A Trilemma for Asset Demand Estimation
Fuchs, Fukuda, Neuhann
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This Discussion

- The trilemma: legs one and two
- What do we need to estimate?

The objective

Estimating an investor's demand curve.

$$\Delta \mathbf{D} = \mathcal{E} \Delta \mathbf{P} + e$$

Why? Investors Elasticities are the answers to many questions

- What is the price impact if I sell short-dated Oil future yesterday... based on information?
- How does Calpers readjusts its bond portfolio when the term premium rises?
- How should I adjust my Tesla holdings its stock price rises?

Success of an empirical strategy should be judged by the questions it answers

This paper

Specificities of finance hinder demand estimation.
Two assumptions and an impossibility result.

1. Finance imposes strong restrictions and links on price of goods (assets)
   ▸ No Arbitrage
2. Payoffs are the fundamental object
   ▸ Investors buy state contingent payoffs, they do not buy stocks
3. It is impossible to have "clean shocks"'

Why is no-arbitrage so important?

No-Arbitrage in prices lead to some discontinuity in demand

Demand estimation is an empirical exercise.

- Price dislocations exist because demand cannot "arbitrage" these away
- Long literature in intermediary asset pricing, slow moving capital, that motivates their existence
- Even earlier model of microstructure would argue that imperfect competition can lead to near-arbitrage (Kyle)

In models

- Arbitrage opportunities in a frictionless models lead to strange conclusions, precisely because they do not arise endogenously in such models
- It is the inelasticity of demand in models with frictions that causes arbitrage opportunities — not the other way around.

Why should we assume that investors only care about payoffs?

Post financial crisis literature.

- A lot of work on non pecuniary motives for holding assets
  - ▸ Krishnamurthy, Vissing-Jorgensen, Lustig: treasuries are special wrt AAA
  - ▸ Vayanos-Weill and the spread between "on-the-run" and "off-the-run" treasuries

- Lots of reasons to think that finance is not IO
  - ▸ ... but payoffs are not the only thing being valued

I cannot recover the ideal change in price ... so what?

Demand estimation is an empirical exercise.

- What question does $\Delta \mathbf{q}_{|j}^{\text{ideal}}$ answer?
    - What is the response of any of the state prices to a change in the price of an asset?
    - Empirical counterpart?

Micro elasticities.

- Spillovers are ok. They are part of the question
  How does my portfolio position in Tesla relative to my portfolio position in Nvidia change when the price of Tesla move relative to the price of Nvidia?
- Essentially a cross-sectional question, is $\Delta \mathbf{q}_{|j}^{\text{supply}}$ enough?

I cannot recover the ideal change in price ... so what?

A simple example (Z. He).

$$\text{asset} \begin{bmatrix} 0.9 & 0.1 \\ 0.1 & 0.9 \end{bmatrix} = Y \quad \overset{\text{state}}{}$$

- Log utility gives us simple prices: $p = q^\top = \mathbf{1}$

- Ideal response

$$\Delta \mathbf{q}_{|1}^{\text{ideal}} = (Y^{-1} \Delta p_1)^\top = (9/8, -1/8)$$

I cannot recover the ideal change in price ... so what?

A simple example (Z. He).

$$\text{asset} \quad \begin{bmatrix} 0.9 & 0.1 \\ 0.1 & 0.9 \end{bmatrix} = Y$$

with "state" labeling the columns.

- Log utility gives us simple prices: $p = q^\top = \mathbf{1}$
- Ideal response

$$\Delta\mathbf{q}_{|1}^{\text{ideal}} = (Y^{-1}\Delta p_1)^\top = (9/8, -1/8)$$

  - Δp_2 is forced to be zero, so Δq_{1d} has to go down to undo the spillover.
  - Δq_{1d} and Δq_{1u} move in opposite direction.

- Empirical response:

$$\Delta\mathbf{q}_{|1}^{\text{supply}} = \left(\frac{1}{0.9(1-s)+0.1}, \frac{1}{0.1(1-s)+0.9} \right) - (1,1) \simeq (0.9s, 0.1s)$$

  - Experiment is way out of reach from ideal experiment
  - Strong spillovers of decreasing the supply of asset 1 also pushes the price of both states up.

I cannot recover the ideal change in price ... so what?

Relative elasticities?

- Relative shift of "ideal change"
  - With $\Delta p_1 - \Delta p_2 = 1 - 0 = 1$
  $$\Delta q_{1u}^{\mathsf{ideal}} - \Delta q_{1d}^{\mathsf{ideal}} = 10/8$$

- Supply driven shift:
  - Compute new price from $p = Yq$
  $$\left(\Delta q_{1u}^{\mathsf{supply}} - \Delta q_{1d}^{\mathsf{supply}}\right) / \left(\Delta p_1 - \Delta p_2\right) = \frac{0.9s - 0.1s}{(0.9 - 0.1)^2 s} = 1/0.8 = 10/8$$

The relative elasticity is the answer to many actual empirical questions

General elasticity decomposition

Practical question can be split in two groups

- Micro elasticities: *how do I change my position in Tesla relative to Nvidia?*
- Macro elasticities: *how do I change my position in value v. growth, stocks v. bonds?*

Macro elasticities in HHHKL.

$$\mathcal{E} = \mathcal{E}_{\mathsf{relative}} + \underbrace{X \mathcal{E}_X X^\top}_{\mathsf{macro/meso\ elasticity}}$$

- Think about decomposition of demand in a simple factor model

$$\mathcal{E} = \underbrace{\frac{1}{\gamma \sigma_\epsilon^2} \mathbf{I}}_{\mathsf{relative,}\ \alpha\ \mathsf{arbitrage}} + \underbrace{\beta \mathbf{\Psi} \beta^\top}_{\mathsf{smart\ beta}}$$

- Relative elasticities cannot answer questions about aggregate changes
- Estimate macro elasticities with time series variation

Final Thoughts

Worth reading.

Take away

- There are spillovers in prices ... not so easy to deal with
- Hard to estimate clean prices ... without clean shocks