Impact of Quarterly Disclosure on Information Asymmetry:
Evidence from Tokyo Stock Exchange Firms

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2010 Northeast Business and Economics Association Conference, Morristown, N. J.

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Background of the Current Study

- **Some of the countries other than US and Canada are moving from semi-annual reporting environment to quarterly reporting environment.**

- The International Accounting Standards require only interim reporting, but the future alignment and directions between FASB and IASB are still subject to uncertainty.

- **The accounting standards in Japan have recently moved to quarterly reporting environment with auditors' review as in the U.S.**

- The stock market regulators in Japan had beforehand asked the listed firms of Tokyo Stock Exchange to move to quarterly reporting.

- Active financial analysts also tend to report quarterly earnings forecasts in countries with developed capital markets as in Japan.

Evolvement of Quarterly Reporting Regulations in Japan

- **Up to fiscal year 2002**, financial statements were disclosed twice a year at most in Japan.

- The Tokyo Stock Exchange required the firms listed on its First and Second sections to disclose quarterly *summary reports* from fiscal year **April 1, 2003**.

- The TSE required their firms to disclose full-scale quarterly *financial statements* from fiscal year **April 1, 2004.**

- However, there was no legal penalty even if firms chose not to disclose full-scale financial statements, and we can safely say that this requirement was not strictly enforceable at this time.

- With the enactment of the new Financial Instruments and Exchange Act on September 30th, 2007, a Japanese equivalent of the Sarbanes-Oxley Act, firms now have to disclose quarterly *financial statements based on Japanese Accounting Standards.* This requirement began with fiscal year **April 1, 2008.**

Firms Who Disclose Quarterly Financial Statements

- There are **1,430** firms which had been listed in TSE from 02 to 07.
- About 80% of the firms listed in TSE started to disclose quarterly full-scale financial statements during in the 3rd quarter of 2004.

	Firms did not disclose any quarterly reports		Firms disclosed only prompt summary reports		Firms disclosed quarterly financial statements		
	Number of Firms	Of which PINs were available	Number of Firms	Of which PINs were available	Number of Firms	Of which PINs were available	
2002Q1	1,380	1,053	48	44	2	2	TSE announced its *"Action Program for Quarterly Financial Disclosure"*.
2002Q3	1,365	1,058	63	56	2	2	
2003Q1	147	135	1,270	1,068	13	12	TSE requires firms to disclose quarterly summary report.
2003Q3	123	116	1,287	1,122	20	18	
2004Q1	17	17	260	212	1,153	1,008	TSE requires firms to disclose quarterly full-scale financial statements.
2004Q3	6	6	199	180	1,225	1,143	
2005Q1	3	3	137	123	1,290	1,201	
2005Q3	2	2	119	110	1,309	1,228	
2006Q1	0	0	64	52	1,366	1,218	
2006Q3	0	0	61	53	1,369	1,252	
2007Q1	0	0	2	2	1,428	1,268	
2007Q3	0	0	2	2	1,428	1,237	

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Research Agenda

- Our research purpose:
  - To find out whether the **quarterly disclosure reporting requirements** by TSE helped reduce the degree of information asymmetry.

- Measure of information asymmetry: ***Adjusted PIN***
  - Duarte and Young (2009, *Journal of Financial Economics*)
  - Probability of private information-based trades estimated by tick-by-tick quote and transaction data.

- We can also simultaneously investigate the impacts of quarterly disclosure on the liquidity which is unrelated to the degree of information asymmetry.
  - We use *a Probability of Symmetric Order-flow Shocks* (***PSOS***) as a measure of illiquidity which is unrelated to information risk.

Research Hypotheses (1)

- *H*1: As the new quarterly prompt summary reports and financial statements begin to be disclosed in capital markets, the probability of private information-based trades (***Adjusted PIN***) will decrease.

- *H*2: As the new quarterly prompt summary reports and financial statements begin to be disclosed in capital markets, the probability of symmetric order-flow shocks (***PSOS***) will decrease.

Research Hypotheses (2)

- *H*3: The firms which report quarterly prompt summary reports and financial statements are accompanied with higher liquidity, as measured by proxy variables, than the firms which do not report.
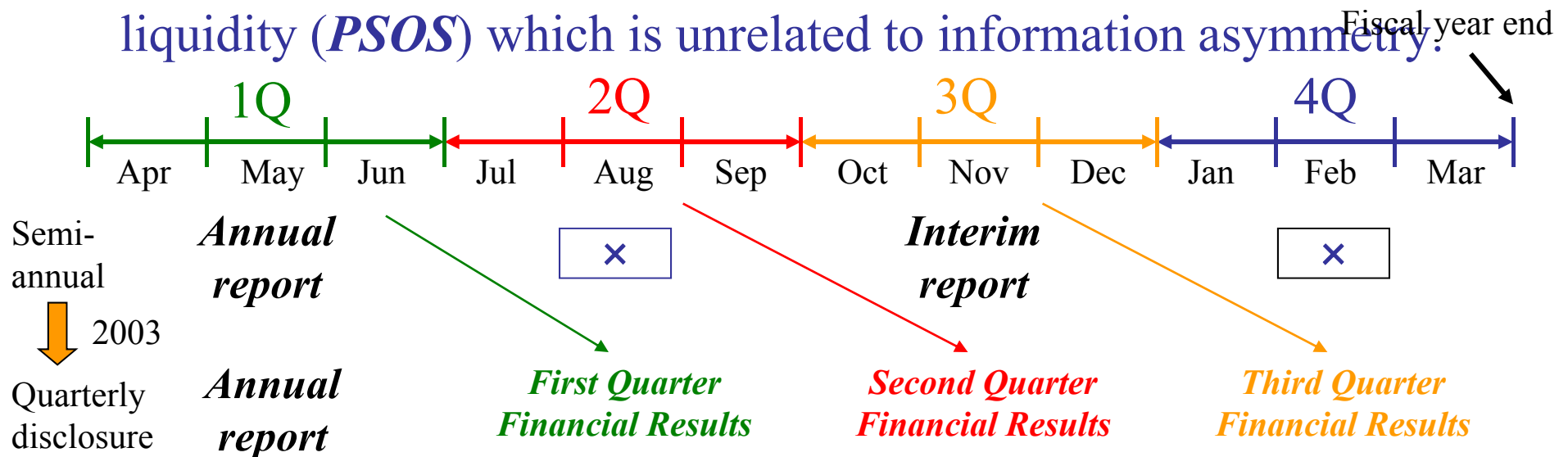
Research Hypotheses (3)

- *H*4: When a firm discloses its full scale quarterly financial reports, the probability of private information-based trades will decrease after being controlled for the illiquidity of the stock.

- *H*5: When a firm discloses its full-scale quarterly financial reports, the probability of symmetric order flow shock as a proxy for market illiquidity will decrease.

With Panel Data Analysis (Chosen ***Random Effects Model*** after examining pooled and fixed effects models)

Advantage of Using Japanese Data

- The Japanese equity market is the third largest in size after the U.S. equity market.

- The frequency of the financial reporting has recently changed, but there were no drastic accounting standard changes durinb our sampling period.

- By using the Japanese data, we expect be able to examine the pure impact of change in financial reporting frequencies on the degree of information asymmetry (*Adjusted PIN*) and the liquidity (*PSOS*) which is unrelated to information asymmetry.

Fiscal year end

1Q	2Q	3Q	4Q
Apr May Jun	Jul Aug Sep	Oct Nov Dec	Jan Feb Mar

Semi-annual

Annual report   ×   *Interim report*   ×

2003

Quarterly disclosure

Annual report   *First Quarter Financial Results*   *Second Quarter Financial Results*   *Third Quarter Financial Results*

Measure of Information Asymmetry, Adjusted PIN

- **PIN** is 'Probability of **p**rivate **in**formation based trades'.
- First Step: Count the buyer and seller-initiated transactions in each trading day

| YMD	Code	Time	Record Type	Serial Number	Price (in Yen)	Depth/ Volume	Classification
2001/12/3	6758	1338	Transaction	1	5,660	100	Buyer-Initiated
2001/12/3	6758	1338	Quote(Ask)	2	5,660	9,400	
2001/12/3	6758	1338	Quote(Bid)	3	5,650	10,000	
2001/12/3	6758	1338	Transaction	4	5,660	1,300	Buyer-Initiated
2001/12/3	6758	1338	Quote(Ask)	5	5,660	8,100	
2001/12/3	6758	1338	Quote(Bid)	6	5,650	15,600	
2001/12/3	6758	1338	Transaction	7	5,660	8,100	Buyer-Initiated
2001/12/3	6758	1338	Quote(Ask)	8	5,670	14,600	
2001/12/3	6758	1338	Quote(Bid)	9	5,660	2,000	
2001/12/3	6758	1338	Quote(Ask)	10	5,670	10,600	
2001/12/3	6758	1338	Quote(Bid)	11	5,660	2,000	
2001/12/3	6758	1338	Quote(Ask)	12	5,670	7,600	
2001/12/3	6758	1338	Quote(Bid)	13	5,660	3,300	
2001/12/3	6758	1338	Transaction	14	5,670	1,300	Buyer-Initiated

TSE Code=6758 SONY **1:38PM**

Quote and Transaction Data for SONY in December 3, 2001 (7288 Records)

Trading System of the Tokyo Stock Exchange

- Tokyo Stock Exchange can be classified as a continuously traded electronically order-driven market **without market makers** (cf., role of limit orders by large institutional investors) .

- We can classify each transaction as either buyer-initiated transaction or seller-initiated transaction without any ambiguity.
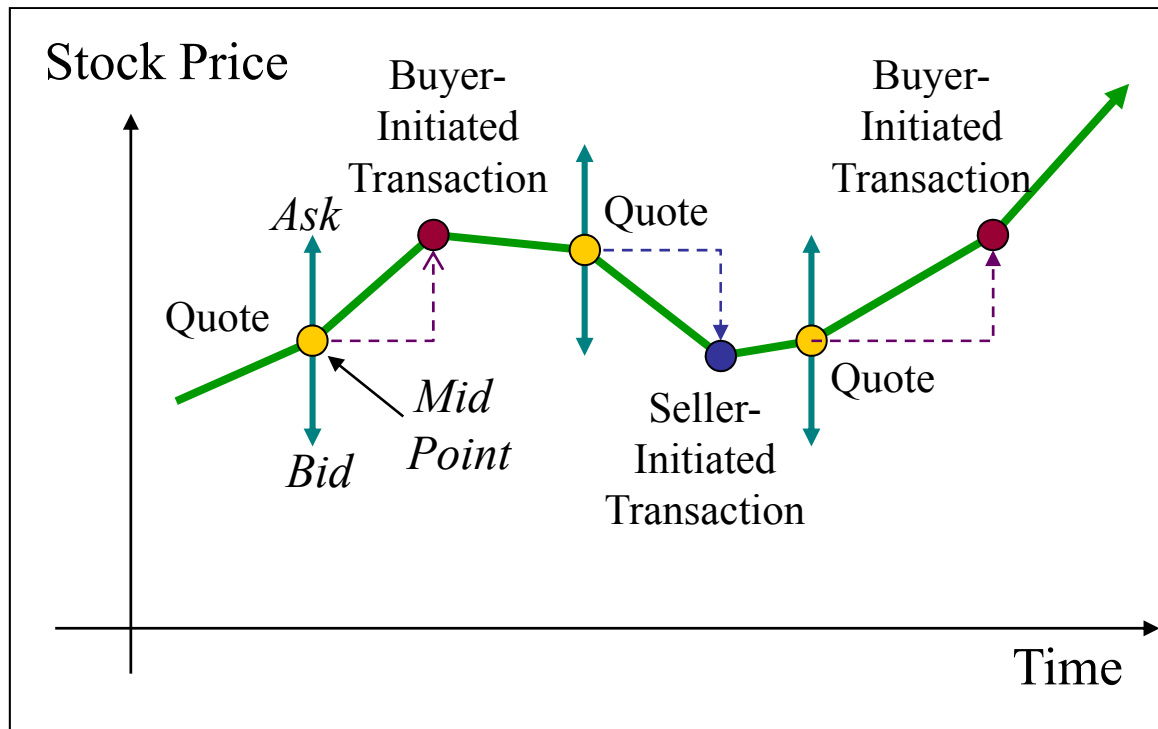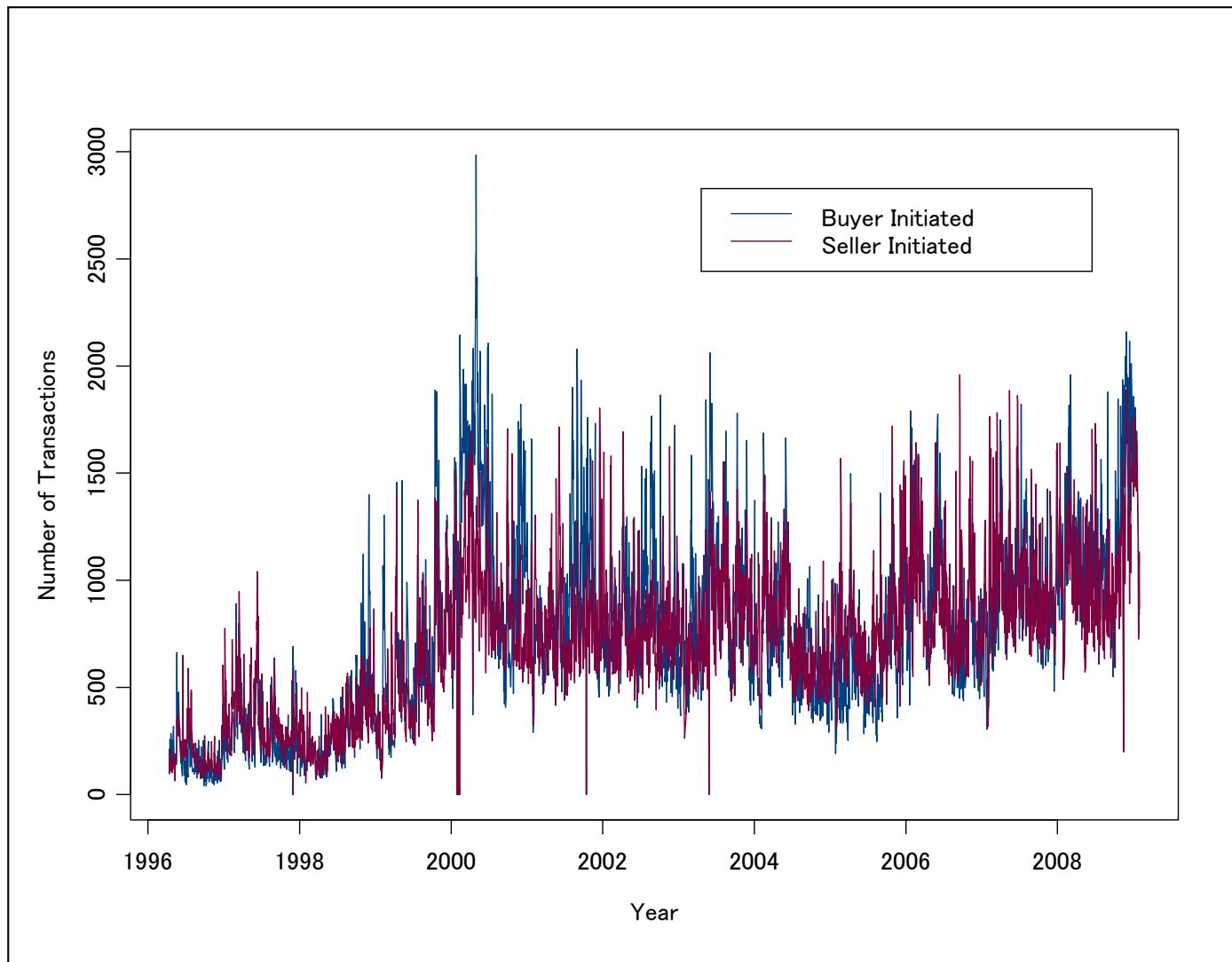

Number of buyer-initiated transactions in day t.

$$B_t$$

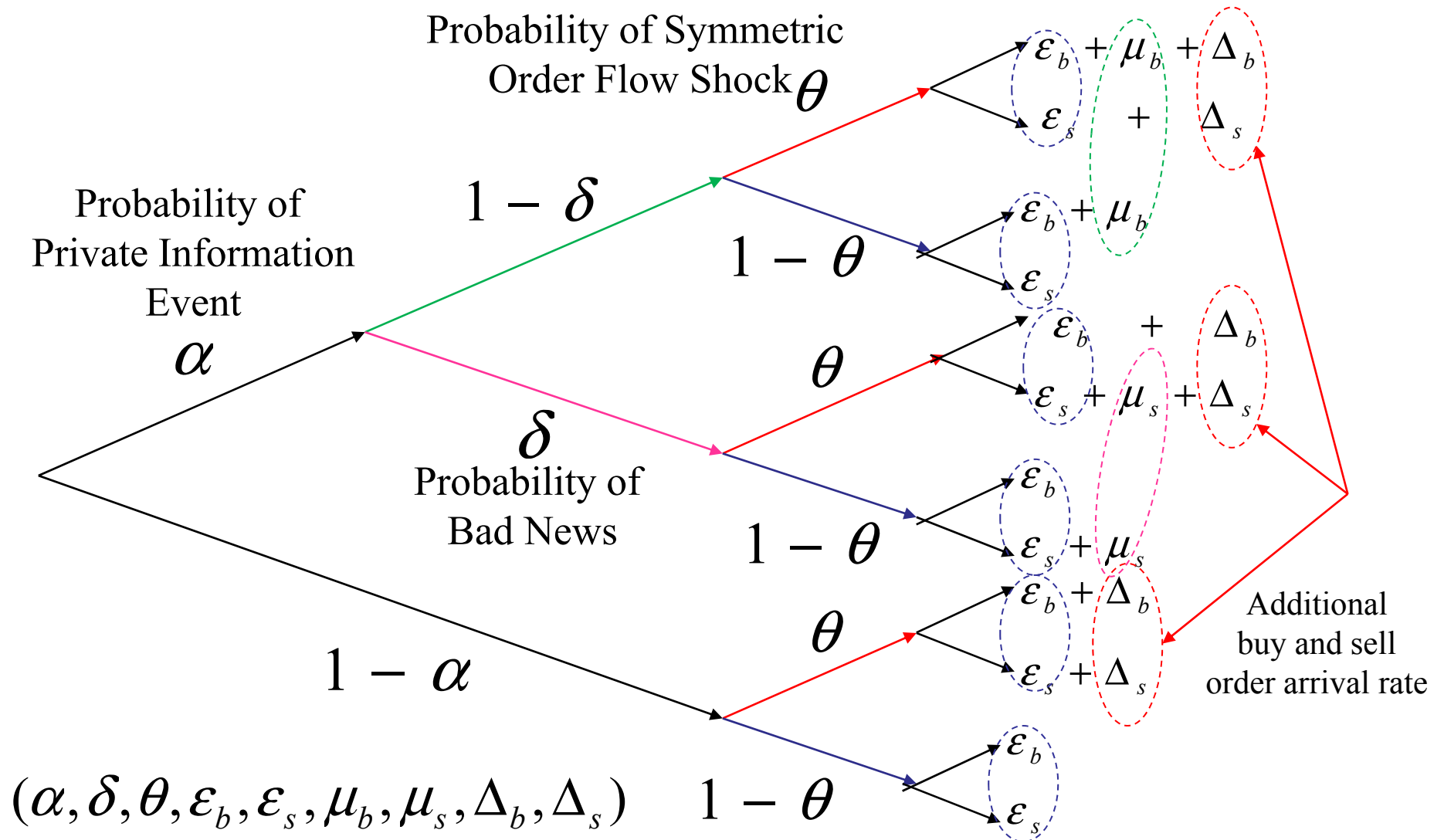Number of seller-initiated transactions in day t.

$$S_t$$

Number of Buyer and Seller Initiated Transactions

- Example: SONY (03/11/1996-12/30/2008)

Sequential Trade Market Microstructure Model

- Two types of traders: informed traders and uninformed traders.
- Traders are assumed to arrive at the market following Poisson processes.

Probability of Symmetric Order Flow Shock θ

$\varepsilon_b + \mu_b + \Delta_b$

$\varepsilon_s \quad + \quad \Delta_s$

$1 - \delta$

$1 - \theta$

$\varepsilon_b + \mu_b$

ε_s

Probability of Private Information Event α

θ

$\varepsilon_b \quad + \quad \Delta_b$

$\varepsilon_s + \mu_s + \Delta_s$

δ

Probability of Bad News

$1 - \theta$

ε_b

$\varepsilon_s + \mu_s$

θ

$\varepsilon_b + \Delta_b$

$\varepsilon_s + \Delta_s$

$1 - \alpha$

Additional buy and sell order arrival rate

$(\alpha, \delta, \theta, \varepsilon_b, \varepsilon_s, \mu_b, \mu_s, \Delta_b, \Delta_s)$

$1 - \theta$

ε_b

ε_s

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Likelihood Function of Duarte and Young(2009)

$$L(\eta \mid B, S) = \alpha(1-\delta)\theta \cdot e^{-(\mu_b+\varepsilon_b+\Delta_b)} \frac{(\mu_b+\varepsilon_b+\Delta_b)^B}{B!} e^{-(\varepsilon_s+\Delta_s)} \frac{(\varepsilon_s+\Delta_s)^S}{S!} \quad (1)$$
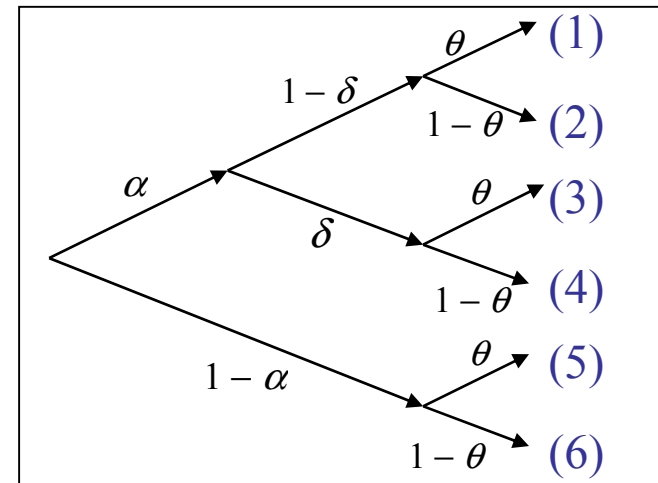
$$+\alpha(1-\delta)(1-\theta) \cdot e^{-(\mu_b+\varepsilon_b)} \frac{(\mu_b+\varepsilon_b)^B}{B!} e^{-\varepsilon_s} \frac{\varepsilon_s^S}{S!} \quad (2)$$

$$+\alpha \cdot \delta \cdot \theta \cdot e^{-(\varepsilon_b+\Delta_b)} \frac{(\varepsilon_b+\Delta_b)^B}{B!} e^{-(\mu_s+\varepsilon_s+\Delta_s)} \frac{(\mu_s+\varepsilon_s+\Delta_s)^S}{S!} \quad (3)$$

$$+\alpha \cdot \delta(1-\theta) \cdot e^{-\varepsilon_b} \frac{\varepsilon_b^B}{B!} e^{-(\mu_s+\varepsilon_s)} \frac{(\mu_s+\varepsilon_s)^S}{S!} \quad (4)$$

$$+(1-\alpha)(1-\theta) \cdot e^{-(\varepsilon_b+\Delta_b)} \frac{(\varepsilon_b+\Delta_b)^B}{B!} e^{-(\varepsilon_s+\Delta_s)} \frac{(\varepsilon_s+\Delta_s)^S}{S!} \quad (5)$$

$$+(1-\alpha)\theta \cdot e^{-\varepsilon_b} \frac{\varepsilon_b^B}{B!} e^{-\varepsilon_s} \frac{\varepsilon_s^S}{S!} \quad (6)$$
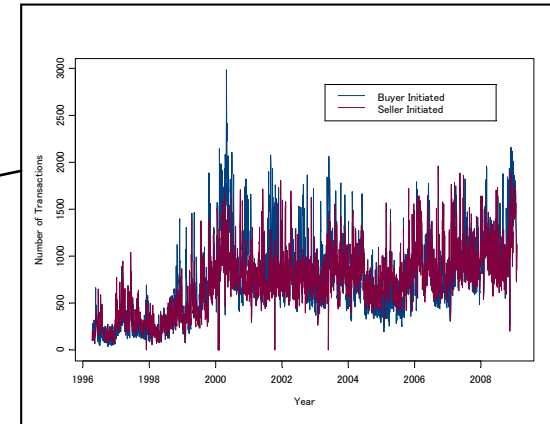
Adjusted PIN and PSOS

- After estimating parameter set η, we compute the *adjusted PIN* and the *PSOS*.

$$\eta = (\alpha, \delta, \theta, \varepsilon_b, \varepsilon_s, \mu_b, \mu_s, \Delta_b, \Delta_s)$$

$$\text{Maximize} \quad \prod_{t=1}^{T} L(\eta \mid B_t, S_t)$$

$$NT = \alpha \cdot ((1-\delta)\mu_b + \delta\mu_s) + (\Delta_b + \Delta_s)\theta + \varepsilon_b + \varepsilon_s$$

$$Adjusted\ PIN = \frac{\alpha \cdot ((1-\delta)\mu_b + \delta\mu_s)}{NT}$$

$$PSOS = \frac{(\Delta_b + \Delta_s) \cdot \theta}{NT}$$

Our Microstructure Data and PIN Estimation

- Data we use:
  - Tick-by-tick quote and transaction data provided by the Tokyo Stock Exchange.
  - The primary data source for daily stock price, return, trading volume, market value, and book-to-market is NIKKEI Portfolio Master Database

- For quarterly adjusted PIN (and PSOS) estimation we impose a condition that there have to be at least 45 days with both of the buyer and seller initiated transactions.

- Sample Period: 2Q/2002 - 1Q/2008. (FY2002-2007)
  - Number of firms which satisfy above condition, had been listed from 2002 through 2007, and whose fiscal year end were in March is **1,430.**
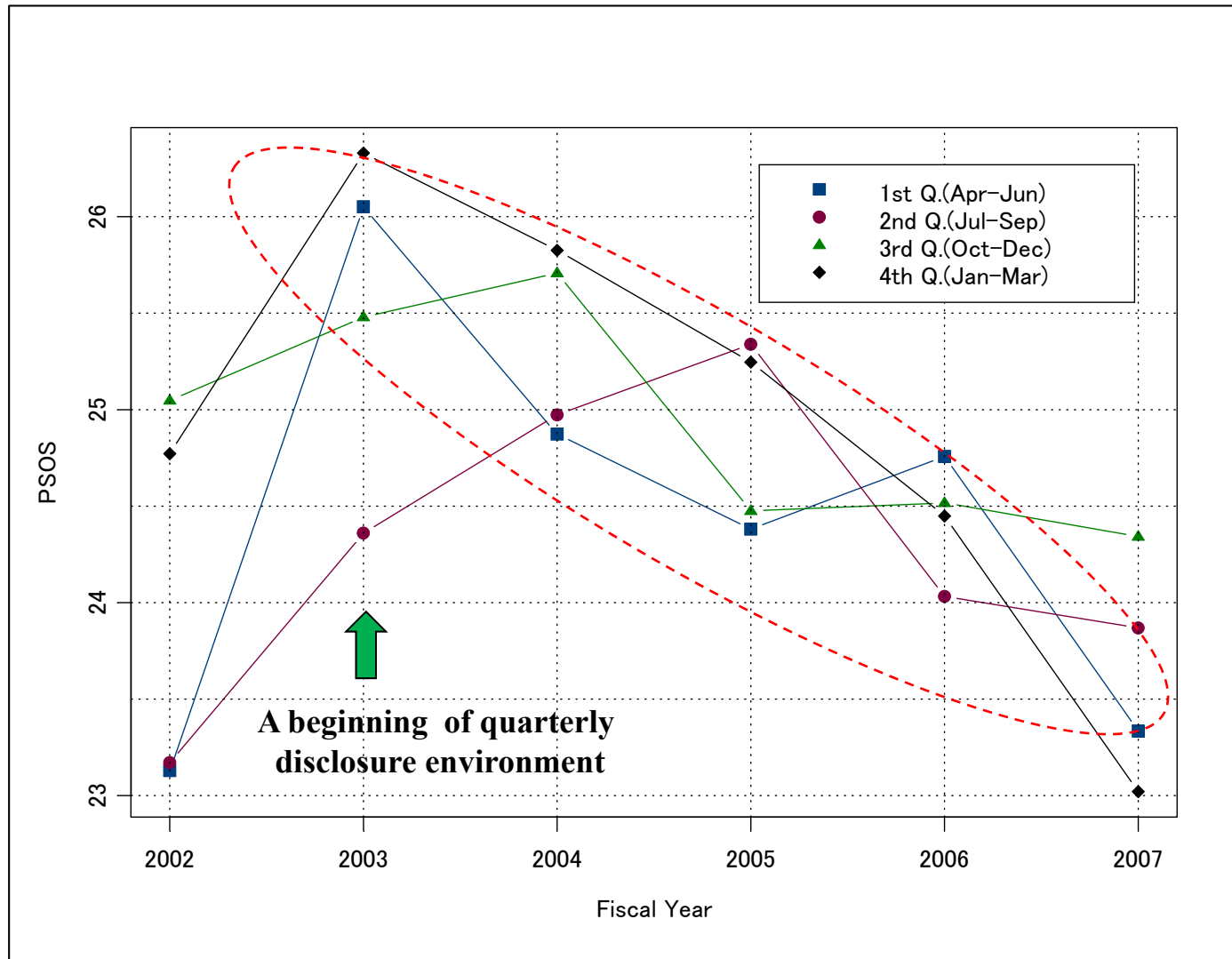
Time-series of Quarterly Estimated Adjusted PIN

- We find that Adjusted PIN values decline over time. This finding supports our *H*1. Quarterly disclosure may have reduced the degree of information asymmetry.
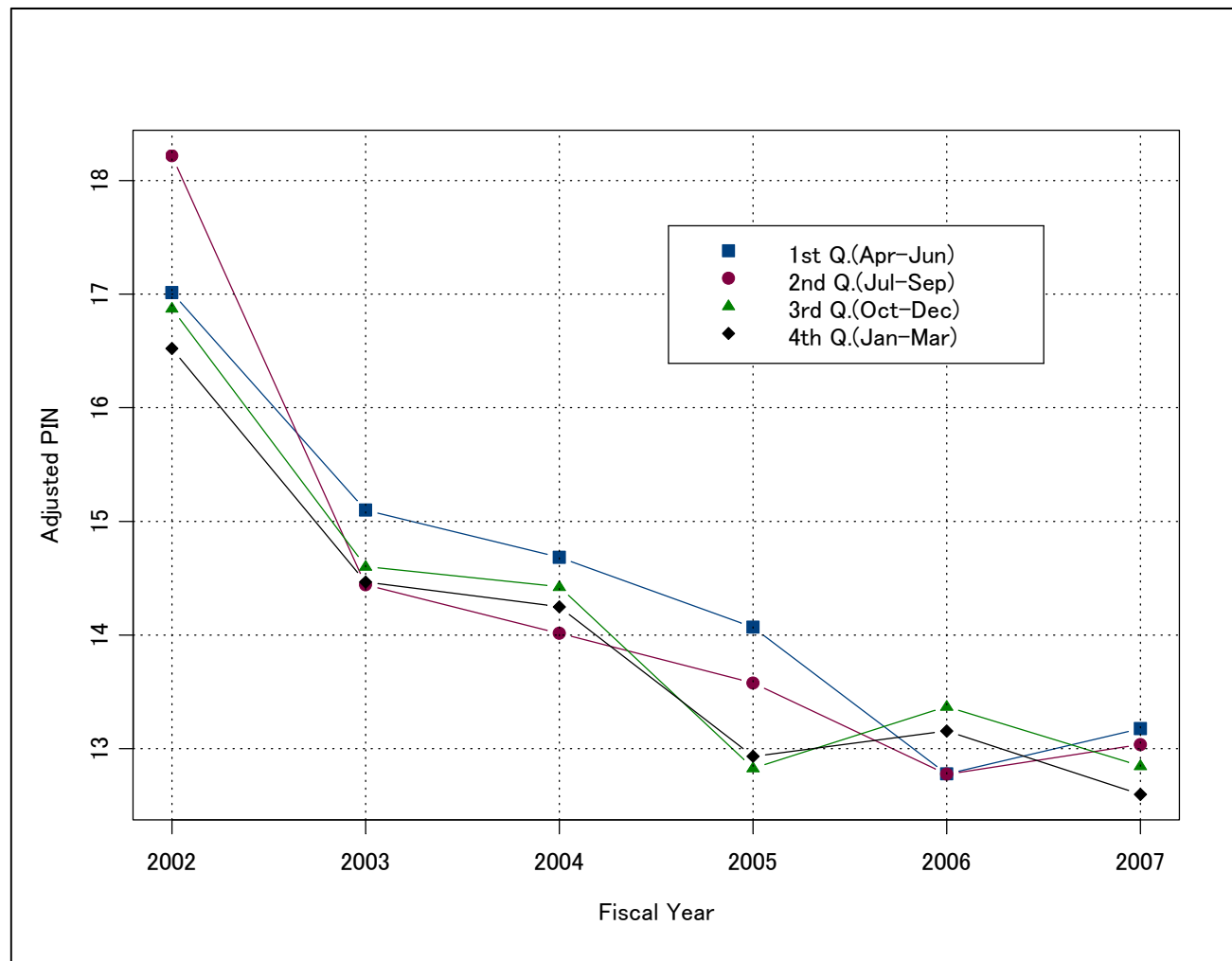
Time-series of Quarterly Estimated PSOS

- The general tendency is slowly decreasing for the total period, This observation is not against our hypothesis *H*2.

Control Variables

- To examine our *H*3, *H*4 and *H*5, we use the following five control variables in the panel data analysis.

- **ln*MV***: Natural log of market value of equity (in million Yen)
  - Degree of information asymmetry is large in small caps.
  - Also, small caps is more illiquid than large caps.

- ***B/M***: Book-to-Market ratio of the firm.
  - PIN is larger in growth stocks than in value stocks in Japan. (→ Kubota and Takehara, *Pacific-Basin Financial Markets*, 2009)

- ***NAnalysts***: Number of financial analysts who follow firms.
  - The larger NAnalysts is, the smaller the PIN.
  - Data source: I/B/E/S Summary History File

- ***NBonds***: Number of straight corp. bonds before the maturity.
  - Bond ratings required when the firms issue the bonds may reveal managers' private information and reduce the degree of information asymmetry.
  - Data source: Nikkei NEEDS Bond Database.

- ***ILLIQ***: Amihud (2002) illiquidity measure of the firm

Differences of Firms' Characteristics between Two Groups

- *Adjusted PIN* is always smaller in the firms which disclosed quarterly financial statements.

- Also, the Difference in *PSOS* is negative in all cases and they are statistically significant in some quarters.

- These findings supports our *H*3.

	Panel A. Adjusted PIN				Panel B. PSOS			
	Firms disclosed	Firms did not disclose	Diff.	*p*-value	Firms disclosed	Firms did not disclose	Diff.	*p*-value
FY2002Q2	17.797	18.236	-0.439	0.655	24.096	23.109	0.987	0.509
FY2002Q4	16.285	16.547	-0.261	0.716	24.893	24.548	0.345	0.756
FY2003Q2	14.321	14.500	-0.179	0.699	24.103	24.237	-0.134	0.861
FY2003Q4	14.245	14.998	-0.752	0.103	26.268	25.731	0.537	0.551
FY2004Q2	13.642	14.170	-0.529	0.176	24.293	25.712	-1.419	0.080
FY2004Q4	13.976	14.162	-0.186	0.636	25.736	27.602	-1.865	0.032
FY2005Q2	13.172	13.635	-0.463	0.281	25.449	26.141	-0.692	0.475
FY2005Q4	12.466	13.375	-0.909	0.056	24.816	26.821	-2.006	0.044
FY2006Q2	12.349	13.002	-0.653	0.427	23.620	22.626	0.995	0.479
FY2006Q4	12.762	14.247	-1.485	0.059	24.331	25.615	-1.284	0.309

Differences of Firms' Characteristics between Two Groups

- More analysts follow the firms which disclosed quarterly financial statements.
- Firms which disclosed quarterly financial statements issued the straight corporate bonds more often.

	Panel E. Number of Following Analysts				Panel F. Number of Bonds Issued			
	Frims disclosed	Firms did not disclose	Diff.	p-value	Frims disclosed	Firms did not disclose	Diff.	p-value
FY2002Q2	6.680	3.622	3.058	0.002	1.940	0.909	1.031	0.269
FY2002Q4	5.708	3.140	2.568	0.001	1.692	0.887	0.805	0.270
FY2003Q2	2.920	3.211	-0.291	0.510	0.884	1.279	-0.395	0.309
FY2003Q4	2.858	3.000	-0.142	0.764	0.852	1.333	-0.481	0.271
FY2004Q2	3.085	2.224	0.861	0.003	0.856	0.827	0.029	0.898
FY2004Q4	2.493	1.620	0.874	0.002	0.784	0.698	0.086	0.704
FY2005Q2	2.783	1.843	0.940	0.007	0.792	0.550	0.242	0.277
FY2005Q4	2.710	1.793	0.917	0.015	0.819	0.595	0.224	0.362
FY2006Q2	2.656	1.516	1.140	0.021	0.794	0.531	0.262	0.459
FY2006Q4	3.000	1.590	1.410	0.013	0.798	0.639	0.159	0.699

QD Impact on Information Asymmetry (*H*4)

- Results of panel data analysis. (Random effects model.)
  Dependent variable = ***Adjusted PIN***

- Quarterly disclosure dummy variable (QDDum) is very strongly significant even after controlling *ILLIQ*, *NAnalysts* and *NBonds*.

- More frequent financial reporting has reduced the degree of information asymmetry. This evidence supports our hypothesis *H*4.

	Intercept	QDDum	ILLIQ	NAnalysts	NBonds	lnMV	B/M	Adj. R^2
Coef.	13.466	-0.757						0.200
p-value	0.000	0.000						
Coef.	13.080	-0.626	9.641					0.190
p-value	0.000	0.002	0.000					
Coef.	13.782	-0.503	7.417	-0.228	-0.040			0.197
p-value	0.000	0.009	0.000	0.000	0.038			
Coef.	23.225	-0.211	2.691	-0.011	0.014	-0.949	0.004	0.215
p-value	0.000	0.264	0.002	0.564	0.480	0.000	0.001	

QDDum=1 if the firm disclosed quarterly financial reports.

QD Impact on Firms' Liquidity (*H*5)

- Dependent Variable = **PSOS**

- Quarterly disclosure dummy variable (QDDum) is very strongly significant even after controlling other variables.

- More frequent financial reporting has reduced the probability of symmetric order flow shock, i.e., QD increased the liquidity of the stock. This evidence supports our hypothesis *H*5.

	Intercept	QDDum	NAnalysts	NBonds	lnMV	B/M	Adj. R^2
Coef.	0.182	-0.022					0.035
p-value	0.000	0.000					
Coef.	0.180	-0.021					0.050
p-value	0.000	0.000					
Coef.	0.194	-0.020	-0.004	-0.001			0.175
p-value	0.000	0.000	0.000	0.000			
Coef.	0.325	-0.016	-0.001	0.000	-0.013	0.000	0.227
p-value	0.000	0.000	0.000	0.673	0.000	0.550	

QDDum=1 if the firm disclosed quarterly financial reports.

Conclusion

- We investigated how quarterly disclosure reporting requirements by TSE helped reduce the degree of information asymmetry and confirmed our contentions. (*H*1 and *H*2).

- We find the liquidity, as measured by chosen proxy variables, is higher for the firms which disclosed quarterly prompt summary reports and financial statements than the firms which did not (*H*3).

- With panel data analyses we found differences in the degree of information asymmetry measured by the Adjusted PIN are strongly related to choices of firms' disclosing decisions (*H*4).

- Also, we found firms' decisions to disclose help reduce the probability of symmetric order-flow shocks (PSOS) which is a measure of firm's illiquidity unrelated to information asymmetry (*H*5).

Interpretation

- We claim our paper can shed light on the changes in distributions of private information based trades in Japanese stock market possibly triggered by the introduction of the new disclosure rule by Tokyo Stock Exchange.

- The new accounting disclosure rule in Japan, enacted after the introduction of this stock market regulations can be implemented with the minimum extra disclosure cost without difficulty imposed to firms and accounting firms. Then, the extra social cost for new accounting regulations is minimum (Feltham and Christensen, 1988).

- However, it is empirically found that higher frequency of the interim disclosure leads to higher volatility of the stock returns (Mensah and Werner, 2008).

Future Work and Trend

- We believe the experience of TSE firms provides with us a valuable and unique social experiment, wherein the gradual decrease of informational asymmetry and the increase in market liquidity could be attained, commensurate with the introduction of new quarterly disclosure requirements.

- Further analysis of the market workings after quarterly reporting requirement of April 2008 by Japanese Accounting Standards Board was enacted is our future work.

- However, I have heard Japanese business communities are asking for the world to go back to the interim semi-annual reporting, which is in accordance with IASB standards, but not with FASB standards. We will see.