On the Recovery of Demand Elasticities in Dynamic Settings

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WFA

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This Discussion

- The objective
- The solution
- What do we learn?

The objective

Estimating an investor's demand curve.

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

Different settings, different problems

- IO:
  - Mergers, new goods, etc...
  - Well-defined counterfactual of ΔP
- Finance
  - What does moving P entail: e.g. discount rate, cash flows
  - Can we even move P (FFN)?

Is $\mathcal{E}$ portable?

- Answer is independent of the nature of the shocks

Setup

Extensive form of demand: the sequence-space representation

$$\begin{aligned}\mathbf{D}_t &= \mathcal{E}\mathbf{P}_t + \xi \\ &= A_0 p_t + \sum_s A_s \mu^p_{t,t+s} + \sum_s B_s \mu^d_{t,t+s} - \sum_s D_s \nu^r_{t,t+s} + \xi_t\end{aligned}$$

Structural?

- Flexible enough to accomodate wide changes in the environment
  - expected returns, beliefs, etc...
  - nests static mean variance .... and Campbell-Viceira (hedging demands)
- Costly! $N^2 \cdot (2S + 1) + N^3/2$ parameters

Results

Instrumented elasticity $(dp/dz)^{-1} dq/dz$.

- Represents the effect of a shock to (residual) supply on all model quantities
  - Passthrough to expectation of all future prices, dividends, and covariances
  - A very specific kind of impulse response
  - Jeopardy: what is the question this is answering?

What went wrong?

- Standard moment condition for IV fails $E(\xi|z) \neq 0$
- Necessary to add structure to the error term

$$\text{old } \xi = \underbrace{\sum_s A_s \mu^p_{t,t+s} + \sum_s B_s \mu^d_{t,t+s} - \sum_s D_s \nu^r_{t,t+s}}_{\text{your asset pricing model}} + \text{new } \xi$$

$$E(\text{new } \xi|z) = 0$$

The solution

Estimate impulse responses on asset prices.

- VAR: $\Gamma \mathbf{Y}_t = u_t$
- Estimate a slice, IRF wrt to "demand": $\mathbf{Y}_t = \sum_h \Xi_h \epsilon_{t-h}$
- "Only" requires a demand instrument
  - Relevance: it moves residual supply z
  - Exclusion: it is orthogonal to other shocks (cash-flows, discount rates, ...) at any horizons

No free lunch.

- Original problem: find variation in p and only in p
- Solution: find variation in demand that is only variation in demand
- Is it a useful change of perspective?

The solution

It works!

- Get identification of all the demand parameters from the IRF
- Demand parameters imply some IRF wrt demand: matching coefficients

Why does it work?

- Matching coefficient is a linear system: easy to analyze
- Example: IRF on price at different horizon ... identifies coefficient on price and expected price path
- General intuition for identification

Implementation

Large parameter model.

- Structural demand matrices are N by N
- 5,000 stocks, unbalanced: unrestricted system infeasible

Compress the cross-section onto K factors (HHHKL).

$$C_s(X) = \underbrace{a_{C,s}\mathbf{I}}_{\text{own (scalar)}} + \underbrace{X\Gamma_s^C X'}_{\text{factor block}}$$

- Take a stand on the factor structure in the cross-section
  - At odds with the claim of flexibility from the sequence-space setting
- HHHKL: need exogenous time series variation across all the factor dimensions

Application

What they do.

- Weekly U.S. stocks
- Order-flow imbalance (OFI) is the demand shock

Same flow, different denominator.

$$\mathcal{E}_{\text{naive}} = \frac{\text{flow}}{\text{contemporaneous impact}} = 0.34$$

$$\mathcal{E}_{\text{``Structural''}} = \frac{\text{flow}}{\text{future return signal}} = 6$$

- Shock is *persistent*
  - 95% of the move is permanent
  - Investor absorbs the flow for that *small* return incentive $\Rightarrow$ elastic

Covariance effect

- part of the flow is attributed to *falling future risk*: more elastic demand

The shock

What do we need from an instrument?

- Relevance: $E(\varepsilon z) \neq 0$
- Standard estimation of demand conditions
  - OFI innovation must be orthogonal to unobserved component of demand: $E(\varepsilon|\xi) = 0$
- **Partial identification of IRF:** instrument must be separated from all the other VAR shocks: $\varepsilon \perp x$
- Tradeoff:
  - VAR provides additional restrictions for flexible demand identification
  - Becomes very hard to find a shock that satisfies the strong exclusion restriction

The shock

Is the instrument a clean demand shock?

- Grossman-Stiglitz: flows are not all noisy supply ... carry information

$$E(\varepsilon|x) \neq 0$$

  - Same flavor of criticism in Kyle model
- Does the flow predict future fundamentals?
- Tradeoff: shock that is broad enough to estimate lead-lag effects but is not driven by fundamentals
  - Index inclusion is too narrow.
  - Flow induced would violate the IRF exclusion. Granular IV?

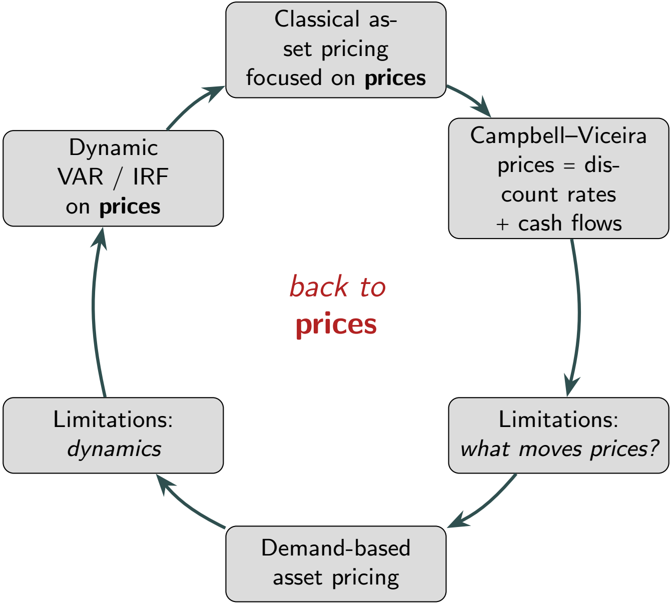
Is the shock portable?

Some thoughts

Demand based asset pricing.

- How to interpret quantity data?
  - 13F, but also intermediary asset pricing
- This paper: Campbell-Viceira, Vuolteenaho style VAR with slightly different restrictions
- Why is the VAR not enough?
  - It is structural for demand!
  - It represents prices
  - What do we learn from the linear representation of demand?

Unfair criticism?



Final Thoughts

Great paper.

Take away

- Estimate demand in a dynamic setting
- Use partial identification of IRF in a VAR to get linear demand