



The Changing Role of Foreign Investors in Tokyo Stock Price Formation

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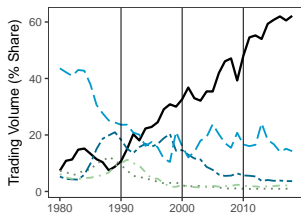
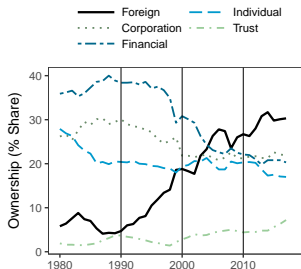
Introduction

- International stock market integration and financial liberalisation have facilitated an increase in foreign portfolio investment over recent decades.
- Foreign investors are now important participants in most local markets, especially EM.
 - Real effects (Henry, 2000a; Bekaert et al., 2005; Bekaert et al., 2011).
 - Liquidity (Bekaert et al., 2007; Rhee and Wang, 2009).
 - Volatility (Bae et al., 2004; Li et al., 2011).
 - Cost of capital (Bekaert and Harvey, 2000; Henry, 2000b).
 - Informational efficiency (Kacperczyk et al., 2018; He et al., 2013; He and Shen, 2014; Kang et al., 2016).
- However, exactly how foreign investors (FIs) contribute to the efficiency of local markets is less well understood.
 - What types of value-relevant information do FIs possess?
 - Have the types of information that FIs possess changed over time as stock markets have become more internationally integrated, and if so, how?

Introduction

- FIs may trade at an information advantage or disadvantage to locals.
 - FIs trade at an disadvantage regarding local information (Kang and Stulz, 1997; Coval and Moskowitz, 1999), but have an advantage in global information (Bae et al., 2012; Kang et al., 2016).
 - FIs outperform locals (Grinblatt and Keloharju, 2000; Karolyi, 2002; Kamesaka et al., 2003; Bae et al., 2006), but also underperform locals (Timmermann and Blake, 2005; Shukla and Inwegen, 1995; Choe et al., 2005).
 - National equity risk premia are internationally determined while the cross-section of stock returns likely is not (Karolyi and Stulz, 2003).
 - International stock market integration has increased local return correlations (Longin and Solnik, 1995; Christoffersen et al., 2012)
- What is the role of FIs in all of this?

Why Study the Role of FIs in Japanese Stocks?



- Unique for a developed market, FI share of ownership and trade has increased substantially since the 1980s.
- Long publicly available time series of transactions classified by investor type.
- Transactions are more closely related to efficiency than ownership (Boehmer and Kelley, 2009).
- Provide insight for other developed markets and complement the existing evidence on emerging markets.

Main Findings

1. **FIs are informed**, while domestic financial, trust and individual investors are uninformed.
 - FI's influence over the efficient price has **increased since around 2000**.
2. However, the increase in FI's information share is due to a substantial **increase in the importance of global stock price and exchange rate information** for the efficient price of Japanese stocks.
 - **Global stock prices** have become more important since around 2000, while the **exchange rate** is important in the 2010s.
3. FIs have shifted toward trading equities based on global information, as **international financial factors** have increasingly influenced the domestic market in recent decades.

Modelling Approach

- We modify Hasbrouck's (1991) "information content of trade" approach to identify the influence of foreign and domestic investors' trades on the efficient price, as well as the importance of public information.
 - VAR model of transactions and returns series.
 - Block-recursive identification.
- Benchmark model endogenous variables:
 - Transactions of four investor groups: FIs, domestic financial institutions, investment trusts, individual investors.
 - Public information represented by the TOPIX index.
- We compare the benchmark model to models including:
 - Global stock price information: S&P 500.
 - Foreign exchange rate information: USD/JPY.
 - Fundamental stock price information: forecast earnings per share.

Modelling the Efficient Price (Hasbrouck, 1991)

- The price of a security, p_t , may be decomposed into the efficient price, m_t , and mispricing, s_t :

$$p_t = m_t + s_t$$

$$m_t = m_{t-1} + \omega_t$$

where m_t follows a random walk process, s_t is a mean-zero covariance stationary process.

- The shock to the efficient price (ω_t) has a permanent influence on the security's price, while that to mispricing (s_t) has only a temporary effect.
- Investors' transactions affect the permanent component (ω_t) and mispricing (s_t).
- Investor groups having a positive long-run price impact (CIRF) and a substantial influence on the efficient price (σ_ω^2 , variance decomposition of the efficient price) are considered informed traders.

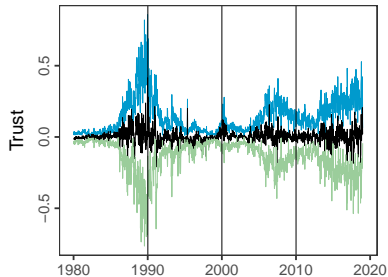
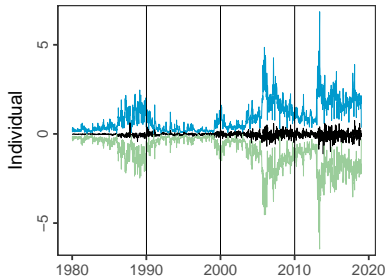
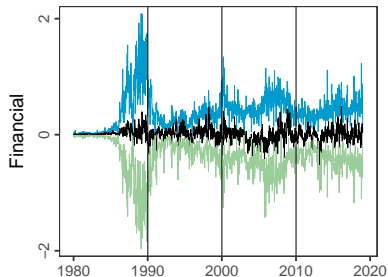
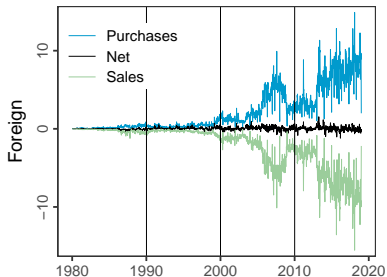
Transactions and Returns Data

- Sample: Weekly from January 1980 to December 2018, divided into four subsamples for the 1980s, 1990s, 2000s and 2010s.
- Transactions:
 - The value of purchases ($B_{g,t}$) and sales ($S_{g,t}$) by different groups of investors ($g = 1, \dots, 4$).
 - We use four investor groups (g) in our analysis: foreign, individual, investment, and financials.
 - Transactions in stocks that are listed on the 1st Section of the Tokyo Stock Exchange.
- Construct a trade Ratio ($x_{g,t}$) for each investor group:

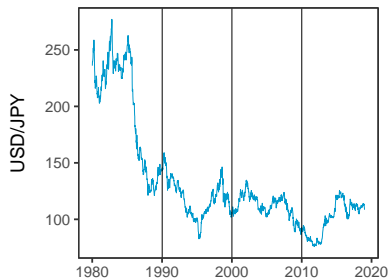
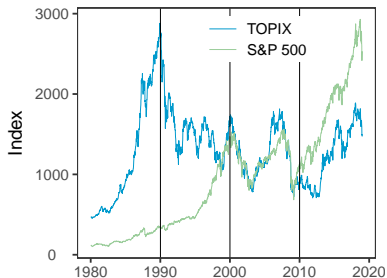
$$x_{g,t} = \log \left(\frac{B_{g,t}}{S_{g,t}} \right)$$

- Returns:
 - Weekly logarithmic return of TOPIX, S&P500 and USD/JPY.
 - Percentage change in forecast earnings per share (FEPS) calculated using NIKKEI forecast P/E ratio.






Transactions (weekly, yen trillions, sales negative)



Equity Index and Exchange Rate Data (weekly)



Benchmark Model

	1980s	1990s	2000s	2010s
<i>(a) Long-Run Price Impact of Trade</i>				
Foreign	1.27	1.89	2.07	1.82
Financial	-0.17	-0.44	0.06	0.04
Trust	0.27	-0.10	-0.36	-0.17
Individual	-0.45	-1.05	-1.02	-1.52
TOPIX	1.71	2.39	2.09	1.53
<i>(b) Variance Decomposition of the Efficient Price (%)</i>				
Foreign	33.23	33.84	 43.74	41.63
Financial	0.57	1.83	0.04	0.02
Trust	1.49	0.09	1.33	0.34
Individual	4.21	10.45	10.60	28.80
TOPIX	60.49	53.79	 44.29	 29.20
Trade-related	39.51	46.21	 55.71	 70.80
<i>(c) Share of the Trade-related Component (%)</i>				
Foreign	84.12	73.23	78.52	58.81
Financial	1.45	3.95	0.07	0.03
Trust	3.78	0.20	2.39	0.48
Individual	10.65	22.62	19.02	40.68

Note: Order of the variables is Foreign, Financial, Trust, Individual and TOPIX.

Model Including S&P 500 Returns

	1980s	1990s	2000s	2010s
<i>(a) Long-Run Price Impact of Trade</i>				
Foreign	0.68	1.59	1.06	1.21
Financial	-0.03	-0.46	0.05	0.12
Trust	0.21	-0.06	-0.21	-0.10
Individual	-0.32	-1.12	-0.71	-0.96
TOPIX	1.66	2.31	1.61	1.27
S&P 500	1.15	1.48	2.23	1.96
<i>(b) Variance Decomposition of the Efficient Price (%)</i>				
Foreign	9.81	22.00	↓ 12.15	↓ 18.69
Financial	0.02	1.82	0.03	0.19
Trust	0.95	0.03	0.48	0.12
Individual	2.25	10.86	5.39	11.79
TOPIX	58.70	46.33	↓ 27.96	↓ 20.41
S&P 500	28.27	18.95	↗ 54.00	48.79
Trade-related	13.03	34.72	18.04	30.79
<i>(c) Share of the Trade-related Component (%)</i>				
Foreign	↓ 75.31	↓ 63.37	↓ 67.32	60.68
Financial	0.14	5.25	0.16	0.63
Trust	7.30	0.08	2.64	0.40
Individual	17.25	31.29	29.88	38.29

Note: Order of the variables is S&P 500, Foreign, Financial, Trust, Individual and TOPIX.

Model Including Exchange Rate Returns

	1980s	1990s	2000s	2010s
<i>(a) Long-Run Price Impact of Trade</i>				
Foreign	1.06	1.89	1.86	1.27
Financial	-0.03	-0.44	0.01	0.01
Trust	0.25	-0.12	-0.16	-0.02
Individual	-0.23	-1.08	-1.02	-1.15
TOPIX	1.58	2.39	2.07	1.33
Exchange rate	-0.32	-0.19	0.88	1.82
<i>(b) Variance Decomposition of the Efficient Price (%)</i>				
Foreign	28.96	33.55	36.05	↓ 20.10
Financial	0.02	1.78	0.00	0.00
Trust	1.68	0.13	0.26	0.01
Individual	1.41	10.86	10.92	16.52
TOPIX	65.19	53.34	44.74	↓ 21.95
Exchange rate	2.73	0.33	↗ 8.03	↗ 41.42
Trade-related	32.08	46.32	47.23	↓ 36.63
<i>(c) Share of the Trade-related Component (%)</i>				
Foreign	90.29	72.44	76.33	↓ 54.88
Financial	0.07	3.85	0.00	0.01
Trust	5.23	0.27	0.54	0.01
Individual	4.41	23.44	23.13	45.09

Note: Order of the variables is USD/JPY exchange rate, foreign, financial, trust, individual and TOPIX.

Model Including S&P 500 and USD/JPY Returns

	1980s	1990s	2000s	2010s
<i>(a) Long-Run Price Impact of Trade</i>				
Foreigners	0.66	1.60	1.09	0.78
Financial	-0.01	-0.44	0.12	0.15
Trust	0.18	-0.06	-0.20	-0.18
Individual	-0.20	-1.15	-0.64	-0.73
TOPIX	1.47	2.23	1.55	1.21
S&P 500	0.98	1.45	2.25	1.78
Exchange rate	-0.27	-0.52	0.48	1.40
<i>(b) Variance Decomposition of the Efficient Price (%)</i>				
Foreign	11.81	22.35	12.68	↓↓ 7.83
Financial	0.00	1.67	0.17	0.30
Trust	0.92	0.04	0.45	0.40
Individual	1.08	11.63	4.45	6.91
TOPIX	58.43	43.64	↓ 25.65	↓ 18.89
S&P 500	25.75	18.35	↗ 54.16	↗ 40.62
Exchange rate	2.00	2.33	2.44	↗ 25.04
Trade-related	13.81	35.69	↓ 17.75	↓ 15.45
<i>(c) Share of the Trade-related Component (%)</i>				
Foreign	85.50	62.63	↓ 71.48	↓ 50.71
Financial	0.03	4.69	0.94	1.93
Trust	6.65	0.10	2.53	2.61
Individual	7.83	32.58	25.06	44.75

Note: Order is S&P 500, USD/JPY exchange rate, foreign, financial, trust, individual and TOPIX.

Model Including FEPS

	1990s	2000s	2010s
<i>(a) Long-Run Price Impact of Trade</i>			
Foreign	1.72	2.02	1.76
Financial	-0.77	0.06	0.08
Trust	0.02	-0.26	-0.16
Individual	-0.95	-1.05	-1.51
TOPIX	1.93	2.06	1.54
FEPS	0.13	-0.02	-0.45
<i>(b) Variance Decomposition of the Efficient Price (%)</i>			
Foreign	36.20	42.96	38.99
Financial	7.28	0.04	0.09
Trust	0.00	0.73	0.31
Individual	11.00	11.68	28.50
TOPIX	45.32	44.58	29.57
FEPS	0.20	0.00	2.53
Trade-related	54.49	55.41	67.90
<i>(c) Share of the Trade-related Component (%)</i>			
Foreign	66.44	77.53	57.43
Financial	13.37	0.07	0.13
Trust	0.01	1.32	0.46
Individual	20.19	21.08	41.98

Note: Order of the variables is FEPS, Foreign, Financial, Trust, Individual and TOPIX.

Model Including FEPS and S&P 500

	1990s	2000s	2010s
<i>(a) Long-Run Price Impact of Trade</i>			
Foreign	1.16	1.05	1.16
Financial	-0.66	0.07	0.16
Trust	-0.06	-0.20	-0.10
Individual	-0.83	-0.73	-0.96
TOPIX	1.56	1.58	1.27
FEPS	0.07	-0.04	-0.44
S&P 500	1.10	2.26	1.93
<i>(b) Variance Decomposition of the Efficient Price (%)</i>			
Foreign	22.10	11.89	17.18
Financial	7.05	0.05	0.31
Trust	0.07	0.44	0.12
Individual	11.10	5.76	11.68
TOPIX	39.85	26.88	20.60
FEPS	0.07	0.02	2.50
S&P	19.77	54.96	47.61
Trade-related	40.31	18.14	29.29
<i>(c) Share of the Trade-related Component (%)</i>			
Foreign	54.82	65.55	58.66
Financial	17.48	0.26	1.06
Trust	0.17	2.45	0.40
Individual	27.53	31.74	39.88

Note: Order of the variables is S&P 500, FEPS, Foreign, Financial, Trust, Individual and TOPIX.

Conclusion

- Using Hasbrouck's information content of trade methodology with TSE transactions and domestic and foreign returns information, we support the evidence that foreign investors improve the informational efficiency of Japanese stock prices.
- The increase in the influence of FI's trades on the efficient price is due to a substantial increase in the importance of global stock price and exchange rate information in stock price formation.
- As international financial factors increased in importance in the domestic market in recent decades, it appears that FI's have changed their trading strategy from forecasting domestic fundamentals to global financial factors.

Thank you

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Appendix

Summary Statistics for 1980s and 1990s

	Mean	Med	Max	Min	Sum	S.D	Skew	Kurt	ρ_1	ρ_2	ρ_3
<i>1980s Equity Transactions</i>											
Total purchases	2084.85	1050.03	9778.34	46.30	1084.12	2058.27	1.33	3.84	0.88	0.83	0.82
Total sales	2073.33	1040.86	9793.53	43.43	1078.13	2050.81	1.33	3.85	0.89	0.83	0.82
Net purchases	11.52	8.70	109.93	-142.02	5.99	25.47	0.24	7.84	0.43	0.23	0.18
Foreign purchases	189.16	134.97	881.95	3.02	98.36	153.75	1.21	4.10	0.69	0.54	0.51
Foreign sales	224.06	150.78	1226.62	5.09	116.51	196.79	1.20	4.24	0.88	0.82	0.81
Foreign net purchases	-34.90	-11.86	203.05	-1045.39	-18.15	94.21	-4.05	34.84	0.85	0.80	0.77
Financial purchases	358.07	84.20	2087.08	5.03	186.20	468.55	1.39	3.99	0.90	0.86	0.85
Financial sales	326.65	61.77	1969.98	1.88	169.86	443.75	1.46	4.24	0.89	0.85	0.84
Financial net purchases	31.43	12.15	394.24	-182.94	16.34	66.98	1.44	7.59	0.56	0.39	0.38
Trust purchases	142.34	49.28	857.57	3.02	74.02	168.94	1.62	5.02	0.89	0.86	0.86
Trust sales	132.07	48.85	764.97	1.15	68.67	157.57	1.69	5.16	0.89	0.86	0.85
Trust net purchases	10.28	1.73	415.08	-212.28	5.34	49.37	1.87	16.78	0.51	0.19	0.14
Individual purchases	595.13	407.91	2464.17	16.12	309.47	493.63	1.39	4.26	0.84	0.76	0.75
Individual sales	631.47	431.55	2477.82	18.71	328.36	518.85	1.35	4.15	0.84	0.76	0.75
Individual net purchases	-36.34	-19.60	623.10	-434.08	-18.90	65.94	0.55	25.50	0.48	0.28	0.22
<i>1980s Equity and Exchange Rate Returns</i>											
TOPIX	0.3497	0.3461	6.9552	-12.1678		1.8468	-0.57	7.77	0.00	0.06	0.07
S&P 500	0.2300	0.4604	8.4617	-13.0071		2.2416	-0.61	6.42	0.01	0.04	-0.04
JPY	-0.0943	0.0373	6.3120	-8.6974		1.5251	-0.64	5.73	0.09	0.09	0.04
<i>1990s Equity Transactions</i>											
Total purchases	1804.39	1584.91	5415.19	125.43	940.09	928.42	1.32	4.78	0.80	0.70	0.64
Total sales	1793.86	1570.32	5405.68	121.51	934.60	929.53	1.33	4.81	0.80	0.70	0.64
Net purchases	10.52	11.37	133.24	-146.73	5.48	20.62	-0.77	16.76	0.43	0.30	0.13
Foreign purchases	422.40	346.24	1860.58	19.42	220.07	266.30	1.95	7.92	0.83	0.75	0.71
Foreign sales	376.88	320.11	1465.84	13.67	196.36	220.95	1.69	6.99	0.87	0.79	0.76
Foreign net purchases	45.52	30.84	719.86	-519.35	23.72	126.99	0.65	6.76	0.62	0.52	0.40
Financial purchases	306.64	285.93	952.35	12.64	159.76	161.18	1.12	4.79	0.75	0.63	0.57
Financial sales	293.38	242.74	1044.81	5.75	152.85	190.53	1.30	4.67	0.77	0.65	0.59
Financial net purchases	13.26	19.23	476.02	-543.45	6.91	109.08	-0.38	5.37	0.63	0.48	0.43
Trust purchases	103.41	70.81	689.14	5.74	53.88	99.26	2.22	8.95	0.86	0.81	0.76
Trust sales	114.31	83.61	644.84	1.95	59.55	97.45	1.91	6.94	0.86	0.81	0.76
Trust net purchases	-10.90	-9.84	280.44	-210.18	-5.68	45.90	0.93	10.99	0.59	0.37	0.26
Individual purchases	325.45	220.77	1629.21	21.00	169.56	264.91	1.84	6.38	0.83	0.72	0.65
Individual sales	343.49	246.58	1408.17	24.19	178.96	251.76	1.64	5.54	0.82	0.72	0.66
Individual net purchases	-18.04	-19.29	384.58	-264.93	-9.40	68.53	1.20	9.15	0.48	0.38	0.20
<i>1990s Equity and Exchange Rate Returns</i>											
TOPIX	-0.0956	-0.0381	10.8383	-11.9169		2.7857	-0.03	4.74	-0.01	0.08	0.04
S&P 500	0.2741	0.3456	7.0619	-6.8626		1.8624	-0.05	3.77	-0.12	0.07	0.01
JPY	-0.0650	0.1094	5.9878	-14.9794		1.7284	-1.48	13.56	-0.04	0.05	-0.01

Summary Statistics for 2000s and 2010s

	Mean	Med	Max	Min	Sum	S.D.	Skew	Kurt	ρ_1	ρ_2	ρ_3
<i>2000s Equity Transactions</i>											
Total purchases	6655.49	5507.85	18911.57	170.15	3474.16	3712.40	0.81	2.74	0.88	0.82	0.82
Total sales	6651.60	5496.66	18907.18	169.55	3472.14	3713.76	0.81	2.75	0.88	0.82	0.82
Net purchases	3.88	4.15	84.70	-87.00	2.03	20.27	-0.20	4.33	0.20	0.08	0.03
Foreign purchases	2699.85	2033.32	9921.18	61.52	1409.32	1795.67	0.94	2.93	0.90	0.85	0.85
Foreign sales	2638.04	1930.63	10122.76	61.90	1377.06	1794.86	1.04	3.26	0.90	0.84	0.83
Foreign net purchases	61.81	48.65	932.43	-911.73	32.27	224.04	-0.03	4.15	0.39	0.31	0.27
Financial purchases	504.76	481.61	1341.30	18.86	263.49	185.05	0.78	4.83	0.62	0.48	0.42
Financial sales	525.80	494.05	1424.84	5.86	274.47	211.07	0.85	4.42	0.64	0.46	0.43
Financial net purchases	-21.03	-18.64	438.73	-692.50	-10.98	131.90	0.12	4.90	0.62	0.48	0.42
Trust purchases	130.32	115.94	410.57	2.23	68.03	75.89	0.69	2.72	0.82	0.78	0.76
Trust sales	120.66	99.21	431.36	1.45	62.98	74.17	0.89	3.32	0.83	0.78	0.77
Trust net purchases	9.66	6.08	226.39	-197.84	5.04	33.82	0.60	9.25	0.45	0.39	0.26
Individual purchases	1196.72	1010.39	4859.04	30.65	624.69	825.24	1.31	5.17	0.89	0.84	0.82
Individual sales	1233.22	1078.94	4534.86	28.43	643.74	831.54	1.16	4.47	0.89	0.85	0.83
Individual net purchases	-36.51	-32.87	587.79	-691.38	-19.06	173.81	0.03	4.29	0.16	0.10	0.04
<i>2000s Equity and Exchange Rate Returns</i>											
TOPIX	-0.1227	0.1026	9.2469	-22.0185		2.9393	-0.94	8.72	-0.06	0.04	-0.03
S&P 500	-0.0528	0.0958	11.3559	-20.0837		2.7847	-0.86	10.07	-0.06	0.06	-0.09
JPY	-0.0186	0.0208	4.5521	-7.5236		1.4609	-0.37	4.42	-0.07	0.06	-0.03
<i>2010s Equity Transactions</i>											
Total purchases	10170.49	10462.93	23617.75	2048.79	4780.13	3936.67	0.16	2.42	0.77	0.68	0.68
Total sales	10167.24	10466.92	23664.30	2047.38	4778.60	3934.44	0.16	2.43	0.77	0.69	0.68
Net purchases	3.25	2.11	89.91	-80.64	1.53	17.38	0.40	7.88	0.33	0.12	0.06
Foreign purchases	5961.64	6160.41	14896.54	1029.23	2801.97	2545.00	0.14	2.20	0.80	0.73	0.72
Foreign sales	5930.58	6214.47	15535.88	844.97	2787.37	2574.39	0.20	2.33	0.81	0.74	0.73
Foreign net purchases	31.06	17.93	1535.62	-1193.50	14.60	289.11	0.23	6.27	0.44	0.30	0.18
Financial purchases	417.12	402.15	1229.02	50.77	196.05	149.76	1.02	6.05	0.48	0.30	0.27
Financial sales	421.62	406.18	1179.05	49.61	198.16	155.32	0.99	5.68	0.47	0.37	0.37
Financial net purchases	-4.49	-6.39	487.89	-543.13	-2.11	116.46	-0.14	5.15	0.61	0.45	0.37
Trust purchases	196.11	187.37	527.98	21.28	92.17	88.32	0.56	2.97	0.69	0.62	0.59
Trust sales	195.97	184.74	537.65	19.70	92.11	91.58	0.71	3.46	0.71	0.61	0.60
Trust net purchases	0.14	0.74	205.39	-223.45	0.07	51.88	-0.38	6.16	0.40	0.17	0.07
Individual purchases	1677.21	1660.68	6855.67	351.73	788.29	775.06	1.46	8.95	0.78	0.69	0.66
Individual sales	1742.05	1699.22	6456.86	303.72	818.76	819.34	1.29	7.37	0.77	0.68	0.65
Individual net purchases	-64.83	-47.90	746.69	-1124.51	-30.47	237.41	-0.47	5.03	0.31	0.11	0.01
<i>2010s Equity and Exchange Rate Returns</i>											
TOPIX	0.1028	0.3788	8.4911	-13.4842		2.6198	-0.62	4.91	0.03	0.00	-0.06
S&P 500	0.1745	0.2835	7.1284	-7.4603		1.9800	-0.60	4.93	-0.11	0.00	-0.05
JPY	0.0327	0.0635	4.2261	-4.8477		1.3253	-0.10	3.54	-0.02	-0.01	0.00

Correlations between Endogenous Variables

	For	Fin	Tru	Ind	TOP	SP5	For	Fin	Tru	Ind	TOP	SP5
<i>1980s</i>						<i>1990s</i>						
Fin	-0.24***						-0.49***					
Tru	-0.37***	0.01					-0.27***	0.15***				
Ind	-0.43***	-0.04	-0.20***				-0.29***	-0.14***	0.06			
TOP	0.33***	-0.21***	0.01	-0.29***			0.24***	-0.30***	-0.10**	-0.26***		
SP5	0.25***	-0.15***	0.03	-0.19***	0.37***		0.11***	-0.13***	-0.05	-0.17***	0.33***	
JPY	-0.10**	0.12***	-0.04	0.14***	-0.16***	-0.04	0.02	0.00	-0.04	-0.04	-0.07	0.11**
<i>2000s</i>						<i>2010s</i>						
Fin	-0.55***						-0.45***					
Tru	-0.25***	0.30***					-0.21***	0.43***				
Ind	-0.56***	0.17***	0.07*				-0.63***	0.16***	0.19***			
TOP	0.48***	-0.18***	-0.03	-0.64***			0.51***	-0.10**	-0.11**	-0.75***		
SP5	0.25***	-0.12***	0.00	-0.34***	0.52***		0.28***	-0.06	-0.06	-0.49***	0.56***	
JPY	-0.04	-0.01	-0.02	-0.09*	0.22***	0.22***	0.30***	-0.09*	-0.12***	-0.44***	0.57***	0.28***

Note: Significant at 1% shown by ***, at 5% shown by **, at 10% shown by *.