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TRADING AND PRICE FORMATION

FIN 872

FALL 2020

Purpose:

A vibrant research (variously labeled as Financial Markets, Information Economics and Markets, or, more narrowly, Market Microstructure) analyzes, both theoretically and empirically, the impact of important (yet often ignored) trading frictions on the process of price formation in domestic and international financial markets (for equity, government and corporate bonds, currency, and real estate, among others).

This effort is motivated by the observation that over the last few decades, market efficiency – one of the dominant principles of modern Finance – has been challenged by several empirical "anomalies." Market efficiency states that prices are determined "fairly" in frictionless markets in which perfectly competitive agents are rationally driven by profit maximization. In such a setting, asset prices should "accurately" reflect assets' payoffs and "immediately" (or rapidly) adjust to any past and new information about them. However, many domestic and international financial markets have been experiencing high volatility, price bubbles, sudden, severe (and often deemed "excessive") downward price movements, drying liquidity, rapid reversals of capital flows, and contagious propagation of shocks across stocks, bonds, and currencies – as recently as during the global financial crisis of 2008-2009 or the coronavirus pandemic of 2020. These phenomena are pervasive and difficult to reconcile with standard asset pricing theory. Yet, because of their significant economic, financial, and social implications, a greater understanding of these phenomena is of increasing, even urgent, importance to academics, practitioners, and policy-makers.

The main goal of this Ph.D. course is to motivate students to pursue theoretical and empirical research in this exciting area of Financial Economics.

Instructor:

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Office Hours:

Tuesdays: 2:00 p.m. to 4:00 p.m. (room R4434)

By appointment as needed

Course Structure & Requirements:

This course requires a joint, energetic commitment to learning. Over the course of the next six weeks, we will cover seminal (or simply interesting) papers on six topics within the broadly defined area of Trading and Price Formation. In the first part of each topic-centered session, we will discuss a (by no means comprehensive) set of theoretical contributions; in the second part, we will discuss empirical work on related insights. The list of topics and papers in this course may unavoidably reflect my (possibly idiosyncratic) tastes and preferences, but also current trends in the field. In any case, suggestions are welcome.

Depending on enrollment, I plan to put each student "in charge" of one theoretical sub-session (for a topic) and one empirical sub-session (for a different topic). When in charge of a sub-session, the student will present one to three (at the most) assigned papers. Of course, each of us has idiosyncratic presentation skills and preferences. With that in mind, I will expect each presentation to provide the following information, clearly and lucidly, for each of the assigned theoretical papers:

- The paper's main research question;
- The paper's main result(s);
- The step-by-step proof of that result;
- Comments, criticism, etc;

and for each of the assigned empirical papers:

- The paper's main research question, as related to existing theory and/or to a different field (e.g., asset pricing, corporate finance);
- The paper's main empirical strategy and data sources used;
- The paper's main empirical insights, as related to (or challenging) existing theory;
- Comments, criticism, etc.

I will provide some *suggestions* when describing each of the topics next; please feel free to add to them (but manage your time accordingly). The two students in charge of a session may benefit from jointly planning their presentations, as well as by meeting with me in advance.

Homework:

Six short homework problem sets will be assigned throughout the term. If you are in charge of the theory portion of a lecture, you don't have to submit the homework due for that lecture. The homework is available on the class website. Each problem set asks you to work through the proof of at least one important result of at least one of the theory papers we plan to discuss in class. Homework is due at the beginning of the corresponding lecture. Homework may be done individually or in groups. Nonetheless, homework assignments must be submitted **individually, on my class desk, prior to class-time on the due date**. Late homework will not be accepted. I will grade the homework on a Pass/Fail basis.

Grading Policy:

In addition to the homework, I will also grade students according to the quality of their presentations and overall class participation. Students' final grade will then depend on these dimensions as follows: homework (45%), presentation (45%), participation (10%).

Course Materials:

There are no required textbooks for this course. However, there are a few books with excellent discussions of many of the topics in the course. It may be worth consulting the

relevant chapters of each of these books either in preparation for a class session or just for future reference:

1. ***Information and Learning in Markets***, Xavier Vives, 2008, Princeton University Press [http://blog.iese.edu/xvives/publications/books/ for chapter slides];
2. ***Market Microstructure Theory***, Maureen O'Hara, 1995, Blackwell Business;
3. ***Empirical Market Microstructure***, Joel Hasbrouck, 2007, Oxford University Press [http://people.stern.nyu.edu/jhasbrou/Teaching/2011%20Fall%20PhD%20Microstructure/PhDMicro2011Fall.html for chapter slides and additional material].

I will provide the required papers for each topic on the Canvas class website (under Files). I also list below additional, optional readings for each sub-session.

Special Accommodations:

The University of Michigan is committed to providing equal opportunity for participation in all programs, services and activities. Students wishing to receive testing accommodations must register with the UM SSD (Services for Students with Disabilities) as soon as possible. Students must then submit their Verified Individualized Services and Accommodations (VISA) form via online web form as early as possible, but no later than two weeks prior to the test or quiz for which accommodations are requested.

Requests must be sent using the Accommodations Request form available at the following website:

https://docs.google.com/forms/d/e/1FAIpQLScqfP5B-bM0rjfwyvtOeKXAMPyTrLNHZwrPbv6oMfgE2yNYPQ/viewform

and must include a scanned or photographed copy of the VISA form. This form only needs to be submitted once during your academic career with Ross unless your accommodations eligibility expires. Questions can be directed to the Accommodations Coordinator at RossAccommodationsCoordinator@umich.edu.

In rare cases, the need for an accommodation arises after the two-week deadline has passed (for example, a broken wrist). In these cases, you should still contact SSD and the Ross Accommodations Coordinator at RossAccommodationsCoordinator@umich.edu. However, due to logistical constraints, the SSD cannot guarantee that an accommodation can be made after the two-week deadline has passed.

Course Content & Class Schedule (tentative):

1. Competitive Rational Expectations Models (SESSION 1)

Theory:

- Grossman, S., and Stiglitz, J., 1980, On the Impossibility of Informationally Efficient Markets, *American Economic Review*, 70, pp. 393-408.
  - [*Suggestion*: Focus on the workhorse CARA-Gaussian model first (see Vives, Chap. 4.2.2) then extend it the endogenous information acquisition case (e.g., Figure 1)]
- Vives, X., 1995, Short-Term Investment and the Informational Efficiency of the Market, *Review of Financial Studies*, 8, pp. 125-160.
  - [*Suggestion*: Notions of (generalized) limit orders in the model, Propositions 1.1, Corollary 2.1, & comparative statics on market depth, price informativeness, trading volume; see also Vives, Chap. 4.3]

Empirical:

- Biais, B., Hillion, P., and Spatt, C., 1995, An Empirical Analysis of the Limit Order Book and the Order Flow in the Paris Bourse, *Journal of Finance*, 50, pp. 1655-1689.
  - [*Suggestion*: The notion of limit order book (e.g., Figure 1), & main empirical results (e.g., bid-ask spreads, order flow, book depth, supply of and demand for liquidity)]

- Chen, Q., Goldstein, I., and Jiang, W., 2007, Price Informativeness and Investment Sensitivity to Stock Price, Review of Financial Studies, 20, pp. 619-650.
  - [*Suggestion*: Focus mostly on Section 1.1 (price non-synchronicity measuring price informativeness), less so on Section 1.2 (PIN, covered in Session 2), main hypotheses, & empirical results]
- Kacperczyk, M., and Seru, A., 2007, Fund Manager Use of Public Information: New Evidence on Managerial Skills, *Journal of Finance*, 62, pp. 485-528.
  - [*Suggestion*: Empirical predictions as related to model (sketch), RPI measure, & main tests of Eqs. (11) and (12)]

Additional readings: Vives (Chap. 4); O'Hara (Appendix of Chap. 4).

2. Strategic Trading and Asymmetric Information (SESSION 2)

Theory:

- Kyle, A., 1985, Continuous Auctions and Insider Trading, *Econometrica*, 53, pp. 1315-1335.
  - [*Suggestion*: Theorem 1, & comparative statics for equilibrium variables]
- Subrahmanyam, A., 1991, Risk Aversion, Market Liquidity, and Price Efficiency, *Review of Financial Studies*, 4, pp. 417-441.
  - [*Suggestion*: Propositions 1 (Figure 1) and 4, & comparative statics for price efficiency; for the exposition, consider first the case of $k > 1$ risk-neutral speculators (versus $k = 1$); then assume they are risk-averse and repeat comparison]
- Pasquariello P., and Vega, C., 2007, Informed and Strategic Order Flow in the Bond Markets, *Review of Financial Studies*, 20, pp. 1975-2019.
  - [*Suggestion*: Propositions 1 and 2, & comparative statics for equilibrium variables]

Empirical:

- Hasbrouck, J., 1991, Measuring the Information Content of Stock Trades, *Journal of Finance*, 46, pp. 179-207.
  - [*Suggestion*: Permanent versus transitory price impact; use example of Section II for the intuition]
- Amihud, Y., 2002, Illiquidity and Stock Returns: Cross-Section and Time-Series Effects, *Journal of Financial Markets*, 5, pp. 31-56.
  - [*Suggestion*: ILLIQ versus price impact, & asset pricing tests]
- Pastor, L., and Stambaugh, R., 2003, Liquidity Risk and Expected Stock Returns, *Journal of Political Economy*, 111, pp. 642-685.
  - [*Suggestion*: Notion of liquidity risk, intuition and construction of the gamma measure, & main asset pricing tests]
- Chordia, T., and Subrahmanyam, A., 2004, Order imbalance and individual stock returns: Theory and evidence, *Journal of Financial Economics*, 72, pp. 485-518.
  - [*Suggestion*: Intuition of the model, Eq. (12), & accompanying tests]
- Pasquariello P., and Vega, C., 2007, Informed and Strategic Order Flow in the Bond Markets, *Review of Financial Studies*, 20, pp. 1975-2019.
  - [*Suggestion*: Measures of news and noise, Eqs. (12) and (13), & accompanying tests]

Additional readings: Bagehot (1971); Vives (Chap. 5); O'Hara (Chap. 4); Hasbrouck (Chaps. 7, 9).

3. **Sequential Trade Models of Asymmetric Information** (SESSION 3)

Theory:

- Glosten, L., and Milgrom, P., 1985, Bid, Ask, and Transaction Prices in a Specialist Market with Heterogeneously Informed Traders, *Journal of Financial Economics*, 13, pp. 71-100.

- [*Suggestion*: Proposition 1, concept of "no regret," & comparative statics (Proposition 5)]

- Easley, D., and O'Hara, M., 1987, Price, Trade Size, and Information in Securities Markets, *Journal of Financial Economics*, 19, pp. 69-90.
  - [*Suggestion*: Bayes Rule, Propositions 1 to 6; see also Easley et al. (2002) below, Section II]

Empirical:

- Naranjo, A., and Nimalendran, M., 2000, Government Intervention and Adverse Selection Costs in Foreign Exchange Markets, *Review of Financial Studies*, 13, pp. 453-477.
  - [*Suggestion*: Section 1 (motivation), Section 2 (FX intervention and controls), & accompanying tests]
- Easley, D., Hvidkjaer, S., and O'Hara, M., 2002, Is Information Risk a Determinant of Asset Returns?, *Journal of Finance*, 57, pp. 2185-2221.
  - [*Suggestion*: Section I (motivation), Section II (PIN estimation), & asset pricing tests]
- Bharath, S., Pasquariello, P., and Wu, G., 2009, Does Information Asymmetry Drive Capital Structure Decisions?, *Review of Financial Studies*, 22, pp. 3211-3243.
  - [*Suggestion*: PIN in ASY, interpretation, & capital structure tests]

Additional readings: Stoll (1989); O'Hara (Chap. 3); Hasbrouck (Chap. 5).

4. Models of Multi-Asset Trading (SESSION 4)

Theory:

- Caballe, J., and Krishnan, M., 1994, Imperfect Competition in a Multi-Security Market with Risk Neutrality, *Econometrica*, 62, 695-704.
  - [*Suggestion*: Propositions 3.1 and 3.2]
- Kodres, L., and Pritsker, M., 2002, A Rational Expectations Model of Financial Contagion, *Journal of Finance*, 57, pp. 769-799.

- [*Suggestion*: Propositions 1 to 3, & three-asset example of Eq. (17)]

- Pasquariello, P., 2007, Imperfect Competition, Information Heterogeneity, and Financial Contagion, *Review of Financial Studies*, 20, pp. 69-90.
  - [*Suggestion*: Notion of information heterogeneity, Proposition 1, Definition 2, contagion implications, & three-asset examples of Eqs. (2) and (20)]
- Pasquariello, P., and Vega, C., 2015, Strategic Cross-Trading in the U.S. Stock Market, *Review of Finance*, 19, pp. 229-282.
  - [*Suggestion*: Notion of information heterogeneity, Proposition 1, Remark 1, and Corollary 1, & intuition of the three-asset example of Eq. (5)]

Empirical:

- Pindyck, R., and Rotemberg, J., 1993, The Comovement of Stock Prices, *Quarterly Journal of Economics*, 108, pp. 1073-1104.
  - [*Suggestion*: Section II (intuition only), Section III (methodology), & main results (e.g., latent variable models) as they relate to Table II]
- Forbes, C., and Rigobon, R., 2002, No Contagion, Only Interdependence: Measuring Stock Market Co-Movements, *Journal of Finance*, 57, pp. 2223-2261.
  - [*Suggestion*: Derivation of Eq. (11), Tables III (East Asia in 1997), VI (Mexico in 1994), and VIII (October 1987 crash)]
- Barberis, N., Shleifer, A., and Wurgler, J., 2005, Comovement, *Journal of Financial Economics*, 75, pp. 283-317.
  - [*Suggestion*: Predictions 1 and 2 (intuition), & main results on S&P500 index inclusions (from Eqs. (14) and (15)]
- Boyer, B., Kumagai, T., and Yuan, K., 2006, How Do Crises Spread? Evidence from Accessible and Inaccessible Stock Indices, *Journal of Finance*, 59, pp. 957-1003.
  - [*Suggestion*: Main intuition and hypotheses (e.g., H1 and H2), & main results on accessible and inaccessible firms]

- Pasquariello, P., and Vega, C., 2015, Strategic Cross-Trading in the U.S. Stock Market, *Review of Finance*, 19, pp. 229-282.
  - [*Suggestion*: Estimation of direct and cross-price impact, Eqs. (8) and (9), proxies for fundamental linkages and information heterogeneity, Tables III and IV, & tests of comparative statics (especially Table X)]

5. Fragility and Frictions (SESSION 5)

Theory:

- Chowdhry, B., and Nanda, V., 1998, Leverage and Market Stability: The Role of Margin Rules and Price Limits, *Journal of Business*, 71, pp.179-210.
  - [*Suggestion*: Proposition 1, & main implications (intuition)]
- Brunnermeier, M., and Pedersen, L., 2009, Market Liquidity and Funding Liquidity, *Review of Financial Studies*, 22, pp. 2201-2231.
  - [*Suggestion*: Proposition 1 and properties (e.g., fragility), Proposition 6 (commonality in liquidity and fragility), & Eq. (31) (funding liquidity risk is priced)]

Empirical:

- Garleanu, N., and Pedersen, L., 2011, Margin-based Asset Pricing and Deviations from the Law of One Price, *Review of Financial Studies*, 24, pp. 1980-2022.
  - [*Suggestion*: Intuition of main results (Eqs. (1) and (2)), & tests on the CDS-bond basis]
- Adrian, T., Etula, E., and Muir, T., 2014, Financial Intermediaries and the Cross Section of Asset Returns, *Journal of Finance*, 69, pp. 2557-2596.
  - [*Suggestion*: Section 2 (motivation), measure of broker-dealer leverage, & main cross-sectional results]
- Pasquariello, P., 2014, Financial Market Dislocations, *Review of Financial Studies*, 27, pp. 1868-1914.
  - [*Suggestion*: Construction of MDI, interpretation, & main U.S., international asset pricing tests]

6. Behavioral Finance (SESSION 6)

Theory:

- Bhattacharyya, S., and Nanda, V., 2013, Portfolio Pumping, Trading Activity and Fund Performance, *Review of Finance*, 17, pp. 885-909.
  - [*Suggestion*: Intuition of utility function, main results (e.g., Propositions 1 to 3, and Remarks 1 to 3), & main empirical implications]
- Pasquariello P., 2014, Prospect Theory and Market Quality, *Journal of Economic Theory*, 149, pp. 276-310.
  - [*Suggestion*: Remark 1 versus Conclusion 1, Remark 2 versus Conclusion 5, & empirical implications]
- Mele, A., and Sangiorgi, F., 2015, Uncertainty, Information Acquisition and Price Swings in Asset Markets, *Review of Economic Studies*, 82, pp. 1533-1567.
  - [*Suggestion*: Proposition 1, comparison with Grossman and Stiglitz (1980), & empirical implications]

Empirical:

- Barberis N., and Huang, M., 2001, Prospect Theory and Asset Prices, *Quarterly Journal of Economics*, 116, pp. 1-53.
  - [*Suggestion*: Intuition of the model, calibration strategy, & main results]
- Grinblatt, M., and Han, B., 2005, Prospect Theory, Mental Accounting, and Momentum, *Journal of Financial Economics*, 78, pp. 311-339.
  - [*Suggestion*: Section 2 (sketches of the model), empirical design and variables (e.g., Eqs. (9) to (11)), & main results]
- Pasquariello, P., and Vega, C., 2009, The On-The-Run *Liquidity* Phenomenon, *Journal of Financial Economics*, 92, pp. 1-24.
  - [*Suggestion*: Intuition of the model's main results (Proposition 1, Corollary 1 and 2), empirical strategy (e.g., Eqs. (11) and (13)), & main results]