ALL THAT GLITTER IS GOLD AND SILVER

NED

BACKGROUND

Ned, our neighbor, won the lottery and is interested in investing his riches into the precious metal market. He asked us for advice on how to do that:

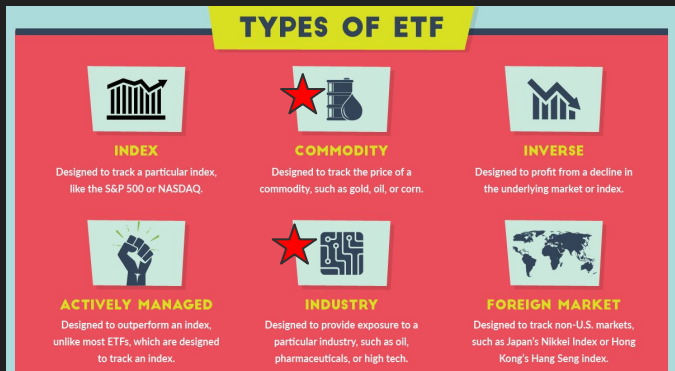What is the best time to put money in the market?

Does it matter if he invests in silver, silver mining, or gold mining? All 3 look to be around similar prices.

Is Gold or Silver a better investment for long vs short term?

Dataset: Alpha Vantage API

Tickers/Symbols and Terms to Know

Silver ETFs	SLV (Bullion)	SIL (Mining)
Gold ETFs	GLD (Bullion)	GDX (Mining)
Market Index	DJI (Dow Jones Industrial Average)	

TYPES OF ETF

INDEX
Designed to track a particular index, like the S&P 500 or NASDAQ.

COMMODITY
Designed to track the price of a commodity, such as gold, oil, or corn.

INVERSE
Designed to profit from a decline in the underlying market or index.

ACTIVELY MANAGED
Designed to outperform an index, unlike most ETFs, which are designed to track an index.

INDUSTRY
Designed to provide exposure to a particular industry, such as oil, pharmaceuticals, or high tech.

FOREIGN MARKET
Designed to track non-U.S. markets, such as Japan's Nikkei Index or Hong Kong's Hang Seng index.
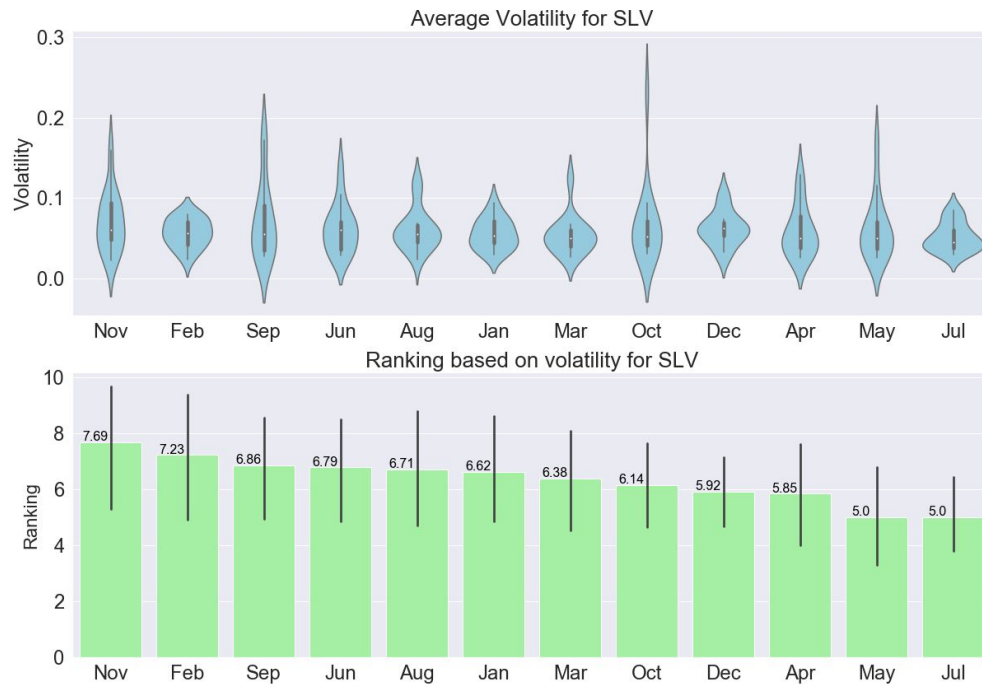
*ETF = Exchange-Traded Fund

SLV, SIL, GLD, GDX Price Over Time

Closing price

November is the most volatile month on average over the past 20 years. Is this real or just because of the chance?
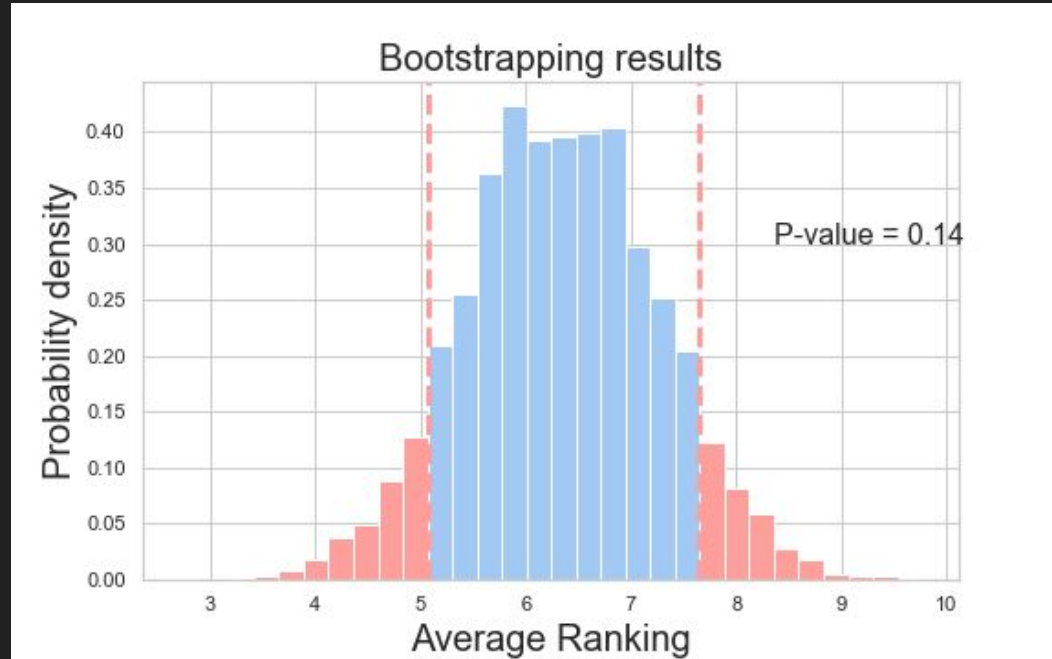
Hypothesis testing #1: Is there any seasonality?

Bootstrapping Method

H_0: No seasonal effects are present

H_A: Seasonal effects are present

Hypothesis testing #2: Does it matter if Ned invests in GDX, SIL, or SLV?

One-Way Anova

ANOVA stands for analysis of variance.

If the null hypothesis is not rejected, the F-statistic follows the F-distribution with $\alpha - 1$ and $N - \alpha$ degrees of freedom.

Assumptions:

All populations have common variance
Within each sample observations are sampled randomly and independent of each other
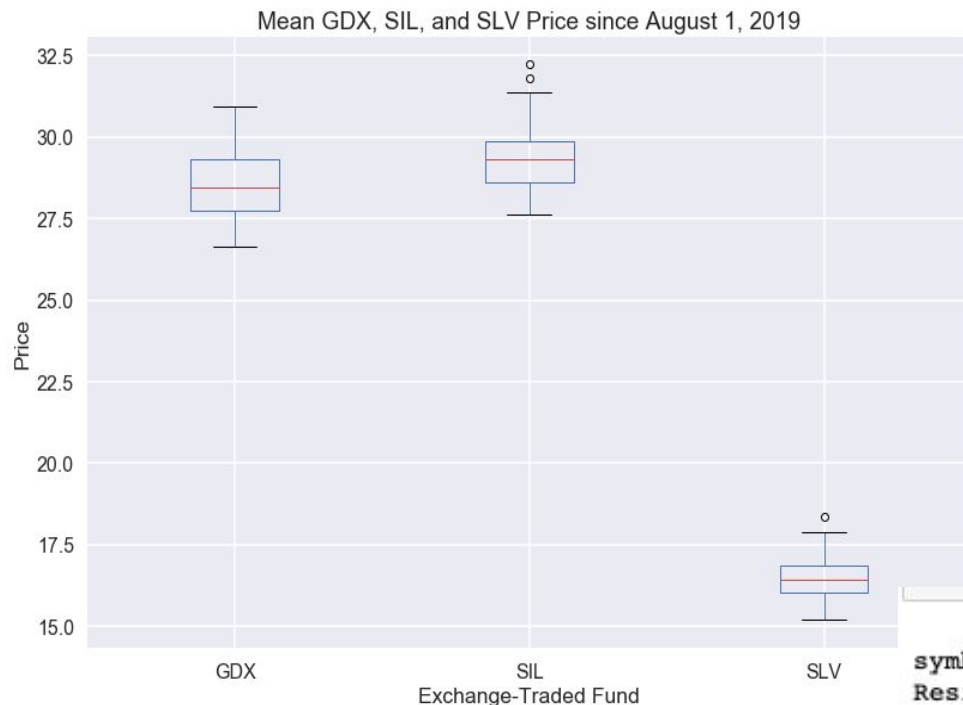Each group sample is drawn from normally distributed population
Factor effects are additive

Hypothesis testing #2:

$H_o : \mu_1 = \mu_2 = \mu_3$

H_a : At least one of the means differs from the other means

Mean GDX, SIL, and SLV Price since August 1, 2019

Means:
GDX - $28.53 (Gold Mining)
      VanEck Vectors Gold
      Miners ETF

SIL $29.42 (Silver Mining)
Global X Silver Miners
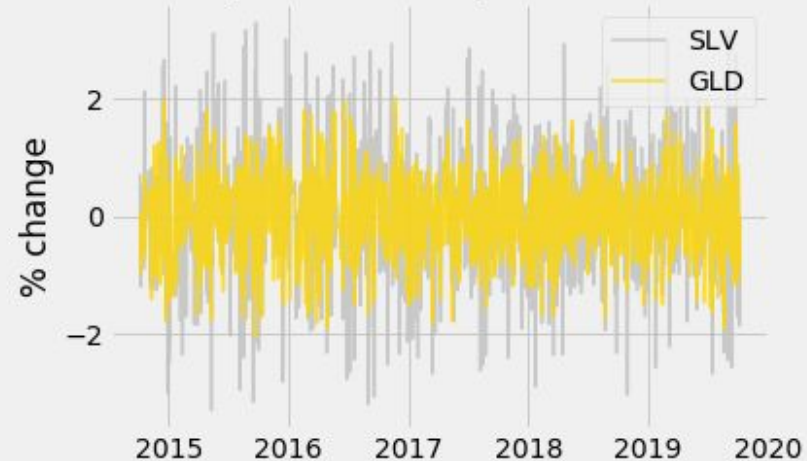
SLV $16.50 (Silver Bullion)
iShares Silver Trust

	sum_sq	df	F	PR(>F)
symbol	4788.269694	2.0	2656.474363	3.997616e-109
Residual	121.668106	135.0	NaN	NaN

Hypothesis test #3 : SLV vs GLD - long vs short term

Hypothesis test #3 : SLV vs GLD - paired t-test

$H0$: movement_SLV - movement_GLD = 0

Ha : movement_SLV - movement_GLD > 0

	Statistically different? (p-val)	By how much? (coh_d)	Conf Interval (alpha = 0.05)
Daily Movement	¯_(ツ)_/¯ (0.0497)	N/A	-0.04 - 0.0
Weekly Movement	YES (0.01)	Not Much At All (0.13)	0.01 - 0.06
Monthly Movement	YES (0.02)	Not Much (0.25)	0.01 - 0.06

If Ned wants to do short-term investment, on average SLV moves ever so slightly better than GLD on a weekly- and monthly- basis

INSIGHTS

- There is a significantly low probability that average closing prices for GDX, SLV, and SIL are not all equal one another for the past few months
- We failed to find sufficient evidence to support the existence of seasonal volatility for all symbols
- GLD is a good investment on a long-term basis, but SLV not so bad on a short-term basis

FUTURE WORK

- Perform analyses using time-series model
- Set parameters for ARIMA to investigate hypothesis that during the financial crisis, GDX follows DJI closer than GLD follows DJI