Mineral Company Investment Decision Making

1. Purpose of the Project
   Compare company valuations and make an informed, best diversified investment decision by simulating optimal choices across companies with different mineral products. The project will begin by compiling financial data (stocks and fundamentals) for selected mining companies, along with their respective mineral products. The amount of money (e.g. $500,000) will be simulated as the best decision to diversify the investment by considering the valuation of companies (fundamental conditions and stock prices) and the outlook for each mineral they produce.

2. Research Question
   Will it be possible to perform a company's valuation and conduct back testing that demonstrates maximum investment profitability using a free data source (free API)? I'm not sure about this, but it interests me since more developers are providing programming languages to analyze companies. Personally, I believe that the way financial experts conduct valuations will gradually shift from Excel to programming languages in the near future. I am interested in this topic because I enjoy learning more about finance and how programs such as GAMS, Python, and R, combined with visualization tools like Tableau, can maximize productivity. I am also trying to use at least two from the three languages that I have been learn. What I understand is that each language has its advantages and disadvantages, so that maybe by learning the shell file, I will increase my understanding of the workflow.

3. Data Sources
   I am looking for a free API related to companies' valuations that can be obtained from websites, as there is a possibility to add or remove more data. I am not familiar with API, but I have tried to generate some of them before. I want to gain a deeper understanding of this. Some of the data sources listed below:
   a. Alpha Vantage
   b. Yahoo Finance
   c. Financial Modeling Prep
   d. Fred
   e. Quandl (Now Nasdaq Data Link)
   f. USGS API

4. Methodology
   For the methodology, this is the big picture of how I will evaluate companies and make scenarios. I need to finish some journals and books that will give me more understanding

of the valuation, since I am also taking the Economic Evaluation. I hope the details will grow along the way. This is the workflow of my project:

a. Define company and mineral categories for investment
b. Load market fundamentals, this formula below generate from my previous class in Advanced Project Analysis:
    i. Entities & Notation
        1. Companies i = 1..N; commodities/minerals c ∈ $\mathcal{C}$.
        2. Portfolio weights $w_i \geq 0$, $\sum_i w_i = 1$. Budget B (e.g., $500,000).
        3. Shares: $n_i = \text{floor}((w_i \cdot B) / P_i)$
        4. Market return R_m; commodity return R_c; company return R_i.
    ii. Core Fundamentals & Valuation
        1. Enterprise Value (EV)
            a. $EV_i = MarketCap_i + TotalDebt_i + MinorityInterest_i + PreferredEquity_i - Cash_i$
        2. Key Multiples (lower is cheaper)
            a. $PE_i = P_i / EPS_i$
            b. $EV/EBITDA_i = EV_i / EBITDA_i$
            c. $P/B_i = P_i / BookValuePS_i$
        3. Mining-Specific NAV (asset-level), for each mine k in company i, discounted at r_i (≈ WACC):
            a. $NAV_{ik} = \Sigma_{t=1..T} [(Q_{ikt} \cdot (P_{c,t} - AISC_{ik,t}) - SustCapex_{ik,t} - Taxes_{ik,t}) / (1 + r_i)^t]$
            b. $NAV_i = \Sigma_k NAV_{ik} + OtherAssets_i - Liabilities_i$
            c. $P/NAV_i = MarketCap_i / NAV_i$
        4. Reserve/Cost Quality
            a. $RLI_i = (Proven + Probable Reserves)_i / AnnualProduction_i$
            b. $AISC\ Margin_i = \Sigma_c\ \alpha_{ic} \cdot (P_c - AISC_{ic}) / P_c$
c. Valuation calculation (still looking at the details)
d. Investment scoring (still looking at the details)
e. Price scenario (“Arima” Time Series)
f. Back test scenario (still looking at the details)
g. Investment recommendation with constraints
    i. Valuation weights: w_PE=0.25, w_EVEBITDA=0.35, w_PB=0.20, w_PNAV=0.20
    ii. Quality weights: w_RLI=0.50, w_AISC=0.35, w_Lev=0.15
    iii. Composite: θ_V=0.50, θ_Q=0.30, θ_M=0.20
    iv. Outlook blend: λ_B=0.70, λ_O=0.30
    v. Return blend: ρ=0.30, κ scaled to annual