Impact of Policy Uncertainty on Gold Price in India: Evidence from Multi Commodity Exchange (MCX) India and World Gold Council Prices

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Abstract

India is one of the largest consumers of gold but remains largely unexplored and requires proper attention from investors, regulators and policymakers. Our study aims to uncover the relationship between policy uncertainty and gold prices in India, considering a timeline from 1963–2020. Using India EPU and geopolitical uncertainty-related index the empirical estimation was performed in a time series framework using standard OLS and augmented regression using data from MCX India and WGC prices. Our statistical investigation signals that policy uncertainty and gold prices in India are positively associated. This implies a higher degree of policy uncertainty and a higher gold price. Monetary policy uncertainty and interest rate changes have adversely impacted the gold price in India; the effects were more pronounced after 2015. Furthermore, policy uncertainty contains information explaining gold futures prices and has a two-month lag impact. Thus, gold trading in India is sensitive to the economic outlook of the economy and policy uncertainty. Gold imports in India have an adverse effect on gold prices. It is also reported that the INR/USD exchange rate plays a vital role in gold price setting. Hence, the study suggest that India's government should develop a healthy gold ecosystem and gold policy.

Keywords: Economic policy uncertainty; Gold price; Geopolitical risk; Inflation; Uncertainty; Federal fund rates; Exchange rate
JEL Classification: G12; G13; G18; E52

1. Introduction

Understanding the factors affecting gold prices has always been an intriguing and stimulating topic for researchers, investors, regulators, and policymakers. The literature suggests that during the period of the classical gold standard when gold had a strong monetary function (Bordo & Kydland, 1995), the gold price was linked primarily to gold demand for monetary use, regardless of the supply (Barro, 1979; Rockerbie, 1999). However, after the dissolution of the Bretton Woods System in 1973, the monetary function of gold declined (Qian, Ralescu & Zhang, 2019), and literature on gold prices emerged in various streams. Some researchers have continued to focus on the interaction of gold supply and demand in determining prices (Rockerbie, 1999; Ismail, Yahya & Shabri, 2009; Apergis, 2014), while others have analyzed the role of gold as a safe haven, hedge, or derivative instrument (Baur & Lucey, 2010; Wang et al., 2011; Bialkowaski et al., 2015; Cheng, Chen & Lai, 2018). The co-movement of gold prices has also been analyzed extensively concerning crude oil prices (Zhang & Wei, 2010; Reboredo & Ugolini, 2016; Kanjilal & Ghosh, 2017; Shahbaz et al., 2017; Mokni et al., 2020) and energy markets (Mandacı, Cagli & Taşkın, 2020; Mensi, Rehman & Vo, 2020). Another prominent stream of research investigates the relationship between gold prices and economic policy uncertainties (Jones & Sackley, 2016; Raza, Shah & Shahbaz 2018; Beckmann, Berger & Czudaj, 2019; Gao, You &

Chen, 2019; Gozgor et al., 2019; Huynh, 2020). This paper strengthens this research stream and investigates the impact of policy uncertainty and regulation-related issues on gold price oscillations in the context of India, which is the second largest consumer of gold in the world, after China, but still largely remains unexplored. We investigated the effect of major macroeconomic indicators, such as monetary policy meetings, GDP reports, and other macroeconomic reports, on gold pricing in India using the MCX commodity Index and World Gold Council Prices. The study investigates the extent to which the policy uncertainty captured by India Economy Policy Uncertainty (IEPU) index is related to gold prices in India

This approach to explain gold price instability is novel in several aspects. First, this is the first attempt to uncover the effects of policy change on the gold prices in India. Second, we propose to use an extended time series framework along with India EPU and geopolitical uncertainty-related index to analyze the above-mentioned research questions. Third, this study develops a empirical model for understanding gold price movement and volatility using the conditional volatility framework encompassing major policy reforms (see Table 1). Our empirical results indicate that uncertainty (economic policy uncertainty) and gold prices in India are positively associated. This suggests a higher degree of policy uncertainty results in higher gold price. Further, study report that monetary policy uncertainty and interest rate changes have adversely impacted the gold price in India; the effects were more pronounced after 2015.

Table 1 Government's policies and regulations for the gold market in India

Period	Event Dummy	Description
Post-Independence Period (1947-62)	—	The FERA Act (Foreign Exchange Regulation Act) was introduced just after the Independence of India in 1947, which banned the import and export of Gold in India (Dash,1999). Kolar gold mines producing 95% of Gold at that time was nationalised in 1956, and in the same year, the proportional reserve system was replaced with a minimum reserve system for the purpose of currency issue (Foster, 1996). The first Gold Bond Scheme was introduced in 1962 to mobilize the Gold held with common people in the country, which resulted in the collection of 16.3 tonnes; here the bonds were issued in exchange of coins, ornaments etc. as the Government wanted people to abstain from purchasing Gold and instead of surrendering their holdings to the Government (Reddy, 1996). The statistical data for this period is not available so it has not been considered in the study.
Pre-Liberalization Policy (1963-89)	D1	In 1963, the Gold Control Rules were introduced, which prohibited the manufacturing of gold ornaments of more than 14-carat purity from reducing the public craving for Gold (Rao & Sabha,1964). In 1966 this ban was lifted. In March 1965, a new series of Gold Bonds 1980 was issued. A chance was given to hoarders of unaccounted money to convert into gold bonds (Swarnkar 2009). In October 1965, National Defence Gold Bonds 1980 was introduced, and unlike earlier schemes in which maturity proceeds were in Rupees, these bonds were redeemable in Gold of standard purity. Under the Gold Control Act, 1968, citizens were prohibited from holding gold coins and bars, gold trading was banned, the cap for goldsmiths was 100 gm, and for licensed dealers was 2kg (Shah, 2012). The idea was to control the demand for Gold but it didn't happen and as a result the smuggling (30-70% of actual import) of Gold increased (Shah,2012; Kanungo & Chakrabarti 2021). The Act didn't go through major changes until the Voluntary Disclosure of Income and Wealth (Amendment) Ordinance was introduced in 1975. Further, in 1978 to curb smuggling and remove arbitrage between domestic and international gold prices, the Government started Gold auctions through RBI but discontinued it later in the same year as it was unsuccessful in attaining both the objectives (Reddy,1996).
Post-Liberalization Policy (1990-2011)	D2	Liberalization in the Indian economy resulted in major changes in gold policy. The Gold Control Act 1968 was revoked in 1990. To meet the evergreen demand for Gold in the country and without wasting scarce foreign exchange for the import of nonessential items like Gold in the country, the Government introduced NRI Scheme in 1992 (Virmani 2001). Under this scheme, NRI was permitted to bring 5 Kgs of Gold in India every six months by paying a nominal duty (Reddy 1996). Till 1996-97, 87% of gold import was through NRI Scheme and rest 13% was through SIL (Special Import Licence) given to exporters (Virmani, 2001). SIL was extended to Gold in 1994, which permits a category of exporters to send back their overseas earning by importing gold bullion, jewellery, and coins (Shashi,2006). In 1997, under provisions of the Banking Regulation Act, RBI (Reserve Bank of India) permitted some scheduled commercial banks to import Gold (Kanjilal & Ghosh,2014). In 1999, the Government introduced Gold Deposit Scheme (GDS) to encourage mobilisation of privately held stock of Gold to reduce dependence on the import of Gold which was later discontinued and relaunched in 2009.
Post-Liberalization Policy (2012-2013)	D3	The period from 2012-2013 is a significant period from the gold policy point of view in India and therefore requires special attention. According to NITI Ayog Report (pg 96,2018) in order to curb the demand for Gold and control the record trade deficit at that time, the Government and central bank increased the import duty on bullion repeatedly from Rs.300/10 gm in 2011 to 2% in Jan2012 to 10% in August 2013 followed by suspension of import in 2013. In August 2013, the controversial 80:20 scheme was introduced. Under this scheme, "20%, of every lot of import of gold imported to the country is exclusively made available for the purpose of exports and the balance for domestic use". Proponents of this scheme support the scheme by stating that the Government introduced this scheme to curb gold imports in order to control the big current account deficit and lingering foreign exchange crisis, while according to opponents of the scheme, it encouraged gold smuggling, gold hoarding, and artificial inflation of retail price.
Pre-Demonetization	D4	Another important event that is directly affecting the Indian economy in the recent past is demonetisation of Rs. 500 and Rs. 1,000 notes in November 2016. We are considering the period from 2014-2016 as the pre-demonetization period. In November 2014, the

Policy (2014-2016)		Government lifted all restrictions on gold import, and 80:20 scheme was also withdrawn[3]. According to Government, the 80:20 scheme could not restrict gold import for which it was aimed at and scrapping it would help reduce the illegal imports of Gold (Celestine, 2014). This scheme has resulted in the illegal record import of around 335 tons Gold in India. (Martin,2019). Moreover, according to CAG (Comptroller and Auditor General of India) Report (March 2015) this scheme has resulted in a loss of Rs.1 trillion to government treasury'[4]. In November 2015, three new schemes were launched. The Gold Deposit Scheme (GDS) 1999 was relaunched as Gold Monetisation Scheme (GMS) to mobilize Gold held with households and to reduce dependence on gold import. Now, GMS comprises GDS as well as GML (Gold Metal Loan) [5]. GMS was not as successful as expected due to small returns, lack of awareness, and reluctance of people to part with physical Gold, and deposits worth only 2% (6410 kg) of annual imports in 2016 (Kundu,2017). Under the GML scheme, the Gold collected under the GMS is profitably lend by the banks to jewellers to meet their inventory requirement (D'Souza, 2015). NITI Aayog, 2018 mentions that despite low-interest rates, few takers of GML and banks were not able to lend the small gold deposits collected under GMS, so banks have refused to accept more gold deposits under GMS. Another scheme launched in November 2015 was Sovereign Gold Bond Scheme to cut the demand for physical Gold and move the portion of domestic savings used to buy Gold towards financial savings (Chaturvedi,2021). The first-ever National Gold Coin was also launched in November 2015. In January 2016, it was made mandatory to quote PAN (Tax Number) by the customer on jewellery purchase above Rs.200,000 to check on black parking money in Gold. Also, 1% Excise duty was imposed on jewellers with a turnover of more than Rs.120 million. A forty-two-day strike was called by jewellers across the country demanding rollback of both. According to jewellers, those customers who are not willing to produce PAN Card will buy from an unorganized sector. It will hit legitimate jewellers and result in an increase in gold smuggling. Later in December 2016, the Government scrapped 1% excise duty on branded gold coins with 99.5%purity. The New Bureau of Indian Standards (BIS) Act was introduced, which made hallmarking compulsory.
Post-Demonetization Policy (2017 onwards)	D5	Demonetisation resulted in an abrupt surge in gold prices (Gold peaked to Rs.34000/10gm) due to high purchases in the black market (Agarwal, 2018). Gold bars and jewellery were bought at a premium of up to 50% in exchange for banned currency notes (Saghal,2020). But, after the action taken by Income Tax Department, gold prices dropped as demand for Gold came down eventually (PTI, 2017). According to RBI Assessment paper, gold imports declined in December 2016 and January 2017 post demonetization (PTI, 2018). Sovereign Gold Bond Scheme 2017-18 series I, Sovereign Gold Bond Scheme 2018-19 series I were introduced.

Source: Author's calculation

1.1 Demand and supply scenario for gold in India

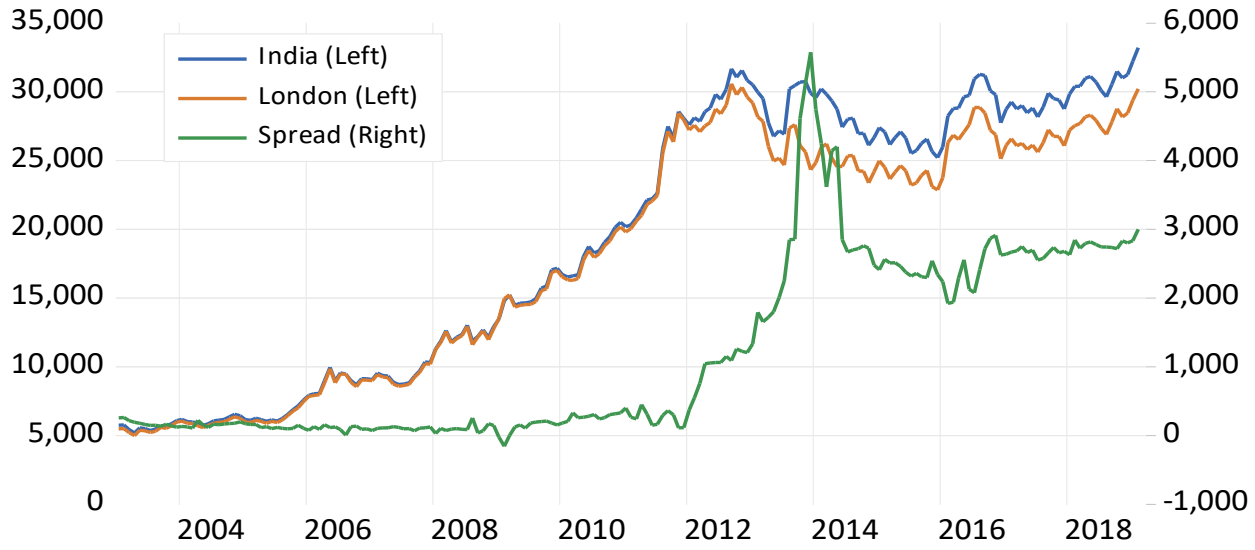
India has always been a leading market for gold globally. Buying gold is intertwined with every occasion in Indian culture, such as weddings, religious ceremonies, or celebrations. The literature also suggests that demand for gold in India is not affected by per capita income, as Indian consumers view gold as an asset to protect them from volatility and uncertainty in other assets (Star & Tran, 2008). According to World Gold Council (WGC), in 2019, demand for gold in India 690.4 tons (see Appendix I) was the second highest in the world after China's 899.5 tons. Furthermore, around 22,000 tons of gold is estimated to be possessed by Indian households, with a value of more than $1 trillion (Soundararajan et al., 2014). India is a leading consumer of gold globally, but it fulfills the demand primarily through imports, which can be attributed to insignificant mining and recycling of gold in India. In 2019, India imported 646.8 tons of bullion against a domestic supply of 130.6 tons (through mining and old scrap) (see Appendix II).

Due to large imports, gold contributes to a high current account deficit (CAD) in the Indian economy, next only to crude oil. To reduce high CAD, government policies in India are traditionally framed to reduce gold imports. These policies are in the form of regulations and circulars by the Reserve Bank of India (RBI), Central Board of Direct Taxation (CBDT), Directorate General of Foreign Trade (DGFT), and Bureau of Indian Standards (BIS). To name a few, schemes such as the Gold Monetization Scheme (GMS) modified the earlier 'Gold Deposit Scheme' (GDS) and 'Gold Metal Loan Scheme' (GML) and were intended to reduce the import of gold and mobilize gold held by households and institutions of the country. The Sovereign Bond Scheme Series was intended for those who want to invest in gold. Additionally, government policy on shifting from fixed import tariffs to Ad Valorem Tax makes gold expensive for retail customers.

A comprehensive list of these policies is discussed in Table 1. The table provides the historical display of policies and regulations issued in the form of legislative acts and gazette circulars from 1960–2020. Moreover, historical data also suggest that the average spread between gold prices in India and London has been positive, although the spread was considerably reduced in the Indian economy after significant deregulation of the Indian Gold market by the

government in 1991 (see Appendix III). Further, Figure 1 exhibits the temporal plot of the gold price (per 10gm) in India and London.

Figure 1Time series plot of Gold price (INR) in India



There was exponential growth in the gold price from 2003 to 2013, and it reached its lowest level in 2016 (Figure 1). Moreover, gold regained its highest value in 2019. In comparison to 2019, the gold prices for the year 2020 had seen a substantial increase due to the COVID-19 pandemic and other factors. The highest increase in gold prices occurred from 2010 to 2011, when the annual average gold price increased from Rs.18,500 per 10gm to Rs.26,400 per 10gm. One of the critical observations from the graph is that gold traded at a higher price in India than in its London counterpart[1]. Hence, we can see that there is considerable spread between the two markets.

1.2. Measuring policy-related uncertainty

Economic policy drives investment, production, employment, and other macroeconomic indicators of the economy. Generally, investors closely follow their favorite financial/economic dailies to form the best investment proposal. Baker, Bloom, and Davis (2016) developed an economic policy uncertainty index (EPU) based on newspaper archives by text mining for the economic and financial keywords, such as "economic/economy," "uncertain/uncertainty," "deficit,", "monetary policy," "gross domestic product," and "legislation/regulation," frequently appear in newspapers and online portals. This index has received market validation and has been used by

[1]Source: Reserve Bank of India.

several market data providers, including Bloomberg, FRED, and Reuters. A similar text-mining tactic has been employed to trail policy-related uncertainty for the Indian economy.

To measure policy-related economic uncertainty for India, Baker, Bloom, and Davis (BBD) (2016) constructed an Indian EPU (IEPU) index following the same approach as American newspapers to build a monthly US EPU Index. BBD utilizes seven Indian newspapers: The *Economic Times*, the *Times of India*, the *Hindustan Times*, *the Hindu*, the *Statesman*, the *Indian Express*, and the *Financial Express*. For each paper, they counted the number of news articles containing at least one term from each of the three term sets: (1) *uncertain*, *uncertainties*, or *uncertainty*; (2) *economic* or *economy*; and (3) *policy*-relevant terms, such as '*regulation*,' '*central bank*,' '*monetary policy*,' '*policymakers*,' '*deficit*,' '*legislation*,' and '*fiscal policy*.' It is believed that gold, as one of the safe havens for investment, is affected by policy uncertainty. Each dated circular has extensive media and press coverage and is disseminated via the abovementioned newspapers. Therefore, the IEPU gauges policies and regulations that affect India's gold market and captures the uncertainty about the macroeconomy, monetary policy, and other macroeconomic indicators of the Indian economy.

Our study on the relationship between policy uncertainty and gold prices in India proceeds as follows: Next section presents the theoretical background and literature analysis followed by the data sources and the descriptive analysis. Further section 'discusses the method, hypothesis building, results', and discussion. Last section ends with a conclusion and policy implications.

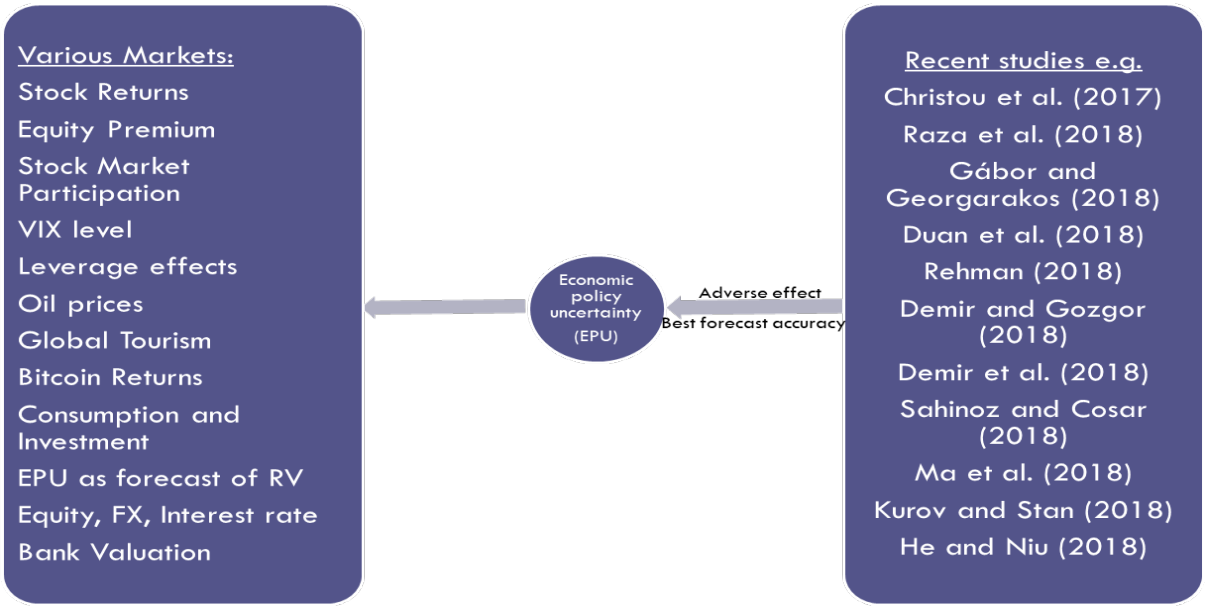
2. Theoretical background and literature investigation

The literature investigates the effects of policy uncertainty on various asset classes. The relationship between policy uncertainty and equity market behavior has been investigated. A general equilibrium model that explains the effect of political and economic shocks due to government policy choices on equity risk premium was developed by Pástor and Veronesi (2013). They found that under bad economic conditions, the risk premium is driven by political uncertainty, whereas, in good conditions, it is largely driven by economic uncertainty.

Christou et al. (2017) examined policy uncertainty and stock returns for Pacific Rim countries in a panel Vector Autoregression (VAR) setting. Empirical outcomes explain that stock market returns have been negatively affected following an increased level of policy uncertainty. Furthermore, Raza et al. (2018) examined the equity premium for G7 countries based on monthly data under economic policy uncertainty using Quantile-on-Quantile regression. The authors reported a negative association between the quantile of EPU and the quantile of the equity premium and a negative association for extremely low and high tails. Gábor and Georgarakos (2018) explored EPU and stock market participation based on a survey of household stockholding. After controlling several indicators for household stockholding, they found that a household with higher exposure to EPU news is less likely to invest in stocks. Additionally, such participation is independent of the level of market volatility and household expectations. Duan et al. (2018) first investigated the leverage effect and EPU on future stock market volatility based on the regime switching framework. Regarding the information content of HAR-RV type and GARCH-class models, HAR-RV, including leverage effects and EPU, outperform the traditional GARCH-class models. Hu et al. (2018) replicated the study of Bali et al. (2017) for the Chinese equity market based on the EPU index and found that China's A-shares were

significantly affected by the US EPU index shocks. Additionally, US-based EPU index shocks on the Chinese market across different industries are perceived to be asymmetric. Finally, investors have to pay a premium to buy Chinese A-shares linked to EPU uncertainty.

Figure 2 Policy uncertainty and asset prices literature evidence



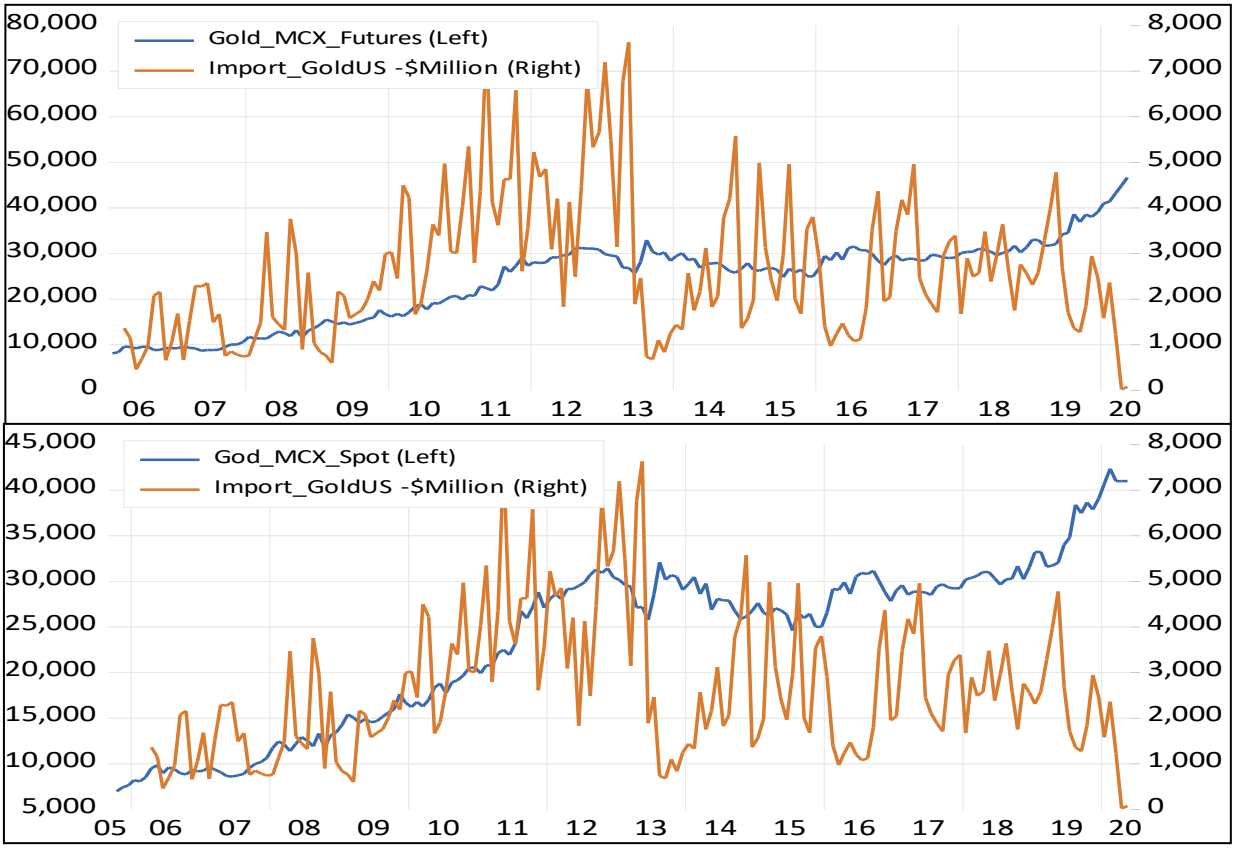
As seen in Figure 2, there are numerous studies that document the effects of policy uncertainty on various asset classes. The policy uncertainty index rises significantly during major economic and political events and causes the investment and saving behavior of the economy. A rise in the EPU index increases the general level of gold price volatility. The EPU index and gold price volatility index appear positive and significant. However, there is a lack of studies on gold prices in relation to policy uncertainty in emerging economies, such as that of India. This study examines the India EPU (IEPU) on an important asset class, i.e., gold.

3. Data sources, description, and preliminary analysis

To analyze the behavior of gold prices in India amid policy and regulation changes, we consider the monthly price of gold and other policy-related factors and macroeconomic indicators. Table 1 summarizes the various indicators of gold price and uncertainty variables. We set our timeline from December 1978 to May 2020. Then, depending upon the available data, we chose the estimation window accordingly. Gold price in India is considered based on the calculation of the World Gold Council (WGC), in which we consider monthly gold price and the gold price index. In addition, we consider monthly gold Spot prices and Futures from the MCX commodity exchange. Our study also incorporates monetary policy uncertainty. We review Monetary Policy Committee (MPC)/Federal Open Market Committee (FOMC) meetings and federal fund rate changes. We also consider the exchange rate in INR/USD, CPI and gold imports, and further government G-sec yield. Policy uncertainty has been expressed using EPU India, EPU US, and the GPR index of India and the US. Since the commodity and equity markets are connected, we consider the

MCX commodity index and the BSE Sensex equity index. Furthermore, to uncover the effects of policy changes (for details, see Table 1), we consider contemporaneous changes in gold-related policies.

Figure 3 Gold futures price and gold import



Before formulating the empirical model, we present a descriptive analysis of the variables under statistical investigation in gold price and policy uncertainty studies. Figure 3 exhibits the temporal plot of gold futures and spot price traded on the MCX commodity exchange, and the amount of gold import is expressed in million USD. There was an exponential increase in gold prices and gold imports from 2005 to 2012, but despite the greater inflow of gold, the gold price declined in 2013. A plausible reason for the shift in gold price may be the policy *intervention* period (2012–2013). From 2013 to 2015, gold prices experienced a declining trend, and gold imports declined significantly. During this period, gold policy and regulation experienced more *transparency* in the gold trade and import and export. After 2016, there was a significant fall in gold imports and a surge in gold prices. The period from 2016 to 2019 was characterized by major policy changes in gold imports and gold monetization. During this period, GMS and Sovereign Gold Bond schemes were significantly amended to allow gold to enter the formal trading platform with less reliance on gold imports. The correlation coefficient between the gold price and gold imports appears positive (0.201) and statistically significant (Table 2). However, after 2015, the association between gold imports and gold prices in India was negative (-0.48) and significant at a 1% level. The pre-2015 gold import and gold price policy favored gold imports, while post-2015 gold market regulation and policy changes discouraged gold imports.

Table 2 Correlation coefficients

Correlation	GOLD_MCX_FUT	GOLD_MCX_SPOT	GP_INDIA
CPI	-0.3066	-0.3151	-0.2869
p-value	0.0000[a]	0.0000 [a]	0.0001 [a]
EPUIND	0.1011	0.0911	0.1563
p-value	0.1895	0.2374	0.0418
GPR	0.4135	0.4221	0.3771
p-value	0.0000 [a]	0.0000 [a]	0.0000 [a]
GPR_INDIA	0.0755	0.0648	0.0653
p-value	0.3281	0.4010	0.3974
STFFR_INDIA	-0.1796	-0.1620	-0.1678
p-value	0.0191 [b]	0.0348	0.0287 [b]
FEDFR_US	-0.5199	-0.5226	-0.5485
p-value	0.0000 [a]	0.0000 [a]	0.0000 [a]
IMPORT_GOLDUS$MILLION	0.2011	0.2166	0.2488
p-value	0.0085 [a]	0.0046 [b]	0.0011 [a]
EXR_USD	0.8655	0.8664	0.8290
p-value	0.0000 [a]	0.0000 [a]	0.0000 [a]
SENSEX	0.7706	0.7762	0.7401
p-value	0.0000 [a]	0.0000v	0.0000 [a]

Significant at [a]1%, [b]5%, [c]10%

Figure 4 Gold price and Economic Policy Uncertainty

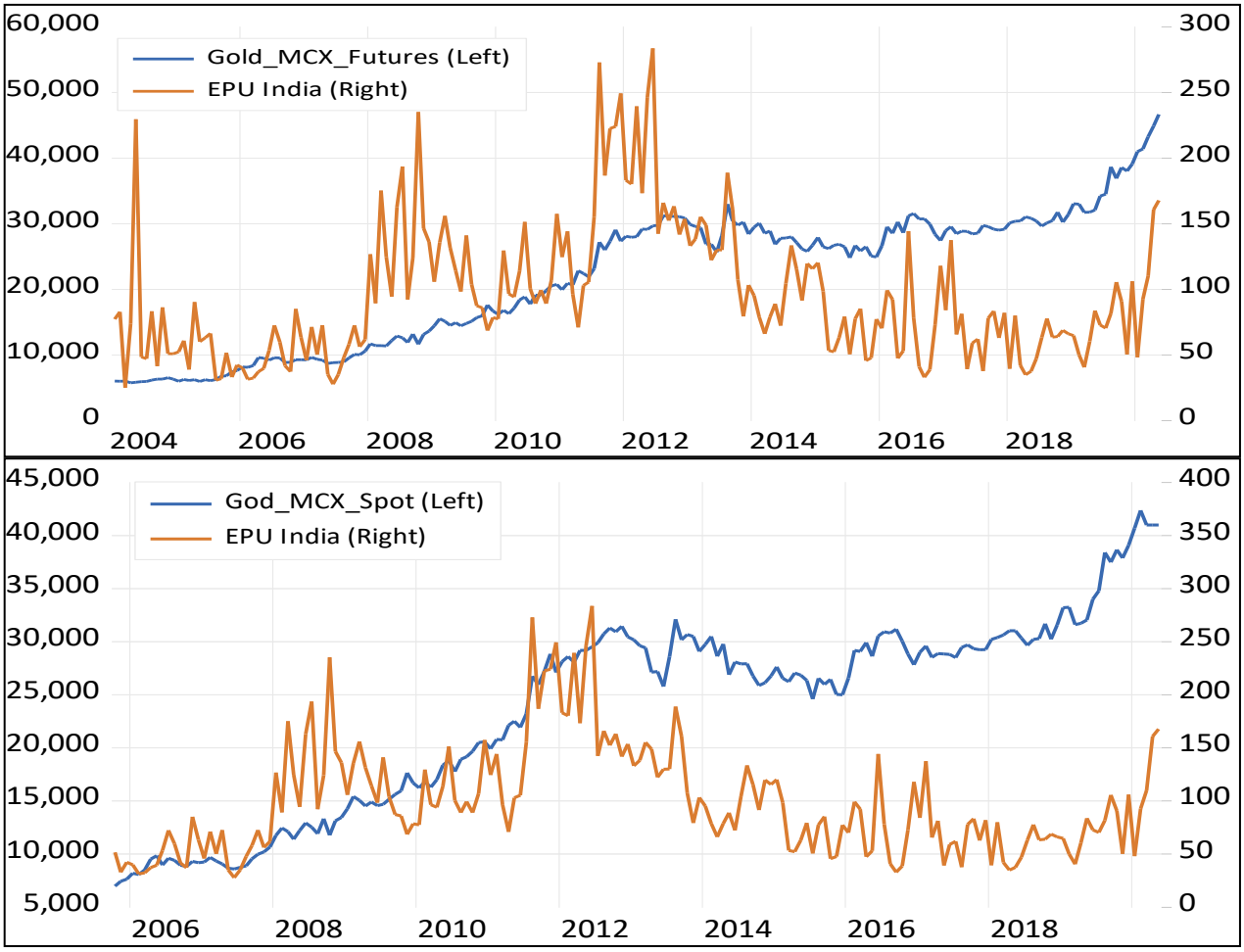


Figure 4 shows the performance of gold futures and spot price following the outlook of the macroeconomy. The graph exhibits the EPU index calculated for India based on the framework of Baker et al. (2016); this index is the measure of economic and political uncertainty prevailing over the period. We can see that the policy uncertainty index rising since 2005-06 remains higher till 2012 which is very close to 300 points. One can see the gold price was also trending following the recent policy changes (as reported in Table 2). The correlation between the gold price and policy uncertainty found to be positive (0.101) but not statistically significant. But the degree of association is more pronounced between 2015-2020, and it's 0.45 and statistically significant.

Figure 5 Gold price (Futures and spot) and policy rates

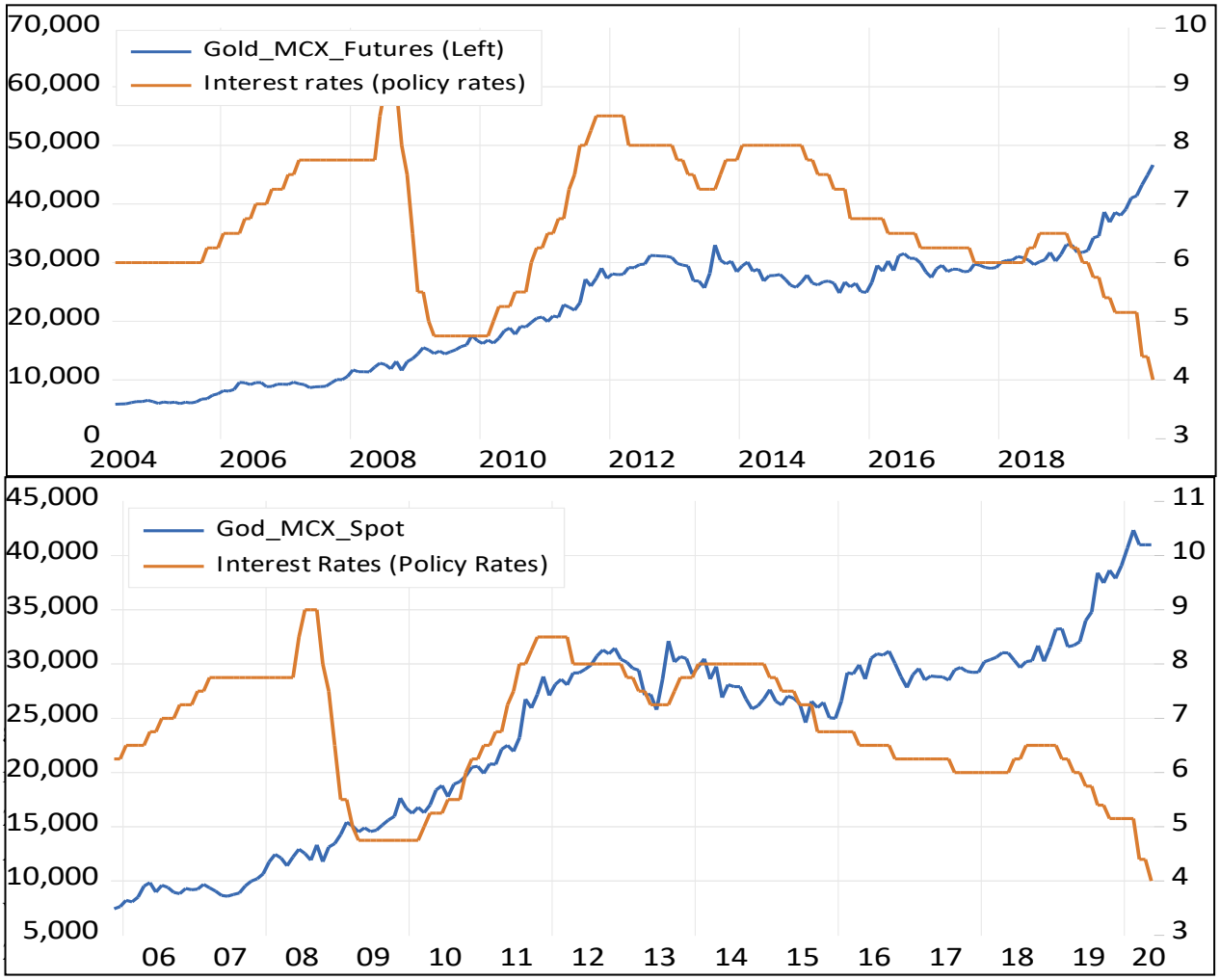


Figure 5 displays the temporal plot of gold prices and interest rates in India. It seems that policy rates were below 5% before 2009, and gold futures traded at the maximum level of INR 35,000. Gold spot price and policy lending rates moved in the same direction from 2009 until 2015. However, the spot price of gold jumped post-2015, while policy interest rates decreased from 8.5% to 4.00% by 2020. Interestingly, the gold future appears to be inverse to the policy rates. The correlation between gold prices and interest rates was found to be −0.179 and statistically significant

Figure 6 presents the geopolitical risk and investment in the safe haven asset Gold. The Geopolitical Risk (GPR) index gauges international political tension and adverse political events that affect saving and investment patterns inversely. Agents associated with international political uncertainty run toward safe havens, such as gold. GPR was higher during Global Financial Crises (GFC) 2007–2009 and higher during the US presidential election in 2016 and further spiked from 2018–2020. The correlation between gold prices in India and GPR risk was positive (0.413) and statistically significant. This provides evidence that gold acts as a safe haven against political uncertainty (Caldara & Iacoviello, 2019; Mokni, Hammoudeh, Ajmi & Youssef, 2020).

Figure 6 Gold price and Geopolitical risk

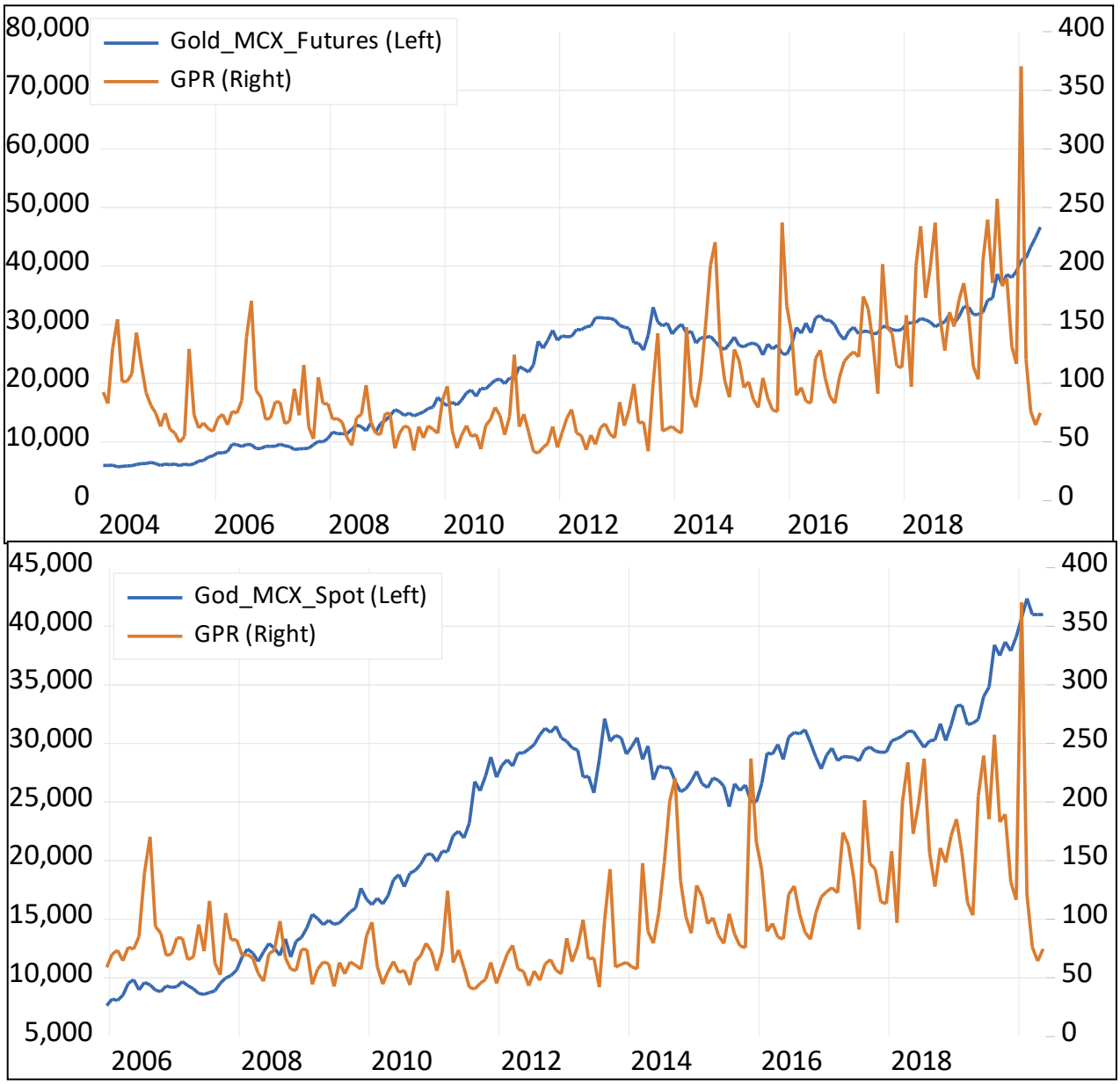
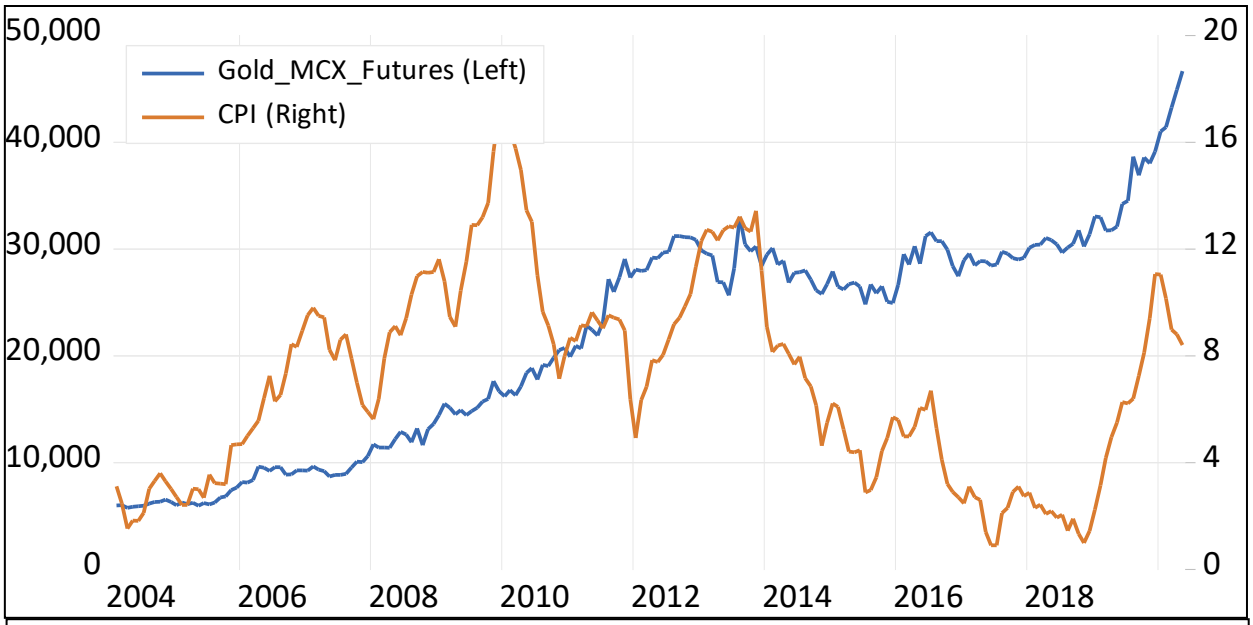


Figure 8 displays the time series plot of inflation and gold price in India and represents the general convention that gold acts as a safe haven against an inflationary environment and as a storer of time value. Table 2 shows that the correlation between CPI and gold price appears to be negative for the full sample, but inflation and gold price remained highly correlated from 2015–2020. The degree of association was 0.754 and statistically significant is in line with the study of Batten, Ciner & Lucey (2014).

Figure 8 Gold price and Inflation



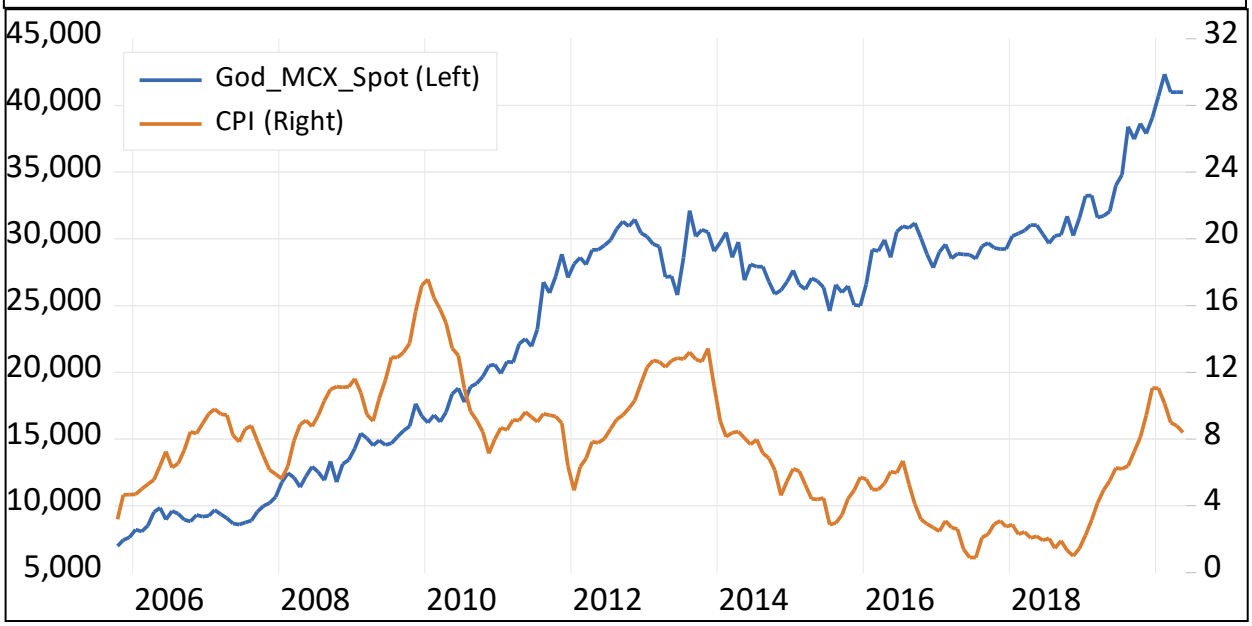


Table 2 shows the correlation between gold prices and economic and political uncertainty and is further depicted in the above temporal graphs. We can see that gold prices in India responded to global political uncertainty and federal fund rate uncertainty during the FOMC meetings. The correlation between FEDFR-US and gold prices in India exhibited a negative association (−0.512) and was statistically significant. Moreover, the gold price also reacted to the INR/USD exchange rate, and the correlation coefficient was found to be 0.865 and positive. Furthermore, the equity market and gold prices also exhibited a positive association.

4. Empirical model, hypothesis development, results, and discussion

This section attempts to design an empirical model to uncover the gold price movement temporally on a monthly scale. The dependent variable is gold price, and changes are measured for the gold price in India considering MCX futures prices and spot prices (Ansari & Sensarma, 2019). The WGC calculated the gold price for India. The right-hand-side regressors are the EPU index, GPR index, Federal Fund Rates (policy rates), and the control variables are gold import, CPI, exchange rate, change in the commodity, and equity market indices ((Baker, Bloom, & Davis, 2016; Bali, Brown, & Tang, 2017; Pastor & Veronesi, 2012; Caldara & Iacoviello, 2019). Our regression specification is:

$$\Delta\, GP_t = \alpha_0 + \beta_i U_{it} + \gamma_i Z_{it} + e_t \quad (1)$$

$$\Delta\, GP_t = \alpha_0 + \beta_i D_{it}^{MPU\pm} * U_{it} + \gamma_i Z_{it} + e`_t \quad (2)$$

$$\Delta\, GP_t = \alpha_0 + \beta_i D_{it} * U_{it} + \gamma_i Z_{it} + e``_t \quad (3)$$

where, $\Delta\, GP_t$ is the change in the gold price i.e., *MCX Futures*, *Spot*, and *WGC* price,

α_0 is the classical intercept coefficient that captures the effects of unobserved factors and policy changes that influence India's gold prices. The intercept coefficient should appear positive and statistically significant. The significant positive slope indicates an encouraging effect of future uncertainty on gold prices in India.

β_i is the slope coefficient and can assume either of the signs (±) associated with the uncertainty variable. Our a priori hypothesis is that 'uncertainty and gold prices are positively associated'; thus, the beta coefficient should appear positive and statistically significant.

U_{it} is the vector of uncertainty variables, i.e., EPU India, GPR India, and Global. Here, EPU is the economic policy uncertainty indicator that gauges India's economic outlook and policy uncertainty. GRP is the geopolitical risk gauge for India and at the global level. In our empirical model, we consider the 'uncertainty' related variable in the first difference.

γ_i is the slope coefficient and can assume either of the signs (±) associated with the control variables. Hence, our a priori hypotheses are: (1) 'Gold import adversely impacts gold price in India'; (2) 'Exchange rate (INR/USD) and gold price are positively associated'; (3) 'Inflation (CPI) and gold price move in the positive direction'; and (4) 'Gold price and commodity and equity market are positively correlated'.

Z_{it} is the vector of the control variable, i.e., gold import, CPI, Exchange rate, Commodity index, and Equity market index.

D_{it} is the dummy variable that assumes 1 for the period in which major gold-related policies and regulations are imposed and is otherwise 0. The slope associated with this dummy should be positive and statistically significant.

$D_{it} * U_{it}$ is the interaction term depicting the effects of gold-related policies and regulation on the gold price in India gauged into the Uncertainty index.

$D_{it}^{MPU\pm}$ is the dummy variable that measures the MPC rate changes, with '+' indicating an increase in the policy rates and '−' indicating a decrease in the policy rates.

$D_{it}^{MPU\pm} * U_{it}$ is the interaction term that measures the effects of monetary policy uncertainty on the gold prices in India.

e_t is the classical error term that follows the white noise process.

Our estimation of equations 1–3 is based on the Newey and West HAC consistent standard errors and test statistics.

4.1 Effects of policy uncertainty on gold prices in India

Table 3 shows the regression output of the effects of policy uncertainty on the Indian gold market. Our study aims to show how the gold price in India responds to economic and political changes. We examine the behavior of gold prices by considering the India EPU index available on a monthly scale constructed by Baker et al. (2016). Market agents closely follow announcements from the Central bank and government policies published contemporaneously in the leading newspaper in India. The India EPU index is a gauge of the general outlook of the Indian economy and political changes. Table 3 clearly shows that policy uncertainty affects gold prices in an upward direction, since the slopes of the EPU appear positive. Contemporaneously and one- and two-period lags of EPU show a positive impact on the MCX future prices. The EPU(−2) slope coefficient is 0.0203 with a t-stat of 2.61, which implies that policy uncertainty contains information explaining future gold prices and has a two-month lag impact. We also find a similar outcome for the MCX-spot gold price; the estimate is 0.0178 (t-stat = 2.58) significant at the 1% level, and gold price based on WGC also depicts a positive two-period lag impact. Hence, this is the prima facie evidence that gold trading in India is quite sensitive to the economic outlook of the economy and policy uncertainty. Moreover, we set some control variables that define the gold price (e.g., Batten, Ciner & Lucey, 2014), such as the amount of gold imported, the exchange rate, inflation, and other commodities, and equity market performance. It seems that gold imports in India have an adverse impact on gold prices. Estimates, such as MCX futures, Spot, and GP-WGC prices (−0.0106, t-stat = −2.28; −0.0068, t-stat = −1.19; and −0.0256, t-stat = −4.68, respectively), indicate that gold imports adversely impact gold prices in India. As seen in Table 2, the Government of India has taken many initiatives to discourage gold imports, impacting CAD (e.g., Watal committee; Watal, 2018) and many federal schemes to allow gold from unorganized markets to enter organized markets. Many studies (e.g., Kriz, 1952; Batten, Ciner & Lucey, 2014; Salsman, 2020) show that the exchange rate affects the gold price domestically and internationally. Thus, we employ the exchange rate as one of the regressors, and MCX-Futures and Spot price respond positively to the exchange rate but not significantly. The exchange rate, INR/USD, plays an important role in the gold price setting in the Indian market;

therefore, we perform sub-sample analysis to reveal more insights. Furthermore, some studies (e.g., Lastrapes & Selgin, 1996; Ansari & Sensarma, 2019) show that gold acts as a safe haven and storer of value and remains defensive against significant inflation changes. Our empirical results show that gold prices in India are rising due to rising inflation. A sub-sample analysis discloses that gold investment has provided a safeguard against inflation. In addition, commodity trading on the MCX market contributes positively to the gold futures and spot market and GP-WGC. However, one can see that the equity market and gold price have shown a significant negative association. The significant negative estimate indicates that the sell-off rally in the equity market has an asymmetric impact on the gold market. A significant positive intercept coefficient indicates that unobserved uncertainty indicators contribute positively to the gold market in India.

Table 3 Policy uncertainty and Gold price in India

	EPU					
	MCX-Futures		MCX-Spot		GP-WGC	
Regressor	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Intercept	0.0078	2.88 [a]	0.0074	2.69 [a]	0.0089	3.53 [a]
Δ (LOGEPUIND)	0.0121	1.18	0.0088	0.93	0.0155	1.73 [c]
Δ (LOGEPUIND(-1)	0.0046	0.48	-0.0003	-0.04	0.0118	1.15
Δ (LOGEPUIND(-2)	0.0203	2.61 [b]	0.0178	2.58 [a]	0.0100	1.38
Δ (LOGIMPORT)	-0.0106	-2.28 [b]	-0.0068	-1.19	-0.0256	-4.68 [a]
Δ (LOGEXR_USD)	0.1265	0.94	0.0732	0.54	-0.0423	-0.27
Δ (LOGCPI)	0.0056	0.46	0.0006	0.04	0.0132	1.18
Δ (LOGMCXCOMD_INDEX)	0.4921	7.10 [a]	0.4866	8.37 [a]	0.1824	3.67 [a]
Δ (LOGSENSEX)	-0.1180	-2.36 [b]	-0.1197	-2.35 [b]	-0.1454	-2.75 [a]
Adj. R^2		0.35		0.32		0.27
F-stat		9.87 [a]		10.70 [a]		8.96 [a]
p-value		0.000		0.000		0.000

[Table shows the OLS results of eq. (1) $\Delta\, GP_t=\alpha_0+\beta_i U_{it}+\gamma_i Z_{it} + e_t$ Considering EPU, Our estimation is based on the Newey and West HAC consistent standard errors and test statistics. Significant at [a]1%, [b]5%, [c]10%]

4.2 GPR and gold price in India

Caldara and Lacoviello (2019) developed a geopolitical index to examine the nations' global politics and diplomatic conflicts. Global organizations, such as the World Bank, International Monetary Fund, and central banks of different countries, emphasize political conflicts and geopolitical events and buy progressively more gold, as they are cautious of future political and economic uncertainty. Policymakers, global investors, and the public pay close attention to such uncertain political events, e.g., Brexit (Smales, 2016; Oehler, Horn, & Wendt, 2017).

Our aim is to include the GPR index in our study to uncover how gold trading in India responds to geopolitical risk. Higher uncertainty and geopolitical risk investors prefer to invest in safe havens, and central banks consider gold a safe haven and enhance gold reserves to meet future uncertainty. Hence, we aim to determine what GPR contains to explain the Indian gold market. A sudden spike in the GPR risk depresses economic activity and makes investors more nervous (Caldara & Iacoviello, 2019). Table 4 shows the nexus between geopolitical risk and gold trading. The estimates associated with GPR India up to two lags-MCX-Futures are 0.0040 (t-stat = 0.30), 0.0057 (t-stat = -0.35), and −0.019 (t-stat = -0.15), and we calculate similar sign estimates for MCX-spot. Gold prices and geopolitical events

hold less import for gold trading in India. However, considering the GPR-Global index (Table 5), gold prices in India respond adversely to global political tension but not significantly. One of the important insights we derive from the results is that gold imports adversely impact the gold futures and gold prices reported by the WGC. Furthermore, inflation shows a favorable impact on the gold price, and the MCX-commodity index contributes a significant positive effect on gold trading. However, the equity market and gold price hold a substantial inverse relationship. As hypothesized, we report a positive significant intercept coefficient.

Table 4 Geopolitical Risk (India) and gold price in India

	GPR					
	MCX-Futures		MCX-Spot		GP-WGC	
Regressors	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Intercept	0.0080	2.84 [a]	0.0076	2.70 [a]	0.0091	3.36 [a]
Δ (LOGGPR_INDIA)	0.0040	0.30	0.0000	0.00	0.0053	0.50
Δ (LOGGPR_INDIA(-1)	0.0057	0.35	0.0038	0.24	-0.0058	-0.43
Δ (LOGGPR_INDIA(-2)	-0.0019	-0.15	-0.0078	-0.60	0.0024	0.21
Δ (LOGIMPORT)	-0.0106	-2.15 [b]	-0.0059	-0.93	-0.0284	-4.93 [a]
Δ (LOGEXR_USD)	0.1582	1.12	0.0914	0.66	-0.0181	-0.12
Δ (LOGCPI)	0.0086	0.64	0.0038	0.28	0.0135	1.10
Δ (LOGMCXCOMD_INDEX)	0.4954	7.08 [a]	0.4915	8.40 [a]	0.1768	3.35 [a]
Δ (LOGSENSEX)	-0.1173	-2.11 [b]	-0.13	-2.45 [b]	-0.14	-2.26 [b]
Adj. R^2		0.31		0.30		0.26
F-stat		10.44 [a]		9.85 [a]		8.36 [a]
p-value		0.000		0.000		0.000

[Table shows the OLS results of eq. (1) $\Delta GP_t=\alpha_0+\beta_i U_{it}+\gamma_i Z_{it} + e_t$ Considering GPR India, our estimation is based on the Newey and West HAC consistent standard errors and test statistics. Significant at [a]1%, [b]5%, [c]10%]

Table 5 Geopolitical Risk (Global) and gold price in India

	GPR-Global					
	MCX-Futures		MCX-Spot		GP-WGC	
Regressors	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Intercept	0.0079	2.88 [a]	0.0075	2.64 [a]	0.0093	3.44 [a]
Δ (LOG5GPR)	-0.0023	-0.28	-0.0028	-0.33	0.0113	1.45
Δ (LOG5GPR(-1)	-0.0076	-1.05	0.0043	0.46	0.0032	0.37
Δ (LOG5GPR(-2)	-0.0119	-1.14	-0.0107	-0.99	-0.0076	-1.06
Δ (LOG9IMPORT)	-0.0099	-1.88 [c]	-0.0066	-1.11	-0.0270	-4.64 [a]
Δ (LOG8EXR_USD)	0.1671	1.22	0.1090	0.78	-0.0339	-0.22
Δ (LOG7CPI)	0.0083	0.62	0.0037	0.27	0.0125	1.05
Δ (LOG13MCXCOMD_INDEX)	0.4875	6.89 [a]	0.4884	8.26 [a]	0.1816	3.45 [a]
Δ (LOG10SENSEX)	-0.1131	-2.14 [b]	-0.1167	-2.24 [b]	-0.1650	-2.86 [a]
Adj. R^2		0.35		0.30		0.27
F-stat		10.69 [a]		10.06 [a]		8.75 [a]
p-value		0.000		0.000		0.000

[Table shows the OLS results of eq. (1) considering GPR Global, our estimation is based on the Newey and West HAC consistent standard errors and test statistics. Significant at [a]1%, [b]5%, [c]10%]

4.3 Monetary policy and federal fund rate changes and gold price

WGC (2019) draws our attention to the likely impact of interest rate changes on gold price; historical evaluation shows that gold price rises when the central bank shifts from tightening to a neutral stance. The phenomenon is expressed here to attract more investors to invest in gold and gold price surges. WGC reports that policy rates have a more significant impact on the performance of various asset classes, including gold. The basis of the central bank's policy rates is an important policy issue. If policy rates shift from higher rates (tightening) to steady rates (neutral), WGC analysis shows that gold prices in due course react positively as Central bank stand to remain neutral and ease monetary policy. Hence, what encompasses an increase or decrease in policy rates to explain the gold market is reported in the following sections.

Table 6 RBI Monetary policy and gold price

	STFFR					
Regressors	MCX-Futures		MCX-Spot		GP-WGC	
	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Intercept	0.0075	2.87 [a]	0.0074	2.72 [a]	0.0091	3.46 [a]
Δ (LOGSTFFR_INDIA)	-0.1358	-1.66 [c]	-0.0069	-0.06	0.0291	0.37
Δ (LOGSTFFR_INDIA(-1)	0.0916	0.53	0.0118	0.07	0.0067	0.07
Δ (LOGSTFFR_INDIA(-2)	-0.0679	-0.75	-0.0290	-0.32	-0.0822	-0.71
Δ (LOGIMPORT)	-0.0111	-2.05 [a]	-0.0071	-1.23	-0.0274	-5.31 [a]
Δ (LOGEXR_USD)	0.1650	1.23	0.1097	0.78	-0.0263	-0.16
Δ (LOGCPI)	0.0046	0.34	0.0019	0.14	0.0149	1.22
Δ (LOGMCXCOMD_INDEX)	0.4978	7.16 [a]	0.4862	8.21 [a]	0.1713	3.11 [a]
Δ (LOGSENSEX)	-0.1025	-1.86 [a]	-0.1125	-1.99 [b]	-0.1551	-2.61 [a]
Adj. R2		0.32		0.29		0.26
F-stat		11.05 [a]		9.69 [a]		8.27 [a]
p-value		0.000		0.000		0.000

[Table shows the OLS results of eq. (1) $\Delta GP_t=\alpha_0+\beta_i U_{it}+\gamma_i Z_{it}+e_t$ Considering MPC meetings and policy rates change, our estimation is based on the Newey and West HAC consistent standard errors and test statistics. Significant at [a]1%, [b]5%, [c]10%]

Table 6 exhibits the effects of the Central Bank's (RBI) policy rate changes on gold price. The immediate contemporaneous results show an adverse impact on the MCX-Futures gold price (−0.1358, t-stat = −1.66), similar depiction for the MCX-spot price. Further, it seems that interest rate changes have a two-period lag impact on gold prices in India; the slope coefficients are negative but not significant. The regression outcome signifies that short-term interest changes influence gold prices, and the impact was found to be asymmetric. Table 7 displays the effects of the FOMC federal fund rate changes on the Indian gold market. Although gold is a global commodity and storer of value influenced by the US federal fund rate change, the trading community pays close attention to the short-term interest rate changes for the US economy. Thus, we identify which US federal fund rate changes explain the Indian gold market. The slope coefficient up to two lags appears negative for both MCX-futures and spot markets, indicating that a rise in the policy rates negatively impacts the Indian gold market but is not statistically significant. In addition, another control variable appears as per our a priori hypothesis in both tables. The intercept coefficient was estimated as positive and significant. Gold imports have an adverse impact on the exchange rate, affecting inflation positively and equity market negatively.

Table 7 FOMC Fed's rate change and gold price

	FEDFR-US					
Regressors	MCX-Futures		MCX-Spot		GP-WGC	
	Estimate	t-stat	Estimate	t-stat	Estimate	t-stat
Intercept	0.0072	2.82 [a]	0.0073	2.78 [a]	0.0090	3.44 [a]
Δ (LOGFEDFR_US)	-0.0007	-0.04	0.0119	0.64	0.0071	0.69
Δ (LOGFEDFR_US(-1)	-0.0174	-1.10	-0.0125	-0.79	0.0005	0.07
Δ (LOGFEDFR_US(-2)	-0.0124	-0.56	-0.0078	-0.36	-0.0329	-1.67 [c]
Δ (LOGIMPORT)	-0.0115	-1.59	-0.0096	-1.26	-0.0291	-4.86
Δ (LOGEXR_USD)	0.1745	1.26	0.1181	0.84	-0.0440	-0.28
Δ (LOGCPI)	0.0071	0.54	0.0014	0.11	0.0134	1.12
Δ (LOGMCXCOMD_INDEX)	0.4926	6.78 [a]	0.4792	8.03 [a]	0.1757	3.27 [a]
Δ (LOGSENSEX)	-0.1041	-2.01 [a]	-0.1057	-1.96 [b]	-0.1462	-2.58 [a]
Adj. R2		0.33		0.30		0.28
F-stat		11.20 [a]		10.08 [a]		9.07 [a]
p-value		0.000		0.000		0.000

[Table shows the OLS results of eq. (1) $\Delta\ GP_t=\alpha_0+\beta_i U_{it}+\gamma_i Z_{it} + e_t$ Considering the FOMC meeting and Federal fund rate change, our estimation is based on the Newey and West HAC consistent standard errors and test statistics. Significant at [a]1%, [b]5%, [c]10%]

4.4 Effects of MPC rate changes on gold

Table 8 shows the uncertainty associated with the MPC committee review and gold prices in India. As stated in the previous discussion, the MPC rate change affects gold investment. Thus, we set dummies for the MPC rate increase as 1 and otherwise as 0. We ran two separate regressions to uncover the effects of change in the short-term interest rates interacting with the policy uncertainty index. When the MPC committee decides to increase the interest rate, it raises the gold price; the respective estimates MCX-Futures (0.0442, t-stat = 2.17) and MCX-spot (0.0445, t-stat = 1.87) appear to be positively significant.

The increase in policy rates increases gold price, while a decrease in the policy rates shows marginal impact. Our regression model intercept coefficient measures the neutral stand of the MPC committee and other economic and political events. The significant positive intercept signifies that no change in the short-term interest rate significantly increases the gold price. Hence, uncertainty about the future rate change affects gold trading in India. We report further evidence on monetary policy uncertainty in the next section using daily data.

Table 8 Short term interest changes and gold price in India

	MPC Increase (+)		MPC Decrease (–)	
Panel A: Futures				
	Estimate	t-stat	Estimate	t-stat
Intercept	0.0080	2.87 [a]	0.0074	2.86 [a]
MPC_IND* Δ (LOGEPUIND)	0.0442	2.17 [b]	-0.0599	-1.34
Δ (LOGCPI)	0.0096	0.75	0.0010	0.07
Δ (LOGEXR_USD)	0.1738	1.26	0.1625	1.15
Δ (LOGIMPORT)	-0.0110	-2.46 [b]	-0.0138	-3.19 [a]
Δ (LOGSENSEX)	-0.0962	-1.81 [c]	-0.1194	-2.31 [a]
Δ (LOGMCXCOMD_INDEX)	0.4780	6.72 [a]	0.4581	5.67 [a]
Adj. R^2	0.33		0.34	
F-stat	14.62 [a]		15.32 [a]	
p-value	.0.000		0.000	

Panel B: Spot				
Intercept	0.0076	2.66 [a]	0.0070	2.63 [a]
MPC _IND* Δ (LOGEPUIND)	0.0445	1.87 [a]	-0.0516	-1.21
Δ (LOGCPI)	0.0038	0.30	-0.0038	-0.26
Δ (LOGEXR_USD)	0.1190	0.84	0.1077	0.77
Δ (LOGIMPORT)	-0.0067	-1.25	-0.0092	-1.71
Δ (LOGSENSEX)	-0.0974	-1.74 [c]	-0.1195	-2.26 [b]
Δ (LOGMCXCOMD_INDEX)	0.4743	8.08 [a]	0.4592	6.64 [a]
Adj. R^2	0.31		0.32	
F-stat	13.70 [a]		14.05 [a]	
p-value	0.000		0.000	
Panel C: GP-WGC				
Intercept	0.0092	3.49 [a]	0.0093	3.50 [a]
MPC _IND* Δ (LOGEPUIND)	0.0113	0.45	0.0181	1.24
Δ (LOGCPI)	0.0153	1.31	0.0170	1.39
Δ (LOGEXR_USD)	-0.0296	-0.18	-0.0323	-0.20
Δ (LOGIMPORT)	-0.0273	-5.05 [a]	-0.0267	-4.93 [a]
Δ (LOGSENSEX)	-0.1475	-2.63 [a]	-0.1488	-2.69 [a]
Δ (LOGMCXCOMD_INDEX)	0.1762	3.58 [a]	0.1896	3.56 [a]
Adj. R^2	0.26		0.27	
F-stat	11.02 [a]		11.11 [a]	
p-value	0.000		0.000	

[Table shows the OLS results of eq. (2) $\Delta GP_t = \alpha_0 + \beta_i D_{it}^{MPU\pm} * U_{it} + \gamma_i Z_{it} + e``_t$ Considering the FOMC meeting and Federal fund rate change, our estimation is based on the Newey and West HAC consistent standard errors and test statistics. Significant at [a]1%, [b]5%, [c]10%]

4.5 Major gold policy changes and gold prices in India

Many gold policies have been formulated and implemented in India since independence (1947), but such policies have resulted in market misrepresentation and have failed to accomplish their aims. The guidelines started with the limited ownership of gold, aiming to regulate gold supply, control smuggling, and reduce the gold price. The prohibition era began in 1963 with the introduction of the '*Gold Control Act*' that restricted the manufacturing of gold jewelry of a specific carat, limiting individual gold holding and tracking jewelry transactions. Later, the government realized that prohibition policies failed to liberalize the gold market with deregulation through 1990–2011. The government felt that such an approach resulted in a rise in gold demand and increased gold imports and prices; eventually, the current account deficit (CAD) grew exponentially. Therefore, the government decided to intervene (2012–2013) in such an adverse situation by introducing custom duty with an 80:20 policy.

Furthermore, from 2014–2016, the government added more *transparency* in the gold market by introducing the National Gold Coin Scheme, Sovereign Gold Bond, PAN requirement, the constitution of Bureau of Indian Standard (BIS), Removal of the 80:20 rule, and withdrawal of the Gold Deposit Scheme. Recently, the government also introduced policies for gold *monetization* with (GMS)-2015, GMS linked loan (GML)-2015, and Hallmarking and Assaying 2017. However, such policies have shown limited impact on gold demand and bullion trading in India. The forced new gold policy and many regulatory regimes have adversely impacted gold smuggling. Hence, the Bullion Federation of India decided to adhere to government policies to bring more transparency to bullion trading, avoid unaccounted money, and comply with tax regulations.

Table 9 Major gold policies and MCX gold futures

	EPU			GPR	
Regressor	Estimate	t-stat	Regressor	Estimate	t-stat
Intercept	0.0084	3.38 [a]	Intercept	0.0091	3.37 [a]
D2* Δ (LOGEPUIND)	0.0374	3.04 [a]	D2* Δ (LOGGPR)	0.0049	0.36
D3* Δ (LOGEPUIND)	0.0167	0.93	D3* Δ (LOGGPR)	0.0340	3.88 [a]
D4* Δ (LOGEPUIND)	-0.0094	-0.62	D4* Δ (LOGGPR)	0.0031	0.15
D5* Δ (LOGEPUIND)	-0.0016	-0.23	D5* Δ (LOGGPR)	0.0160	1.10
Δ (LOGSTFFR_INDIA)	-0.0246	-0.31	Δ (LOGSTFFR_INDIA)	-0.0048	-0.06
Δ (LOGIMPORT)	-0.0240	-5.31 [a]	Δ (LOGIMPORT)	-0.0268	-4.96 [a]
Δ (LOGEXR_USD)	0.0285	0.16	Δ (LOGEXR_USD)	-0.0201	-0.13
Δ (LOGCPI)	0.0161	1.31	Δ (LOGCPI)	0.0149	1.20
Δ (LOGMCXCOMD_INDEX)	0.1688	3.22 [a]	Δ (LOGMCXCOMD_INDEX)	0.1753	3.33 [a]
Δ (LOGSENSEX)	-0.1060	-1.90 [c]	Δ (LOGSENSEX)	-0.1492	-2.57 [a]
Adj. R^2	0.29		Adj. R^2	0.26	
F-stat	7.72 [a]		F-stat	6.91 [a]	
p-value	0.000		p-value	0.000	

[Table shows the OLS results of eq. (3) $\Delta\, GP_t = \alpha_0 + \beta_i D_{it} * U_{it} + \gamma_i Z_{it} + e``_t$ Considering important gold-related policies and regulations, our estimation is based on the Newey and West HAC consistent standard errors and tests statistics. D2=Gold liberalization period 1990-2011, D3=Gold intervention period 2012-2013, D4=Gold transparency period 2014-2016, and D5= GMS and operational guidelines 2018-2019. Significant at [a]1%, [b]5%, [c]10%]

Table 9 shows some of the essential empirical shreds of evidence on the major reforms in economic policies and policies related to gold import and market regulation. We express our regression results in terms of the MCX-futures gold price, considering the interaction of dummies and uncertainty indicators. We set dummy variables showing policy implementation about the gold market, with the Import Restriction period from 1947–1962, Prohibition period from 1963–1989, Liberalization period from 1990–2011, Intervention period from 2012–2013, Transparency period from 2014–2016, and GMS operational guidelines from 2018–2019. Based on our sample, we cover the period from 1990–2020, and we create dummies for each period stated above. First, we summarize the regression results with the interaction term $D_{it} * EPU_{it}$. It shows the EPU index's movement during the major reforms in gold-related policies and regulations. The D2-associated policy uncertainty period shows a favorable impact on the gold prices in India; the significant (0.0374, t-stat = 3.04) positive estimate indicates that during the Gold Liberalization period (1990–2011), the gold price was increasing exponentially. During the liberalization, the Gold Control Act was revoked, banks were allowed to import gold, and gold depot schemes were introduced. These policies led to a favorable economic environment for gold imports and trading in India. The slope coefficient of D3*EPU also appears positive but not significant. D3 indicates the period of gold intervention with the imposition of the 80:20 rule; this has pushed the market but not significantly. The estimates related to D4*EPU and D5*EPU appear negative but not significant, implying that policies and regulations about gold transparency (2014–2016) and GMS operationalization guidelines (2018–2019) have adversely impacted the gold market. The negative slope indicates that the removal of the 80:20 rule, GMS scheme, Gold Coin, PAN requirement, GST, increased import duty, and BIS hallmarking do not bring more transparency or enhance price discovery in the gold market.

Hence, the government must reevaluate the current gold policies and regulations to provide more transparency and an organized place for gold trading. Still, bullion trading has many gray areas, and current policies have failed to curb those inefficiencies. We also present the effects of GPR during these major reforms in gold policies. The estimate

linked to D3*GPR depicts a significant positive impact on gold price, while the rest of the dummies show a marginal positive impact. The results reported with the GPR index signify that gold as a commodity is a safe haven when there is global political uncertainty and border tension.

The intercept coefficient was positive and significant in Table 9, implying that gold prices surged significantly during economic and political uncertainty. It also signifies that a higher uncertainty about the economic outlook of the economy market participant prefers to invest in a safe haven asset, such as gold. Moreover, other control variables appear as hypothesized.

5. Conclusion and policy implications

Our study aims to uncover the relationship between policy uncertainty and gold prices in India. In this study, we consider the gold prices in India on a monthly scale available from WGC and MCX India. Moreover, we consider the proxy for policy uncertainty in terms of the EPU, GPR, and MPC meetings. The other economic factors that affect the gold price are gold import, inflation, other commodities, equity market, exchange rate, and government T-bill. The empirical estimation was performed in a time series framework using standard OLS and augmented OLS. Our study observes several significant findings and policy implications.

Since gold is a safe haven and India is one of the largest consumers of gold, proper attention is needed from regulators and policymakers to enact a better gold policy. Thus, in this study, we consider policy uncertainty and gold price in India. Earlier, there was no quantitative measure that could measure policy-related uncertainty in India, but there is now a proxy for policy uncertainty, known as the EPU built by Baker, Bloom, and Davis (2016). Therefore, our work is novel, discussing the effects of uncertainty on the Indian gold market. Increases in the Indian middle-class income can positively impact India's gold demand, necessitating a higher import of gold. However, this may adversely impact India's foreign reserve and balance of payment. The current policies and regulations for the gold market fail to accommodate the bullion trading community's needs and concerns. In the last two decades, many policies have been formulated and operationalized but were unable to achieve the policies' objectives. The government's concern over managing the foreign reserve and current account deficit resulted in the uncertainty of gold import and gold monetization, and empirical evidence is apparent from our study.

Our statistical investigation signals that uncertainty (economic policy uncertainty) and gold price in India are positively associated. This implies a higher degree of policy uncertainty and a higher gold price. Monetary policy uncertainty and interest rate changes have adversely impacted the gold price in India; the effects are more pronounced after 2015. Our empirical results show that policy uncertainty contains information explaining gold futures prices and has a two-month lag impact. Hence, gold trading in India is sensitive to the economic outlook of the economy and policy uncertainty. Gold imports in India also have an adverse effect on gold prices. The INR/USD exchange rate plays a vital role in gold price setting. Moreover, the results show that gold prices in India are rising, subject to rising inflation. However, sub-sample analysis reveals that gold investment has provided a safeguard against inflation. Gold prices and geopolitical events hold less import for gold trading in India. However, when we consider the GPR-Global index, gold prices in India respond adversely to global political tension but not significantly.

Looking through MCX-futures and spot markets, a rise in the policy rates negatively impacts the Indian gold market but not significantly. Thus, short-term interest changes influence gold prices, and the impact is asymmetric. Our MPC committee review studies show that the increase in the policy rates increases gold price, while decreasing the policy rates has only a marginal impact. Research indicates that RBI's announcements affect the gold market, and the decrease in the gold price surrounding the meetings implies tightening monetary policy from a neutral state. An essential finding of the study reveals that interest rates and the Central Bank's actions have discouraged gold trading in India. Our empirical study shows that the Post-Independence Period (1947-62) era has shown marginally less impact on the gold demand; hence, it has encouraged gold to enter India from informal channels. However, the Post-Liberalization Policy (2012-2013) induced uncertainty, leading to more gold imports and lower gold prices. This study shows that, post-implementation of the GMS scheme, gold imports were significantly reduced. We quantitatively expressed essential policy changes in our regression model and found that most of the policies influenced gold trading. For example, policies and regulations about gold Pre-Demonetization Policy (2014–2016) and Post-Demonetization Policy guidelines of GMS (2018–2019) have adversely impacted the gold market. India is one of the largest gold consumers across the world. Hence, India mostly relies on gold imports from the nominated agencies and banks to meet the local gold demand. There is a lack of an organized market that can track gold trading in India. Therefore, India needs a regulatory framework so that it can ease the bullion trade in India, e.g., The Proposed Gold Board of India, The Proposed Bullion Exchange of India, The Proposed Gold Domestic Council. Hence, the government's action on the gold ecosystem and gold policy can help better price discovery and India's influence over the world gold prices.

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Appendix

Appendix I Consumer demand in India

Year	2010	2011	2012	213	2014	2015	2016	2017	2018	2019
Tonnes	1,001.7	974.0	914.2	958.6	833.5	857.2	666.1	771.2	760.4	690.4
US$mn	39,436.6	49,213.0	49,052.4	43,492.8	33,934.6	31,972.3	26,786.0	31,171.3	31,0116.0	309112.0

Source: Metals Focus, World Gold Council

Appendix II Indian supply estimates (tonnes)

Year	2012	2013	2014	2015	2016	2017	2018	2019
Supply								
Gross Bullion imports	974.5	959.4	994.8	1,065.0	642.1	975.3	871.7	827.4
of which doré[1]	23.2	36.9	84.1	229.0	141.9	250.6	275.9	211.5
Net bullion imports	842.8	876.4	898.6	913.6	551.5	879.0	755.7	646.8
Scrap	118.0	95.8	92.5	80.2	79.5	88.4	87.0	119.5
Domestic supply from other sources[2]	10.0	9.6	9.9	9.2	9.9	8.8	10.5	11.1
Total supply[3]	970.8	981.8	1,001.0	1,003.0	640.9	976.2	853.1	777.4

1 Volume of fine gold material contained in the doré.
2 Domestic supply from local mine production, recovery from imported copper concentrates and disinvestment.
3 This supply can be consumed across the three sectors – jewellery, investment and technology. Consequently, the total supply figure in the table will not add to jewellery plus investment demand for India.

Source: Metals Focus, World Gold Council

Appendix III Average spread between gold prices in India and London

Period	Average spread
1977-79	41.3%
1981-85	46.6%
1986-91	56.6%
1991-92	53.1%
1993	20.6%
1994	20.1%
1995	19.9%
1996	17.5%

Source: By authors based on Reddy (1996)