix which is a function of the information set τ_{t-1} .

- The study uses the Diagonal BEKK-GARCH model to calculate the required covariances.

Empirical Methodology (Cont...)

➤ Second, a pricing equation is estimated by performing a Seemingly Unrelated Regression (SUR) analysis. It involves the joint estimation of all equations together with two state variables: gold price and TBR.

• The pricing equation is given as follows:

$$R_{i,t+1} = C_i + A \cdot \sigma_{im,t+1} + B_1 \cdot \sigma_{i,Gld,t+1} + B_2 \cdot \sigma_{i,Tbr,t+1} + e_{i,t+1}$$

where A , B_1 , and B_2 are the common slope coefficients

C_i is the intercept

$\sigma_{i,Gld,t+1}$ is the conditional covariance between stock 'i' and gold price

$\sigma_{i,Tbr,t+1}$ is the conditional covariance between stock 'i' and TBR

➤ The return series are calculated using the formula:

$$rstock_t = \ln \left(\frac{stock_t}{stock_{t-1}} \right)$$

Empirical Methodology (Cont...).

- In the first set of analysis, we consider BSE 500 index and construct four different portfolios in accordance with the value of market capitalization of the constituent stocks for June, 2022.
 - ✓ Stocks are arranged in ascending order of the value of market capitalization and are categorized into 4 quartiles. Therefore, we construct four stock portfolios: small-cap, mid-cap 1, mid-cap 2, and large-cap.
 - ✓ Similarly the analysis is carried out for the other two indices, viz. S&P BSE SENSEX and NIFTY 50.
- Analysis : based on daily data for the period, December 16, 2005, to June 30, 2022, covering 3863 daily observations.

Variables

Variables	Description	Source
BSE 500 portfolio excess return	Dependent variable. It is calculated over the 91-day TBR risk-free rate	Prowess ; Centre for Monitoring Indian Economy (CMIE)
S&P BSE SENSEX stocks' excess return	Dependent variable. It is calculated over the 91-day TBR	Prowess (CMIE)
NIFTY 50 stocks' excess return	Dependent variable. It is calculated over the 91-day TBR	Prowess (CMIE)
Conditional covariance of BSE 500 stock portfolios	Independent variables. The market is proxied by BSE 500	Prowess (CMIE)
Conditional covariance of S&P BSE SENSEX individual stocks	Independent variables. The market is proxied by BSE-200	Prowess (CMIE)
Conditional covariance of NIFTY 50 individual stocks	Independent variables. The market is proxied by NIFTY-500	Prowess (CMIE)
Gold returns	Independent variables.	Multi-Commodity Exchange of India Limited (MCX)
91-days TBR	Independent variables	Economic and Political Weekly Research Foundation (EPWRF)

Findings

Table 1: Risk-return relationship for BSE 500 stock portfolios without intertemporal hedging demand

	Coefficient	Wald	Prob
Intercept	-0.062	22653.7 [0.00]	0.000***
Cov_{Mkt}	2.100	6.65 [0.00]	0.000***

risk-aversion coefficient A for BSE 500 stock portfolios is estimated to be 2.10, indicating a positive and highly significant association between risk and return.

*** indicates statistical significance at 1% level of significance

Findings(cont..)

Table 2: Risk-return relationship for BSE 500 stock portfolios with intertemporal hedging demand and market return of BSE 500

	Coefficient	Wald	Prob
Intercept	-0.061	23998.2 [0.00]	0.000***
Cov_{Mkt}	2.157	6.63 [0.01]	0.01**
Cov_{Gld}	19.147	13.26 [0.00]	0.00***
Cov_{Tbr}	5.489	4.89 [0.02]	0.02**

** indicates statistical significance at 5% level of significance

Findings(cont..)

Table 3: Risk-return relationship for S&P BSE SENSEX stocks with intertemporal hedging demand and market return of BSE 200

	Coefficient	Wald	Prob
Intercept	-0.064	22580.4 [0.00]	0.000***
Cov_{Mkt}	1.661	8.45 [0.00]	0.003***
Cov_{Gld}	2.871	2.99 [0.08]	0.083*
Cov_{Tbr}	0.457	0.21 [0.64]	0.645

positive coefficient of cov_{gld} predicts positive future market returns
Gold is a priced risk factor with a positive risk premium and a negative
intertemporal hedging demand and favourable shift in investment opportunity set.

*indicates statistical significance at 10% level of significance

Findings(cont..)

Table 4: Risk-return relationship for NIFTY 50 stocks with intertemporal hedging demand and market return of NIFTY 500

	Coefficient	Wald	Prob
Intercept	-0.067	8761.3 [0.00]	0.000***
Cov_{Mkt}	3.377	3.09 [0.01]	0.000***
Cov_{Gld}	3.096	3.46 [0.06]	0.062*
Cov_{Tbr}	-0.066	16055.3 [0.00]	0.000**

***conditional covariance of the individual asset returns with the gold returns: statistically significant and positively correlated, signifying that the gold prices can predict the next period's returns on the NIFTY 50 stocks.**

***favourable shifts in the investment opportunity, a negative intertemporal hedging demand, and a positive risk premium**

Discussions

- Based on our SUR estimations, gold, as a hedging variable, appears to be a priced risk factor, and can be considered as a proxy for investment opportunities.
- In Table 1, the risk aversion coefficient ' A ' for BSE 500 stock portfolios is positive and highly significant, implying a positive relationship between risk and return without the intertemporal hedging demand. The intercepts are not jointly equal to zero according to the Wald statistic.
- In Table 2, the hedging demand is taken into account. The risk aversion coefficient is still positive and highly significant. The estimated coefficient of gold (Cov_{Gld}) is positive and significant, implying gold is a priced risk factor with a positive risk premium.
- The estimated coefficient of TBR (Cov_{Tbr}) is also positive and highly significant, implying TBR is also a priced risk factor.
- Similar analysis carried out for S&P BSE SENSEX (table 3) and NIFTY 50 (table 4) depict positive estimates for gold. However, the TBR show varied results.

Conclusions

- **First**, the relative risk-aversion coefficient remains positive and statistically significant both with and without incorporating the inter-temporal hedging demand.
- **Second**, the positive risk-aversion estimates are robust to alternative stock and market portfolio specifications.
- **Third**, gold returns as a hedging variable appear to be a priced risk factor. It depicts favorable shifts in the investment opportunity and a positive risk premium.
- **Fourth**, the treasury bill rates display varied results.

Policy Implications

- The investors can contemplate incorporating gold into their portfolios for diversification purposes and constructing portfolios to safeguard their investments.
- The GOI can promote the financialization of gold and establish it as an asset class. This can be achieved by improving the current initiatives such as the Gold Monetisation Scheme, Sovereign Gold Bond Scheme, and Gold Savings Account. This would therefore attract investors to diversify their portfolios by linking financial instruments to gold.

Thank You