On the Estimation of Demand-Based Asset Pricing Models

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September 12, 2023

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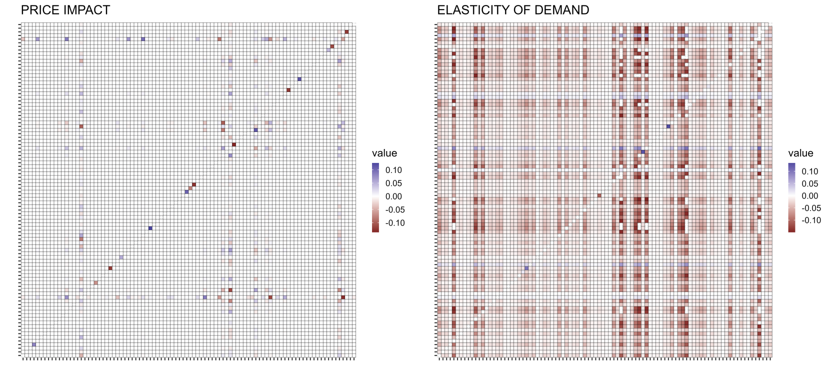
  - Investment strategy

Bradesco on February 2020



Estimation using trades

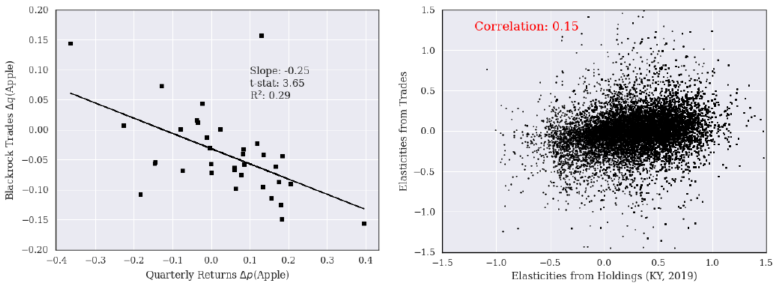
- It removes the omitted variable bias from unobserved static portfolio tilts
- It allows directly estimating investors' change in demand as a response to changing prices
- The estimated elasticities are non-negative for all investors
- Trades can be computed over an arbitrary time horizon
- The estimation in trades allows identifying stock-specific elasticities, as well as cross-elasticities
- One can directly apply existing instruments from the event-study literature, such as mutual fund flows or index reconstitution

Trades or holdings?

Figure 1: **Elasticity Estimates: Trades Δq_t^i vs Holdings Q_t^i.**
Panel (a) of the figure plots Blackrock's quarterly trades $\Delta q_t^{\text{Blackrock}}(\text{Apple})$ and Apple's quarterly returns $\Delta p_t(\text{Apple})$ from 2010 to 2020. Quarterly trades are defined in excess of asset growth as $\Delta q_t^i(n) = \log\left(Q_t^i(n)/Q_{t-1}^i(n)\right) - \log\left(A_t^i/A_{t-1}^i\right)$. The results remain unchanged if asset growth $\log\left(A_t^i/A_{t-1}^i\right)$ is computed without the valuation gain of Apple itself. Panel (b) compares the elasticity estimates for all investor-quarter pairs for the estimation in levels and changes. The x-axis plots the estimates in levels using holdings Q_t^i as in KY (2019): $\log Q_t^i(n) = -\zeta^i \log P_t(n) + X_t(n)\beta^i + \varepsilon_t^i(n)$. The y-axis plots the estimates in changes Δq_t^i as proposed in the current paper: $\Delta q_t^i(n) = \zeta^i \Delta p_t(n) + X_t(n)\beta^i + \varepsilon_t^i(n)$. The stock-specific controls $X_t(n)$ are book equity, market beta, profitability, investment and dividends-to-book equity. They do not change substantially over quarters and are hence kept in levels. The results remain unchanged if lagged controls or $X_{t-1}(n)$ or changes in the controls $\Delta X_t(n)$ are added. Both specifications are estimated without the use of instruments for endogenous prices $\log P_t(n)$ and endogenous price changes $\Delta p_t(n)$.

(a) Blackrock trading Apple

(b) Trades vs Holdings



Logit demand (Koijen & Yogo 2019)

$$\delta_{i,t}(n) = \exp\left\{\beta_{0,i,t} me_t(n) + \sum_{k=1}^{K-1} \beta_{k,i,t} X_{k,t}(n) + \beta_{K,i,t}\right\} \epsilon_{i,t}(n)$$

$$\delta_{i,t}(n) = \frac{w_{i,t}(n)}{w_{i,t}(0)}$$

Power and limitations

- Taste variation
- Substitution patterns
- Unobserved factors

Main ideia

Price equilibrium is a non-linear function

$$\log P \quad = \quad g(A, X, \beta, \epsilon)$$

so estimate the impact of shocks on the equilibrium price as a first-order approximation

$$\begin{aligned} \Delta p &= \mathcal{M} \Delta D \\ \mathcal{M} &= \left(\sum_{i}^{I} diag(Q)^{i} \zeta^{i} \right)^{-1} \end{aligned}$$

Estimation specification

Investor demand

$$\begin{aligned} \Delta q_t^i(n) &= \zeta^i \Delta p_t(n) + \epsilon_t^i(n) \\ \epsilon_t^i(n) &= \alpha_t^i + \sum_{k=1}^{K} \beta_{k,t}^i X_{k,t}(n) + \epsilon_t^i(n) \end{aligned}$$

Variables construction

$$\begin{aligned} \Delta p_t(n) &= \log P_t(n) - \log P_{t-1}(n) \\ \Delta q_t^i(n) &= \log \frac{Q_t^i(n)}{Q_{t-1}^i(n)} - \log \frac{A_t^i}{A_{t-1}^i} \\ Q_t^i(n) &= \frac{S_t^i(n)}{Q_t^*(n)} \\ A_t^i &= \sum_n P_t(n) Q_t^i(n) \end{aligned}$$

Identification

- Flow-induced demand

$$\begin{aligned} f_{t+1}(n) &= \sum_{i=1}^{I} Q_t^i(n) \frac{F_{t+1}^i}{A_t^i} \\ &= \sum_{i=1}^{I} Q_t^i(n) f_{t+1}^i \end{aligned}$$

- Exogenous flows

$$\begin{aligned} f_{t+1}^i &= C_t^i \beta_t + f_{t+1}^{\perp,i} \\ C_t^i &= \sum_n w_t^i(n) X_t(n) \end{aligned}$$

- Exogenous flow-induced demand

$$f_t^{\perp}(n) = \sum_{i=1}^{I} f_{t+1}^{\perp,i} Q_t^i(n)$$

Price Pessure

Table 2: **Price Pressure from exogenous Mutual Fund Flows.**
The table reports the results of estimating 15 from 2010 to 2020 for different specifications. (1) is estimating the coefficient without controls or fixed effects. (2) and (3) are estimations with Controls and fixed effects respectively. (4) uses quarterly returns including dividends instead of percentage price changes $\Delta p_{t+1}(n)$. (5) is an estimation over the largest 500 stocks only. (6) uses as an dependent variable a dummy equal to 1 if $f^{\perp}_{t+1}(n)$ is in the largest quintile.

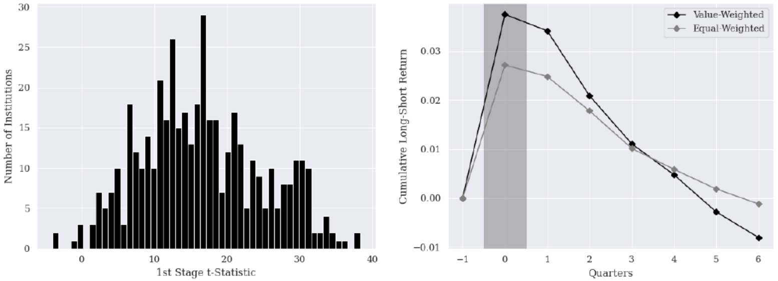
	Returns Δp_{t+1}					
	(1)	(2)	(3)	(4)	(5)	(6)
$f^{\perp}_{t+1}$	6.82***	2.65***	2.55***	2.53***	5.97***	0.01***
	(0.231)	(0.307)	(0.369)	(0.369)	(0.704)	(0.002)
Controls	No	Yes	Yes	Yes	Yes	Yes
Fixed Effects	No	No	Yes	Yes	Yes	Yes
Include Dividends	No	No	No	Yes	No	No
Largest 500 Stocks	No	No	No	No	Yes	No
Dummy($f^{\perp}_{t+1}$ Quintile 5)	No	No	No	No	No	Yes

Figure 2: **Relevance and Exogeneity Tests.**

Panel (a) plots the first stage t-statistic on θ for the investor-specific estimation of (15). Panel (b) plots the cumulative returns to long-short portfolios that go long (short) the decile of stocks with the highest (lowest) flow-induced demand $f^{\perp}_{t+1}(n)$. Stocks are sorted into portfolios at quarter 0 (the event date). Value-weights are computed using the previous quarter's market capitalization.

(a) 1st Stage Weak Instrument Test

(b) Price Pressure Reversion



(a) Long Horizon Predictability

		Return Horizon $r_{t+1,t+h}$		
	r_t	$h=12$	$h=24$	$h=36$
$f_t^{\perp}$	0.28***	-1.39***	-0.1***	0.101
	(0.848)	(0.24)	(0.167)	(0.137)
Controls	Yes	Yes	Yes	Yes
Fixed Effects	Yes	Yes	Yes	Yes

(b) Long-Short Portfolio

	Raw Return	α	**Factor Loadings** β_{Mkt}	β_{HML}	β_{SMB}	β_{MOM}	β_{REV}
Long-Short Deciles (vw)	0.32	0.29*	0.05	-0.24**	0.04	-0.18***	0.21***
	(0.225)	(0.171)	(0.049)	(0.099)	(0.084)	(0.046)	(0.075)
Long-Short Deciles (ew)	0.15	0.17	-0.02	-0.43***	-0.00	-0.11***	0.35***
	(0.277)	(0.202)	(0.045)	(0.129)	(0.065)	(0.036)	(0.086)

Investor-specific elasticities

- First stage

$$\Delta p_t^i(n) \quad = \quad \theta f_{t+1}^{\perp,-i}(n) + \epsilon_{t,1}^i(n)$$

- Second stage

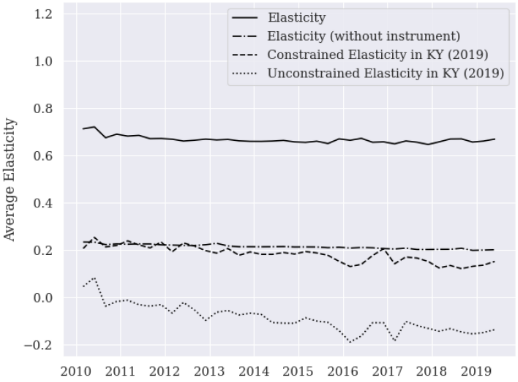
$$\Delta q_n^i(t) \quad = \quad -\zeta^i \Delta \tilde{p}_t^i(n) + \epsilon_{t,2}^i(n)$$

ζ^i is a scalar

Elasticities

KY19

Figure 3: **Average Institutional Price Elasticities of Demand.**
The figure compares the AUM-weighted average elasticity over time for the estimation in changes with and without instruments to the elasticities in KY (2019). Elasticities are averaged over 13F institutions only, i.e., the household sector is excluded. KY (2019) add the coefficient constraint $\zeta_t^i > 0$ for all investor-quarter pairs. The dotted line at the bottom of the figure reports the average elasticities obtained from their specification without the coefficient constraint.



Integrating Alternative

Koijen & Yogo (2019)

Just plug in the estimation of trades in the holdings framework

$$\log \frac{w_t^i(n)}{w_t^i(0)} = (1-\zeta^i)\log P_t(n) + \sum_{k=1}^{K} \beta_{k,t}^i X_{k,t}(n) + \epsilon_t^i(n)$$

Not so simple

Cross-Elasticities identification

$$\cancel{\Delta q_t^i(n) = \sum_{m=1}^{N} \zeta_{n,m}^i \Delta \hat{p}_t(m) + \epsilon_t^i(n)}$$

The problem reduces to estimating interaction effects:

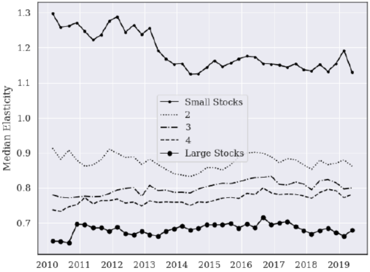
$$\zeta_{n,m}^i = \begin{cases} X_t(n)\zeta_X^i & \text{if } n = m \\ Y_t(n,m)\zeta_Y^i & \text{if } n \neq m \end{cases}$$

$$\Delta q_t^i(n) = \zeta_X^i \Delta \hat{p}_t(n) X_t(n) + \frac{\zeta_Y^i}{|I(n)| - 1} \sum_{m \in I(n)} \Delta \hat{p}_t(m) + \epsilon_t^i(n)$$

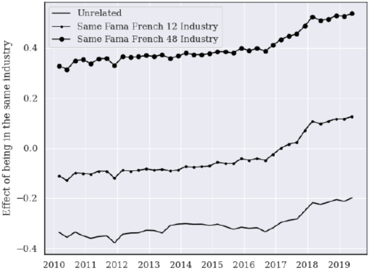
Cross-Elasticities

Figure 5: **Stock-specific and cross-elasticities.**
Panel (a) plots the median stock-specific elasticity across 5 size quintiles. Size quintiles are computed using market equity and the reported elasticity coefficients are ownership-weighted across institutions. Formally, the aum-weighted average stock-specific elasticities are computed as $z\bar{e}ta_n = \sum_i Q_t^i(n)\zeta_n^i$. Stock-specific elasticities are parameterized as a function of lagged log market equity, log book equity, market beta and idiosynratic risk. Panel (b) plots the ownership-weighted cross-elasticities $-\bar{\zeta}_{n,m} = -\sum_i Q_t^i(n)\zeta_n^i m$. The bottom line reports the cross-elasticity when n and m are neither in the same Fama French 12 industries nor in the same Fama French 48 industries. The line above reports the cross-elasticity when n and m are in the same Fama French 12 industry, but not in the same Fama French 48 industry. The top line reports the cross-elasticity when n and m are in the same Fama French 48 industry.

(a) Stock-Specific Elasticities

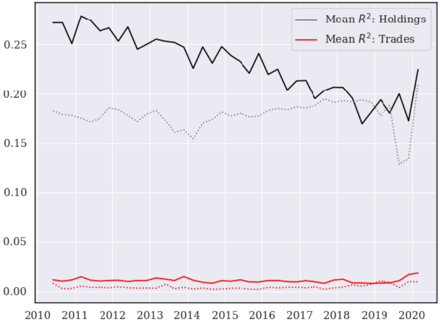


(b) Cross-Elasticicties



Latent demand

Figure 6: **Goodness of Fit: Holding vs. Trading.**
The figure plots the average aum-weighted R^2 of explaining changes (levels) of holdings with changes (levels) of stock-specific characteristics. Formally, the estimation in changes and levels are given by $\log Q_t^i(n) = \beta_t^i X_t(n) + \epsilon_t^i(n)$ and $\Delta q_t^i(n) = \beta_{1,t}^i \Delta X_t(n) + \beta_{2,t}^i X_t(n) + \epsilon_t^i(n)$ respectively. As explanatory characteristics $X_t(n)$, I follow KY (2019) and choose book equity, dividends to book equity, profitability, investment and market beta. Note, that the specification in changes also includes the fundamentals in levels as explanatory variables because there is little time series variation in the quarterly characteristics. I omit prices (market capitalizations) because the focus lies on the ability of exogenous characteristics in explaining portfolios. Changes Δ are quarterly and defined as $\Delta X_t = X_t - X_{t-1}$.



Take-aways

- If investors are inelastic, they cannot offer liquidity when demand shocks from a third party occur
- The set of investors' elasticities determines the transmission of the demand shocks to the cross-section of asset prices
- It is possible to build counterfactual scenarios by redistributing an investor's shares

Critical points

- Which method to use in estimation?

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- Who are the investors? Are we talking about institutions, funds, or households?

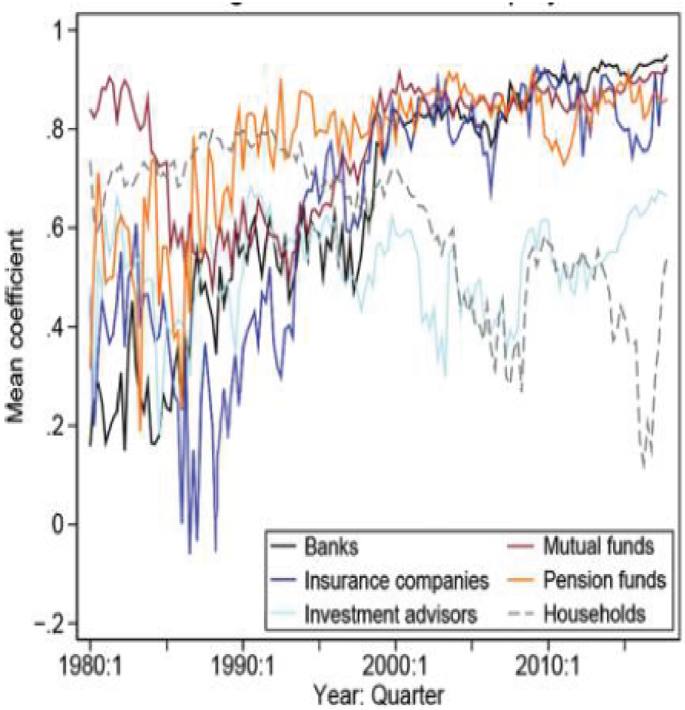
Demand-based price impact for Brazilian stocks

Ranking on February 2020

1. Bradesco
2. Itaú-Unibanco
3. Banco do Brasil
4. Safra
5. Credit Suisse
6. Santander
7. Julius Baer
8. BTG Pactual

Agenda

- Cross elasticities
- Function specification
- Beliefs
- Additional asset classes
- Predictability
- Risk management


Mean coefficient
1
.8
.6
.4
.2
0
-.2
1980:1
1990:1
2000:1
2010:1
Year: Quarter
Banks
Insurance companies
Investment advisors
Mutual funds
Pension funds
Households

Voltar