Prediction Company:

The Business of Model-Based Trading
**Corporation**

- Foundation of the company
- Principals: Farmer, Packard, McGill

**Modeling**

- 1992
- 1993: Modeling other futures
- 1994: Modeling Equities
- 1995
- 1996: Begin ramping equities to large size
- 1997
- 1998
- 1999
- 2000: Globalize, Diversify
Foundation of Contract with UBS

• Prediction Company builds models to predict financial markets from historical data.
• Bank commits to trade based on predictions (given performance threshold).
• Profits are shared.

Nature of the relationship

• Model-based trading experiment is quite pure (no traders).
• Bank monitors trading, does all back-office.
• Trading by bank is proprietary (no publically available fund, currently).
• Prediction Company is mostly comprised of software engineers and researchers (ratio of 2:1).
  No traders.
• Prediction Company has developed substantial technology in order to implement model-based trading. Both research infrastructure and production infrastructure.
Modeling: what is needed

• Clean (or at least cleanable) data, e.g. at least 10 years.

• Predictable structure in the data, strong enough to overcome execution costs.

• Many instances (many degrees of freedom).
Modeling: producing aim positions

Raw data → Predictive Signals → Predicted Returns $R^{t}_{\text{pred}}$ → Positions $P^{t}$

- Time series transformation
- Model with fitted parameters
- Portfolio optimization in the presence of:
  - Risk constraints
  - Execution costs
  - Market impact
Modeling: executing orders

Orders are produced by change in position:

\[ O^t = \delta P^t = P^t - P^{t-1} \]
Prediction Company Models

Used to generate aim positions daily:

- Long term return predictions (months)
- Medium term return predictions (days)
- Transaction cost predictions (built from execution data)
- Market impact predictions

Used to execute orders intra-day:

- Short term (minutes - hours) predictions of both direction and liquidity.
Modeling: a geometric picture

\[ G^t = R_{\text{pred}}^t P^t \]

Edge
= expected gain

\[ E^t \]

\[ E^{t-1} \]

\[ P^t \]

\[ P^{t-1} \]
Modeling: a more realistic picture

- **Edge** = expected gain

- Gain unrealizable from market impact

- Realizable gain:
  \[ G^t = R_{MT}^t P^t - C(\delta P) \]

- Gain unrealizable from execution costs,
  \[ C(P^t - P^{t+1}) = C(\delta P) \]
Modeling: importance of modeling execution costs

- Execution costs (slippage + fees + opportunity cost) can be accurately modeled only from execution data.
- Third party execution cost calculation available (e.g. Plexus).
- Execution cost models are used for:
  - Performance estimation
  - Portfolio balancing algorithm
  - ramp analysis
Ramping up: wishful thinking
Ramping up: more realistic

Edge

~ Optimal ramp level

~ Disaster

Position

Positions scaled up
Making Believable Models

Two biggest problems:

- Limited data ⇒ overfitting
- Nonstationarity

Main approaches to coping with the problems

- Regularization, e.g.
  - ridge regression for linear fits
  - weight decay for neural networks
- Adaptive models
  - Crucial issue: time scale of adaptation
- Temporal consistency conditions
Nonstationarity

Predictive signal strength from 1975 - 1998 for two predictive signals:

Slow decay:

Slow strengthening:
What else can go wrong

• “Sudden” nonstationarity: sudden interruption or shifts in market dynamics (e.g. large money flows from one sector to another; exposure to unrecognized, unhedged risk factors).

• Indirect exposure to risk factors (e.g. market correlation)

• Increase in execution costs (causing possible over-ramped positions).

• Structural market changes (e.g. decimalization, day-trading?).

• Structural investor change (e.g. LTCM effects; political climate of partner).
Future Business Directions

Fund-based trading products

- Lower frequency (longer time-scale), higher capacity products; eventually toward asset management products.
- Higher frequency products, eventually toward automated market making, execution products.
- Move to other markets (Fx, commodities).

Other financial products

- Weaken purity? E.g., decision support.
- Sell execution (wholesale: mutual funds; retail: online brokerage).
- Individual investor services.

Non financial products

Large scale data-mining on proprietary data. E.g.:
- Predict customer preferences
- Analysis of Bio/pharm data
- Predict packet flow through networks