Risk Sharing, Costly Participation, and Monthly Returns

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What drives transitory price changes?

- What portion of observed stock price changes can be attributed to transitory (liquidity) shocks?
  - Decomposing price changes into *transient* and *permanent*
    - E.g., random walk decompositions, variance ratios, …
  - Is latter due to liquidity, time-varying risk premiums, … ?
    - Amihud & Mendelson (1987, 1991); Poterba & Summers (1988); Cochrane (1994), Hasbrouck (2007) …
- This paper & accompanying research agenda
  - Transitory price pressures are important (28% of efficient)
  - They can be attributed to trading due to risk sharing among agents with differing participation costs
    - Theoretical and empirical analysis ☺

Theoretical analysis

- Economy:
  - One risky asset, two rounds of trading (1, 2)
    - Market-makers (MMs): risk-averse, short-term, clear the market
    - Individuals: risk-averse, pay cost ***c*** to trade at 1 (but at 2 is free)
      - λ is the "endogenous" portion of them trading at 1
    - Institutions: risk-averse, trade freely both at 1 & 2
    - Why trade? Perfectly negatively correlated consumption shocks
  - What is the economic intuition of ***c***? Why only at 1?
    - Cost of information acquisition? Can you make it endogenous?
    - Ability to trade, to gain access to markets or prices? Even today?
    - Information precision or availability?
  - Why do individuals have to trade at 2? Model assumes so
    - Idea of cost implies the possibility of trading earlier only…

Theoretical analysis (2)

- Economy:
  - Efficient price P_1^* = no ***c*** & both types trading at 1 & 2
    - Price pressure s_1 is negative: to induce individuals to trade?
    - Authors: it compensates MMs for taking inventory at 1
  - Equilibrium λ?
    - Level where individuals are indifferent to delaying trading at 2
      - ❖ Note: no source of heterogeneity among individuals (explaining why their trading imbalances are persistent [result #6])
    - For λ to be within [0,1], ***c*** has to be within $[\frac{1}{2}\delta\sigma_2^2, \frac{9}{8}\delta\sigma_2^2]$
      - ❖ Are these constraints sensible? How big does ***c*** have to be to get some individuals to delay, from which all action in the model comes?
  - Idea: limiting individuals' early trading affects MMs' ability to clear the market early (& achieve the efficient price)
    - ❖ Focus on the key (novel) implication, rather than on all of them

Empirical analysis

- Key implication of the model: there is (negative) price pressure stemming from MMs' inventories
  - Three databases to test it (1999-2005):
    - NYSE sample of monthly specialists' inventory positions
    - NYSE CAUD sample of individuals' order imbalances
    - NYSE TAQ for price mid-quotes
- Empirical strategy
  1. Estimate *unobservable* price pressures
  2. Relate them to MMs' inventories, individuals' trades *for each stock*
  3. Investigate some of the model's comparative statics

Empirical analysis (2)

- My view: Both dependent, independent variables are far from their primitives, clouding interpretation

1. Estimate unobservable price pressures

1a) Identify the idiosyncratic component of MMs' inventory, changes in individuals' order imbalances, & returns

Why not CRSP VW or EW?

Why focus on market return innovations as a "market factor" but not on stock return innovations?

Why 4 lags for the market return & for its residual in individual returns

What about specialists handling multiple stocks? Stock-level inventories may be affected and so their price pressures

r_t	Market-wide return or common factor. Equal to: $r_t = \sum_i \omega_{i,t} r_{i,t}^{std}$.
f_t	Innovation in market-wide returns. Defined as: $f_t = \xi_t$ from the regression: $r_t = \alpha + \phi_1 r_{t-1} + \phi_2 r_{t-2} + \phi_3 r_{t-3} + \phi_4 r_{t-4} + \xi_t$.
$r_{i,t}^{idio}$	Idiosyncratic portion of stock i's return. Defined as: $r_{i,t}^{idio} = \xi_{i,t}$ from the regression: $r_{i,t} = \alpha + \phi_0 f_t + \ldots + \phi_4 f_{t-4} + \xi_{i,t}$.
γ_t^{Spec}	Common (market-wide) inventory factor at the end of month t. Defined as: $\gamma_t^{Spec} = \sum_i \omega_i \times Spec_{i,t}^{std}$.
$Spec_{i,t}$	Idiosyncratic part of specialist's inventory. Defined as: $Spec_{i,t} = \varepsilon_{i,t}$ from the regression: $Spec_{i,t}^{\$} = \alpha + \beta \cdot \gamma_t^{Spec} + \varepsilon_{i,t}$.
γ_t^{Indv}	Common (market-wide) inventory factor at the end of month t. Defined as: $\gamma_t^{Indv} = \sum_i \omega_i \times Indv_{i,t}^{std}$.
$\Delta\gamma_t^{Indv}$	Net trading of common factor over month t: $\Delta\gamma_t^{Indv} = \gamma_t^{Indv} - \gamma_{t-1}^{Indv}$.
$Indv_{i,t}$	Idiosyncratic part of individuals' inventory. Defined as: $Indv_{i,t} = \varepsilon_{i,t}$ from the regression: $Indv_{i,t}^{\$} = \alpha + \beta \cdot \gamma_t^{Indv} + \varepsilon_{i,t}$.
$\Delta Indv_{i,t}$	Idiosyncratic part of net trades. Defined as: $\Delta Indv_{i,t} = \varepsilon_{i,t}$ from the regression $\Delta Indv_{i,t}^{\$} = \alpha + \beta \cdot \Delta\gamma_t^{Indv} + \varepsilon_{i,t}$.

Empirical analysis (3)

- My view: Both dependent, independent variables are far from their primitives, clouding interpretation

1. Estimate unobservable price pressures

1b) Subtract from each stock's log price its estimated required return to get $p_{i,t}$

Why do you need to do this?

1c) Decompose price changes into efficient and pressure terms using Kalman filter & relate the latter to trading variables

Authors: test of the basic implication of the model is $\alpha^{spec} < 0$ (negative price pressure to compensate MMs)

At this stage returns and trading variables have been so manipulated that I am unsure of that interpretation

Step 1: Do a fixed-effects panel regression with all 1,019 stocks using the whole sample period: $r_{i,t} = \alpha + \beta_0 f_t + \beta_1 f_{t-1} + \beta_2 f_{t-2} + \beta_3 f_{t-3} + \beta_4 f_{t-4} + \varepsilon_{i,t}$.

Step 2: Do a stock-by-stock regression of the form: $r_{i,t} = \alpha_i + \beta_{i,0} f_t + \beta_{i,1} f_{t-1} + \beta_{i,2} f_{t-2} + \beta_{i,3} f_{t-3} + \beta_{i,4} f_{t-4} + \varepsilon_{i,t}$.

Step 3: Calculate stock i's beta as: $\beta_i = \frac{\sum_{j=0}^{4} \beta_{i,j}}{\sum_{j=0}^{4} \beta_j}$.

Step 4: Calculate the required return as: $\delta_{i,t} = r_{f,t} + \beta_i \left(1.06^{\frac{1}{12}} - 1\right)$.

Both dependent and independent variables are estimated, with potential for measurement errors & biases

$$
\begin{aligned}
p_{i,t} &= m_{i,t} + s_{i,t} + \beta_{i,0} f_t + \ldots + \beta_{i,3} f_{-3} \\
m_{i,t} &= m_{i,t-1} + \beta_i f_t + w_{i,t} \\
w_{i,t} &= \kappa_i^{spec} \tilde{S}pec_{i,t} + \kappa_i^{indv} \Delta \tilde{I}ndv_{i,t} + u_{i,t} && (4) \\
s_{i,t} &= \alpha_i^{spec} \tilde{S}pec_{i,t} + \alpha_i^{indv} \Delta Indv_{i,t} + \alpha_i^{D} D_{i,t} + \epsilon_{i,t} && (5)
\end{aligned}
$$

Empirical analysis (4)

- My view: Both dependent, independent variables are far from their primitives, clouding interpretation

1. Estimate unobservable price pressures

Why are you using an AR(1)?

1d) More manipulations before the Kalman filter is run: $Spec_{i,t}$ & $\Delta Inv_{i,t}$ in Eqs. (4) & (5) are actually the residuals of AR(1) models for the <u>already idiosyncratic</u> counterparts estimated a few slides ago

$$
\begin{aligned}
p_{i,t} &= m_{i,t} + s_{i,t} + \beta_{i,0} f_t + \ldots + \beta_{i,3} f_{-3} \\
m_{i,t} &= m_{i,t-1} + \beta_i f_t + w_{i,t} \\
w_{i,t} &= \kappa_i^{spec} \tilde{S}pec_{i,t} + \kappa_i^{indv} \Delta \tilde{I}ndv_{i,t} + u_{i,t} && (4) \\
s_{i,t} &= \alpha_i^{spec} \tilde{S}pec_{i,t} + \alpha_i^{indv} \Delta Indv_{i,t} + \alpha_i^{D} D_{i,t} + \epsilon_{i,t} && (5)
\end{aligned}
$$

$\tilde{S}pec_{i,t}$ Defined as the residual from an AR(1): $\tilde{S}pec_{i,t} = \varepsilon_{i,t}$ from the regression $Spec_{i,t} = \phi_0 + \phi_1 Spec_{i,t-1} + \varepsilon_{i,t}$.

$\tilde{I}ndv_{i,t}$ Defined as the residual from an AR(1): $\tilde{I}ndv_{i,t} = \varepsilon_{i,t}$ from the regression: $Indv_{i,t} = \phi_0 + \phi_1 Indv_{i,t-1} + \varepsilon_{i,t}$.

$\Delta \tilde{I}ndv_{i,t}$ Defined as the residual from an AR(1): $\Delta \tilde{I}ndv_{i,t} = \varepsilon_{i,t}$ from the regression: $\Delta Indv_{i,t} = \phi_0 + \phi_1 \Delta Indv_{i,t-1} + \varepsilon_{i,t}$.

<u>Correlation analysis</u>, to provide further motivation for the above specification
However, most of correlations seem very small, so I am unclear as to what we learn from this exercise, given the model

<u>Assumption</u>: dummy $D_{i,t}$ to capture "discrete" interaction of MMs' and individuals' trading
Why not allow for cross-product terms instead?

<u>Assumption</u>: model is estimated at stock level, assuming no cross-stock effects
Issue with specialists' inventory management

Empirical analysis (5)

- My view: Both dependent, independent variables are far from their primitives, clouding interpretation

2. Test of the model's main implication: $\alpha^{spec} < 0$

Table 7 (averages of stock-level α^{spec}) is key, with no constraints on parameters, so why Tables 5 & 6?

α^{spec} is indeed negative, yet mostly so for the smallest of the stocks in the sample

From the text (but maybe it should be in the tables), effect is statistically (in)significant for less than 25% (65%) of the stocks: good or bad?

Suggestion: at stock level, idiosyncratic fluctuations (your focus) are likely very noisy possibly biasing your analysis.
So, you could construct portfolios of stocks (e.g., by size, or industry) and run your tests on portfolios rather than on individual stocks

Transitory Price Equation

α_i^{spec}	$\lvert\alpha_i^{spec}\rvert \times \sigma(Spec)$	α_i^{indv}	$\lvert\alpha_i^{indv}\rvert \times \sigma(\Delta Indv)$	α_i^{D}	$\sigma(\epsilon)$
-0.26 (-7.6)	167	-0.05 (-5.0)	164	-65.42 (-7.5)	186
-0.61 (-4.0)	263	-0.15 (-3.3)	196	-68.56 (-3.6)	206
-0.33 (-5.4)	173	-0.05 (-5.2)	177	-92.55 (-4.1)	187
-0.20 (-5.5)	138	-0.02 (-4.8)	129	-74.12 (-4.4)	195
-0.12 (-4.7)	130	-0.01 (-3.2)	153	-37.59 (-2.3)	162
-0.05 (-4.1)	132	-0.00 (-5.4)	167	-33.83 (-2.3)	176

Suggestion: run the analysis for portfolios mirroring the portfolios of stocks for which specialists provide liquidity to address specialist-level inventory management issues

Conclusions

- Analyzing the interaction between specialists' inventories and price formation is very interesting
  - Especially in light of ongoing changes to market structure & academic debate on stock return predictability
  - This paper: inventories are negatively related to (transient) price changes because of individuals' inability to trade continuously
- A summary of my suggestions to the authors:
  - Streamline the model's discussion to focus on key idea
  - Perform sensitivity analysis of your empirical approach
  - Remove some less obvious/necessary steps to reduce the distance of your variables from their primitives

Open discussion