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PRECIOUS METAL STOCKS & PRECIOUS METALS AS HEDGE, SAFE HAVENS & DIVERSIFERS

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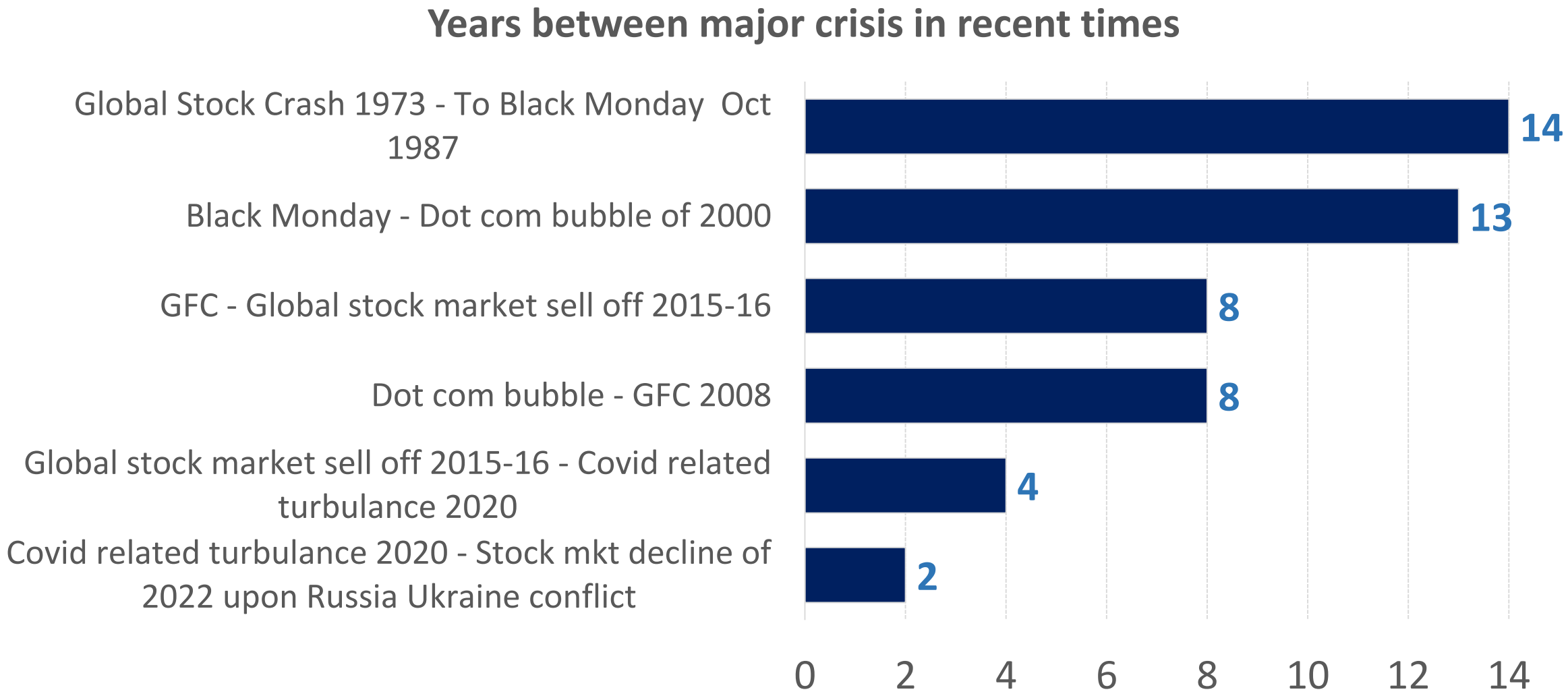
Frequency of extreme movements in asset market



Heightened relevance of safe havens, diversifiers and hedges

- **Hedge**: Negatively correlated Assets/investments
- **Diversifier**: Assets/Investments with +ve but less than perfect correlation
- **Safe Haven**: Uncorrelated assets/investment & -vely correlated during extreme events

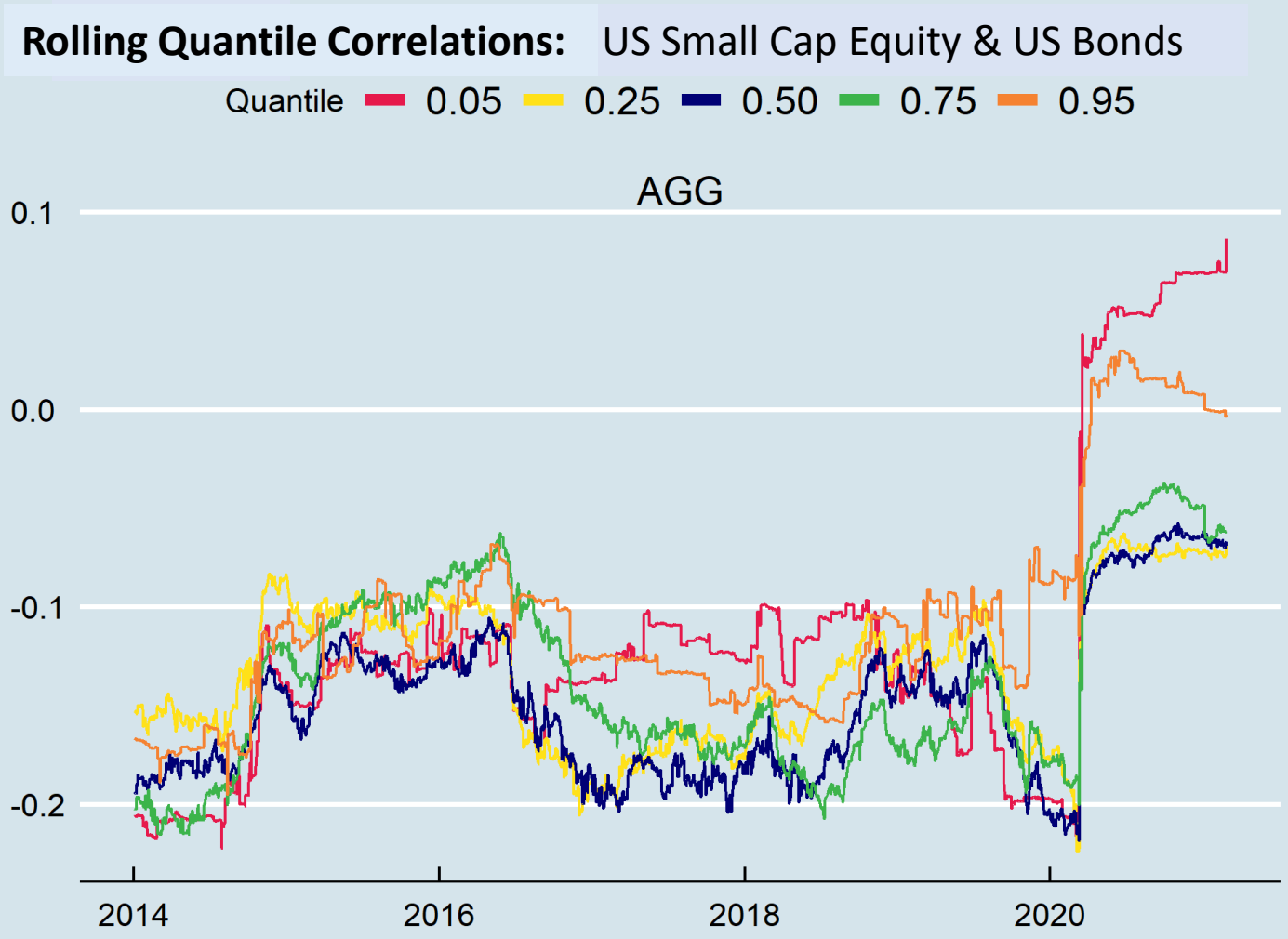
Motivation: From precious metals to precious metal equities

- Research biased towards inclusion of precious metals as traditional safe haven at times hedge (*Baur and Lucey, 2010; Li and Lucey, 2017; Lahiani et al., 2021*)
- A strand of literature highlights the role of precious metal stocks (*Johnson and Lamdin, 2016; Lucey & O'Connor et al., 2017; Dar et al., 2019; Paul et al., 2023)*
- Valuation of precious metal stocks depends upon underlying reserves, macro factors company mgmt…
- …besides it's a cheaper alternative for invst in metals

Focus: Associations under extreme asset price movements

- Explore these properties at different investment horizons & at furthest quartiles
- Decompose asset returns across time horizons using Maximal overlap discrete wavelet transformation (MODWT)
- Wavelet quantile correlation (Kumar & Padakandla, 2022) to explore association across time horizons and furthest quantiles

Quantile correlation provide granular insights in tail events



- Most Managers expect –ve correlation between equities and bonds
- More likely to be true under usual circumstances
- Correlation shoots up significantly into the +ve territory at the extreme downturn events such as March 2020 sell off the
- Besides while the right tail correlation goes down to zero at the end of 2020 the left tail correlation continues to remain high in the +ve domain

Source: https://www.linkedin.com/pulse/quantile-correlations-impact-diversification-marlon-do-couto/

Relevance of different time horizons in the study

- Conventional investment theory assumes that investment decisions are invariant to the time horizon
- However, (*Kristoufek 2013; Zhu H et al 2022*)showed that investors make their decisions based on the investment horizons they are operating
- We believe in the existence of varied preferences of timescales of investors operating in the market
- Motivates us to look into the different time horizons

Description of Variables

Variable	Proxy	Source
Gold	London Bullion Market (LBMA) Gold Bullion	Thomson Reuters DataStream database
Silver	LBMA Silver price	Thomson Reuters DataStream database
Gold Mining	FTSE Gold Mining index	Thomson Reuters DataStream database
Silver Mining	Solace Active Silver Index	Thomson Reuters DataStream database
Equity	FTSE Index	Thomson Reuters DataStream database

- Period of study: April 25th 2006 to May 03rd 2023

MODWT decompositions into 05 different time horizons

Horizon	weeks
D1	2-4 weeks
D2	4-8 weeks
D3	8-16 weeks
D4	16-32 weeks
D5	32-64 weeks

Wavelet Quantile Correlation btwn two variables X & Y

- Let Q_τ,X be the τth quantile of X and Q_τ,Y(X) be the τ th quantile of Y conditional upon X
- Q_τ,Y(X) is independent of X if and only if the random variables I(Y - Q_τ,Y) > 0 and X is independent
- Here I(.) is the indicator function. For 0 < τ < 1, the quantile covariance is defined as:

$qcov_t$ (Y,X) = cov{I(Y - Q_τ,Y > 0), x} = E(ϕ_τ (Y - Q_τ,Y)(X - E(X))

ϕ_τ(w) = τ - I(w < 0). We calculate QC as:

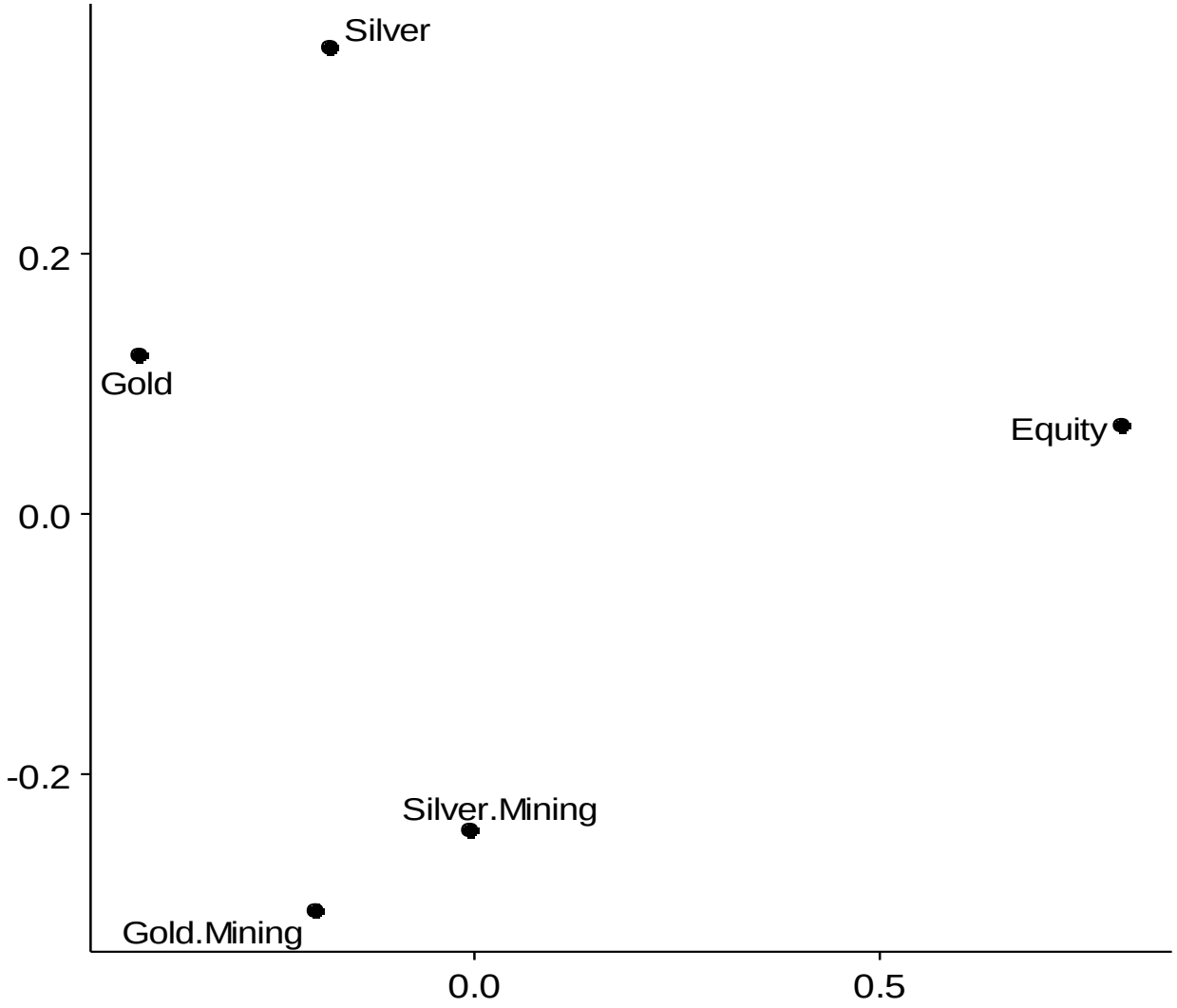
$$qcor_t\ (X,Y)=\frac{qcov_t(Y,X)}{\sqrt{(var(\phi_\tau(Y-Q_{\tau Y})var(X))}}$$

- Safe-haven property is ascertained by testing the correlation at lowest quantiles

Use Multidimensional scaling (MDS) on returns for asset classification

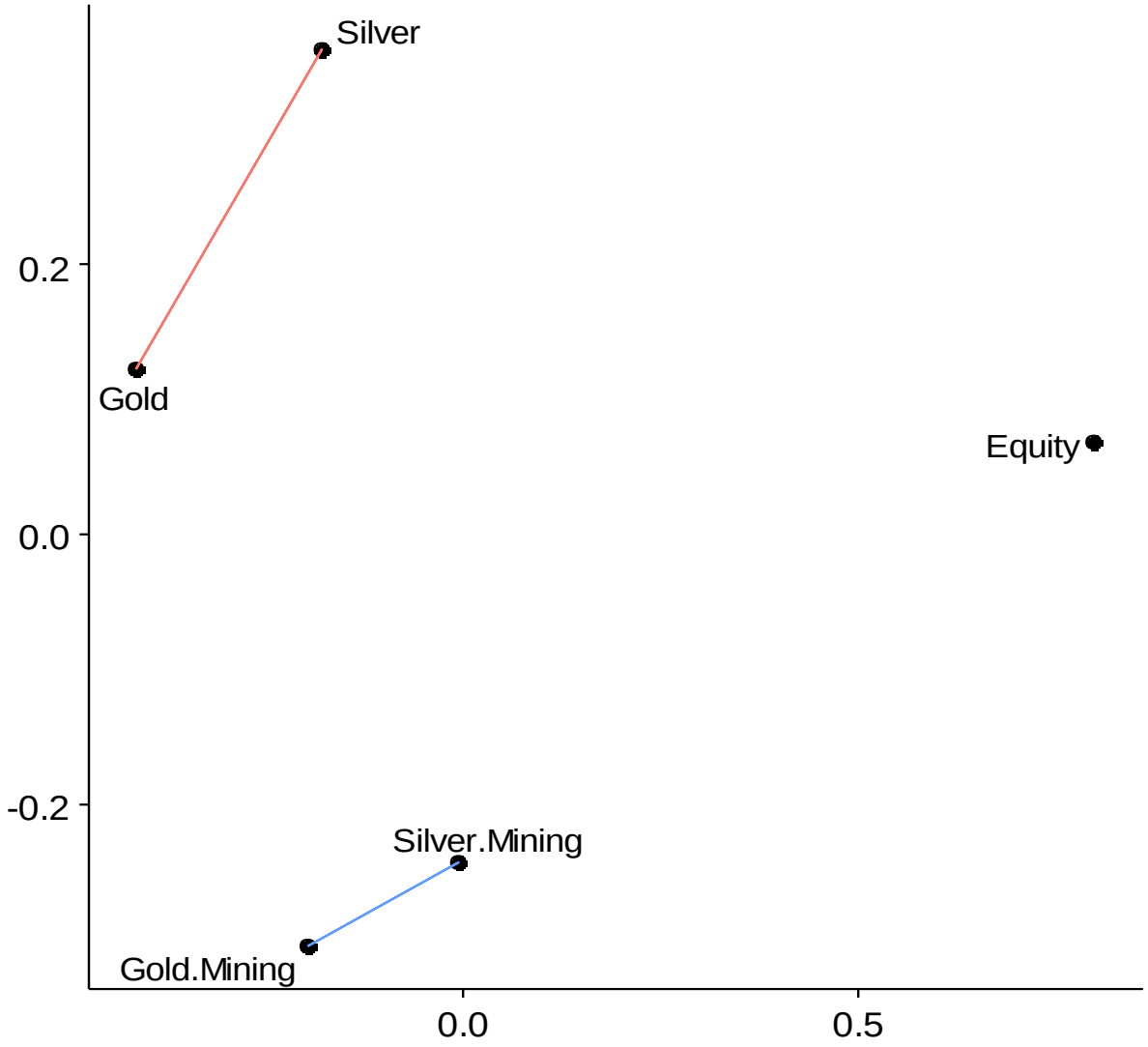
- Projects **n-dimensional** data to **2- dimension** space
- Lower dimensional representation of dissimilarity mtx, preserve pairwise distances (minimizing distortions)
- Visual **representation of distances** more intuitive
- Distances btwn variables based on correlation coeff
- $d_{i,j} = 1 - \rho_{i,j}$ for i,j = 1,…,n
- Variables/Objects more similar are closer together on the graph than objects that are less similar

Multidimensional scaling (MDS): 05 asset classes



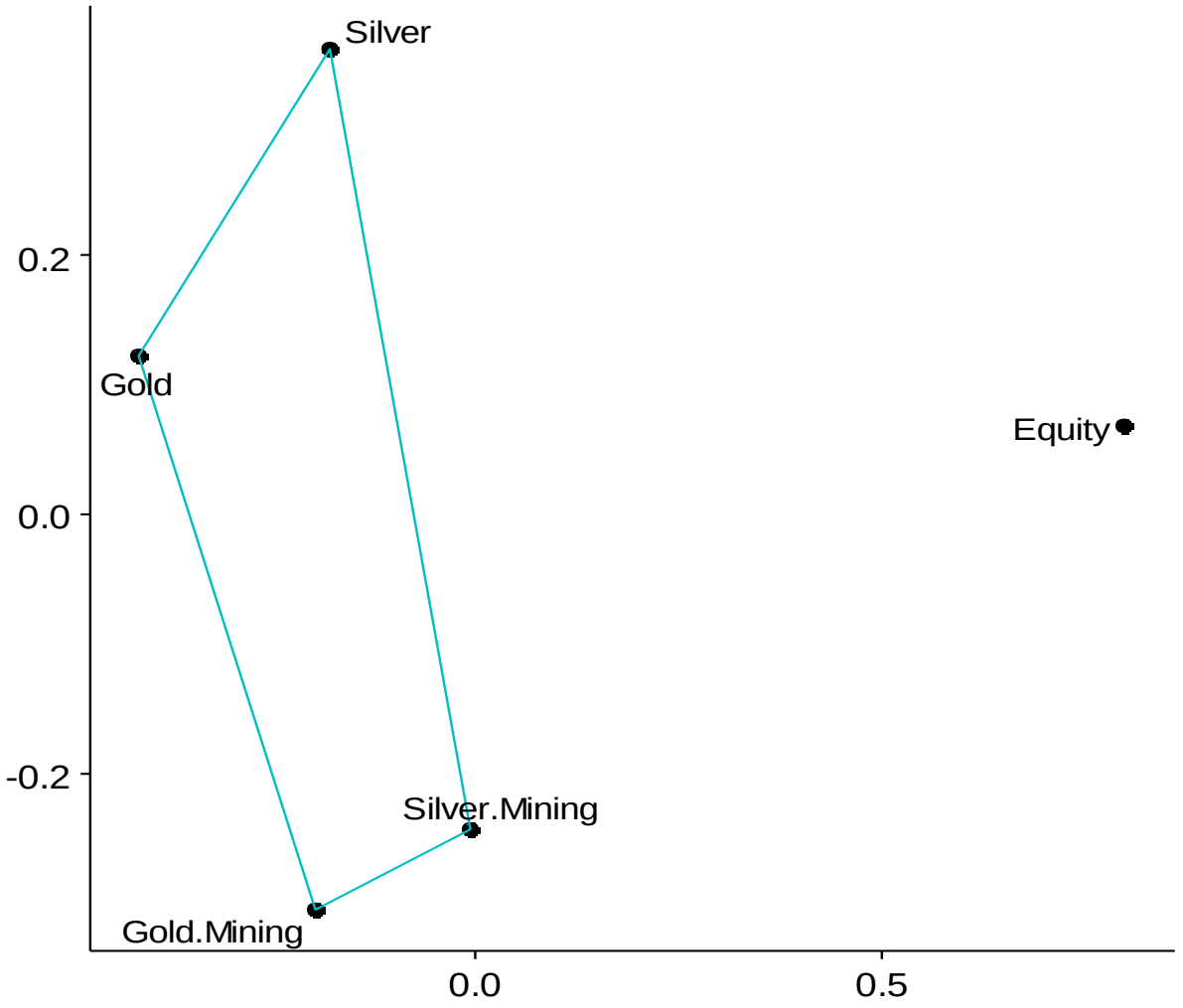
- Classification into 5 assets (variables)
- Each asset manifests as a separate class

Multidimensional scaling (MDS): 03 asset classes



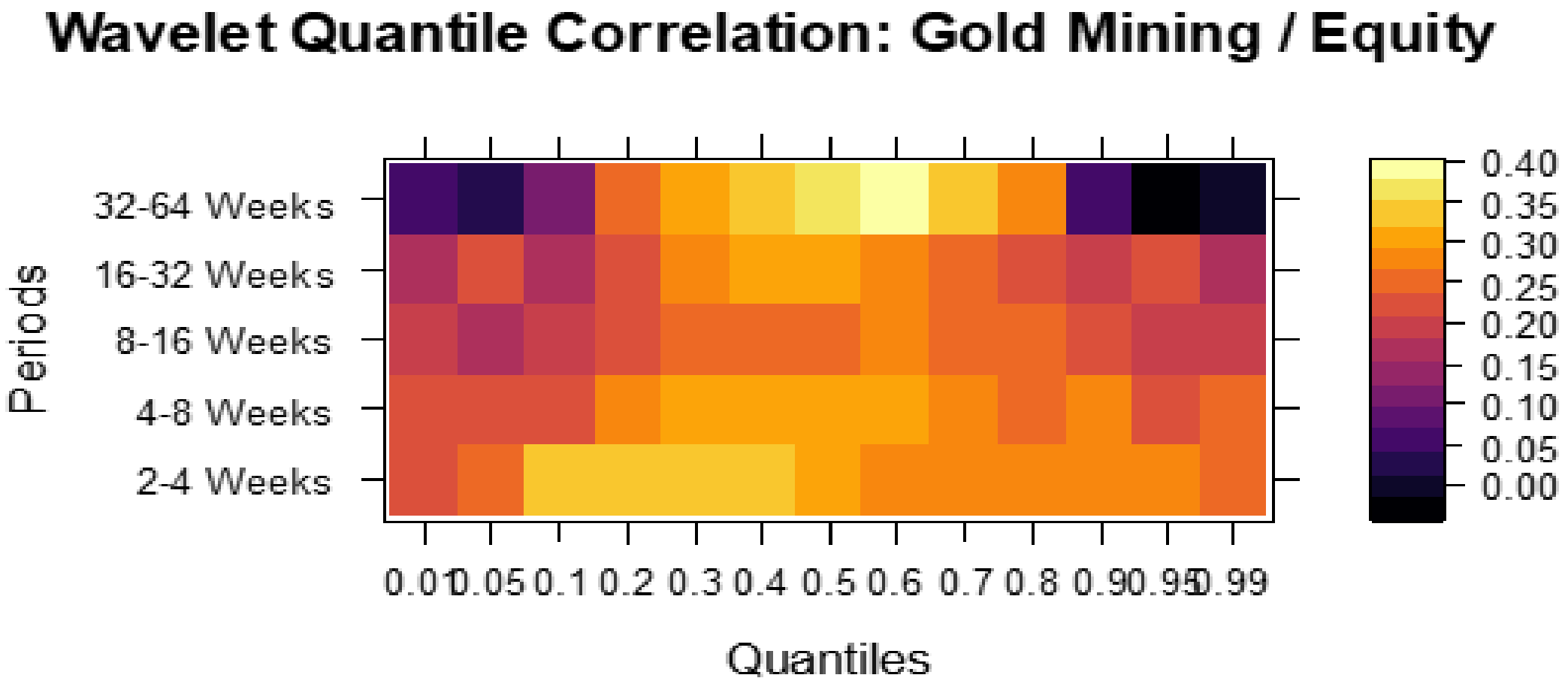
- Classification into 3 asset class (variables)
- *Equity* continue as an unique asset
- *Precious metal* emerge as a separate asset class....
- *Precious Metal Equities* stands out as well manifesting differently to underlying physical metal

Multidimensional scaling (MDS): 02 asset classes

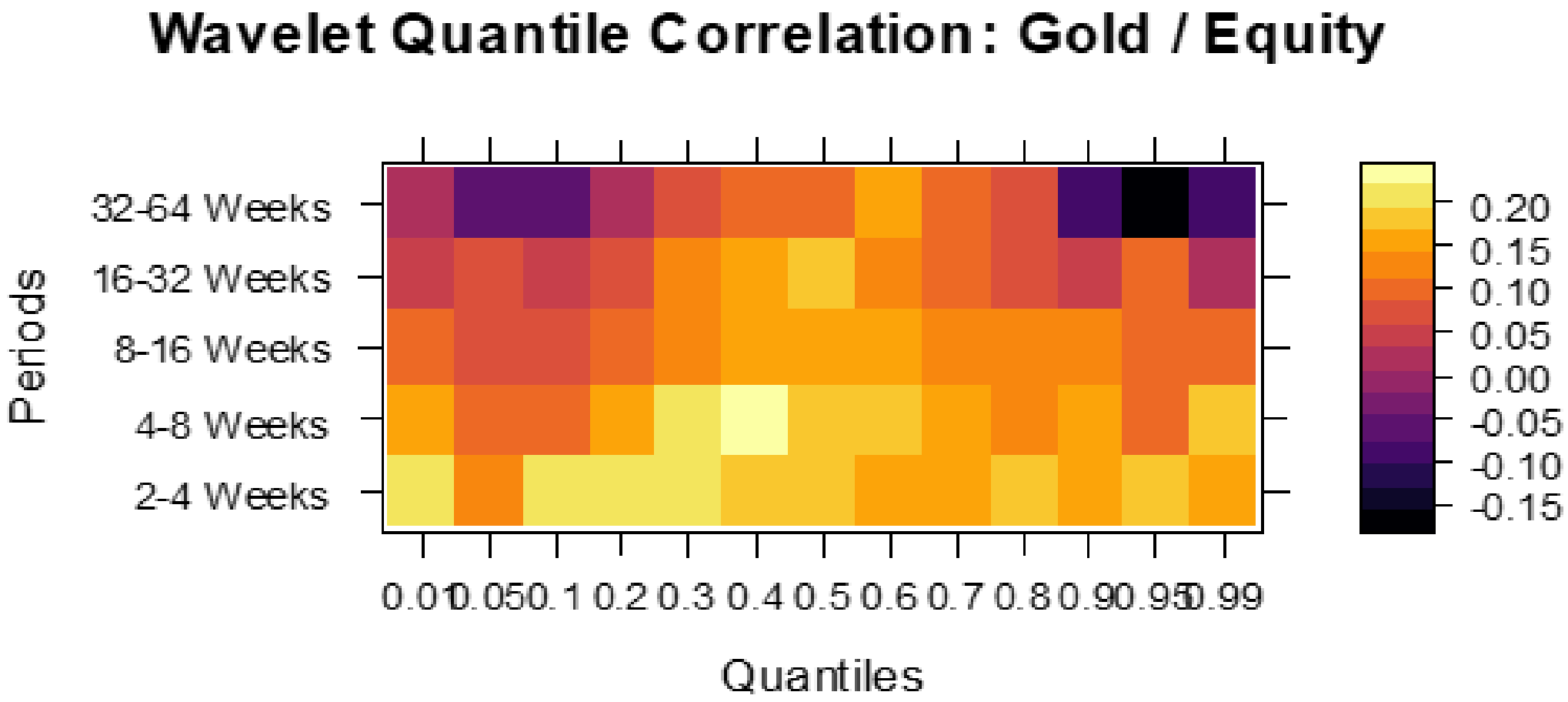


- Classification into 2 asset class (variables)
- *Precious metal* behave as one asset class together with their *stock counterpart*
- *Equity* separate out as an unique asset class
- Intuitive … equity market dynamics are different to precious metal market

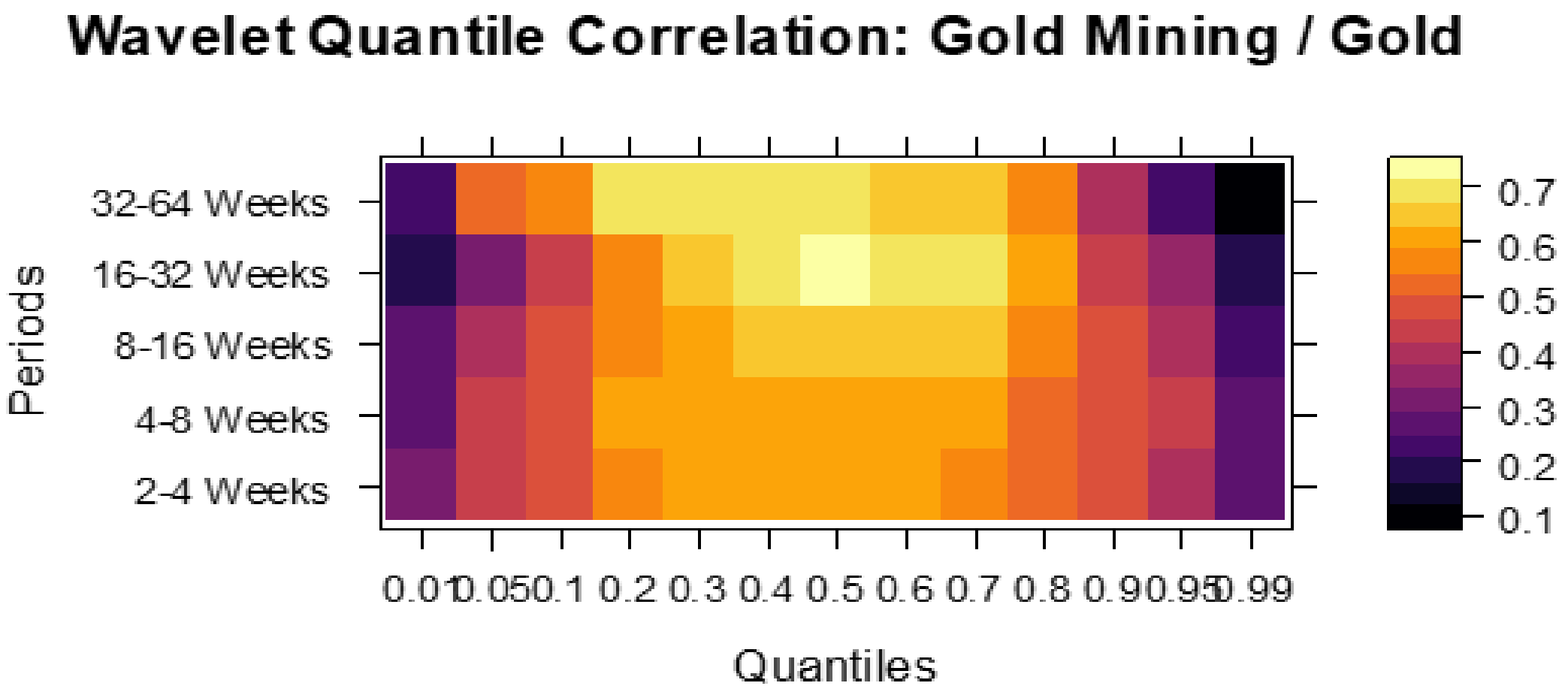
Wavelet Quantile Correlation btwn Gold Mining Stocks & Equity



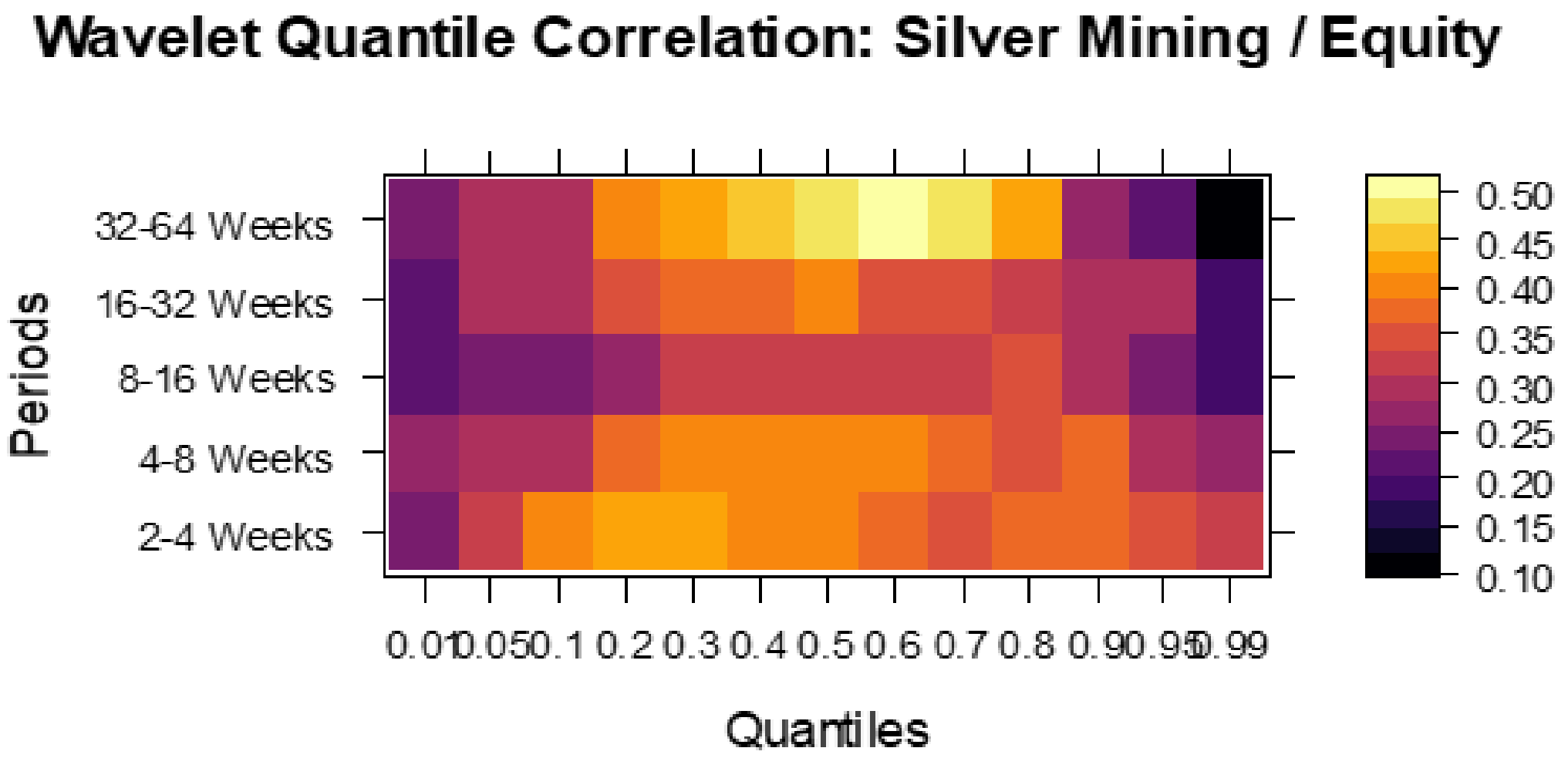
Wavelet Quantile Correlation btwn Gold & Equity



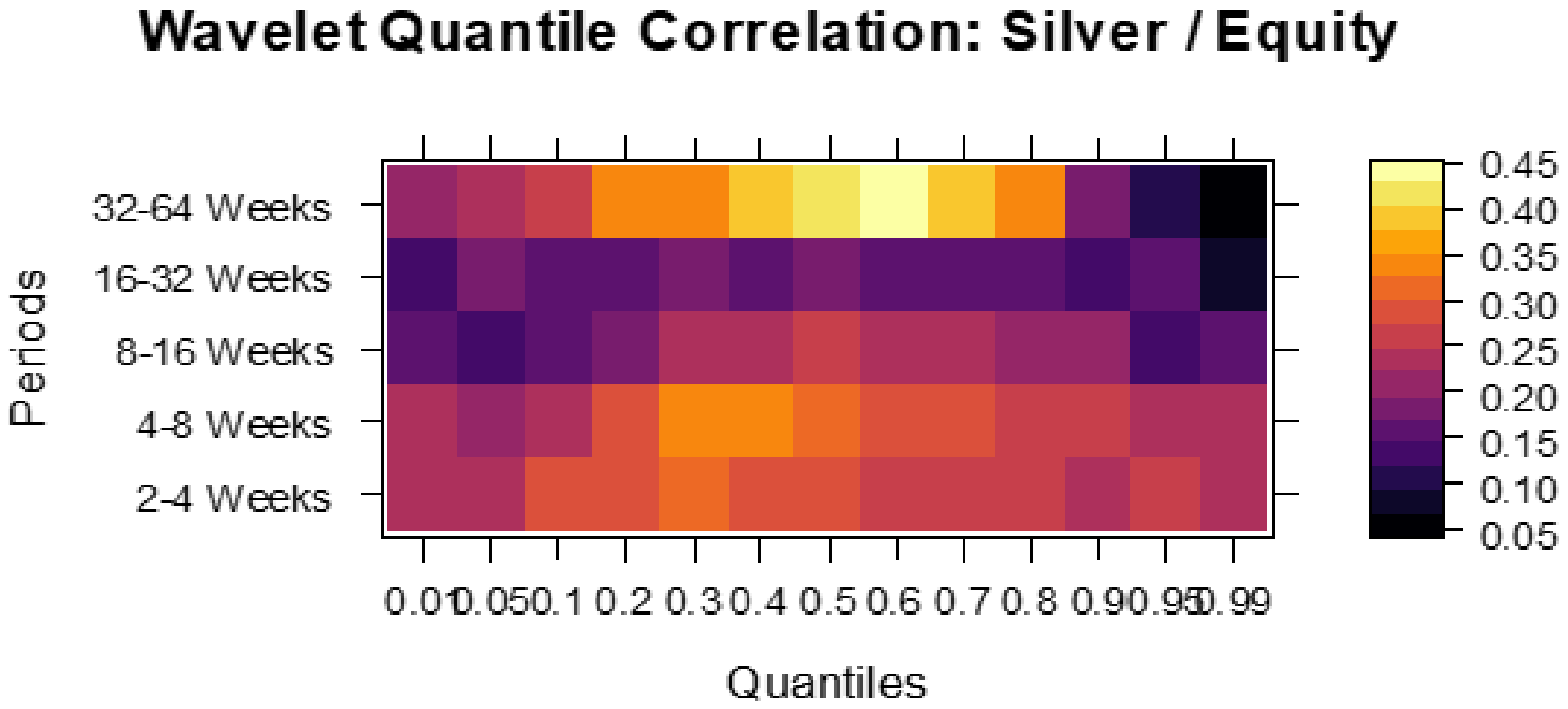
Wavelet Quantile Correlation btwn Gold & Gold Equity



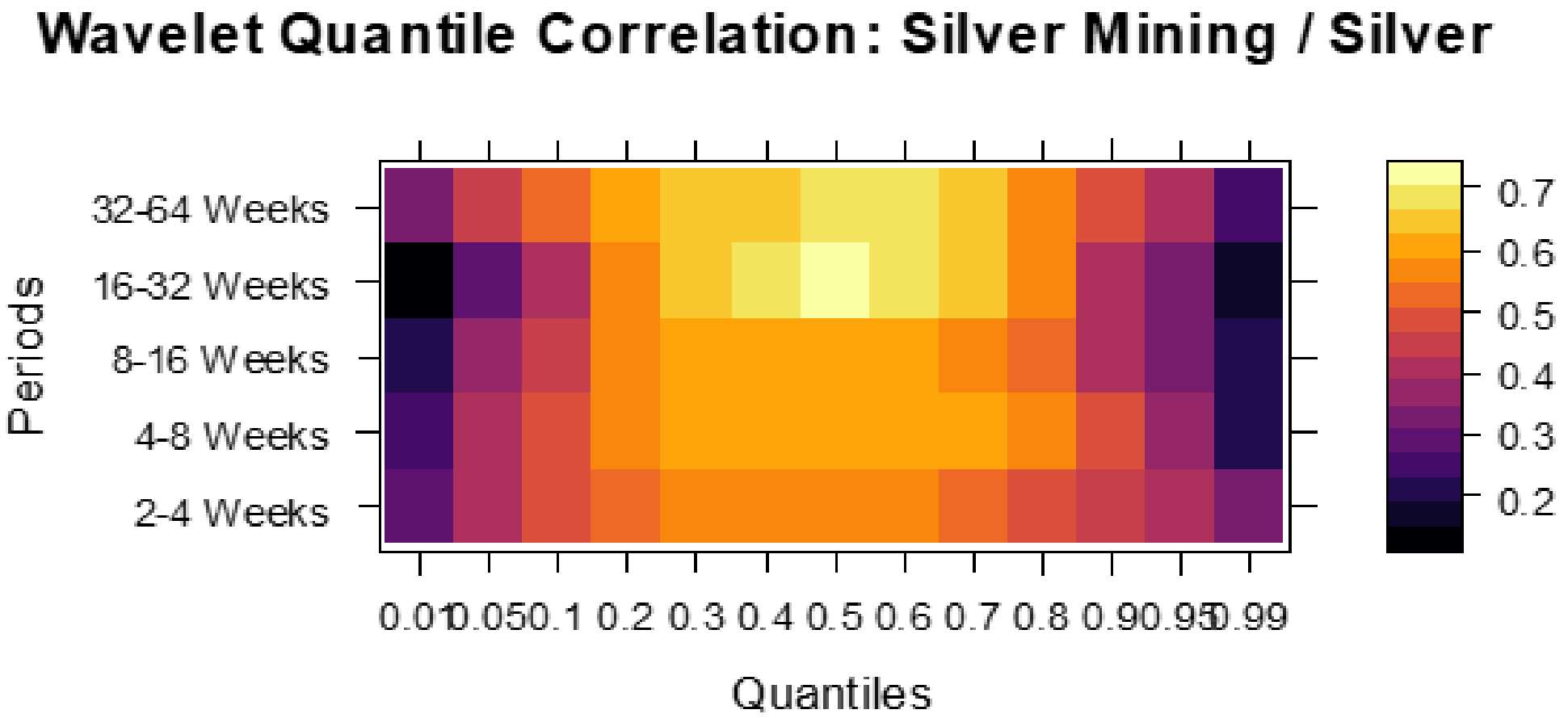
Wavelet Quantile Correlation Silver mining & Equity



Wavelet Quantile Correlation Silver & Equity



Wavelet Quantile Correlation Silver Mining & Silver



Conclusion

- Precious metal are relatively more correlated with precious metal stocks than equities at all quantiles and time horizons
- Gold shows hedge and safe-haven property (strong) at the longer time horizons
- Silver shows the diversifier property at all the time horizons and quantiles
- Both the precious metal stocks only exhibit diversifier properties at all-time horizons

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Thank you!