

Data Visualizations of Gold and Silver Price VS Geopolitical Risk from 1985 to 2025

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I. INTRODUCTION

Gold has historically served as a “*safe-heavens asset*”, a store of value that has risen in times of political or economic uncertainty. The geopolitical risk index (GPRD) quantifies global political tensions with the use of news-based measurements of threats and actual conflicts. Seeing the record-high gold prices and the also increasing silver ones, the market has seen an increase in interest during the past year. It must be noted that GPRD has not reached the levels seen in mid 2025 since 2003, illustrating the exceptional intensity of the current geopolitical global climate.

This report aims to visualize potential relationships between precious metal prices and geopolitical risk that could help determine what is the optimal moment to acquire these assets, but it must be considered that the main study of the data will be in relation to gold and in a lower measure silver. The necessary exploratory analysis to achieve the previous goal will be conducted with the use of multiple data visualizations displayed further in the report with the aim to enhance understanding of how geopolitical dynamics influence the valuation of these metals.

II. DATA DESCRIPTION

The dataset used for the analysis previously mentioned consisted of a collection of data from both valuation features of precious metals and geopolitical characteristics on a large variety of dates [1]. Concretely the used dataset consists of a merging of data from two different sites, the first being an extraction of commodities information [2] and the second being a collection of geopolitical risk and its subsets [3]. It must be noted that preprocessing on the raw data was conducted, some of its steps consisted of rounding to two decimals numeric price values, formatting percentages as numeric values or standardizing dates and aligning them to a daily frequency.

The data studied consists of a total of 10,571 instances and had 15 unique fields described in detail in Table I. These instances described information from the markets since 1985 to 2025 and had an average of 260 instances per year (not 365 since markets close on Saturday and Sunday). Only eleven major events are recorded in the dataset, and none of them consists of the terrorist attacks of 9/11 since the markets closed for four days due to the relevance of the attack and no data on precious metals is recorded for those days. Neither does the outbreak of COVID-19 as only acts of war and/or terrorism are contemplated in the geopolitical risk index and therefore this event does not affect it.

TABLE I. DATA ATTRIBUTES

Attribute	Type	Example Value	Description
Date	Categorical	10/09/2025	Trading date (Daily frequency).
Gold Price	Numeric	3,630.900	Closing price of gold in USD.
Gold Open	Numeric	3,633.610	Opening price of gold in USD.
Gold High	Numeric	3,634.420	Highest price of gold during the market window of that day in USD.
Gold Low	Numeric	3,620.900	Lowest price of gold during the market window of that day in USD.
Gold Change %	Numeric	-0.07000	Daily percentage change in gold price.
Silver Price	Numeric	40.92000	Closing price of silver in USD.
Silver Open	Numeric	40.89000	Opening price of silver in USD.
Silver High	Numeric	40.94000	Highest price of silver during the market window of that day in USD.

Attribute	Type	Example Value	Description
Silver Low	Numeric	40.72000	Lowest price of silver during the market window of that day in USD.
Silver Change %	Numeric	0.09000	Daily percentage change in silver price.
GPRD	Numeric	117.260	Geopolitical Risk Index. Broad measure of geopolitical tensions globally.
GPRD Act	Numeric	97.420	Subset of overall GPRD index. Only counts mentions of realized geopolitical acts.
GPRD Threat	Numeric	146.260	Subset of overall GPRD index. Only counts mentions of threats or rising tensions, not actual acts of war or conflict.
Event	Categorical	Paris Terrorist Attacks	Major event labels associated with spikes or changes in the GPR Index.

III. METHODOLOGY AND RESULTS

To conduct the desired visual exploratory analysis of the dataset all the information was loaded into Tableau. Latter visualizations will often show (side by side) the same graphical analysis for both silver and gold, even though the analysis will be mainly centered around gold. First, and to deepen the understanding of how precious metal prices change with time, a study of its price evolution since 1985 has been developed. In Fig. 1 below it can be clearly seen that gold prices showed a much lower yearly variance than those of silver, with both precious metals having greater variances since 2020 (which could be explained by late geopolitical instability). The information displayed by Fig. 1 shows how, even though silver seems to have a good upward trend, gold is a much more stable and secure form of investment, which shows lower variances even during times of political turmoil.

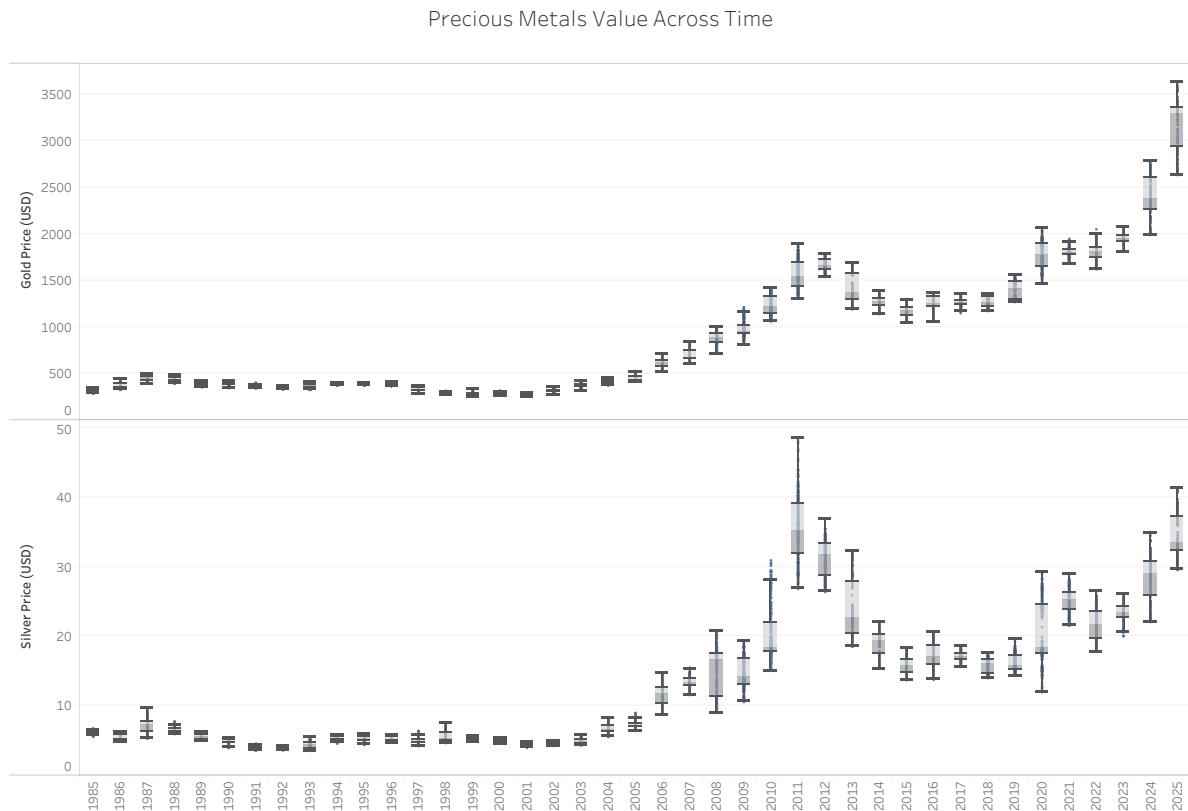


Fig. 1 Silver and Gold price Variation across Time (1985-2025)

After extracting the previously stated conclusions it was considered relevant to determine if the detected variance in price for each year corresponded to true variance or if it could be due to some years having missing values and therefore a lower representation. For it to be a fair comparison each year should have a similar amount of data to study or else values would have different weights in each year of the graph. To evaluate this possible scenario Fig. 2 studies the quantity of instances per year of the dataset in the form of a histogram.

The first idea that Fig. 2 invites to explore is the fact that even though each year has a similar number of instances these have a count of around 260 per year instead of the logical 365. This can appear to be an arbitrary and unexpected value at first, but it is quite the opposite, this value shows that there is little to none missing values in the dataset. It must be considered that the market for trading precious metals opens from Monday to Friday which corresponds, approximately, to 261 days out of the entire year. Fig. 2 also shows a decrease in the count of values for 2025 which is not relevant as it just corresponds to the proportionate number of days that the year has finished. Even though not critical this last scenario invites us to be careful when drawing conclusions for 2025 as final values are yet to be revealed.

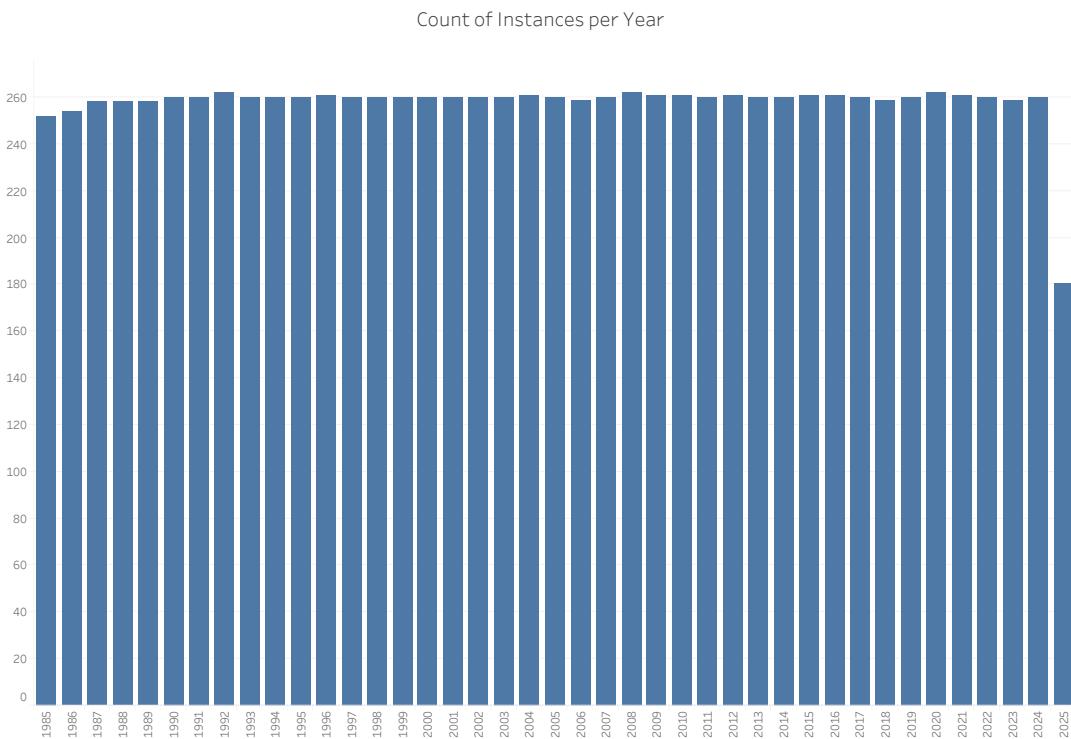


Fig. 2 Count of Instances per Year

Fig. 3 aims to analyze the trends and patterns, if any, between gold and geopolitical threads by displaying all instances in a scatter plot. To be able to visualize the density of the associations in the data the opacity was set to a value of 20%. While Fig. 3 shows similar results for both gold and silver, individual correlations and patterns can be observed for each precious metal. For both metals it can be observed how most points are condensed in a geopolitical risk index range of 0 to 250, since the average geopolitical risk tends to be a low value and only arrives to higher values in extreme situations this was expected. In Fig. 3 it can be observed (specially with gold) how higher price valuations correspond only with times of greater political uncertainty, with an index of at least 60.

In Fig. 3 is also observed how a vast number of instances are in a lower price range. This is not unusual, and it must be considered that for the first 20 years of the dataset (as seen in the box-and-whisker plot from the previous Fig. 1) precious metal valuations had an upward trend with a much lower growth per year than the following years.

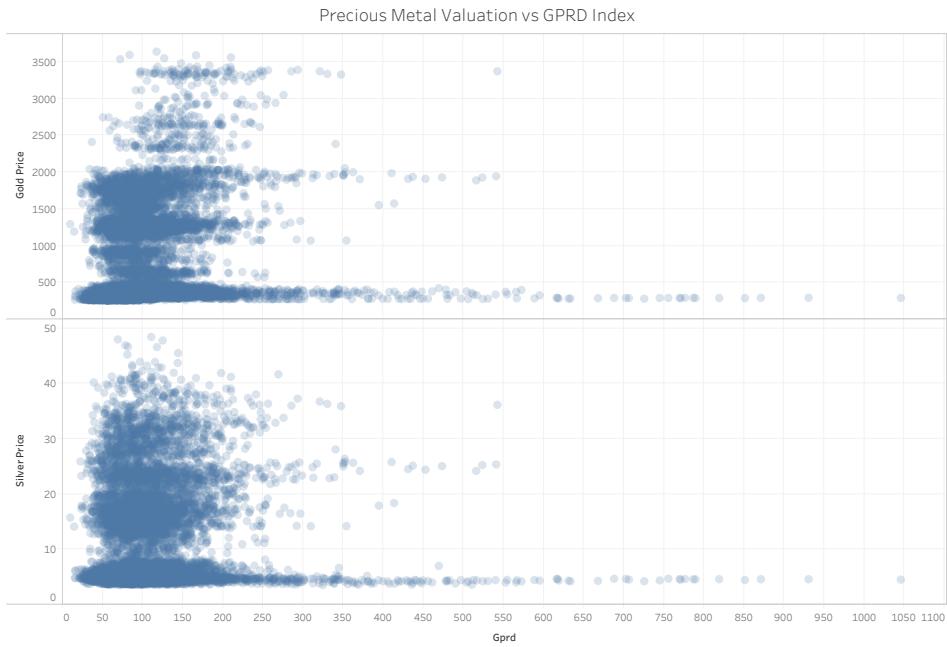


Fig. 3 Precious Metal Valuation vs Geopolitical Risk

Seeing the trends in data it was considered interesting to also analyze the value of precious metals versus a subset of GPRD, geopolitical risk threat index. This index only considers those mentions of tensions and threats, not acts of war or terrorism actively happening. The idea behind this analysis is to see how markets react not to geopolitical risk but to geopolitical uncertainty.

In Fig. 4 it can be observed how the trends in data previously mentioned accentuate even more when the geopolitical risk doesn't consider reality and just considers uncertainty. Fig.4 shows even more clearly than Fig. 3 how GPRD correlates with gold and silver prices, with higher prices having a distribution tending towards higher GPRD Threat indexes.

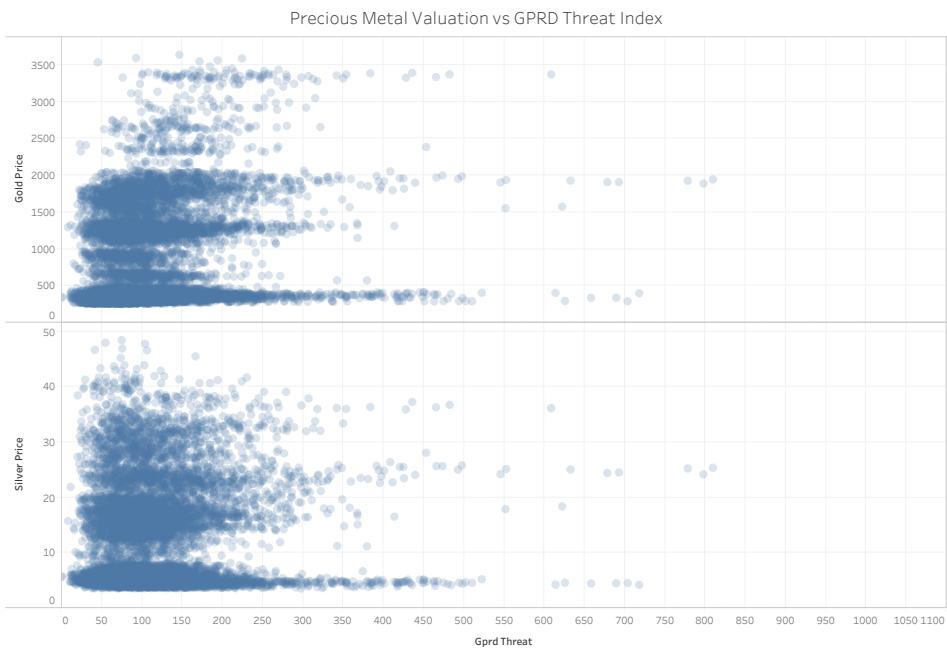


Fig. 4 Precious Metal Valuation vs Geopolitical Risk Threat

In Fig.5 we can observe the evolution of the maximum valuation of gold, minimum valuation of gold and maximum GPRD index for each month since 1985. The coloring palette allows us to clearly detect trends in the data at hands and easily identify which line corresponds to maximum gold pricing (green) or minimum (red), it must be considered that this arbitrary representation may not facilitate visualization and identification of trends for every reader.

In Fig. 5 it can be observed how spikes in GPRD correspond with surges in price for gold in a vast majority of instances (some don't follow this trend like January 1991). If we observe clearly the biggest spike in 2001, and latter spikes in the following years, where the breaking point from a light downward trend to a steep upward one. This observation is repeated in the following years with upward trends related to spikes in GPRD in November 2015, January 2020 or March 2022.

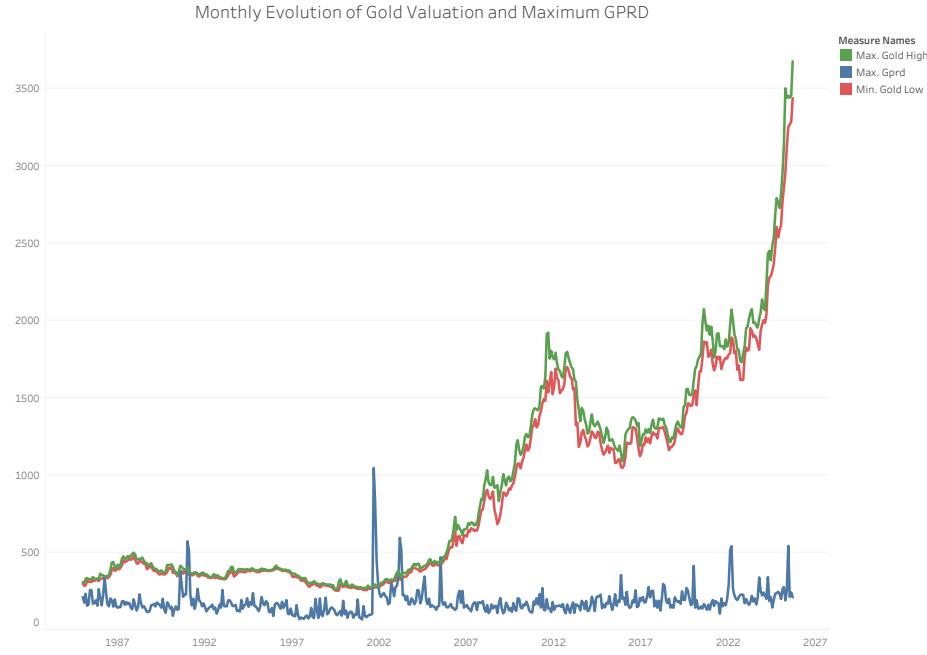


Fig. 5 Monthly Evolution of Gold Pricing and Maximum GPRD

In Fig. 6 the observed graph is like Fig.5 but with the change of precious metal, instead of studding the evolution of gold, the evolution of silver is the one studied. It must also be considered that since the historical range of price for silver goes up to around 50\$ compared to the gold one of around 3700\$, the value of GPRD had to be normalized to scale correctly and allow for easy visualization of all variables. The preprocessing step followed to achieve this result consisted of creating a new variable (GPRD_Max_Per_Month_Div50) which basically normalized the values by putting them in a smaller scale.

Fig. 6 allows for the visualization of the same trend detected in Fig. 5. Nevertheless, in the case of silver these trends become less relevant as it has a general more volatile valuation. Peaks of GPRD in the early 2000 also correlated with a great increase in value, and peaks in 2015, 2020 and 2025 showed a lighter upward trend, but unrelated big upward and downward trends were also detected (e.g. 2008).

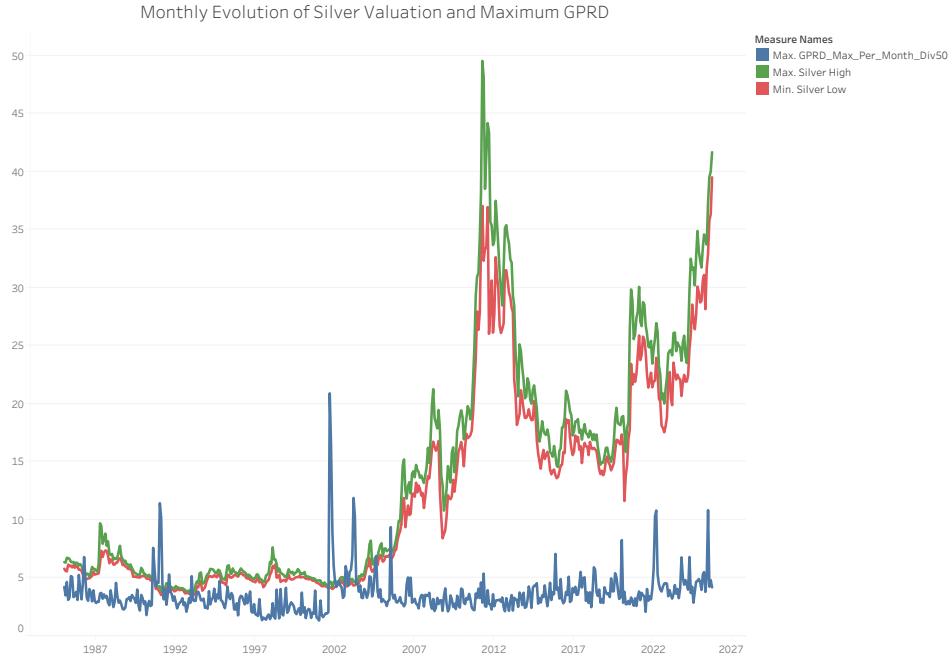


Fig. 6 Monthly Evolution of Silver Pricing and Maximum GPRD

IV. DISCUSSION

In the previous section (Section III), several visualizations like scatter plots, histograms and line graphs were used to explore the relationships and patterns between precious metal valuations and geopolitical risk. Looking at this representations, patterns and trends become visible to the naked eye and provide an initial understanding of how gold and silver prices behave in relation to global uncertainty.

Fig. 1 revealed that gold maintains a much more stable trajectory over time, with smaller yearly price variances than silver. This reinforces the popular idea of gold as a “safe-heavens asset” during periods of instability. In Fig. 1 silver showed larger fluctuations both upward and downward, making it more suitable for investors seeking short-term speculative investments rather than a store of value. In Fig. 2 it could be observed how the facts previously stated in this paragraph reflected true market dynamics rather than having the possibility of being explained by missing information.

When studying correlations and trends for precious metals versus geopolitical risk, from Fig. 3 through Fig. 6, clear tendencies became apparent. In general, higher GPRD values corresponded to upward trends in pricing of precious metals (specially for gold). This pattern is most obvious in Fig. 4 when comparing pricing versus geopolitical threat, demonstrating that uncertainty of future events has a higher correlation with increases of price than geopolitical tensions. Fig. 5 and Fig. 6 further emphasized this idea by showing how upwards trends in data were often preceded or accompanied by spikes in GPRD.

The exploratory analysis suggests that while geopolitical tensions do not directly cause price increases, they consistently correlate with upward movements in gold valuation, reinforcing the notion that gold serves as a “safe heaven” investment. Data visualization techniques helped make this idea obvious and provided a foundation for future predictive or economic studies in the field.

V. CONCLUSIONS

With this report a deep exploratory analysis of the relationships between precious metal valuations and geopolitical risk index was conducted, with interesting findings in trends, correlations (which does not mean causations) and differences between metals. With the help of the data visualizations implemented and the use of design considerations and theories of perceptions, this previously mentioned findings were easily highlighted for a clear explanation of ideas and display of facts.

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