SYNTHETIC FINANCIAL DATA:
AN APPLICATION TO REGULATORY COMPLIANCE FOR BROKER-DEALERS

8 November 2019

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Part 1: Big Data
In the age of “big data”, those in the investment management industry have a “small data” problem.

Companies like Walmart, Amazon, PayPal, Facebook, and Google collect petabytes (one petabyte equals a million gigabytes) of data every hour.

Financial market participants often use the small data of financial markets to generate and test investment strategies. This comes with two major problems.

- Historical data from an earlier time may tell us little or nothing about future prices and returns.
- Inferences about the profitability of investment strategies may be sensitive to a handful of outliers.
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Example 1:

For decades, investment advisers and broker-dealers have assumed that the historical premium of equities over risk-free securities implied that stocks are a generally superior investment strategy for the "long term."

But the implication is highly fragile. In a pathbreaking work: Bessembinder (2018) finds that the majority of U.S. listed common stocks have returned (inclusive of dividends) less than the risk-free rate (that is, the one-month Treasury bill) over their lives as listed companies.

Just 4% of listed U.S. companies account for all of the gains of the U.S. stock market from 1926 to 2016.
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Example 2:

- Dogs generally look the same over a period of decades (even allowing for new hybrid breeds).

- This allows for successful image recognition algorithms.

- Financial markets present a far different problem.

- We know very little about the mechanisms that generate prices.

- Financial-market data is likely to be generated by mechanisms (interactions of traders using information) that are not stable through time.

- Even if a researcher finds a good model of price behavior in a particular period of time, there is little reason to believe that prices will behave today as they did 10 or 20, or even 5 years, ago.
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Part 2: Financial Regulation
The New Compliance Risk

In June 2019, the U.S. Securities and Exchange Commission (SEC) adopted Regulation Best Interest (RBI). The regulation requires broker-dealers to exercise reasonable diligence, care, and skill in making a recommendation to a retail customer. This is known as the "Care Obligation." The SEC's Final Rule states:

• "Whether a broker-dealer's recommendation satisfies the Care Obligation will be an objective evaluation turning on the facts and circumstances of the particular recommendation and the particular retail customer."

• The care obligation requires that a broker-dealer understands "potential risks, rewards, and costs associated with the recommendation."

• "[Bad intent] will not be required to establish a violation of Regulation Best Interest."
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How to reduce the risk of litigation and regulatory actions?

• Given the known limitations of historical data, how can a broker or fiduciary gain confidence that an investment strategy will not result in future regulatory action or litigation?

• What work would a broker-dealer or fiduciary want to show was done to support its recommendations and actions if accused of basing advice on bad inferences from historical data?
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Part 3: Possible Solutions
A Synthetic Data Approach

• We use a fraud detection approach to identify high-dimensional outliers in the historical dataset.
• We replace the outliers with a larger alternative dataset that reflects the different ways in which the joint prices might alternatively have been realized in the past.
• The resulting synthetic datasets have little to no dependence on historical anomalies while maintaining all other characteristics with a high degree of accuracy.
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2008-2018: Outlier Returns $t$ vs. $t - 3$

- **Dow Jones returns**
- **Outlier returns**

Scatter plot showing the relationship between $r(t)$ and $r(t - 3)$. The plot includes a legend with two markers: blue for Dow Jones returns and red for outlier returns.
2008-2018: Outlier Returns $t$ vs. $t - 4$

- **Dow Jones returns**
- **Outlier returns**
2008-2009: Distribution of Outlier Returns

- Mean Outlier returns: 2.200%
- Mean Dow Jones returns: -0.015%
- Outlier returns

Frequency

Return

Range: -0.075 to 0.125
2008-2018: Distribution of Outlier Returns

Mean Outlier returns: 0.377%
Mean Dow Jones returns: 0.029%
Outlier returns
Cumulative Returns
average synthetic price path = 61.2%
DJ = 101.8%
Annualized returns
average synthetic price path = 4.28%
DJ = 6.35%
Annualized volatility
average synthetic price path = 17.7%
DJ = 18.6%
Part 4: Summary
Summary:

- Finance has a small data problem.
- Regulation Best Interest means broker-dealers have a Care Obligation. Bad intent is not required for regulatory violation.
- Working with historical data is misleading.
- Synthetic data is one way of meeting the Care Obligation.
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