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Factors influencing gold demand: Evidence from developing countries

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Abstract:

Gold serves not only as a store of wealth but also as a safe hedge against socio-economic risks, particularly during times of uncertainty. The recent surge in gold demand, despite its high price, may contribute to overall macroeconomic instability, as it could exacerbate the burden of external debt and lead to the depreciation of a country's sovereign currency. This study investigates the determinants influencing physical gold demand in 10 developing countries across different continents over the period from 2008 to 2020, utilising data from World Gold Council (WGC) reports and the World Bank database. By employing various regression models - Pooled Ordinary Least Squares, Fixed Effects, and Random Effects-for a micro panel dataset, the study provides further empirical analysis, suggesting several important factors influencing gold demand in these developing economies, such as gross domestic product (GDP), GDP per capita volatility, and the real interest rate. The results offer significant implications for development policy, financial intermediation, and the gold market in developing economies.

Keywords: **COVID-19, developing countries, gold demand, gross domestic product, real interest rate.**

Classification numbers: **2.1, 2.2**

1. Introduction

Despite the demonetisation of gold following the collapse of the Bretton Woods system, gold continues to function as a store and symbol of wealth, particularly in emerging economies [1, 2]. Gold provides a reliable hedge against socio-economic risks due to its relatively stable value, especially in times of uncertainty. Furthermore, the return on gold is generally independent of that on other assets, making it an effective tool for investment diversification [3-5]. During the COVID-19 pandemic, for example, gold prices remained robust amid the market sell-off in early 2020. Specifically, between 1 February and 1 April 2020, the S&P 500 declined by 23%, while the price of gold fell by less than 0.1% [6].

Since the onset of the COVID-19 pandemic, inflation rates have risen as a result of ongoing disruptions in global supply chains, labour market turmoil, and strong consumer demand following the reopening of local economies. Consequently, gold demand reached its highest level in the past two years as retail investors sought a safe haven against rising inflation and ongoing economic uncertainties. Central banks in both emerging and developed markets have also continued to add to their gold reserves, remaining net purchasers of gold. Overall, demand for gold from investors, central banks, jewellers, and technology companies has been growing over the past decade, with global gold demand increasing by 12% year-on-year to 2,189 tons in the first half of 2022.

The rising demand for gold, despite its high price, could lead to substantial dollar outflows, potentially worsening a country's current account deficit. This deficit might, in turn, increase the burden of external debt and cause the depreciation of that country's sovereign

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currency, thereby leading to overall macroeconomic instability [7]. Thus, studying the determinants of gold demand is crucial for governments aiming to stabilise their economies, especially during periods of economic turbulence.

A review of empirical studies on the determinants of gold demand reveals several factors that influence gold demand. Most studies have been conducted in developed countries such as the United States and within the European Union, or in countries with high gold demand, such as India. There is a need for more research into the determinants of gold demand in developing markets to understand the long-term effects of macroeconomic and non-macroeconomic factors on gold demand. These countries have distinct economic and political environments, and as such, their gold demand may be influenced by different factors compared to developed countries. Furthermore, there is still limited consensus in the literature regarding the factors affecting countries' gold demand. To the best of our knowledge, this is the first empirical study to investigate the determinants influencing physical gold demand in 10 developing countries across continents during the period from 2008 to 2020. Additionally, previous studies have primarily focused on the influence of macroeconomic factors on gold demand, rarely considering the volatility of these factors, except in studies on developed countries [8]. It is essential to explore the role of macroeconomic volatility in influencing gold demand in developing countries to determine whether these influences differ among countries or groups of countries.

This paper aims to fill this gap by investigating the determinants that influence physical gold demand in 10 developing countries, including Vietnam, Sri Lanka, Thailand, the Philippines, Malaysia, Indonesia, Brunei, Chile, Peru, and Mexico, over the period from 2008 to 2020. A major hypothesis to be examined is whether financial and economic volatilities stimulate a country's demand for gold. Our findings provide further empirical analysis, suggesting that GDP, GDP per capita volatility, and the real interest rate statistically influence gold demand in these developing economies, with levels of significance at 1%, 5%, and 1%, respectively. The results imply critical implications for development policy, financial intermediation, and the gold market in developing economies.

A brief literature review on the determinants of physical gold demand is presented in section 2. Section 3 outlines the methods and empirical work employed to analyse gold demand and its determinants. The estimation results are discussed in section 4, followed by the conclusion and policy implications in section 5.

2. Literature review and hypothesis formation

2.1. The gold market

The composition of gold demand has been evolving, particularly in the context of global socio-economic instability, while gold supply remains relatively fixed [5]. According to the WGC, total gold demand is categorised into four components: jewellery, technology, central bank reserves, and investment demand. While demand for gold in the jewellery and technology sectors tends to follow the business cycle - which is largely determined by consumer income and, consequently, spending power - the demand for gold from investors appears to be counter-cyclical, with demand rising during economic downturns [5]. Historically, gold demand has been dominated by the jewellery sector. However, the pattern of gold consumption has shifted as investment demand, particularly through exchange-traded funds (ETFs) and similar products, has surged in recent years. Specifically, the demand for gold jewellery dropped significantly in 2020, by 38% compared to 2019. In contrast, investment demand for gold through ETFs increased by 38.8% in 2020, reaching 1,769.2 tonnes, making it the largest single category of gold demand that year, accounting for over 48% of total gold demand in 2020 (Fig. 1).

The dramatic rise in gold prices observed since 2015 can thus be attributed to increased investor interest in this precious commodity, reinforcing the perception of gold as a secure investment.

2.2. Empirical studies on determinants of gold demand

Empirical studies focusing on gold demand in both developed and emerging economies have identified several key determinants of gold demand [1, 9-12].

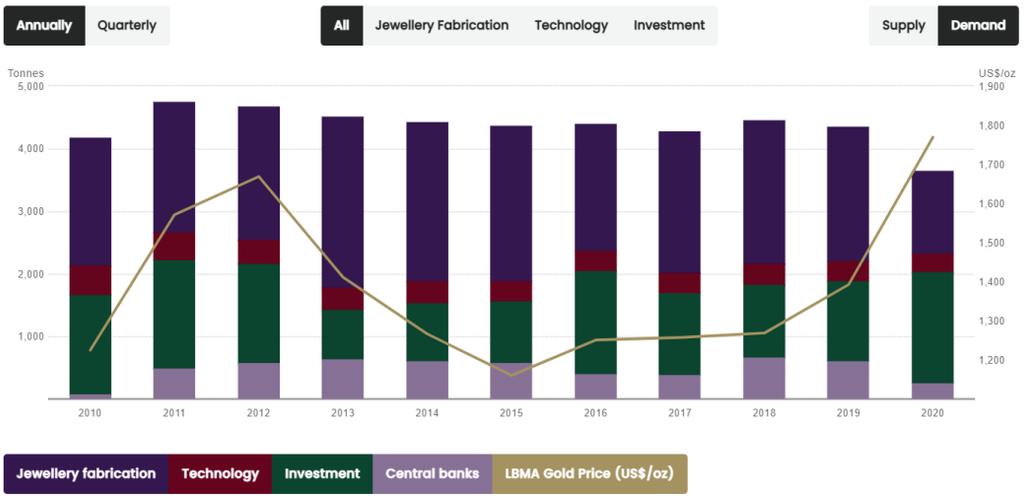

Fig. 1. Composition of gold demand from 2010-2020.

Sources: ICE Benchmark Administration, Metals Focus, Refinitiv GFMS, World Gold Council.

Notably, real income has a positive impact on gold demand, even in the long run, whereas price tends to negatively affect demand [10, 13, 14]. However, in some countries, such as India, gold consumption is unaffected by changes in gold prices [13].

Within this body of literature, previous studies have found that while gold demand in developed countries is income elastic, it is likely to be independent of income changes in developing countries [1]. The authors attribute this finding to the influence of socio-cultural factors across different countries. Additionally, it has been observed that the impact of income and gold prices on gold imports has shifted over time [7]. Specifically, gold demand is found to be moderately inelastic with respect to price in the long run, while higher income is associated with higher gold demand, suggesting that gold is a luxury commodity. Conversely, gold demand exhibits high elasticity concerning price in the short run [7]. However, empirical evidence on this matter is not consistent across studies. For instance, some studies have found no evidence that real income impacts gold demand in certain industrial economies [9, 10]. A recent study suggests that the elasticity of gold demand relative to price depends on macroeconomic conditions and the type of gold. Generally, gold demand and price are positively correlated in middle-income countries but not in high-income ones. Specifically, jewellery demand inversely correlates with gold prices in middle-income nations but is positively unrelated in high-income nations.

Regarding central bank demand for gold reserves, this significant component of gold demand tends to increase substantially during periods of heightened exchange rate risk and monetary policy instability, while higher economic growth and financial development tend to reduce central banks' demand for gold reserves [12, 15, 16]. Additionally, previous studies have re-emphasised that gold (along with real estate) is considered a reliable hedge against inflation, suggesting that gold demand is likely to increase during periods of high inflation and lower real interest rates [5, 17]. In situations of economic policy uncertainty and volatility in major currencies such as the USD, Euro, GBP, and Chinese Yuan, gold demand responds positively to these fluctuations [8]. Gold also acts as a hedging instrument against economic downturns or financial uncertainty [8, 18, 19].

Focusing on gold demand in India - one of the largest consumers of gold globally - research suggests that monetary, fiscal, and financial sectors, such as interest rates, exchange rates, personal income tax, and government spending, in addition to real income and gold prices, influence gold demand in India [20]. Unlike in other countries, gold demand in India is not significantly affected by macroeconomic uncertainty [8]. Many countries maintain gold reserves [8]. Many countries maintain gold reserves [2]. Central banks with substantial external financing or excessive external debt tend to hold higher gold reserves. Specifically, demand for gold bars and coins is positively correlated with global risk in high-income countries but not in middle-income countries. Besides macroeconomic factors, some studies focus on the relationship between gold and other financial instruments, which falls under investor behaviour. For example, the global financial crisis of 2007-2008 strongly motivated the study of gold's viability as a safe haven against financial market downturns. During periods of global risk, higher-income countries tend to demand

greater gold reserves [21]. Particularly in developing countries, where confidence in the financial system is lower, gold remains an asset of significant interest due to its ability to be held outside conventional financial systems and its stable value [22, 23]. Furthermore, in developing countries with limited borrowing options due to less developed credit markets, gold is often seen as precautionary wealth, which can be converted into cash to finance consumption or investment during economic turbulence. Studies have found that gold demand is positively correlated with stock market volatility and the performance of strong currencies such as the US dollar, GBP, or Chinese Yuan [19]. When stock markets or strong currencies are volatile, investors turn to gold as a safe haven asset [5, 8].

3. Research methods

3.1. Sample of data

This study presents estimates of factors affecting gold demand, using panel data from the WGC covering 10 developing countries (Brunei, Chile, Indonesia, Malaysia, Mexico, Peru, the Philippines, Sri Lanka, Thailand, and Vietnam) over the period from 2008 to 2020. We examine the relative importance of various factors that may influence gold demand, including income growth, exchange rate and inflation volatility, the gold price, the extent of a country's financial development, real returns on safe financial assets, and access to credit. Specifically, data on gold demand were collected from annual statistics published by the WGC, while data on other macroeconomic variables were sourced from the World Bank's database (World Bank Open Data) for the same period. Additionally, we include a one-year lagged variable, as current-year gold demand tends to be associated with that of the previous year. Other financial and macroeconomic variables were also obtained from the World Bank database.

3.2. Empirical model and principal variables

The research model is as follows:

$$Y_{it} = a_0 + a_1 . Y_{i,t-1} + \sum_{j=1}^{n} b_j X_{itj}$$

where i indexes countries and t indexes times, a_0 and a_1 are the regression coefficient of the lagged variable, Y represents gold demand (import) in dollars, t-1 represents the one-year lagged period, b_j is the regression coefficient of the independent variable j, X_{itj} are independent variables that affect gold demand across countries and change over time, n represents number of countries.

The dependent variable is the annual gold demand (GOLI). Given that world production and exploitation of gold are relatively small compared to the existing gold stock, the entire stock can be assumed to constitute total potential supply. Thus, flows of gold between countries can be considered as demand [1]. Therefore, the demand for gold can be measured as the level of gold imports into a country in a given year.

A list of explanatory variables includes income per capita (GDPC) and its volatility (VOLC), exchange rate volatility (EVOL), inflation (INF) and its volatility (INFV), changes in the gold price (CGP), the extent of a country's financial development (represented by stock market development, MOG), real returns on safe financial assets (real interest rate, RIR), and access to credit (MGD).

Below is the list of variable definitions and their measurements (Table 1):

Table 1. Variable measurements.

Variable	Measurements	Data sources (2008-2020)
GOLI	Log of annual gold import in dollars	WGC
GDPC	Log of GDP per capita, adjusted for purchasing power parity	World Bank Data
VOLC	Standard deviation of income per capita over the previous 5 years	World Bank Data
EVOL	Standard deviation of nominal exchange rate against USD over the previous 5 years	World Bank Data and Penn World Tables
INF	Log of CPI	World Bank
INFV	Standard deviation of CPI over the previous 5 years	Computed from the above inflation rate
CGP	Change in world gold price	WGC
MGD	Private credit as a share of GDP	World Bank
RIR	Real deposit interest equal nominal interest minus CPI inflation	World Bank
MOG	Market capitalisation as a share of GDP	World Bank

*: The dependent variable is the annual gold demand (GOLI), a list of explanatory variables includes income per capita (GDPC) and its volatility (VOLC), exchange rate volatility (EVOL), inflation (INF) and its volatility (INFV), changes in the gold price (CGP), the extent of a country's financial development (represented by stock market development, MOG), real returns on safe financial assets (real interest rate, RIR), and access to credit (MGD). Source: Authors' summary.

4. Empirical analysis and discussion

4.1. Descriptive statistics summary

The descriptive statistics table presents the maximum, minimum, mean, and standard deviation of the studied variables. Specifically, the average amount of GOLI by the countries from 2008 to 2020 is 1.28 billion tonnes of gold. The country with the highest gold import volume is Thailand, with 16.3 billion tonnes of gold, while the lowest is Chile, with 2,216 tonnes of gold. The difference in the amount of gold imported among countries is 2.53 billion tonnes, making this the variable with the largest disparity between countries (Table 2).

Table 2. Descriptive statistics.

Variable	Obs	Mean	Std. Dev.	Min	Max
GOLI	130	1.28E+09	2.53E+09	2216	1.63E+10
GDPC	130	9260.081	9781.591	1149.424	47739.56
VOLC	130	1147.246	1804.712	98.24203	8904.661
EVOL	130	182.9284	426.0565	0.013687	2014.119
INF	130	3.623465	3.582907	-1.26051	23.11545
INFV	130	1.954314	1.802936	0.239191	7.987018
CGP	130	0.0940823	0.149724	-0.25	0.77
MGDP	130	69.20636	42.46503	20.67314	160.2671
RIR	130	5.096898	4.794507	-10.2458	22.32387
MOG	130	60.99892	36.90466	10.52702	160.2598

*: The dependent variable is the annual gold demand (GOLI), a list of explanatory variables includes income per capita (GDPC) and its volatility (VOLC), exchange rate volatility (EVOL), inflation (INF) and its volatility (INFV), changes in the gold price (CGP), the extent of a country's financial development (represented by stock market development, MOG), real returns on safe financial assets (real interest rate, RIR), and access to credit (MGD). Source: Analysis results from STATA (Period time: 2008-2020).

The GDPC across countries is USD 9,260 per person per year, with the lowest per capita income in Vietnam at USD 1,149 per person per year and the highest in Brunei at USD 47,739 per person per year. Interestingly, the highest inflation rate is observed in Vietnam at 23.11%, while the lowest is in Brunei with a negative inflation rate of -1.26%. The average INF across countries is 3.62%. Among the studied variables, the CGP shows the least variation, at around 0.14%, indicating relative consistency in gold price movements across countries. In terms of credit market capitalisation relative to per capita income (MGDP), the average country-to-country ratio is 69.2%, with the highest being Thailand at 160.26% and the lowest in Mexico at 20.67%. For stock market capitalisation relative to GDP (MOG), the average cross-country ratio is 60.9%, with the highest in Malaysia at 160.25% and the lowest in Sri Lanka at 10.52%.

4.2. A closer look at gold import

Overall, the level of gold imports fluctuated significantly between 2008 and 2014, before stabilising gradually from 2015 onwards. Vietnam experienced the highest levels of gold imports in 2008 and 2011, amounting to 2.7 and 2.5 billion tonnes, respectively. This surge in imports can be attributed to the country's soaring inflation rates during these two specific years, which reached 23% in 2008 and 18% in 2011 (Fig. 2). High inflation typically drives investors to purchase gold as a safe haven for their investments. Thailand consistently recorded the highest gold import levels throughout the period. As one of the most developed economies in Southeast Asia with a high income per capita, Thailand's demand for gold is likely higher than in other countries.

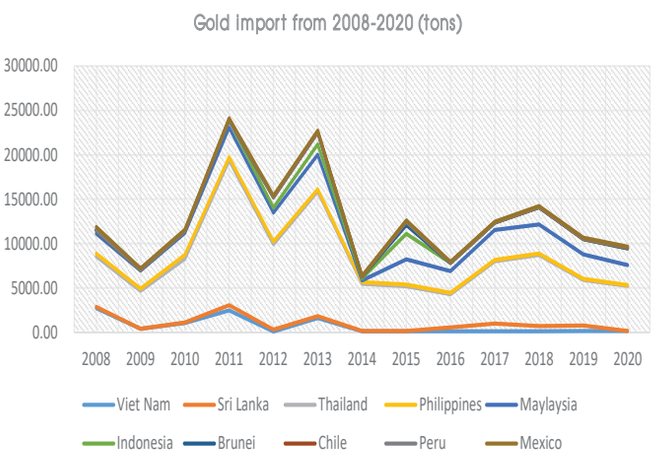

Fig. 2. Gold import in developing countries from 2008-2020.

Sources: WGC report.

In the Americas, Chile and Peru had relatively low levels of gold imports. Chile, for instance, imported only around 2,216 tonnes in 2008 (in USD), but there has been a gradual increase in gold imports since 2012.

Table 3. Correlation matrix.

Variables	LOGGDPC	VOLC	EVOL	INF	INFV	CGP	MGDP	RIR	MOG
LOGGDPC	1.000								
VOLC	0.730***	1.000							
EVOL	-0.441***	-0.203**	1.000						
INF	-0.525***	-0.316***	0.345***	1.000					
INFV	-0.565***	-0.255***	0.351***	0.559***	1.000				
CGP	-0.074	-0.058	-0.051	0.028	0.174**	1.000			
MGDP	0.008	-0.182**	0.039	-0.152*	0.065	-0.034	1.000		
RIR	0.149*	0.184**	-0.042	-0.312***	-0.264***	-0.013	-0.253***	1.000	
MOG	0.235***	-0.085	-0.251***	-0.388***	-0.232***	-0.067	0.627***	-0.174**	1.000

The dependent variable is the annual gold demand (GOLI), a list of explanatory variables includes income per capita (GDPC) and its volatility (VOLC), exchange rate volatility (EVOL), inflation (INF) and its volatility (INFV), changes in the gold price (CGP), the extent of a country's financial development (represented by stock market development, MOG), real returns on safe financial assets (real interest rate, RIR), and access to credit (MGD). *** p<0.01, ** p<0.05, * p<0.1; *: The notations ***, **, * denote the significance levels of 1, 5, and 10%. Source: Analysis results from STATA (Period time: 2008-2020).

Table 4. Variance inflation factor.

Variable	VIF	1/VIF
MOG	2.21	0.451922
INF	2	0.499219
MGDP	1.91	0.524158
INFV	1.68	0.594198
RIR	1.3	0.769816
EVOL	1.3	0.772184
VOLC	1.22	0.817083
CGP	1.06	0.942237
Mean VIF	1.59	

*: The dependent variable is the annual gold demand (GOLI), a list of explanatory variables includes income per capita (GDPC) and its volatility (VOLC), exchange rate volatility (EVOL), inflation (INF) and its volatility (INFV), changes in the gold price (CGP), the extent of a country's financial development (represented by stock market development, MOG), real returns on safe financial assets (real interest rate, RIR), and access to credit (MGD). Source: Analysis results from STATA (Period time: 2008-2020).

4.3. Correlation matrix, multi-collinearity test and regression results

Based on the correlation coefficient matrix, no coefficients exceed 0.8, indicating a low likelihood of severe multi-collinearity (Table 3) [24]. The mean variance inflation factor (VIF) is 1.5 (Table 4), suggesting a low correlation among explanatory variables.

Regression results for the Pooled OLS model, fixed effect model (FEM), and random effect model (REM) are presented in the following table (Table 5):

Table 5. Determinants of gold demand.

Dependent variable (LogGOLI)	POLS	FEM	REM
LogGOLI	0.632***	0.285***	0.632***
	-10.32	-3.39	-10.32
logGDPC	-0.972**	1.913	-0.972**
	(-2.23)	-1.53	(-2.23)
VOLC	0.000177	0.000471**	0.000177
	-1.11	-2.17	-1.11
EVOL	0.000393	0.000608	0.000393
	-0.85	-0.95	-0.85
INF	-0.0719	0.0102	-0.0719
	(-1.09)	-0.15	(-1.09)
INFV	-0.268*	-0.116	-0.268**
	(-1.97)	(-0.71)	(-1.97)
CGP	-0.00473	0.476	-0.00473
	(-0.00)	-0.44	(-0.00)
MGDP	0.00376	-0.0107	0.00376
	-0.69	(-0.50)	-0.69
RIR	-0.179***	-0.155***	-0.179***
	(-4.34)	(-3.02)	(-4.34)
MOG	0.00206	-0.0103	0.00206
	-0.3	(-0.96)	-0.3
constant	16.39***	-1.759	16.39***
	-3.71	(-0.16)	-3.71
N	129	129	129

*: The dependent variable is the annual gold demand (GOLI), a list of explanatory variables includes income per capita (GDPC) and its volatility (VOLC), exchange rate volatility (EVOL), inflation (INF) and its volatility (INFV), changes in the gold price (CGP), the extent of a country's financial development (represented by stock market development, MOG), real returns on safe financial assets (real interest rate, RIR), and access to credit (MGD). The notations ***, **,* denote the significance levels of 1, 5 and 10%, respectively. Source: Analysis results from STATA (Period time: 2008-2020).

The Hausman test indicates that the FEM is preferred over the REM. The results show that the lagged variable logGOLI exerts a significant positive impact on the dependent variable at a significance level of 1%, indicating that current gold import demand tends to influence future gold import demand. Additionally, the demand for imported gold statistically increases with higher volatility in income, with significance levels of 5%. This positive impact of income volatility on gold demand aligns with previous studies, even those conducted during different time periods. This finding supports the notion that gold serves as a hedge against economic uncertainty. As per capita income fluctuates, particularly during economic crises such as the 2008 financial crisis or the COVID-19 pandemic (2019-2021), investors and countries view gold as a preservation tool and a financial cushion for economic support and social welfare programmes. These findings confirm the role of gold as a diversification tool or a safe haven asset during economic turbulence.

However, the results also show no statistical evidence linking income per capita with gold import demand in these developing countries. The inability to determine the impact of income per capita on imported gold demand suggests that gold is not perceived as a luxury good but rather as an ordinary one. While other studies have shown that gold is a risk management tool for economic instability and fragile currencies, our analysis of 10 developing countries during the 2008-2020 period revealed no impact of inflation, inflation volatility, exchange rate fluctuations, or the gold price index on imported gold demand [8, 18, 19].

This result suggests that gold is no longer a safeguard for countries developing under conditions of fluctuating inflation and foreign exchange. This can be explained by the trade-off between risk and return when holding gold to hedge against inflation and exchange rate volatility. Moreover, to discourage physical gold hoarding, countries have applied policies derived from studies showing a very low interest rate on gold deposits compared to domestic currencies. Similar to previous studies, this research finds no evidence of an effect of gold prices on gold demand [13, 22]. This result can be attributed to the small net income margin between buying and selling prices, which does not incentivise investors to treat gold as a financial asset for trading. Furthermore, countries like Vietnam, which prior to 2000 used gold for high-value transactions such as real estate and automobile purchases, have seen a gradual decline in this practice since 2008. By 2010, nearly all such transactions were conducted in national currency.

The results above explain the disparities between previous research [5, 8]. Specifically, the finding that inflation and exchange rates have no impact on imported gold prices aligns with previous results [20]. The research also finds no impact of the development of stock markets and private credit markets on imported gold demand.

5. Conclusions

This analysis demonstrates that the demand for gold in developing countries between 2008 and 2020 was influenced by several factors. Specifically, statistical evidence shows that volatility in GDPC and the RIR significantly impact the demand for imported gold, with significance levels of 5 and 1%, respectively. These findings are consistent with the observation that increased income volatility generally signals a less stable economy, prompting nations and individuals to increase their gold holdings as a safeguard against economic instability. Gold is a relatively safe and liquid asset, making it an attractive option during periods of economic uncertainty. Additionally, when real interest rates decline, the appeal of investment opportunities other than gold diminishes, motivating investors to seek alternative investment channels that ensure stable and safe returns, such as gold, thereby driving up demand. This research provides insights that can help governments and investors identify and mitigate risks in the gold market.

CRediT author statement

Bich Ngoc Vu: Data collection, Writing; Hai Yen Hoang: Reviewing, Supervision.

COMPETING INTERESTS

The authors declare that there is no conflict of interest regarding the publication of this article.

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