Quantitative Investments

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Recall

Last lecture we discussed the APT/factor models.

- Arbitrage pricing theory;
- Trading mispricings;
- Macro risk factors;
- Micro risk factors; and,
- Style factors.

Today we will talk about microfoundations.
Microfoundations

Chapter 16, A Quantitative Primer on Investments with R
This part discusses microfoundations. Specifically:

- Irrationality;
- Behavioral Finance;
- Neurofinance;
- Prospect Theory;
- Limits to Arbitrage;
- “Voodoo Finance;” and,
- The Equity Premium Puzzle.
**Microfoundations**

- *Microfoundations* are the behaviors of individual economic agents.
- We’ve seen results which should hold... but do not quite.
- Some researchers propose investors are *irrational*.
  - Bad assumption: means people do not choose best for themselves.
  - Instead, their behavior *seems* irrational given our information.
- Perhaps their behavior is *boundedly rational*:
  - Rationality limited by people’s knowledge, reasoning, time, money.
- Does it matter that models differ from people’s decision processes?
  - Maybe not: average of decisions may be like modeled.
  - Cowpaths: solution to PDE; Feynman’s ants: don’t know geometry.
Behavioral Finance

- *Behavioral finance* studies effect of people’s decision making.
- Sadly, some research posits behavior, then finds supporting data.
- Also, many theories are contradictory: cannot all hold in aggregate.
  - People overweight history or recent data? Over-/under-infer patterns?
  - Framing questions: economic contradictions or nuance of language?
  - Mental accounting: costly tickets on a date; lost tix ≠ lost money
- Extensions of these premises:
  - Some investors behave irrationally; and,
  - Arbitrageurs’ actions are too limited to ensure efficiency.
- We won’t focus so much on these issues.
  - Little coalescence to theory; ideas need “more time baking.”
Some effects are observed consistently; worth studying.

**Loss avoidance**: individuals sell winners, hold losers.
- Do not see this much for firms; mostly just individuals.

**Overconfidence**: overestimate ability, forecast precisions.
- Sadly, more prevalent among men, newby investors/traders.
- May explain overtrading, prevalence of active management.
- Dunning-Kruger effect: doofuses think they are amazing.

**Regret avoidance**: nobody likes to fail for dumb reasons.
- Would rather fail for typical reasons; hence *window dressing*.
- “If you would be sheepish telling the story to a doctor...”

Should we “nudge” people to better choices? Have better defaults?
Neurofinance

- Surprising area of recent research: **neurofinance**.
  - Looks at brain behavior, biochemistry, and genetic effects.
- Results largely in four areas:
  - Experiments testing financial theories;
  - Hormonal effects on financial decision making;
  - Genetics/dopamine-related effects; and,
  - Mental state effects.
- Some research leads to weird ethical issues; must confront these.
  - What if certain hormones/chemicals make you perform better?
  - Can/should an employer ask employees to take those?²

²For a scary view of what could happen, search for “SAC trader hormones.”
Watch people’s brains while making decisions.

Find that people do perceive something like variance.

Also know risk vs estimation uncertainty vs Knightian uncertainty.

People also can function in markets with differing dynamics:
  - Can think strategically with randomness and handle noisy dynamics.

Also see people dislike realizing losses; prefer to let losses ride.
Hormonal Effects on Financial Decision Making

- Markers for more in-utero exposure to testosterone vs estrogen?
  - Predicts success of high-frequency traders in London.
  - Relates to traders’ risk taking. (Sharpe ratio related to experience.)

- Testosterone levels related to returns, profitability...
- ...while cortisol levels related to risk.

- Traders injected with testosterone were more optimistic;
- Traders injected with cortisol had higher risk preferences.
- Unexpected results also cause spikes in noradrenaline.
Genetics and Balancing Risk versus Reward

- Brain activity autocorrelates: success begets success; same for losses.
- Dopamine increases associated with financial decision-making.
  - Weird: traders took more risks after seeing porn (dopamine increase).
- Top traders more likely to have certain genetic polymorphisms:
  - Alleles related to moderate levels of dopamine. ("Goldilocks")
- Certain polymorphisms make traders more likely to take risks.
  - Also linked to anti-social personality traits, esp. in men, the abused.
Mental State Effects

- So jerky traders are the best? Not exactly.
- *Interoception*, awareness of body signals, related to performance.
  - Better traders are more aware of body signals (e.g. hunger, pain).
- So empathetic traders are better than? Not really.
- Rather, it seems that *introspective* traders are the best.
- This bodes well for the nerd/quant/algorithmic revolution.
Prospect Theory

One of the more challenging findings:

- Documented by lab experiments, many follow-on studies.

Four key assumptions:

1. Decisions seen in terms of gains vs losses;
2. People dislike losses more than similar-sized gains;
3. Decreasing marginal sensitivity to gains/losses; and,
4. People shrink probabilities of events toward mean.\(^3\)

Thus people’s happiness driven by wealth change, not total wealth.\(^4\)

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\(^3\)We over-consider rare events and under-consider common events.

\(^4\)So Bill Gates can get sad.
So what does prospect theory-implied utility look like?

- Utility curve S-shaped in Δwealth, not log(wealth).
- Finance is still working at building this into theory.
Limits to Arbitrage

Markets can stay inefficient due to limits to arbitrage. This effect has strongest evidence; few dispute limits to arbitrage.

- Some limits are externally or self-imposed:
  - External: trading costs, credit limits, investment mandates.
  - Self: risk limits, fear of model risk, fundamental risk.

- Model Risk: uncertainty about valuation model correctness.

- Fundamental Risk: will trade converge by required exit time?

- All these may stop some arbitrageurs from trading.
Even the Law of One Price (LOOP) may be violated. Examples:

- **Equity Carve Outs**: Division spun-off to shareholders.\(^5\)
  - Even if terms set, remainder or spin-off may \(\neq\) traded prices.
  - Implementation costs: borrowing shares may be very difficult.

- **“Siamese Twin” Shares**: separately-listed, economically \(\cong\).\(^6\)
  - Trading costs, price impact, quasi-arbitrage issues.
  - Price divergences lead to price divergences; self-fulfilling.

- **Closed-end Funds**: trade price \(\neq\) NAV; may hold illiquid shares.
  - Implementation costs: NAV deviations larger in illiquid funds.
  - But... are illiquid-holding mutual funds then mispriced?

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\(^5\) e.g. 3Com spun off Palm; Palm shares \(\Rightarrow\) 3Com < $0.

\(^6\) e.g. Royal Dutch-Shell, Unilever, HSBC, RELX.
Limits to arbitrage can affect corporate takeovers.
- Porsche tried to take over VW as 2008 financial crisis raged.
- Imposed credit limits killed deal; Porsche fell; VW bought them.

Taxes can create costs which limit arbitrage.
- *January effect*: stocks down over year sold in Dec for tax loss.
- Prices of those same stocks then rise in January.

Post-financial crisis: condos available for 30% off or more.
- However, you could not get a mortgage from any bank.
- Hence Buffett’s classic phrase: “Cash is king.”
Limits to Arbitrage and Crises

We also now think limits to arbitrage play a big role in crises:

- People make loans, explicitly/implicitly backed by (risky) collateral.
- Crisis: risky assets ↓, volatility ↑ → collateral value ↓, less certain.
- If collateral value drops/less certain, loans are withdrawn.
- Crisis then worsens: Brunnermeier & Pedersen vicious spiral.
- When the most deals are available, credit is not available.
- Thus govt intervention (in true, rare crises) can stabilize markets.

But does the opposite happen? (rising stocks + lower volatility = ?)
B&P: Yes, this leads to growth spirals... and maybe even bubbles.
Home Bias

- **Home bias**: tendency to over-invest in home country assets.
- Effect is far more than needed to counter local inflation.
- Not explainable by currency risk; FX hedges are available.
- Investors could have better portfolios; why don’t they?
  - Difficult to assess, follow news on foreign firms.
  - Difficulty accessing other markets?
- None of this explains under-investment b/w US and Canada.
- Home bias is one of the more puzzling aspects of finance.
  - You should probably hold more foreign stocks, bonds.
So anything goes? In increasing order of craziness:

- **Technical analysis:** Evidence for only a few signals (H+S, resistance).
  - Mostly: “60% of the time it works every time.” Really.
- **Dow Theory:** three horizons of trends affect prices.
  - *Primary:* months–years; *secondary:* weeks; *tertiary:* daily.
- **Elliott waves and Kondratieff waves**
  - Elliott waves: short- and long-term waves (vs. trends).
  - Kondratieff waves: 48–60 years (untestable).
Finally, a puzzle: How to explain US $R_M$ given $\bar{\lambda}, \hat{\sigma}_M^2$?
- US stocks return more than we would expect.
- This is known as the *equity premium puzzle*.

Test with stock returns since late 1800s, 1790s.
- Shows equity premium increases post-1949.
- Indicates realized returns 1950–1999 above expectations.
Equity Premium Not-Puzzle

- Did escape WWII almost unscathed.
- Barberis and Huang: Investors conflate returns w/wealth.
  - Thus investors demand irrationally high returns to invest.
  - Also explains why too few people invest.
- Jorion and Goetzmann: survival bias explains premium.
  - We pick known winners: Study most active/successful markets.
  - We ignore losers: not enough data for sleepy/dead markets.
- Coin flip analogy: contest for most heads; then explain “winners.”
  - Only a few “successes” create long strings of data.
The Road Ahead

We covered the Microfoundations; on to Global Investing next time!

- Valuation II: Global Investing, FX;
- Risk Alleviation: Futures, Options, Credit, Structured Products; and,
- All Together Now: Active Portfolios, Investment Firms, Crises.