PREDICTING INVESTOR BEHAVIOUR IN EUROPEAN BOND MARKETS

European Stability Mechanism

A Machine Learning Approach

Martin Hillebrand, joint work with Bastien Winant, Marko Mravlak, Peter Schwendner

Zurich, 5 September 2019

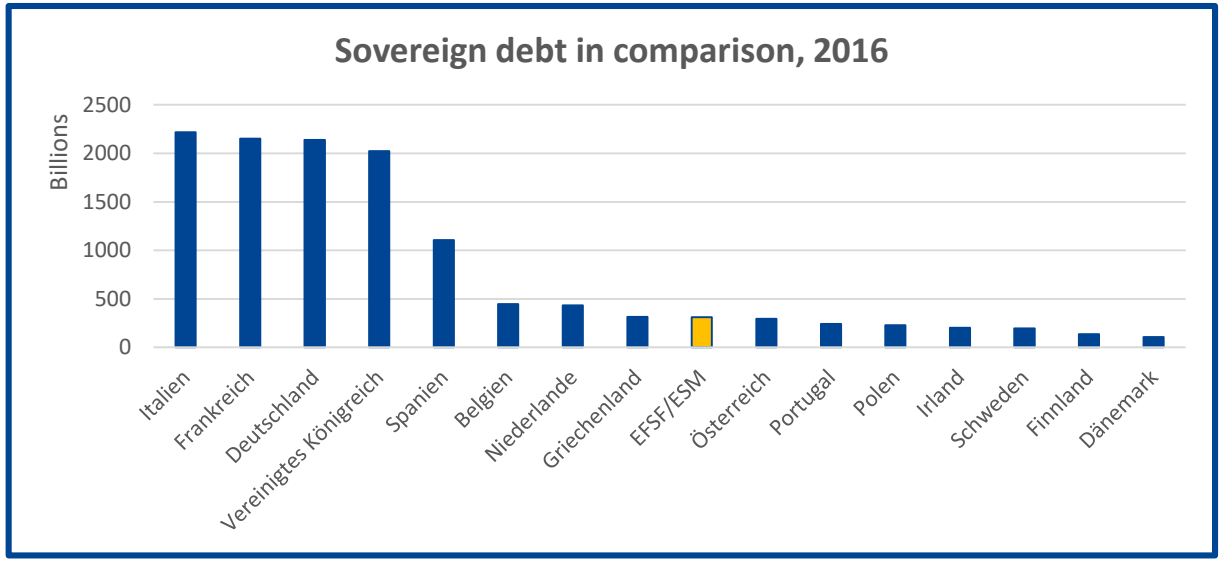
What is the European Rescue and Stability Framework?

The Euro Area rescue framework consists of mainly two institutions: EFSF and ESM

Together they have lent 264.5 billion euros to five countries: Greece, Spain, Portugal, Ireland and Cyprus

These loans are financed by bonds that are guaranteed by all Euro Area countries

Thus ESM / EFSF have as much debt as a small European country



ESM needs to Analyse the Investor Base – And yes, we can!

Understanding Investor behaviour is particularly important for ESM:

- The ESM needs to have market access when sovereigns have lost it
- The ESM investor base needs to be able to absorb large volumes within short time frames
- ESM needs to make sure that its issuance activity is not harming the bond markets of beneficiaries

The ESM is specifically competent for such an analysis:

- Funding Volume is mainly issued in the syndication format – we see the investors in the orderbook
- Investor data are carefully collected and processed – identification, matching, classification
- Analytics tools are continuously enhanced – incorporating cutting edge methodology

Knowing Investor Demand for better Decision Taking

Decision needed on instrument features:

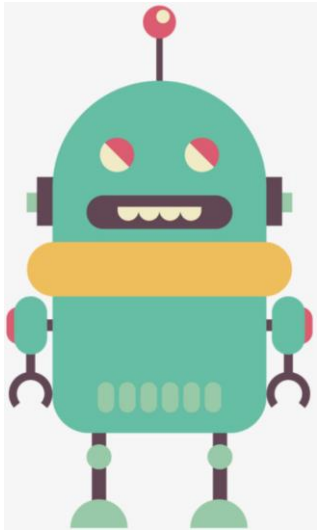
Issue Premium,

Tenor, Notional,…

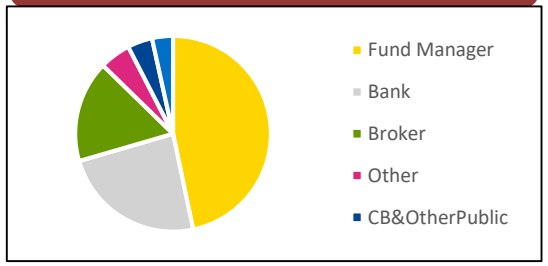
Investor Specific Information

Market Environment

Macro Data



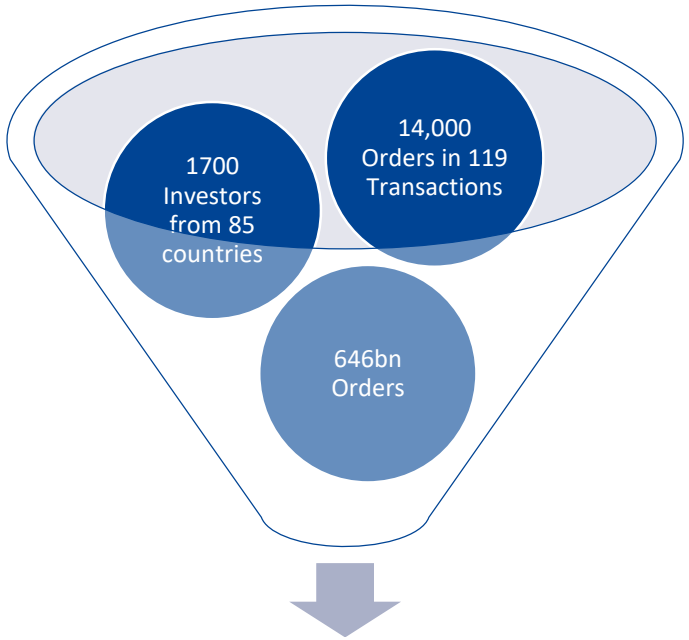
Order Volume Estimate per Investor Type



Machine Learning Tool for Predicting Investor Demand

Input and covariates

- **Instrument Characteristics**
  - Tenor
  - Tranche
  - Transaction Size
  - Reoffer Yield
- **Market Characteristics**
  - Benchmark Spreads
  - Issue Premium
  - Orderbook Size
  - Basis Swap Spreads
  - Competing Issuance Volumes
  - Total Demand
  - Issue Month (Seasonality)
- **Global Macro**
  - National GDP Growth
  - Trade Balance
  - Oil Price
- **Investor Characteristics**
  - Investor Type
  - Investor Country
  - Assets under Management
  - Portfolio Currency
  - CB Reserves



Investor Types

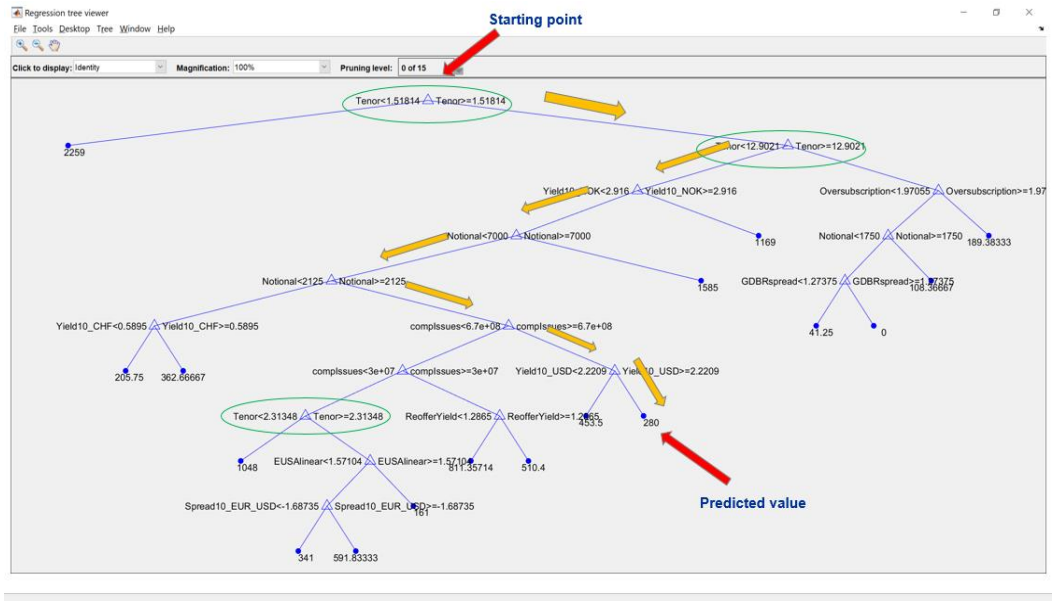
- Asset Managers
- Banks
- Bank Trading
- Central Banks and other Public Institutions
- Hedge Funds /Brokers
- Pension Funds/Insurances

Global Regions

- Euro Area
- UK / Switzerland
- Rest of Europe
- Asia
- Middle East /Africa
- Americas

Methodology: Regression Trees and Ensemble Trees

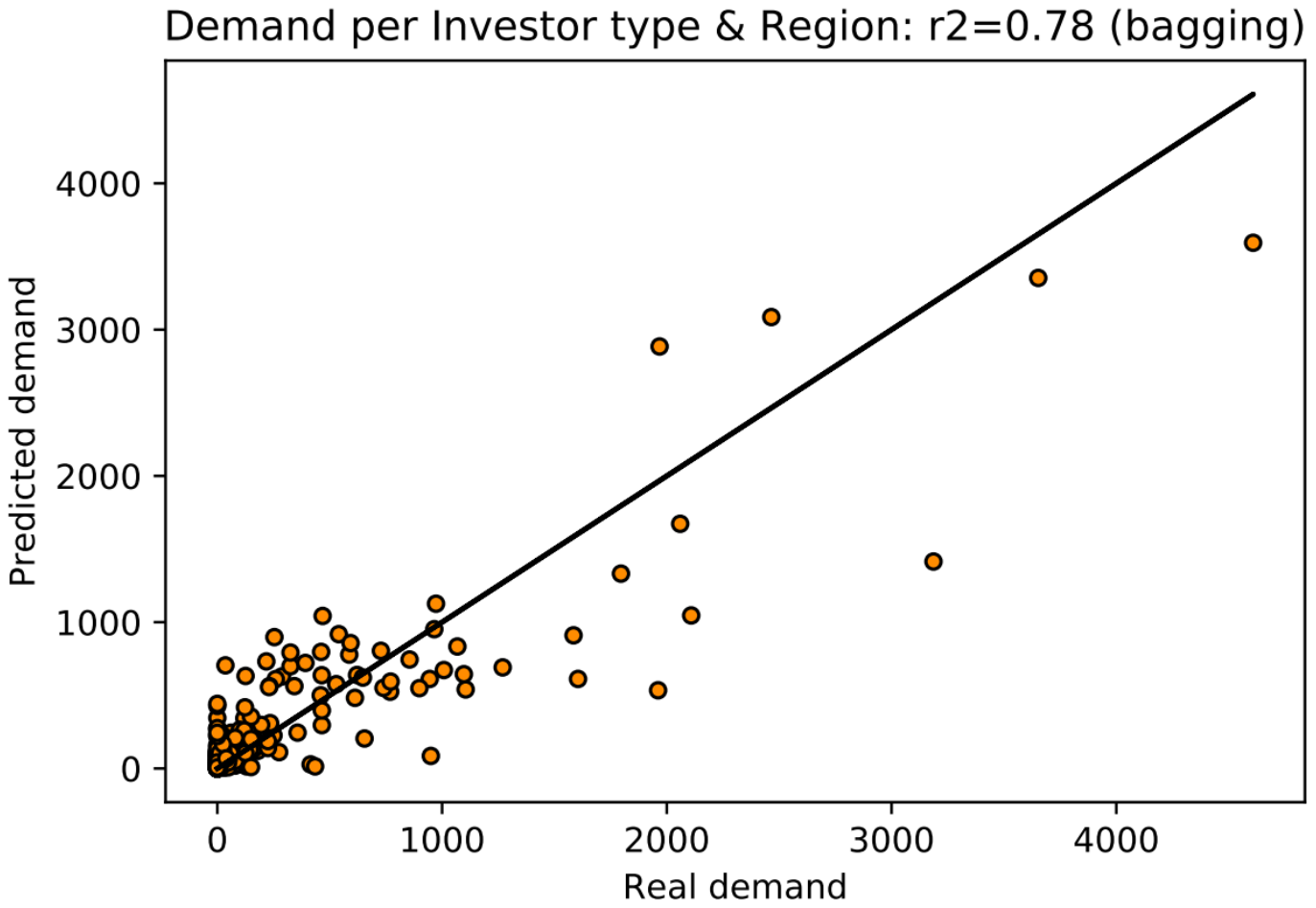
Simple Regression Trees



Bagged Trees: Generating sub-samples through bootstrapping, generating trees, averaging results.

Trees are trained on investor demand data: 13,000 orders of 109 transactions.
The out-of-sample validation is using the 10 most recent transactions.

Forecasting Aggregated Investor Demand per Type and Region



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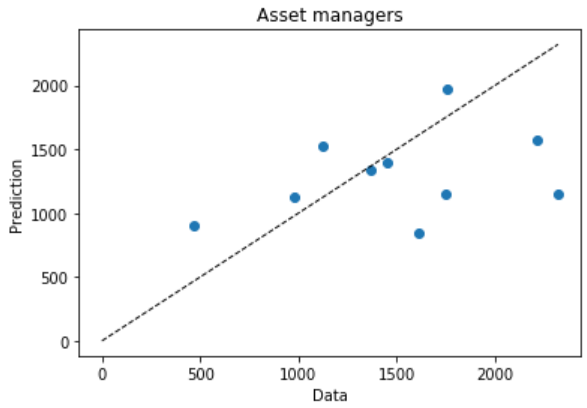
Feature Importance: Measuring the weight of covariates

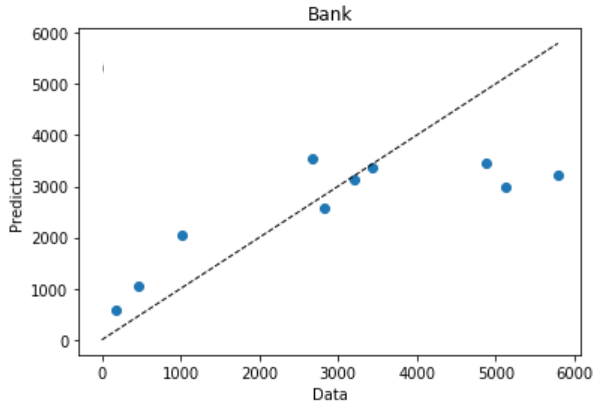
For a simple tree: the increase of the prediction error after permuting the feature values

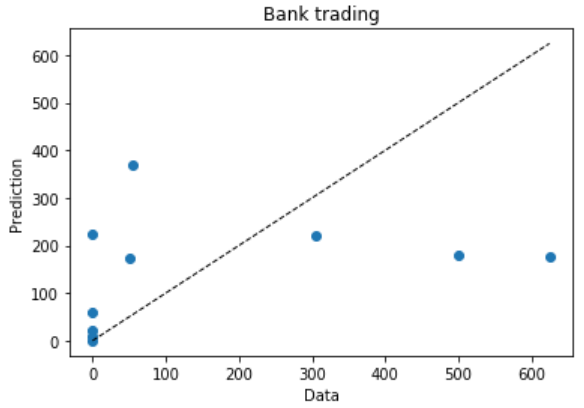
For a bagged tree: average of the simple tree feature importances.

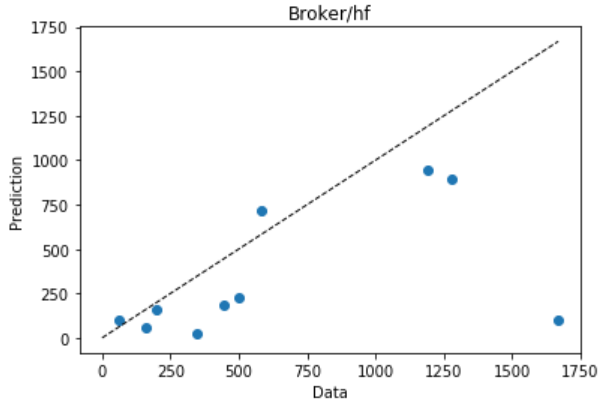
Overall most important features:
Investor Type
Notional
New Issuance Premium
Time to maturity/Tenor

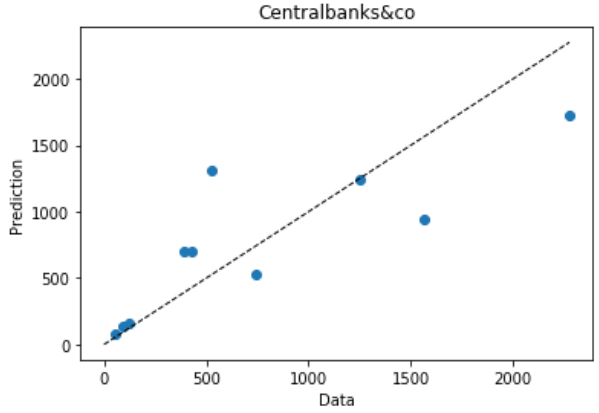
Demand per Investor Type in separate models

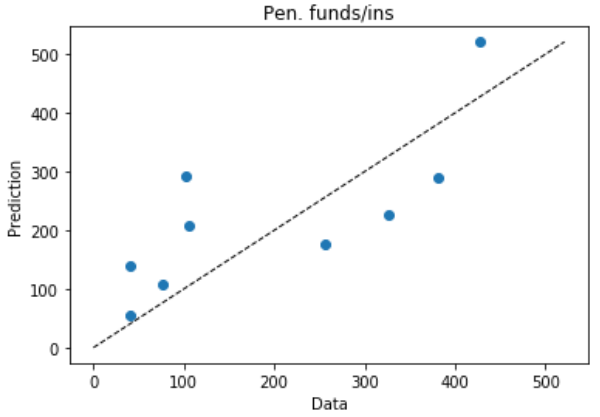








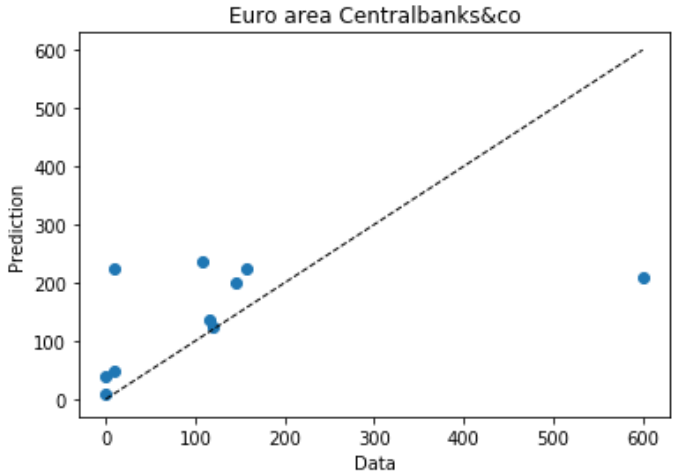




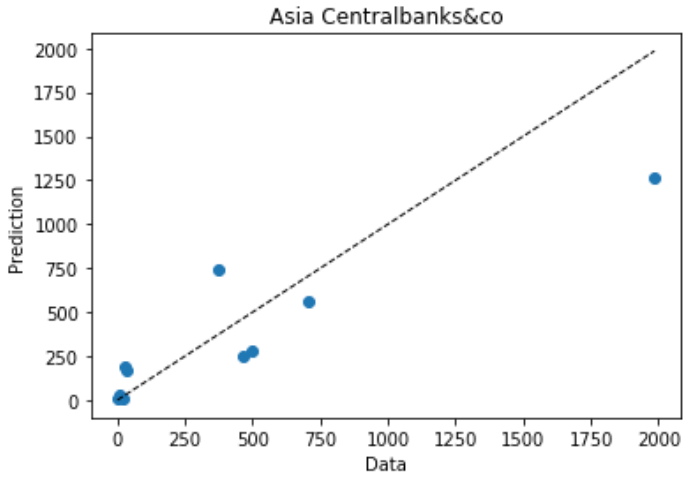
Investor Types show a heterogeneous behaviour

Main Important Features By Investor Type	
Asset Manager	Notional, Yield and Spread Levels
Bank	Notional, New Issuance Premium
Bank Trading	Market Spreads
Broker/Hedge Fund	Macro Indicators, Market Spreads
Central Bank/Other Public	Notional, Tenor
Pension Funds/Insurances	Tenor, Yield Levels

Investor Types may slightly differ by Region



Important Features
Notional
Yield Level
New Issuance Premium



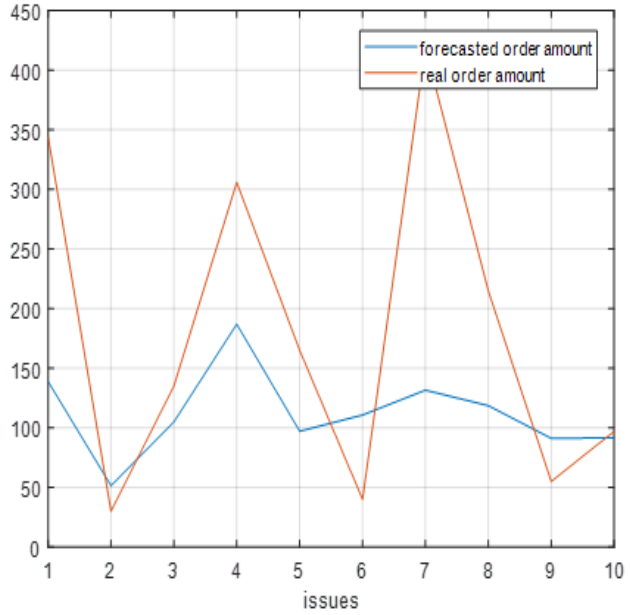
Important Features
Notional
Tenor
Yield Level

Individual Investors: A Few Patterns Detected

Investor demand on a name basis is less accurate due to smaller data amount.

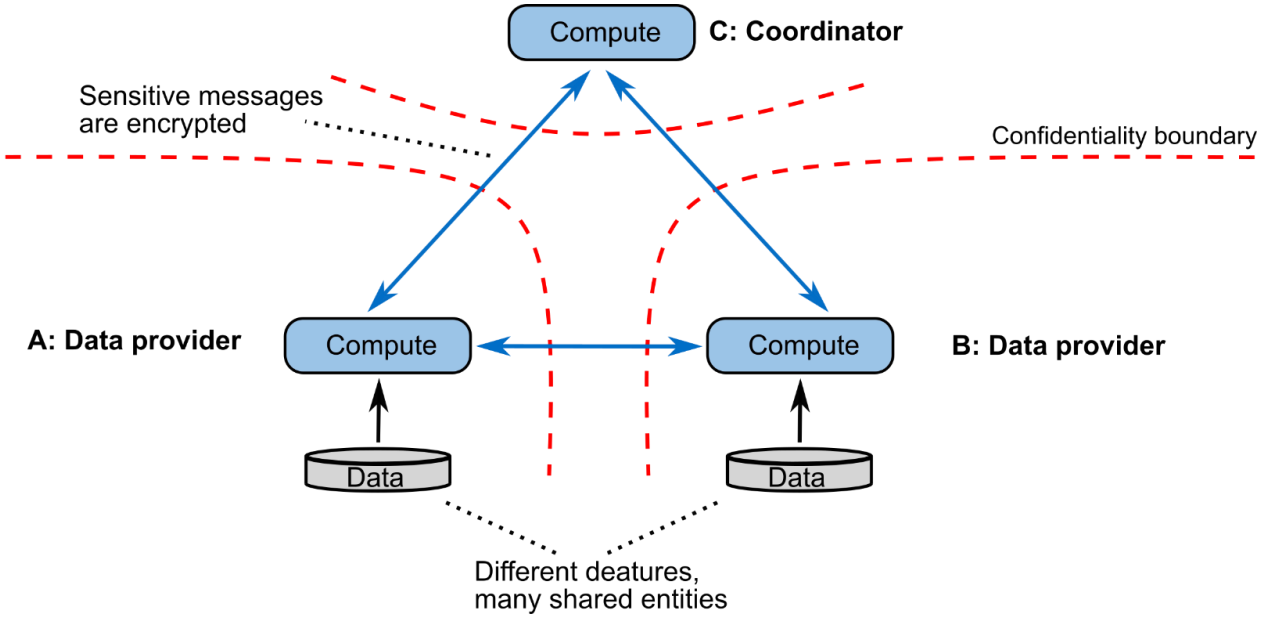
Yet, the direction of demand change seems to be forecasted very well.

Investor X



Outlook: How to obtain a Better Forecast?

- Limitation: available data
- We suggest: integrate primary dealer investor data and issuance data of peers
- Problem: confidentiality
- Possible solution: Federated / Transfer Learning



Summary

Predicting Investor Behaviour using Regression Tree Methodology

Bagged Tree methodology delivers already some useful forecasts

Feature impact studies help characterizing behaviour of different investor types.

On some single investors, the direction of demand change can be forecasted

Forecast quality is expected to improve considerably
when enhancing database and refining technology

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