Distributed Calculation: Viewing Markets Through the Back of a Model

Daniel Beunza and David Stark
Columbia University

June 2008

Presentation at the 1st Workshop on Imagining Business
Oxford, UK
The spread plot
Merger arbitrage

• Previous day, 5.58 pm: Career Education and Whitman Education announce a merger
• Arbitrage: Law of One Price (Ricardo 1817)

Merger arbitrage centers on calculating $p$
Buying

- Arbitrageurs estimate $p$ above 90%
- 10.00 am: Whitman Education opens at a price of $13.95
- The arbitrageurs’ instruments show a spread of 10%
- Max: “I’d like to have a presence in the deal. Let’s bid $1360 for 10,000.”

Speculating by comparing their internal probability estimate with the overall market spread
From spread to implied probability

- Spread = difference in price between merging stocks

- But arbitrageurs interpret the spread as implied probability of merger
  - High spread → lower probability
  - Low spread → greater probability
Decoding the spread plot

Spread = acquirer - target
An example: HSBC and Household Int.

But… how do arbitrageurs quantify implied probability?
“Backc ing out” probabilities

Gold in London = Gold in New York

Value of target = Weighted value of acquirer

\[ V_T = P_A \cdot r \cdot \rho_M \]

\[ P_T = P_A \cdot r \cdot \rho_M \]

\[ \rho_M = f(P_A - P_T) \]

Implied probability = f(spread)
"Backing out" probabilities

\[
\text{Gold (London)} = \text{Gold (New York)}
\]

\[
\text{Whitman} = \text{Career} \times \ldots \ p
\]

\[
p = f \left( \text{Career} - \text{Whitman} \right)
\]

Implied probability = \( f \) (spread)
Implied probability

Social
Incorporates prices into an estimate of a magnitude. Like deciding on the weather by looking at the passers-by (Shelling 1968).

Theory-laden
Extracted from stock prices by using a formula in reverse. The formula is the instrument.

Problems of model-driven observation?
12:00 am: confrontation

- Same spread as at 10:00 am
- Max: “Are we missing something? Or can it be that the deal has gone under the radar screen of other traders?”

12:10 am: search

Relegence FirstTrack: no news
12:15 am: networks

Andy, after speaking on the phone with the broker, “John says buy this WIX, no one’s really hedging it.”

Max: “Let’s work another ten, but pick your spots.”
Distributed calculation: the use of models to translate market prices into the unobservable qualities of a security

**Recursive**

**Ontologic**
Allows traders to unbundle the multiple dimensions of financial value (Beunza and Stark 2004)

**Collective**
Allows multiple arbitrageurs to coordinate without explicit communication (Hutchins 1995, Hayek 1945)

**Widespread**
Used in mergers, options, CDOs, academia, etc. (MacKenzie and Millo, 2003)
Implications for imagining business

• Imagining or calculative visualizing?
• A visualization (spread plot) is the key to the above-normal returns of traders (5% a year)
  – Makes visible the invisible
  – Based on data, not imagination
  – Based on a formula, not free association
  – Brings together the social and the calculative, the people and the databases, the networks and the screens
• Distributed calculation is the engine for exploring the “new quantitative continent” of the capital markets, responsible for much profits, speed and accidents of Wall Street