Objective:

Are there relative value opportunities in global corporate bond markets?

We examined 25 thousand corporate bonds over 10 years in order to identify bond mispricings and determine the environments where these mispricings are more common.

Methods:
- Iterate through pairs of bonds issued by same company, and filter for similarity – same issuer, maturity, quality, high correlation
- Filter for opportunities – 50 basis point duration-adjusted OAS gap
- Visualize similar bonds over time
- Classify
  - Same currency – K-Nearest Neighbor supervised learning
  - Cross currency – filtering by relevant properties
- Compare same and cross-currency opportunities
- Compare common bond properties of identified bonds vs. baseline

Goals:
1. Identify corporate bond pairs that are arbitrage candidates
2. Evaluate viability of identified candidates
3. Compare same-currency and cross-currency cases
4. Analyze characteristics of identified bonds

Figure 1: Visualization of filtering technique
Visualization and Classification of Same Currency Cases

How to Read These Visualizations:
- **Top Graph**: OAS of 2 bonds over time
- **Bottom Graph**: OAS differences over time
- **Middle Red Line**: Median of OAS differences
- **Upper / Lower Red Line**: Boundaries of a 50 basis point duration-adjusted oas gap from the median
- **Vertical White Lines**: Graph crosses boundaries (arbitrage opportunities)

K-Nearest Neighbor Classification:
- Need to identify the profitable cases from the 5000 identified bond pairs
- Trained and validated on 300 manually classified observations
- Chose $k = 18$ (square root of training set size)
- Engineered eight features
  - Proportion of points outside bounds, consecutive points crossing lower bound, upper bound and median, same currency, correlation, volatility, squared difference from median
- Used min-max normalization to scale all features between 0 and 1
- Identified 2090 good arbitrage cases
- Evaluated with 10-fold cross validation
  - Precision: 81.6%
  - Recall: 79.5%

<table>
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<tr>
<th>Predicted</th>
<th>Bad</th>
<th>Good</th>
</tr>
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<tbody>
<tr>
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<td>.097</td>
</tr>
<tr>
<td>1</td>
<td>.085</td>
<td>.376</td>
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Cross-Currency vs Same-Currency Cases:

- More identified same currency cases (2090 vs 179)
- Cross-currency cases demonstrate more and longer divergences
  - 3.84 days vs 9.32 days
- Cross-currency cases have shorter maturities but higher median OAS differences

Analysis of Bond Characteristics:

- Characteristics of identified bonds:
  - More outstanding shares
  - More likely to be issued in USD, EUR, CAD*
  - Commonly traded maturities (5, 10, 30 year) overrepresented
  - Higher quality
  - More likely to be issued by financial institutions
- All differences are statistically significant at 0.01 alpha level

*In descending order. Bonds issued in JPY not considered due to errors in data
Conclusions:

- Arbitrage opportunities exist in the global corporate bond market
- They tend to be characterized by properties shown in our analysis:
  - More outstanding amounts, higher quality, issued by financial institutions, in commonly traded currency pairs, occurs during times of high bond yields and volatility
- Cross-currency cases have lower convergence and higher volatility rates compared to the same-currency cases

Limitations:

- Predictive power of model not yet explored
  - More confident in ability to predict for same-currency cases because of high convergence
- Idiosyncratic bond properties not in data could complicate results
  - Bid/ask spread manually evaluated for several cases, but not systematically
  - Guarantors, debt structure, specific call option structure
- Daily data may hide hourly patterns

Further Analysis:

- Examine additional bond data for cross-currency cases in order to see if there are other structural differences within pairs that could explain divergences
- Test model by making predictions in real time and assessing the profitability of these predictions
- Incorporate bid/ask spread and currency forwards to dataset to formulate hedging strategies for investments