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The essential role of U.S.-China tensions: a fresh insight into the gold market

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Abstract. *Understanding the pivotal role of U.S.-China tensions in shaping the dynamics of gold market is crucial for constructing high-performing portfolios. To this end, our study employs both full and sub sample approaches to explore the intricate relationship between the U.S.-China Tension Index (UCT) and gold price (GP). Our quantitative analysis reveals a dual-faceted impact of UCT on GP, which deviates from the inter-temporal capital asset pricing model's supposition. There are positive effects, suggesting that heightened tensions between the U.S. and China might stimulate a surge in the gold market. Nevertheless, the negative implications challenge this perspective, largely owing to other sources of uncertainty, such as the volatility of U.S. dollar and global financial crises. In turn, GP exerts both beneficial and detrimental effects on UCT, emphasizing that the dynamics of gold market could either amplify or mitigate these tensions, thereby functioning as a warning indicator to a certain degree. Against a canvas of mounting uncertainties in the U.S.-China relations and a skyrocketing trend in gold prices, our research offers insightful recommendations aimed at empowering investors to optimize their returns and guiding policymakers in fostering a more stable economic and political landscape.*

Keywords: gold, U.S.-China tensions, bullion boom, time-dependant relationship.

JEL Classification: C32, P16, P26, G12.

1. Introduction

The investigation endeavors to delve into the potential causal links between the U.S.-China tensions and the performance of gold market, ultimately seeking to ascertain whether these tensions trigger a bullion boom. At the conclusion of World War II, the advent of the Bretton Woods system has marked a pivotal moment in the reinforcement of gold's status within the global economic order (Monnet and Puy, 2020). This system, by anchoring the U.S. dollar to gold and subsequently linking other national currencies to the dollar, has solidified gold's position as the preeminent medium for international payments and reserves (Alogoskoufis *et al*., 2023). While the Bretton Woods system has ultimately crumbled in the 1970s, the aftermath has witnessed the gradual emergence and consolidation of gold's reputation as a safe-haven asset (Bartov *et al*., 1996; Qin *et al*., 2023c). In the intervening decades, the global political and economic landscape has undergone relentless transformation, with a proliferation of uncertainties and risk factors that continue to escalate (Su *et al*., 2023a, b). Amidst this backdrop, gold's safe-haven function has been not only preserved but also significantly strengthened (Vieira *et al*., 2023; Azimli, 2024; Ryan *et al*., 2024). Moreover, in recent years, as the tensions between the U.S. and China have risen to unprecedented levels (Cai *et al*., 2023), there has been growing speculation that gold may offer a unique form of protection against potential conflicts between these two economic superpowers. Gold's status as a universally accepted and trusted asset transcends geopolitical borders (Gkillas *et al*., 2020; Li *et a*l., 2023; Ngo *et al*., 2024), making it an attractive option for investors seeking to diversify their portfolios and protect their assets from the fallout of international disputes. Thus, the gold market might be intricately intertwined with the tensions between the U.S. and China, a significant and worthwhile area of inquiry that has yet to be fully explored and understood. This exploration would empower investors to maximize their financial gains while simultaneously informing policymakers' strategies to nurture a more resilient and balanced economic and political ecosystem.

The rationale for focusing on the impact of the U.S.-China tensions on the gold market primarily stems from the pivotal roles and influences that both nations exert in the realms of global economy and politics, among others (Yang *et al*., 2023). From the perspective of economy, on the one hand, both the U.S. and China are among the world's largest economies (Chor and Li, 2024). Any tensions between them would not only affect their own economic development but also have a significant impact on the global economy, such as a trade war (Chen *et al*., 2023). Naturally, the gold market, as a vital component of the global financial system (Shang and Hamori, 2024), is susceptible to shifts in the U.S.-China tensions. On the other hand, the U.S. and China engage in both competition and cooperation. The deepening of their economic and trade ties also influences commodity markets, including gold (Su *et al*., 2023b). From the perspective of politics, the stability of the U.S.-China relations is directly tied to the global political stability landscape. An intensification of tensions between them has the potential to profoundly reshape the international relations landscape (Jiang *et al*., 2023), with ripple effects on the strategic decisions and the distribution of benefits among other countries. Gold, often viewed as a safe-haven asset, tends to attract investor interest amidst heightened uncertainties (Echaust *et al*., 2024; Tarchella *et al*., 2024). Thus, the U.S.-China tensions could potentially

influence gold prices and market dynamics. Hence, by choosing the U.S.-China tensions, we would gain a deeper understanding of the supply-demand balance and price fluctuations in the gold market, but previous research has overlooked a comprehensive examination of this particular topic, as well as the evolving relationships. This study endeavors to address these gaps in knowledge.

This study introduces three novel aspects: Firstly, prior researches have centered primarily on gold's role as a safe-haven asset against geopolitical risks (Kamal *et al*., 2022; Li *et al*., 2023; Qin *et al*., 2023c; Ngo *et al*., 2024), rather than focusing on the U.S.-China conflicts. However, this study pioneers in examining gold's performance from an unconventional angle—the tensions between the U.S. and China—to ascertain if these tensions trigger a bullion boom. In addition, prior research is limited to unilateral impacts, failing to systematically unravel their intricate interplay, and we would fill it. Secondly, current analyses of the U.S. and China tensions often concentrate on isolated events (Chen *et al*., 2023; Jiang *et al*., 2023), offering an incomplete picture or relying on the U.S. and China relations (Cai *et al*., 2023) that fail to capture the full extent of tensions, potentially skewing conclusions. To address this, this paper employs the U.S.-China Tension Index (UCT) for a more nuanced empirical examination, which represents a significant point of innovation. Subsequently, this study utilizes monthly data spanning from January 1993 to February 2024, incorporating the monthly average price of gold in dollars (GP) as a proxy for the gold market to investigate the relationships among the selected variables. It is observed that increased UCT positively impacts GP, hinting at a potential surge in the gold market, but it is counterbalanced by negative effects stemming from diverse uncertainties. Conversely, GP's influence on UCT is twofold, either amplifying or dampening tensions, thereby serving as a partial warning signal for the evolving geopolitical landscape. Drawing from these insights, strategic recommendations tailored to investors and policy makers would be presented, in order to optimize the returns and foster a more harmonious economic-political landscape. Thirdly, the dynamic nature of the UCT-GP interplay, often overlooked in previous studies, necessitates a nuanced understanding. To address this, we employ four tests focused on parameter stability, validating the inadequacy of a full sample approach. Instead, we adopt a more sophisticated sub-sample methodology (Qin *et al*., 2024a), contributing to the field by revealing the time-varying interactions between UCT and GP.

The structure of this study unfolds as follows: Section 2 compiles and reviews pertinent literature, providing a foundation for the analysis. Sections 3 and 4 respectively outline the theoretical framework and empirical methodology employed. Section 5 introduces the dataset used in this investigation. Section 6 delves into the empirical findings and their implications. Lastly, Section 7 summarizes the key insights and offers recommendations.

2. Literature Review

Although there is a lack of research specifically centered on the U.S.-China tensions, ample studies have delved into the effects of geopolitical risks on the gold market. Some academics contend that geopolitical events act as catalysts for the gold market. Li *et al*. (2021) suggest a notable interaction between geopolitical risks and GP, with the latter

primarily influenced by the former. A dynamic analysis indicates that the interplay between geopolitical risks and the gold market is on an upward trajectory, intensifying markedly in the short term amidst major geopolitical developments. Triki *et al*. (2021) highlight a weaker correlation between the S&P 500 and gold in times of tranquility (marked by a low geopolitical risk) and a stronger one during periods marked by extreme political turmoil. This underscores gold's efficacy as a strong diversifier and safe haven asset, particularly amidst heightened tensions. Li *et al*. (2023) find that the majority of country-specific geopolitical risks exert a driving force on gold volatility, justifying the inclusion of forecasts from multiple such indices when predicting fluctuations in GP (Gkilla *et al*., 2020). Ngo *et al*. (2024) underscore significant hurdles in managing resources amidst geopolitical turbulence. They reveal that gold acts as a safe haven asset while financial and other reserves are utilized to address immediate economic demands.

Yet, some scholars challenge this notion, suggesting that this influence is not constant but varies based on multiple factors. Chiang (2022) demonstrate that GP denominated in USD, GBP, EUR, and CNY exhibits positive reactions to increases in geopolitical risks, positioning gold as an effective hedge against political uncertainty. Conversely, in examining gold returns in Indian rupee, certain coefficients display negative values, implying that gold may be perceived as a substitute for money in these contexts. Kamal *et al*. (2022) discover that gold emerged as a safe-haven asset during extreme crises, specifically in the pre-COVID period against U.S. economic policy uncertainty rather than geopolitical risks, yet the quantile regression analysis did not yield evidence to support its safe-haven characteristics in the post-COVID era. Qin *et al*. (2023c) reveal that both positive and negative impacts emanating from Russian geopolitical risks on GP. The positive influences suggest that an unstable geopolitical climate in Russia could potentially propel the gold market, as investors seek safe havens. However, the negative effects undermine this notion, primarily owing to economic factors and geopolitical dynamics unrelated to Russia. Ustaoglu (2023) indicates that gold functions primarily as a diversifier during times of war, rather than a hedge or safe haven.

In summary, previous studies have predominantly emphasized gold's function as a safe-haven asset during geopolitical uncertainties, neglecting the unique dynamic of the U.S.-China tensions. Also, the majority of existing research concentrates solely on the unilateral impact, with limited exploration into the reciprocal relationship. Furthermore, there is a notable absence of studies that delve into the dynamics of the gold market from U.S.-China tensions and assess the time-evolving causal linkage between UCT and GP. Consequently, this paper adopts a sub-sample analysis approach to unravel the evolving interplay between UCT and GP, thereby offering empirical insights into whether these tensions trigger a bullion boom and elucidating the pivotal role that GP assumes in UCT.

3. Theoretical Model

Following the framework of Cifarelli and Paladino (2010), we construct the Inter-temporal Capital Asset Pricing Model (ICAPM) to examine the interplay between UCT and GP. This theoretical model rests on two assumptions: firstly, the gold market comprises rational

investors who determine the demand for gold based on systemic risks, and feedback investors who shape the market in response to past GP trends (Qin *et al*., 2023a, b). Secondly, systemic risks, including tensions between U.S. and China, cannot be mitigated by adjusting investment strategies (Su *et al*., 2023a). In this research, UCT is used as a proxy for these risks, and Equation (1) represents the demand for gold from rational investors.

$$R_t = \frac{E_{t-1}(\mathrm{GP}_t) - \mathrm{GP}^f}{\mu(\mathrm{UCT}_t)} \tag{1}$$

where R_t represents the proportion of gold demanded by rational investors. $\mu(\mathrm{UCT}_t)$'s value is positive and exhibits a monotonically increasing relationship with UCT. If the gold market is solely composed of rational investors, $R_t = 1$ would hold, and the aforementioned formula would reduce to the traditional CAPM proposed by Sharpe (1964). This CAPM is represented as Equation (2), and it can be observed that an elevation in UCT would result in an increase of GP.

$$E_{t-1}(\mathrm{GP}_t) = \mathrm{GP}^f + \mu(\mathrm{UCT}_t) \tag{2}$$

Furthermore, in the gold market, feedback investors structure their investments based on past GP. Consequently, considering feedback investors in this research, the proportion of their demand for gold (F_t) can be expressed through the following formula.

$$F_t = \zeta \mathrm{GP}_{t-1} \tag{3}$$

where $\zeta > 0$ indicates that feedback investors buy or sell gold when GP increases or decreases in the preceding period. When the non-fungible token market comprises both rational and feedback investors, $F_t + R_t = 1$ holds. By combining Equations (1) and (3), we obtain the following formula.

$$E_{t-1}(\mathrm{GP}_t) = \mathrm{GP}^f + \mu(\mathrm{UCT}_t) - \zeta\mu(\mathrm{UCT}_t)\mathrm{GP}_{t-1} \tag{4}$$

In Equation (4), the parameter of $\mu(\mathrm{UCT}_t)$ is $1 - \zeta\mathrm{GP}_{t-1}$ and $\zeta\mathrm{GP}_{t-1} = F_t < 1$. It is evident that UCT has a positive impact on GP, indicating that an increase in UCT would elevate GP. Therefore, based on the ICAPM discussed above, we propose a hypothesis: the intensification of tensions between U.S. and China may stimulate the gold market and propel GP upwards, affirming a bullion boom sparked by these tensions.

4. Methodology

4.1. Full-sample technique

Drawing inspiration from Sims (1980), a vector autoregressive (VAR) system is established to explore the complex interrelationships between diverse series. However, it

is essential that the chosen sequences and the VAR process adhere to standard normal distributions. If this requirement is not met, the use of the VAR model to analyze relationships among variables must be avoided, as its reliability becomes questionable (Su *et al*., 2024a). To address this issue, Shukur and Mantalos (1997) introduced a critical value derived from the residual bootstrap (*RB*) technique. This method allows for causality testing even when variables and the VAR model exhibit skewed distributions, particularly in small sample sizes (Qin *et al*., 2024a). Furthermore, they refined the likelihood ratio (*LR*) method, making it more adaptable to considerations of size and power (Shukur and Mantalos, 2000). This article employs the revised-*LR* technique based on the *RB* method to investigate the Granger causal relationship between the chosen series. The VAR (*s*) process is formulated as follows.

$$Z_t = \phi_0 + \phi_1 Z_{t-1} + ... + \phi_s Z_{t-s} + \vartheta_t \tag{5}$$

In this scenario, the optimal lag order, denoted by 's', is selected using the SIC to ensure the identification of the most suitable lag order for the VAR model. By incorporating specific variables, we represent Z as $Z_t = (\mathrm{UCT}_t, \mathrm{GP}_t)'$, which subsequently leads to the transformation of the previous formula into Equation (6).

$$\begin{bmatrix} \mathrm{UCT}_t \\ \mathrm{GP}_t \end{bmatrix} = \begin{bmatrix} \phi_{10} \\ \phi_{20} \end{bmatrix} + \begin{bmatrix} \phi_{11}(L) & \phi_{12}(L) \\ \phi_{21}(L) & \phi_{22}(L) \end{bmatrix} \begin{bmatrix} \mathrm{UCT}_t \\ \mathrm{GP}_t \end{bmatrix} + \begin{bmatrix} \vartheta_{1t} \\ \vartheta_{2t} \end{bmatrix} \tag{6}$$

Based on the formula, we establish the VAR (*s*) system. Our initial hypothesis is simple: there is no significant Granger causality between UCT and GP. If no discernible influence is observed from UCT to GP ($\phi_{21,j} = 0, j \in [1, s]$), this hypothesis remains valid. Conversely, if a clear impact of UCT on GP is detected, the hypothesis must be rejected. Analogously, we can assess the original assumption that GP does not have a significant Granger causality on UCT. If there is no notable influence from GP to UCT ($\phi_{12,j} = 0, j \in [1, s]$), the hypothesis is sustained; otherwise, it is rejected.

4.2. Stability test of parameters

The full-sample technique assumes a static set of parameters in the VAR system, which may not always be applicable (Su *et al*., 2024b). If the coefficients undergo structural changes, using this approach may lead to inaccurate estimations. To enhance the precision of our estimations, we incorporate the *Sup-F*, *Ave-F*, and *Exp-F* techniques, which were introduced by Andrews (1993) and Andrews and Ploberger (1994). The *Sup-F* technique identifies structural changes in the selected sequences and the VAR (*s*) model, while the *Ave-F* and *Exp-F* methods assess whether the coefficients experience gradual variations over time. Additionally, we utilize the L_c statistics, proposed by Nyblom (1989) and Hansen (1992), to determine if the parameters exhibit a random walk pattern. When structural changes occur in the selected sequences or the VAR (*s*) process, the correlation between UCT and GP becomes time-dependent. In summary, the full-sample approach may be biased, and it is recommended to adopt the sub-sample approach in this article to accurately capture the temporal relationship among the chosen sequences.

4.3. Sub-sample technique

The sub-sample technique, advocated by Balcilar *et al*. (2010; 2013), is employed to identify the evolving relationship between UCT and GP. This involves dividing the entire sequences into smaller segments using a predefined rolling window width and progressively shifting them from the beginning to the end. However, selecting an appropriate window width is challenging, as a wider window decreases the frequency of analysis, while a narrower one may result in unreliable conclusions. Pesaran and Timmermann (2005) addressed this issue by suggesting that when the parameters in the VAR (*s*) model exhibit time-varying characteristics, the recommended window width should be at least 20 or more. The specific procedure consists of the following steps: First, we assume that the total length of the sequences is *E*, and the rolling window width is *r*. Next, we determine the endpoints of each segment as *r*, *r*+1, ..., up to *E*. In the second step, we utilize the revised-LR technique based on the *RB* approach to identify the relationship within each segment. The third step involves obtaining the estimates of the sub-sample technique by sequentially calculating the *LR* statistics and *p*-values. The mean values $N_b^{-1}\sum_{k=1}^{s}\hat{\phi}_{21,k}^{*}$ and $N_b^{-1}\sum_{k=1}^{s}\hat{\phi}_{12,k}^{*}$ indicate the influence of UCT on GP, as well as the reciprocal effect of GP on UCT. Additionally, the research takes into account the 90% confidence interval, which encompasses the upper boundary defined by the ninety-fifth quantile and the lower boundary defined by the fifth quantile.

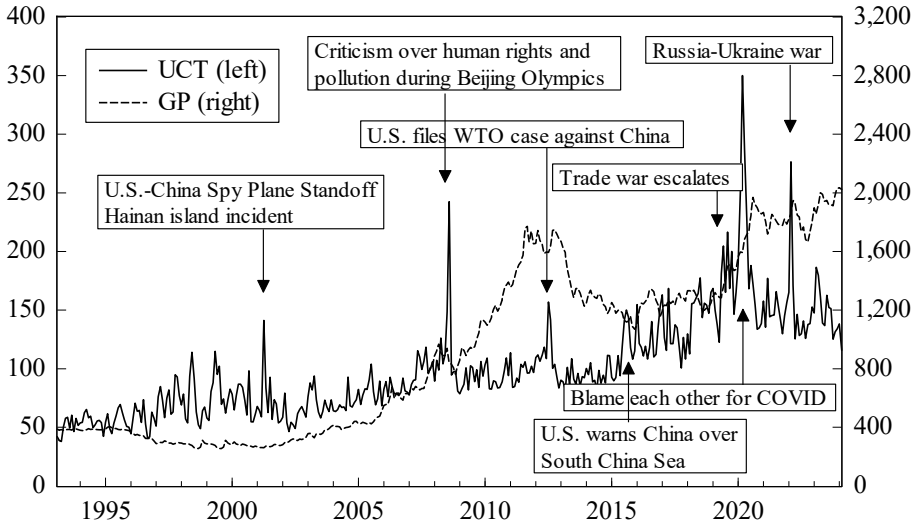
5. Data

The study utilizes monthly data spanning from January 1993 to February 2024 to explore the interrelationship between the gold market and U.S.-China tensions, and further analyzes examines whether these tensions trigger a bullion boom. In July 1993, the U.S. has imposed trade sanctions on China, alleging that it was selling missile parts to Pakistan. Furthermore, they has falsely accused a Chinese cargo ship of carrying chemical weapon raw materials, which resulted in the so-called “Yinhe” incident, significantly deteriorating U.S.-China relations. After a period of tensions, the first formal meeting between the Chinese president and U.S. president Bill Clinton in November of that year was viewed as a turning point in U.S.-China relations, signaling the end of the low level of interaction between the two countries. Since then, the U.S. and China have engaged in closer cooperation and exchanges in various fields (e.g., economy and trade, science and technology, culture), but significant tensions have also persisted, such as the trade war in 2018 and blame each other during the COVID-19. Subsequently, the research opts for the U.S.-China Tension Index (UCT) as a representative measure of the tensions between the U.S. and China, with the data being sourced from the Economic Policy Uncertainty Database. Adopting the methodology of Baker *et al*. (2016), this index is formulated by calculating the proportion of articles that discuss escalating tensions between the U.S. and China. Specifically, it includes articles that mention (i) the U.S. (or United States) and China (or Chinese), (ii) contentious bilateral issues, as well as (iii) phrases indicating tensions. To identify the search terms, topic modeling algorithms such as K-means, guided Latent Dirichlet

Allocation (LDA), and Newsmap analysis are employed to pinpoint potentially relevant words within a substantial collection of manually selected articles discussing the rise in U.S.-China tensions. In addition, this indicator closely aligns with the perspectives of business and policy decision-makers. Its fluctuations correspond to the frequency of discussions about U.S.-China tensions in corporate earnings calls and presidential speeches. Also, it tracks congressional legislation against China and voting disparities between the U.S. and China at the United Nations.

At the same time, the tensions between the U.S. and China would exert a considerable impact on the gold market. To assess this influence, this paper selects the monthly average price of gold in dollars, denoted as GP and sourced from the World Gold Council, as a proxy for the gold market (Qin *et al*., 2023c). This allows us to investigate the relationship between UCT and GP, and further analyzes whether these tensions act as a catalyst for a bullion boom. The trends of both UCT and GP are illustrated in Figure 1. As Figure 1 illustrates, UCT does not adhere to the same trajectory as GP. Based on the preceding discussions, it is evident that the relationship between UCT and GP is not static, but rather complex and dynamic. Given this complexity, employing the full sample methodology to identify the intricate Granger causal relationship among the selected variables would be overly simplistic and may not accurately capture the nuances of their interactions. Consequently, the research adopts a more advanced sub-sample methodology to better understand this complex and time-varying interrelationship. This approach allows for a more nuanced analysis of how UCT and GP relate to each other. Additionally, by using this methodology, the research aims to assess whether the U.S.-China tensions serve as a driving force behind a gold rush.

Figure 1. *The trends of UCT and GP*



Notes: The solid line, marked on the left axis, represents the evolving trend of UCT, whereas the dashed line, plotted on the right axis, depicts the progression of GP.

Table 1 presents the descriptive statistics of UCT and GP, revealing that their averages are 100 and 920.455 respectively, which indicates a concentration of the chosen variables around these two degrees. The maximum values of UCT and GP are 349.946 and 2034, and the minimum ones are 37.983 and 256.1, demonstrating significant fluctuations in both variables over the entire period. Both UCT and GP exhibit positive skewness, suggesting that they follow right-skewed distributions with more deviation from the median or mean on the right side than on the left. The kurtosis of UCT indicates a leptokurtic distribution with high peaks and fat tails, while GP follows a platykurtic distribution with low peaks and thin tails. Furthermore, the Jarque-Bera test rejects the null hypothesis that the variables follow a standard normal distribution at a 1% level for both UCT and GP. As a result, the Granger causal relationship test based on the conventional VAR(*s*) model is not robust. Therefore, the research adopts the revised-*LR* technique based on the *RB* to address the challenge of skewed distributions in UCT and GP. Additionally, the sub-sample methodology is employed to identify the time-dependent transmission mechanism between UCT and GP. Given the large values of the means, medians, maximums, minimums, and standard deviations of UCT and GP, the research applies a natural logarithm transformation to mitigate the adverse effects of unusual fluctuations.

Table 1. *Descriptive statistics for UCT and GP*

	UCT	GP
Observations	374	374
Mean	100.000	920.455
Median	90.908	889.100
Maximum	349.946	2034.000
Minimum	37.983	256.100
Standard Deviation	42.547	574.723
Skewness	1.545	0.324
Kurtosis	7.365	1.642
Jarque-Bera	445.808 ***	35.294 ***
Probability	0.000	0.000

Notes: *** is the significance at a 1% level.

6. Quantitative Analyses and Discussions

The research employs the ADF (Dickey and Fuller, 1981) and PP (Phillips and Perron, 1988) techniques to investigate the presence of unit roots in UCT and GP, aiming to avoid "spurious regression" in the VAR system. The results of these tests are presented in Table 2. It is observed that the level of UCT contradicts the initial assumption of a unit root at a 1% level in both the ADF and PP methods, the level of GP agrees with the initial hypothesis. However, the first-difference sequence of GP shows the opposite result. Therefore, it can be concluded that the level of UCT and the first difference of GP do not have a unit root. Subsequently, the research utilizes these two stationary sequences for further quantitative analysis.

Table 2. *The results of unit root tests*

		ADF	PP
levels	UCT	-3.888 (1) ***	-4.474 [1] ***
	GP	-0.015 (4)	0.068 [5]
first-order difference	GP	-13.784 (1) ***	-16.847 [4] ***

Notes: The numbers enclosed in parentheses indicate the optimal lag order identified by applying the SIC criterion.
The numbers enclosed in brackets indicate the bandwidth chosen by employing the Newey-West technique.
*** is the significance at a 1% level.

In accordance with Equation (6), the research establishes the VAR (*s*) process to conduct comprehensive sample analyses, enabling us to identify the consistent relationship between UCT and GP. For this purpose, the research sets the bootstrap repetitions to 10,000 and selects an optimal lag order of 1 based on SIC criteria. Table 3 presents the pertinent findings. Notably, it is revealed that UCT (GP) does not have a notable Granger causal effect on GP (UCT). This outcome does not align with the ICAPM framework proposed by Cifarelli and Paladino (2010) and is inconsistent with the findings reported in previous research (Kamal *et al*., 2022; Li *et al*., 2023; Qin *et al*., 2023c; Ngo *et al*., 2024).

Table 3. *The outcomes of bootstrap full-sample method*

H_0: UCT is not the Granger cause of GP		H_0: GP is not the Granger cause of UCT	
Statistic	*p*-value	Statistic	*p*-value
1.084	0.270	1.288	0.190

Notes: The research computes *p*-values by utilizing 10000 bootstrap repetitions.

In the full sample methodology, we postulate a hypothesis that the coefficients in the VAR(*s*) model remain constant, and only a Granger causal relationship is perceived throughout the entire time period. However, if the selected sequences and coefficients in the VAR(*s*) model exhibit structural mutations, this property can lead to inaccurate outcomes in Table 3, emphasizing the existence of a constantly evolving interrelationship between UCT and GP. Consequently, the research utilizes the *Sup-F*, *Ave-F*, *Exp-F*, and L_c statistical methods to ensure the applicability of the full sample methodology, with the related results presented in Table 4.

Table 4. *The outcomes of parameter stability techniques*

Tests	UCT		GP		VAR (*s*) process	
	Statistics	*p*-values	Statistics	*p*-values	Statistics	*p*-values
Sup-F	44.835 ***	0.000	33.254 ***	0.001	47.483 ***	0.000
Ave-F	22.349 ***	0.000	15.999 ***	0.004	32.628 ***	0.000
Exp-F	18.067 ***	0.000	12.613 ***	0.001	20.261 ***	0.000
L_c					5.398 ***	0.005

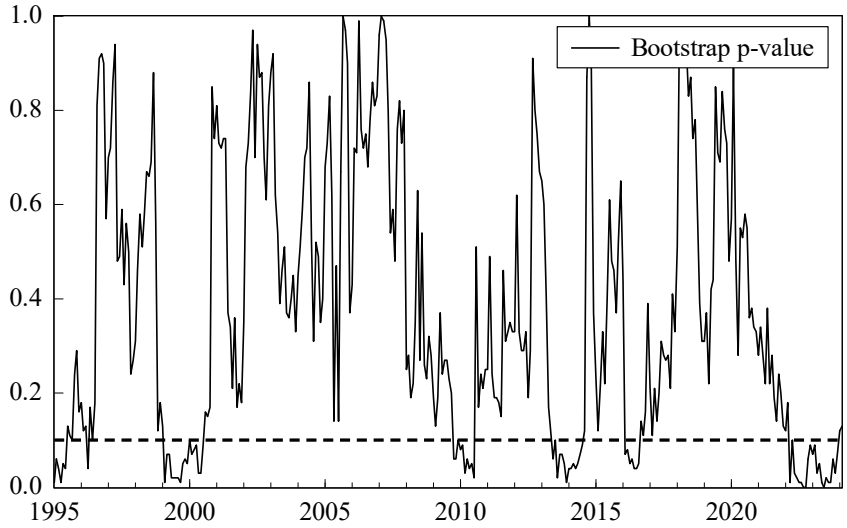
Notes: *** is the significance at a 1% level.

Table 4 reveals that the *Sup-F* method indicates that UCT, GP and the parameters in the VAR(*s*) model exhibit sudden structural changes at a 1% level. The *Ave-F* and *Exp-F* approaches demonstrate that the initial hypothesis can be rejected in UCT, GP and the parameters in the VAR(*s*) model at a 1% level, confirming that they change gradually over time. Additionally, the L_c statistics method shows that the alternative hypothesis is accepted at a 10% level, ensuring that the VAR(*s*) system rejects the random walk. These four tests

confirm that UCT has an ever-changing interrelationship with GP. Based on these analyses, we employ the sub-sample methodology to identify this complex transmission mechanism between UCT and GP. To enhance the accuracy of the estimated results, the research sets the width to 24 months, following Pesaran and Timmermann (2005). Subsequently, the research aims to determine whether the alternative hypothesis that UCT (GP) has a significant Granger causal relationship with GP (UCT) should be rejected or accepted at a 10% level. Furthermore, we can also identify the directions of influence from UCT (GP) to GP (UCT).

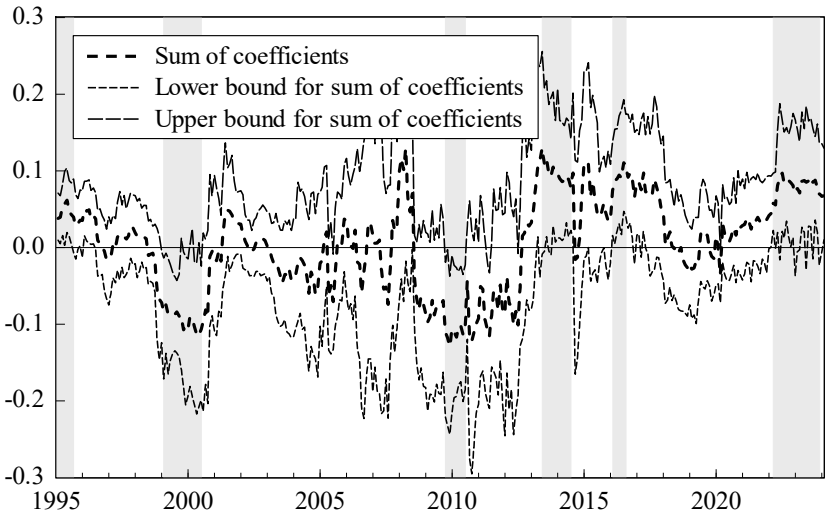
Figure 2 elaborates on the *p*-values from UCT to GP, indicating that UCT exhibits a significant Granger causal relationship with GP at a 10% level during the periods of January 1995 to September 1995, February 1999 to July 2000, October 2009 to July 2010, June 2013 to July 2014, February 2016 to August 2016 and March 2022 to December 2023. Figure 3 illustrates the parameters from UCT to GP, revealing that both positive influences (observed from January 1995 to September 1995, June 2013 to July 2014, February 2016 to August 2016 and March 2022 to December 2023) and negative impacts (February 1999 to July 2000 and October 2009 to July 2010) exist during these six periods.

Figure 2. *Examining the null hypothesis that UCT is not a Granger cause of GP*



Notes: The study estimates *p*-values utilizing 10,000 iterations of the bootstrap method. The solid line represents the distribution of these estimated bootstrap *p*-values, while the dashed line indicates a threshold *p*-value of 0.1 for statistical significance.

Figure 3. *The coefficients of the influence from UCT to GP*



Notes: The shaded region illustrates the period in which there is a statistically significant Granger causality from UCT to GP.

The positive impacts indicate that the U.S.-China tensions could trigger a bullion boom, aligning with the principles of the ICAPM. From January 1995 to September 1995, the U.S.-China relations have encountered challenges (Garrett, 2010). To be specific, the U.S. government has taken actions that infringed upon China's sovereignty and interests, provoking dissatisfaction and strong protests from the Chinese side, thereupon suspending high-level visits and some bilateral negotiations. High UCT has provided certain degree of support to GP, and this phenomenon can be explained by the following reason: When the U.S.-China relations become strained, investors often seek out relatively safe assets to mitigate potential risk, and gold is frequently viewed as a safe-haven asset due to its historical stability and reliability (Vieira *et al*., 2023; Azimli, 2024; Ryan *et al*., 2024). Consequently, if the deterioration of U.S.-China relations leads to heightened market uncertainty, investors may redirect their funds into safe-haven assets like gold (Echaust *et al*., 2024; Tarchella *et al*., 2024), thereby potentially driving up the price of this precious metal. Then, it could intensify price movements and market activity surrounding gold; thereby, the positive influence from UCT to GP between January 1995 and September 1995 is evidenced.

From June 2013 to July 2014, while the U.S.-China relationship has confronted challenges and disagreements during this period, both sides have endeavored to uphold the stability and progress of their ties through dialogue and cooperation. This relatively stable relationship also keeps UCT at a low level. Meanwhile, there is a noticeable downward movement in GP, the positive influence of UCT on it can be attributed to the following factors. First, low UCT makes the demand for gold as a safe-haven asset likely decrease (Echaust *et al*., 2024; Tarchella *et al*., 2024), as investors perceive lower risks and sought alternative investment avenues. This reduction in demand would subsequently translate

into lower GP (Su *et al*., 2023b). Second, low UCT might stimulate national economies, making the Federal Reserve Board embark on monetary tightening measures, such as raising interest rates. Then, the cost of holding non-interest-bearing assets like gold increases, potentially prompting investors to sell their holdings (Qin *et al*., 2023c), thereby exerting downward pressure on GP. Thirdly, amidst the decline of GP, investors' sentiment towards the gold market would shift to bearishness, potentially prompting them to offload their gold holdings, thereby intensifying the downward pressure on GP. Subsequently, it can be conclusively stated that UCT has a positive influence on GP within the timeframe spanning from June 2013 to July 2014.

From February 2016 to August 2016, the Sino-U.S. relationship also faces some challenges and disagreements, keeping UCT above 100 during this period. Two significant issues among them are the South China Sea dispute and cybersecurity (Cai *et al*., 2023). For example, the U.S. has dispatched an aircraft carrier battle group into the waters near the South China Sea to provoke, and China has taken decisive and forceful countermeasures in response to these provocations. Additionally, there were reports that the personal information of many think tank experts had been attacked by hackers, which is also a sensitive issue. Then, high UCT makes GP increase from 1199.9 dollars per troy ounce to 1341.1 dollars per troy ounce, growing by nearly 12%. The underlying reasons are as follows: On the one hand, high UCT leads to a heightened sentiment of risk aversion in the market, prompting investors to shift towards safe-haven assets like gold (Azimli, 2024; Ryan *et al*., 2024), which subsequently pushes up GP. On the other hand, high UCT may drag on national economic development, in order to combat potential downward pressure, the U.S. would adopt loose monetary policies, including interest rate cuts. These policies reduce the opportunity cost of holding gold, enhancing its attractiveness (Qin *et al*., 2023c). Thereafter, it can be confirmed that UCT has a favorable effect on GP between February 2016 and August 2016.

From March 2022 to December 2023, UCT is consistently above 100, which is primarily caused by two factors. On the one hand, there are certain differences between the U.S. and China regarding their positions on the Russia-Ukraine conflict. The U.S. and some of its allies have provided substantial military and economic aid to Ukraine, while China has always upheld the principles of peace, justice, and objectivity calling for the resolution of differences through dialogue and negotiation (Li *et al*., 2023). On the other hand, the U.S. has also taken a series of actions that have damaged China's interests and dignity in issues involving Taiwan and Xinjiang further escalating tensions between the two sides. These actions include allowing the leader of Taiwan to visit the U.S., hyping up the so-called "cross-border law enforcement" issue from China, and continuously adding Chinese companies to the entity list. At the same time, GP is at a relatively high level, which is close to 2000 dollars per troy ounce. The favorable effect of UCT on GP is demonstrated as: High UCT leads investors to lose confidence in risky assets and seek refuge in safe-haven assets, with gold, as a traditional safe haven, naturally attracting investors' attention (Azimli, 2024; Ryan *et al*., 2024). In addition, under the intensifying tensions between the

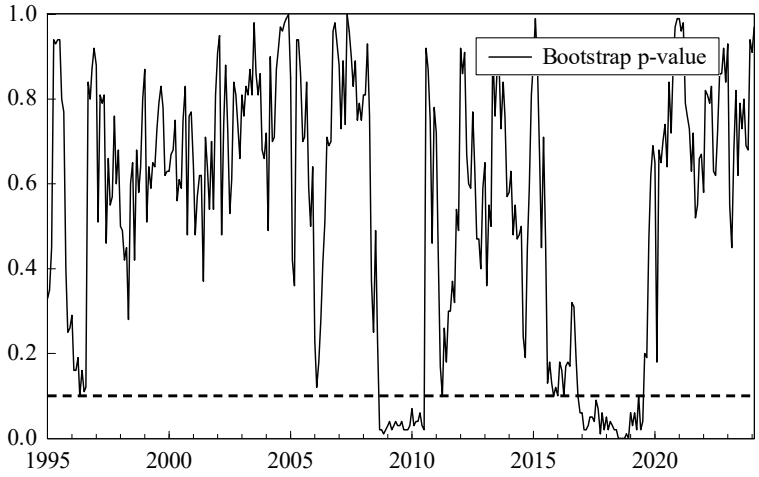
U.S. and China, several countries and regions have increased their demand for gold reserves (Su *et al*., 2023b). Hence, it is affirmed that UCT exhibits a positive influence on GP within the timeframe spanning from March 2022 to December 2023.

However, the detrimental consequences of UCT on GP undermine the aforementioned perspective. Despite episodes of strain in the U.S.-China relationship, GP index exhibits a declining pattern during February 1999 to July 2000, the following two causes could explain this phenomenon. On the one hand, the strengthening of U.S. dollar has detrimental effect on GP during this period. As the value of U.S. dollar rises, other currencies correspondingly decline in worth against it. This trend often prompts investors to favor holding U.S. dollars over gold, as the latter, being a traditional safe-haven asset, experiences a decrease in its investment return (Qin *et al*., 2023c). Consequently, the price of gold declines. On the other hand, a significant contributor to the downturn in GP is the sale of gold by central banks. Under the Washington Agreement, 15 central banks have been authorized to sell gold over a five-year period. This increase in gold supply to the market subsequently leads to a further decrease in GP. Thus, UCT's adverse influence on GP is confirmed from February 1999 to July 2000.

Affected by the global financial crisis, the relations between the U.S. and China are relatively friendly during October 2009 to July 2010, as the two nations have to collaborate to overcome the crisis. However, GP increases from 1043.2 dollars per troy ounce to 1193 dollars per troy ounce, which grows by nearly 15%. The primary cause is that the global financial crisis worsens the economic environment across the world. The aftermath of this crisis has witnessed a significant erosion of investor confidence in risky assets such as stocks and real estate, prompting a shift towards safer havens (Shahzad *et al*., 2018; Linardi, 2020). Gold, with its inherent safe-haven status, emerged as a favored investment option, attracting investors seeking to mitigate risk (Echaust *et al*., 2024; Tarchella *et al*., 2024). Moreover, in response to this crisis, the U.S. has implemented accommodative monetary policies. This influx of liquidity not only bolsters economic activity but also fuels the upward trajectory of precious metals prices, including gold (Su *et al*., 2023b), as investors seek to capitalize on the heightened demand for safe assets. Therefore, it is verified that from October 2009 to July 2010, UCT exerts an adverse influence on GP.

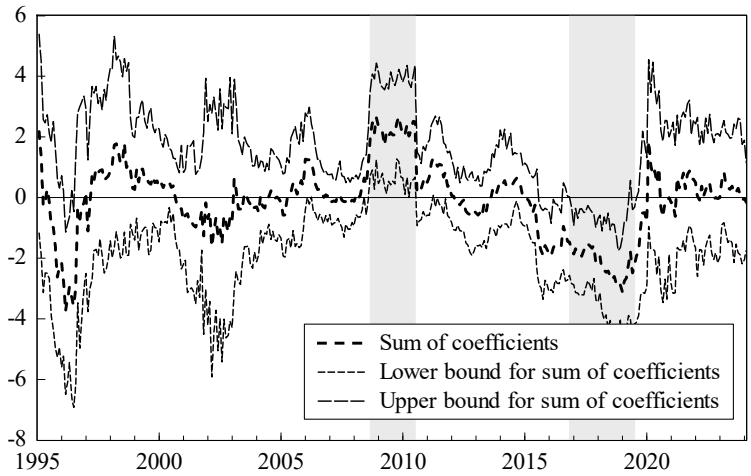
Figure 4 elaborates on the *p*-values from GP to UCT, indicating that GP exhibits a significant Granger causal relationship with UCT at a 10% level during the periods of September 2008 to July 2010 and November 2016 to July 2019. Figure 5 illustrates the parameters from GP to UCT, revealing that both positive influences (observed from September 2008 to July 2010) and negative impacts (November 2016 to July 2019) exist during these three periods.

Figure 4. *Examining the null hypothesis that GP is not a Granger cause of UCT*



Notes: The study estimates *p*-values utilizing 10,000 iterations of the bootstrap method. The solid line represents the distribution of these estimated bootstrap *p*-values, while the dashed line indicates a threshold *p*-value of 0.1 for statistical significance.

Figure 5. *The coefficients of the influence from GP to UCT*



Notes: The shaded region illustrates the period in which there is a statistically significant Granger causality from GP to UCT.

From September 2008 to July 2010, GP increases 829.9 dollars per troy ounce to 1193 dollars per troy ounce, growing by more than 40%. The positive impact emanating from GP on UCT can be elucidated by the subsequent two rationales: On the one hand, the rise in GP may lead to increased exports, thereby exerting pressure on the U.S. gold reserves. This could potentially exacerbate trade imbalances between the U.S. and China, possibly leading to trade frictions or tensions. On the other hand, gold is often perceived as a haven asset, and its price hike might reflect market concerns about global economic and political instability. In such a scenario, world uncertainties may rise, posing certain challenges to

the U.S.-China relations. Accordingly, we demonstrate that GP might positively affect UCT between September 2008 and July 2010.

From November 2016 to July 2019, GP is suppressed during this period and does not show a significant upward momentum, but UCT is relatively high due to the U.S.-China trade war. The underlying cause behind this negative influence from GP to UCT could be explained as follows: The depressed state of the gold market signifies a robust position for the U.S. dollar, a clear indicator that the national economy remains on a solid growth trajectory. This economic vitality serves as a foundation, empowering the U.S. to maintain and even escalate its trade war strategies, particularly with its largest economic rival, leading to a relentless deterioration of the already fragile relations between the two nations. Consequently, our analysis reveals that GP has an adverse influence on UCT during the period spanning from November 2016 to July 2019.

The study employs a full sample approach and uncovers no clear Granger causality from UCT (GP) to GP (UCT). This finding does not align with the ICAPM, emphasizing UCT's positive influence on GP. However, this methodology's limitation lies in its ability to detect only a single Granger causality, rendering it vulnerable to instability when VAR system coefficients fluctuate. To address this time-sensitivity, four techniques are applied to assess parameter stability and uncover dynamic characteristics within the selected series and the constructed model. Subsequently, we identify abrupt structural shifts in UCT, GP, and the VAR process, suggesting the inadequacy of the full sample approach. Consequently, we adopt a sub-sample methodology to better understand the time-varying transmission mechanism of variables under investigation. The sub-sample analysis methodology reveals an influence from UCT to GP, with both positive and negative impacts observed. This finding contradicts the ICAPM's assumption of a unilateral favorable effect. The positive effect indicates that, under certain conditions, increased tensions between the U.S. and China could lead to a bullion boom. However, the negative impacts refute this view, primarily due to other uncertainties like the fluctuations of U.S. dollars and global financial crisis. Conversely, there are also favorable and adverse effects of GP on UCT, highlighting that the fluctuations in the gold market have the potential to either intensify or de-escalate the tensions between the U.S. and China, thereby serving as a cautionary signal to some extent.

7. Conclusions and Policy Recommendations

The study delves into the mechanism that links the gold market with U.S.-China tensions, and subsequently assesses if these tensions trigger a bullion boom. To achieve this, we employ both full and sub sample methodologies to uncover the intricate relationship between UCT and GP. We find a complex interplay between UCT and GP, with both enhancing and dampening effects evident. The positive effect of UCT on GP suggests that heightened tensions between the U.S. and China could, under specific circumstances, act as a catalyst for a bullion boom. However, the negative impacts undermine this notion,

emphasizing that factors beyond U.S.-China tensions, including U.S. dollar fluctuations and global financial instability, also significantly impact the gold market. This conclusion contradicts the ICAPM's simplified notion of a solely positive relationship. Conversely, the gold market's fluctuations exhibit both stabilizing and destabilizing effects on U.S.-China tensions, thereby functioning as a mixed signal of caution. Upon examining the dynamic relationship between UCT and GP, it becomes evident that the tensions between the U.S. and China do not always ignite a bullion boom, and gold rush is not necessarily reappear.

Based on the aforementioned findings, we will formulate pertinent policy suggestions tailored to investors and regulatory bodies. For investors, first, investors should diversify their portfolios by incorporating gold alongside stocks, bonds, and other commodities to mitigate the risks associated with any single market or event, especially considering the intricate link between the gold market and the U.S.-China tensions. Second, they should stay updated on the evolving dynamics of U.S.-China relations, such as trade policies, sanctions, and geopolitical tensions, as these can significantly influence the gold market. Third, they should be rational in their investment decisions and avoid being swayed by market sentiment. Although gold is considered a safe haven asset, it can also fluctuate significantly under certain circumstances. For policy makers, firstly, they should strengthen cooperation with other countries on a global scale, fostering dialogue and consultation to resolve differences, thereby minimizing the likelihood of trade wars and geopolitical conflicts. This approach will contribute to stabilizing not only the gold market but also broader financial markets. Secondly, by strengthening oversight of the financial market, they should prevent speculative and excessive trading activities, fostering a stable and healthy market environment. Thirdly, they should promote the internationalization of the gold market. This involves enhancing market transparency and openness, attracting more international investors, and ultimately boosting liquidity and stability within the market. Fourthly, it is imperative to establish and refine an emergency mechanism specifically tailored to the gold market. This includes devising contingency plans to address market fluctuations triggered by unforeseen events, such as the U.S.-China tensions. Fifthly, public education on financial matters must be intensified. By improving the financial literacy of the general public, they can elevate investors' risk awareness and self-protection capabilities, ultimately reducing the prevalence of irrational investment behaviors.

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