

Stock Effects of the Bank of Japan's Equity Holdings

Hibiki Ichiue (Keio University)

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EEA-ESEM

BoJ purchases of equity ETFs

- The first announcement on 10/05/2010.
- On 03/31/2021, its holdings stood at ¥51.5 trillion.
 - More than 10% of free float market cap of the 1st Section of the TSE.
- Most ETFs are TOPIX or Nikkei 225 index ETFs.
- In March 2021, the BoJ decided to purchase only TOPIX ETFs from April.
- The BoJ has not sold any of the ETFs and still holds a large amount.

Flow and stock effects

- Flow effects are defined as the response of prices to ongoing purchasing operations.
 - Flow effects may simply reflect short-run liquidity effects.
 - Flow effects may understate the overall effect: e.g., if market prices already incorporate the expected impact as the result of the announcement, the market responses to actual purchases may be weak.
- Stock effects can be defined as persistent changes in asset prices that result from changes in actual and expected central bank holdings.
 - The literature often uses event studies to measure stock effects.

What I do

- I estimate the price multiplier or the pp changes in returns when investors (i.e., the BoJ) increase their holdings by 1% of the market cap.
- The baseline analysis runs cross-sectional IV regressions of security-level cumulative returns between 9/30/2010 and 03/31/2021 on the share of BoJ holdings in the market cap on 03/31/2021.
 - While stock prices reflected expectations of the BoJ's future purchases of Nikkei 225 ETFs before the end of the purchases, there are no such expectations after that.

Literature

- Central bank bond purchases
 - Event study (e.g., Gagnon et al., 2011; Krishnamurthy et al. 2011)
 - Cross-sectional regressions (D'Amico and King 2013)
- The BoJ's ETF purchases
 - Flow effects (e.g., Matsuki et al., 2015; Shirota, 2018; Harada and Okimoto, 2019; Charoenwong et al., 2021; Fukuda and Tanaka, 2022; Fukui et al., 2022; Hattori and Yoshida 2023)
 - Event study (Barbon and Gianinazzi 2019; Katagiri et al. 2022a)
- Estimating the price multiplier (e.g., Shleifer 1986; Harris and Gurel 1986, Wurgler and Zhuravskaya 2002; Gabaix and Koijen 2022)

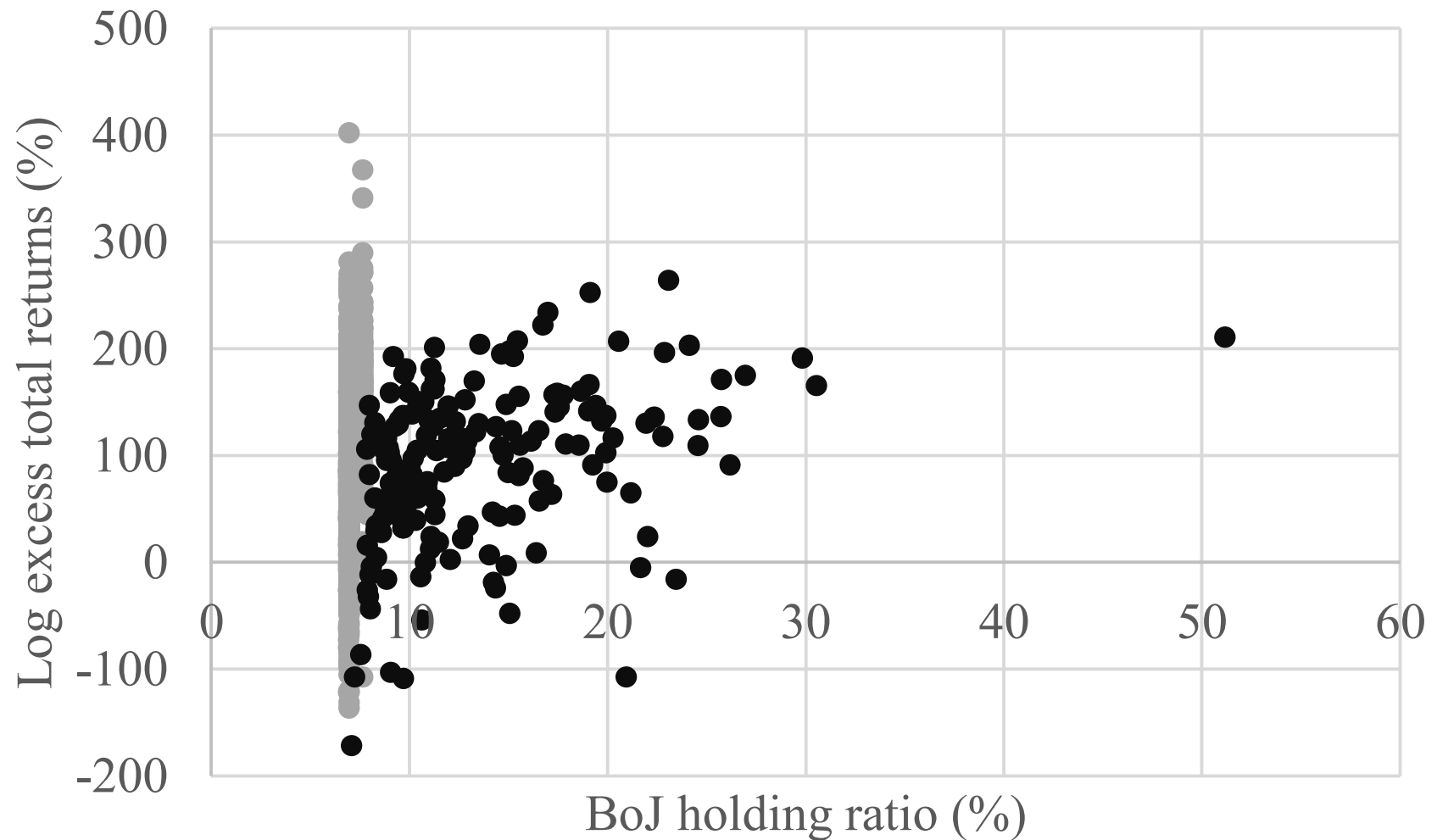
Outline

- Introduction
- Baseline analysis
- Fama-Macbeth regressions
- Conclusion
- Other analysis

Top 10 non-financial firms by BoJ holdings to free float on 03/31/2021

Ranking	Firm name	(1) BoJ holdings to free float (%)	(2) Nikkei 225 weight to TOPIX weight (multiple)	(3) BoJ holdings (trill. yen)
1	Fast Retailing Co Ltd	104.8	25.1	1.96
2	Konami Group Corp	44.0	9.3	0.17
3	Advantest Corp	42.5	8.9	0.49
4	Taiyo Yuden Co Ltd	36.9	7.4	0.14
5	Hitachi Construction Machinery Co Ltd	35.5	7.1	0.09
6	COMSYS Holdings Corp	34.7	6.9	0.09
7	TDK Corp	34.6	6.8	0.41
8	Matsui Securities Co Ltd	33.8	6.8	0.02
9	NTT Data Corp	32.6	6.3	0.24
10	Trend Micro Inc/Japan	32.5	6.3	0.15

Total returns against the BoJ holding ratio



Overview of baseline model

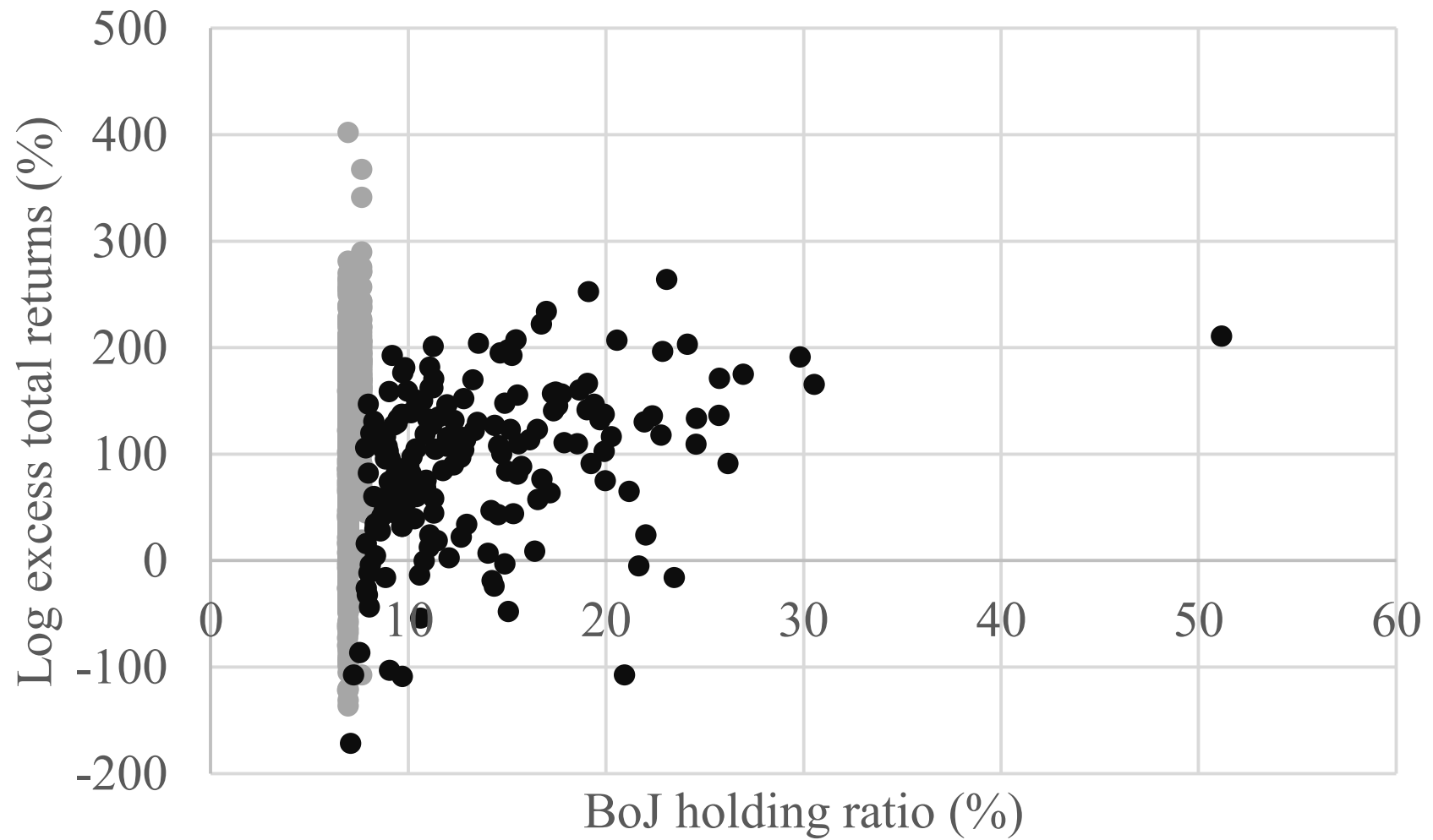
$$R_n = \gamma Q_n + \rho' Z_n + \epsilon_n$$

- R_n is the raw or abnormal return between 09/30/2010 and 03/31/2021 on stock n .
- Q_n is the BoJ holding ratio on 03/31/2021.
 - Instrumented by the index weight ratio on 09/30/2010.
- Z_n is a vector of controls, which are calculated using data up to 09/30/2010.
- 1,158 non-financial stocks that were listed in the 1st Section of the TSE and for which price observations were essentially available for all business days between 09/30/2005 and 03/31/2021.
- All variables are winsorized at the 1 and 99% levels.
- Standard errors are clustered at the industry level as of 09/30/2010.

Results

	(1)	(2)	(3)	(4)	(5)	(6)
	Raw	1 factor	3 factors	4 factors	5 factors	6 factors
BoJ holding ratio	5.73** (4.98)	5.95** (4.19)	6.40** (4.70)	6.74** (4.82)	5.21** (3.83)	5.54** (3.89)
Beta	-0.22	-0.78**	-0.62**	-0.68**	-0.57**	-0.65**
Firm size	0.02	0.01	0.09*	0.09*	0.05	0.05
Book to market ratio	0.14	0.20*	0.30**	0.31**	0.34**	0.38**
Profitability	1.42**	1.73**	1.80**	1.88**	1.88**	2.04**
Asset growth	-0.77*	-1.20**	-1.17**	-1.21**	-1.31**	-1.36**
Lagged returns	-0.19*	0.01	0.02	0.03	0.01	0.03
Nikkei 225 member	-0.37**	-0.38**	-0.35**	-0.36**	-0.31**	-0.33**
Observations	1,158	1,158	1,158	1,158	1,158	1,158
<i>R</i> -squared	0.088	0.227	0.201	0.217	0.193	0.215

Distributional effects



When did the index weight ratio predict returns?

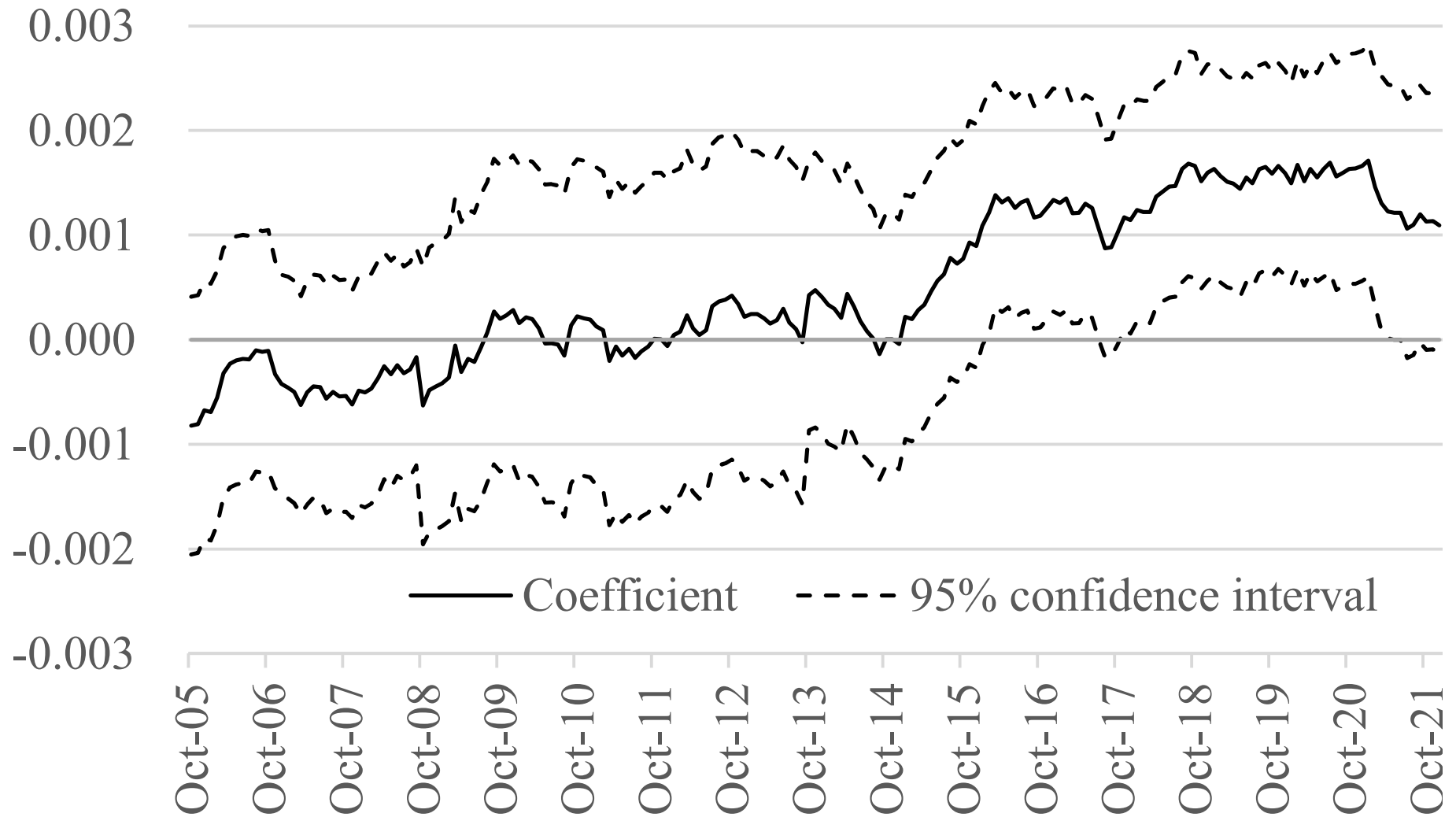
- In the baseline IV regression, it is assumed that the index weight ratio contained information beyond the controls to predict the return only through the BoJ holding ratio.
- If this assumption holds, the index weight ratio should be able to forecast future returns only after the BoJ made the first announcement of ETF purchases.
- This prediction is checked by Fama-Macbeth (1973) regressions

Fama-Macbeth regressions

$$r_{n,t+1} = \gamma q_{n,t} + \rho' z_{n,t} + \epsilon_{n,t+1}$$

- $r_{n,t+1}$ is one-month raw return on stock n .
- $q_{n,t}$ is the index weight ratio.
- $z_{n,t}$ is a vector of controls, which are essentially the same as those used in the baseline, they differ in two respects.
 - I employ a 6-month gap, following the Fama and French (1993).
 - I use the 11-month lagged, skipping the most recent month, instead of the 3-year lagged return.
- All variables are winsorized at the 1 and 99% levels.
- The coefficients are obtained by taking the averages of the coefficients estimated in the cross-sectional regression for each month.

5Y rolling FM regressions



Conclusion

- The stock effect of the BoJ's ETF holdings is very large.
- The price multiplier may be larger when shocks originate from investors who are expected to hold assets for a longer period of time, irrespective of price developments.

Other analysis

- Predictive power of the index weight ratio
- Do other investors' stock holdings contaminate the baseline results?
- Effects on profitability, investment, and governance
- Normalizing BoJ holdings using shares outstanding
- Are the effects permanent?
- ETF weights vs. index weight
- Portfolio analysis
- Issues regarding the free float

Background: amount of purchases

- Started as a temporary measure that was supposed to be terminated by around the end of 2011, with a maximum amount of only around ¥0.45 trillion.
- The BoJ has repeatedly increased the maximum amount and extended the termination date.
- In April 2013, the BoJ moved to open-ended purchases at an annual pace of increase in the amount outstanding of ¥1 trillion with the introduction of QQE.
- The BoJ subsequently increased the pace of purchases several times.
- The BoJ's announcements often did not provide sufficient information.
 - In 2017, many discussed the possibility that the BoJ would increase the pace of purchases to meet the target by the end of year.

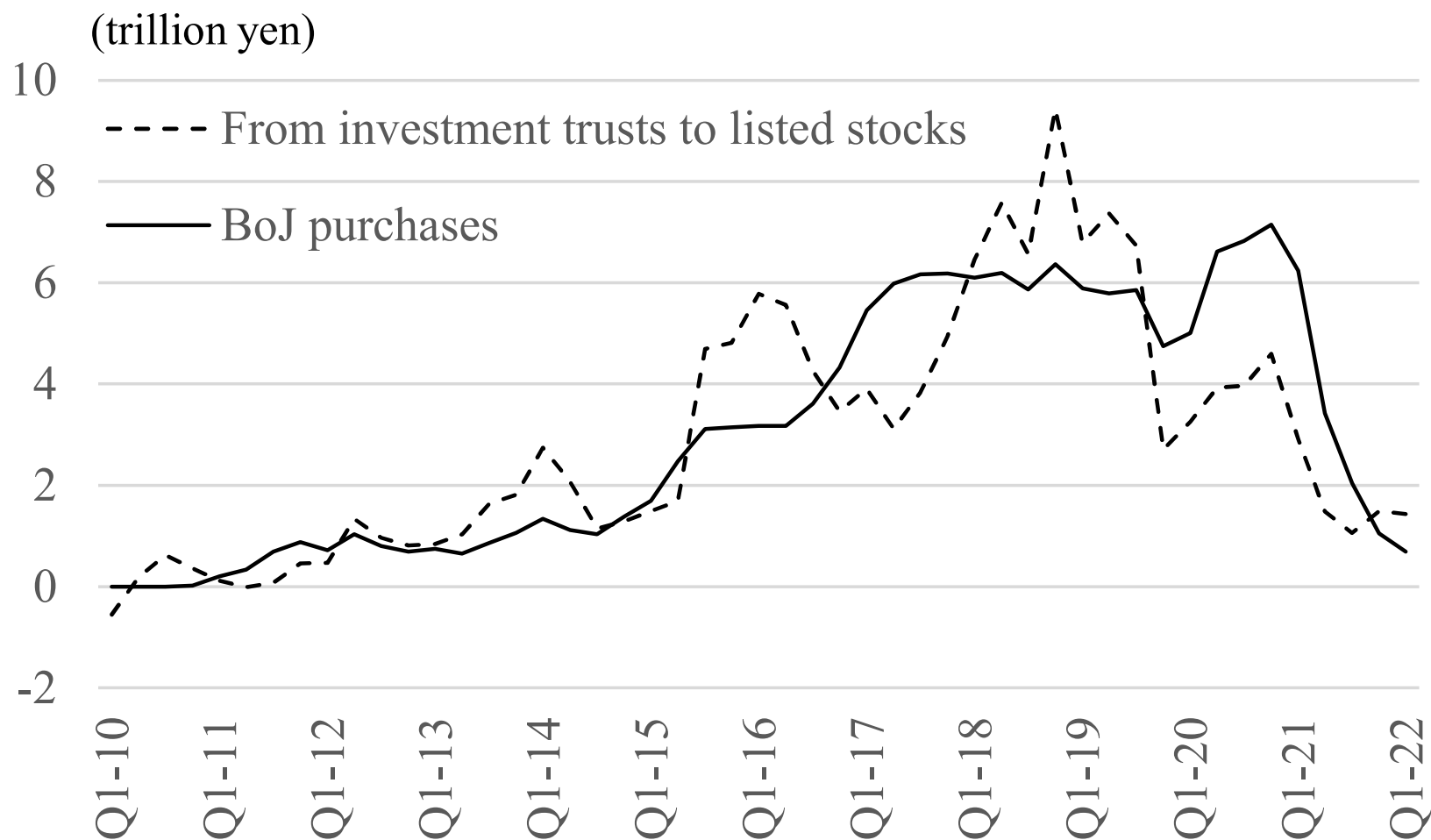
Background: composition of purchases

- The BoJ initially purchased only ETFs that track the TOPIX or the Nikkei 225. In 2014, it added ETFs that track the JPX-Nikkei 400 index.
- Until September 2016, the BoJ allocated ETF purchases roughly in proportion to the total market value of individual ETFs. Since then, the BoJ has revised the ETF purchase program several times to increase the allocation weight to TOPIX ETFs.
 - E.g., it allocated about 25% to ETFs tracking either of the three indexes, taking into account the amount outstanding in circulation of ETFs, while about 75% was allocated to investment in TOPIX ETFs only.
 - In March 2021, the BoJ decided to purchase TOPIX ETFs only from April onward.

Background: different programs

- In 2016, the BoJ established a supplementary program to purchase ETFs to support firms proactively investing in physical and human capital.
 - The size of purchases has been only ¥0.3 trillion per year.
 - The BoJ has held less than ¥0.15 trillion of these ETFs and allocated most of the funds from the supplementary program to JPX-Nikkei 400 ETFs instead (Samigawa and Nakano 2021).
 - In March 2021, the BoJ decided that from April it would not purchase JPX-Nikkei 400 ETFs.
- Under a different program, the BoJ purchased stocks from banks to encourage them to reduce stock holdings until April 2010.
 - Total net sales from 2010 to 2021 are only ¥1.9 trillion.

Flows from the BoJ to funds and from funds to listed stocks (trillion yen, 4Q MA)



The BoJ's indirect stock holdings

	Frequency	Source
BoJ purchases	Daily	BoJ
Market capitalization of ETFs	Daily	Nikkei NEEDS
Last prices of indexes	Daily	Bloomberg
Weights within indexes	Daily	Bloomberg

Data Sources

	Frequency	Source
Flow of Funds Accounts	Quarterly	BoJ
BoJ ETF purchases	Daily	BoJ
Market capitalization of ETFs	Daily	Nikkei NEEDS
Last prices of indexes	Daily	Bloomberg
BoJ's total ETF holdings	Annual	BoJ
Weights of indexes	Daily	Bloomberg
Stock prices	Daily	Bloomberg
TSE-defined free float	Daily	Bloomberg
Bloomberg-defined free float weights	Daily	Bloomberg
Total return indexes of individual stocks	Daily	Financial Data Solutions Inc.
Common equity	Daily	Financial Data Solutions Inc.
Uncollateralized overnight call rate	Daily	BoJ
Fama-French-Carhart 6 factors	Monthly	Kenneth French
Exchange rates	Monthly	BoJ
TSE First Section Total Return Index	Daily	Bloomberg
Book values	Annual	Nikkei NEEDS
Current earnings	Annual	Nikkei NEEDS
Total assets	Annual	Nikkei NEEDS
Treasury stocks	Annual	Nikkei NEEDS
Weights of ETFs	Daily	Bloomberg
Total flows into publicly offered Nikkei 225 index funds	Monthly	Investment Trusts Association, Japan
GPIF's exposures to individual stocks	Annual	GPIF
Nikkei Stock Average Volatility Index	Daily	Bloomberg

Estimation of the BoJ's Indirect Stock Holdings: the first step

- When the BoJ purchased ETFs roughly in proportion to their total market value, it is assumed that the BoJ made purchases exactly in proportion to the ETF's market value on the previous day.
- When the BoJ purchased ETFs taking the amount outstanding in circulation into account, it is assumed that the BoJ purchased them in proportion to the market value minus its holdings on the previous day.
 - Since the holdings are estimated in the second step, the first and second steps are iteratively carried out 10 times.
- As for the supplementary program, it is assumed that the BoJ allocated all funds for the program to JPX-Nikkei 400 ETFs.
- The data cover 27 ETFs, excluding leveraged and inverse ETFs.

Estimation of the BoJ's Indirect Stock Holdings: the second step

- The BoJ's holdings of each ETF are estimated by cumulating returns and flows:

$$h_{j,t} = h_{j,t-1}(1 + r_{j,t}) + f_{j,t}$$

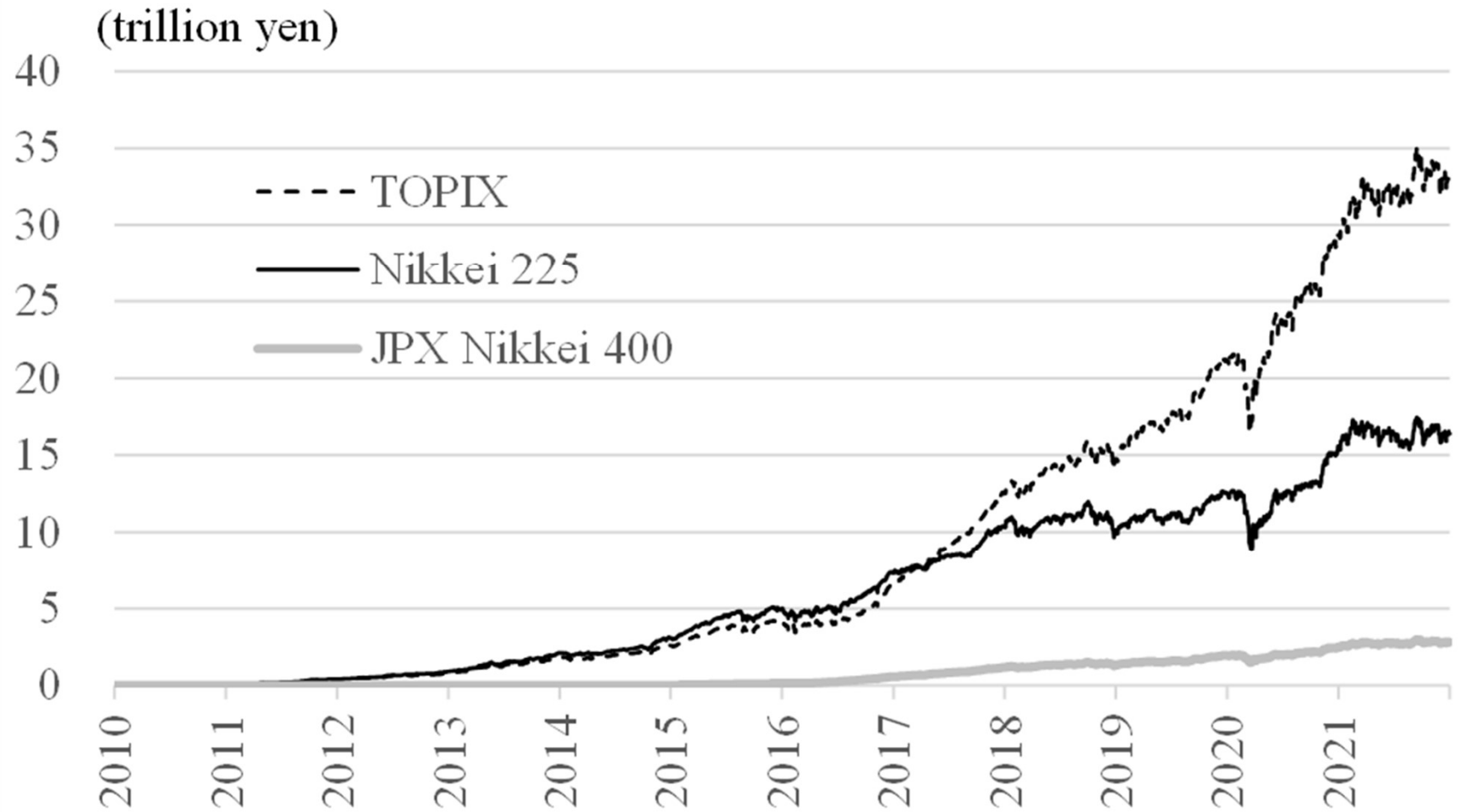
- The estimated holdings are adjusted for using the BoJ's accounting data on the market value of its total ETF holdings at the end of March from 2015 through 2021.
- The estimated BoJ holdings of each ETF are adjusted by the same adjustment rate so that the sum of the adjusted BoJ holdings is equal to the BoJ's accounting data for each end of March.
- The adjustment rate is linearly interpolated for all days from 04/01/2015 to 03/30/2021, and a constant rate is assumed up to 03/31/2015 and from 03/31/2021.

Adjustment rate

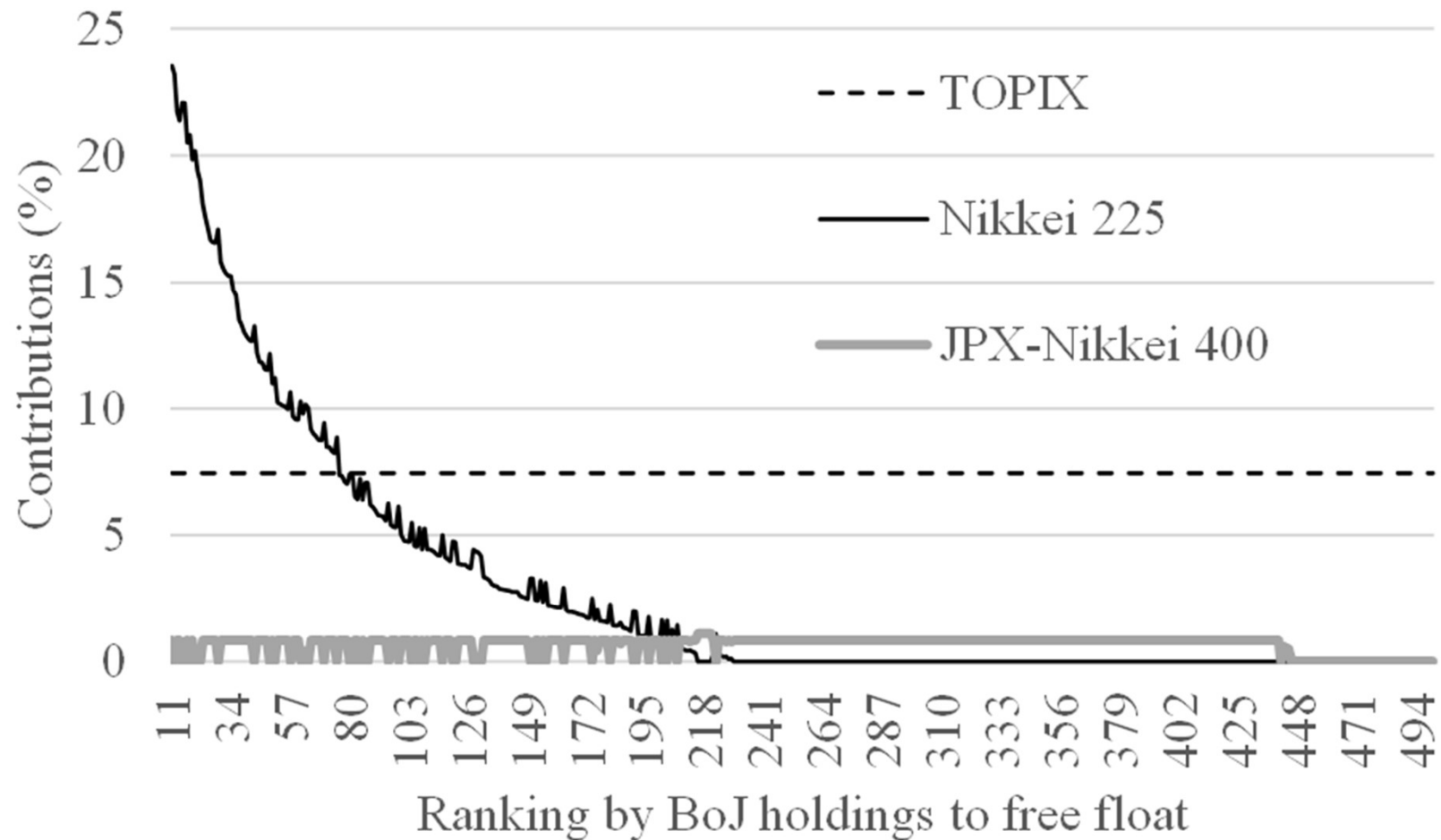
- The unadjusted estimates underestimate the BoJ's holdings, likely in part because it is assumed that the BoJ purchased ETFs at the closing price.
- In practice, it likely purchased ETFs at a lower price due to its *de facto* rule of purchasing ETFs in the afternoon of days on which stock prices fell sharply in the morning.

	2015	2016	2017	2018	2019	2020	2021
Adjusted holdings (trillion yen)	7.0	8.8	15.9	24.5	28.9	31.2	51.5
Pre-adjusted holdings (trillion yen)	6.9	8.6	15.7	24.2	28.5	30.6	50.7
Adjustment rate (%)	1.31	1.50	1.27	1.24	1.40	1.96	1.58

BoJ holdings of ETFs by index



Contributions of indexes to BoJ Holdings to Free Float



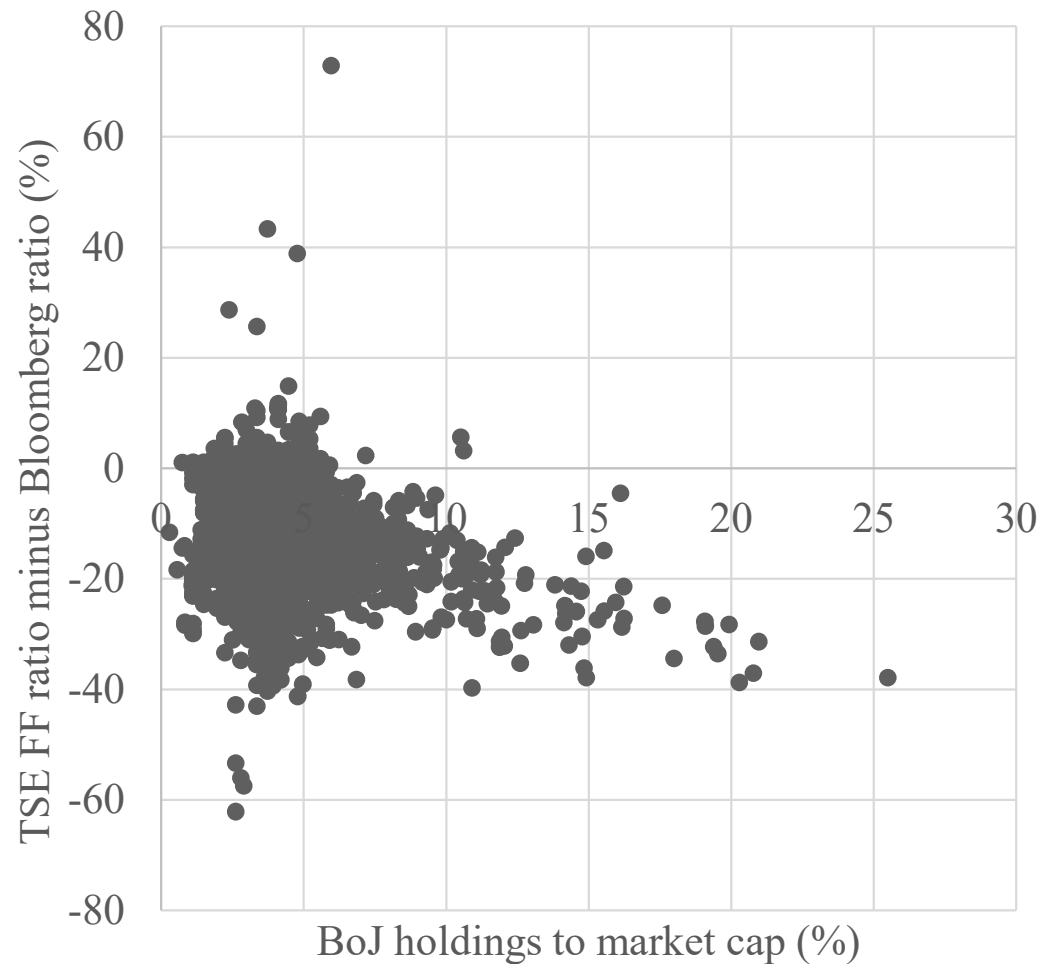
BoJ holding ratio

- BoJ holdings are normalized by the free float, not the shares outstanding (i.e., shares issued minus treasury stocks).
- Harada (2021) argues that the TSE appears to exclude BoJ holdings from the free float.
- Appendix B for further considerations and evidence to support her argument.
- Based on this evidence, the baseline regressions use the ratio of BoJ holdings to the sum of BoJ holdings and the free float market capitalization.
- This ratio is called the BoJ holding ratio.

Issues on Free Float

- Harada (2021) argues that the TSE appears to exclude BoJ holdings from its definition of free float.
- The TSE in principle excludes stocks held by the top 10 largest shareholders, treasury stocks, and so forth.
- Many of the top 10 largest shareholders are trust banks.
- The TSE can make an exception when trust banks manage stocks held by an unspecified large number of investors.
- Harada (2021) shows that the TSE-defined free float ratio (the ratio of free float to shares issued) is much lower than the Bloomberg-defined free float ratio for the 15 stocks for which the BoJ share appears to be high.
- This paper examines 2,177 stocks that were listed on the 1st section of the TSE on March 31, 2021.

Free float ratio difference vs. BoJ holdings to market cap



$$y = -0.0695$$

(0.0041)

$$-1.1731 x$$

(0.0854)

$$R^2 = 0.0798$$

IV

- Since the BoJ purchases stocks indirectly through ETFs and follows preannounced rules in selecting the ETFs it purchases, there is little leeway for the BoJ to favor specific stocks.
- Potential sources of endogeneity
 - Better firm fundamentals lead to both a higher return and a higher probability that the stock will be added to or remain in the Nikkei index, resulting in larger BoJ holdings.
- The ratio of the Nikkei 225 weight to the TOPIX weight of a stock on September 30, 2010, is used to instrument the BoJ holding ratio.

Summary statistics

	(1)	(2)	(3)	(4)	(5)
	Mean	Median	Std. dev.	Min	Max
Raw return	0.938	0.916	0.716	-1.710	4.027
Abnormal return (1 factor)	-0.101	-0.044	0.846	-3.593	2.786
Abnormal return (3 factors)	-0.227	-0.163	0.801	-3.566	2.745
Abnormal return (4 factors)	-0.275	-0.212	0.830	-3.564	2.619
Abnormal return (5 factors)	-0.116	-0.061	0.780	-3.427	2.973
Abnormal return (6 factors)	-0.153	-0.102	0.831	-3.687	2.794
BoJ holding ratio	0.081	0.069	0.033	0.069	0.512
Index weight ratio	0.440	0.000	1.526	0.000	19.496
Beta	0.969	0.956	0.382	0.154	2.503
Firm size	24.474	24.240	1.585	21.183	29.872
Book-to-market ratio	0.073	0.106	0.538	-2.979	1.620
Profitability	0.085	0.077	0.120	-0.514	1.415
Asset growth	-0.001	0.001	0.097	-1.032	0.583
Lagged returns	-0.495	-0.475	0.398	-2.811	1.151
Nikkei 225 member	0.153	0.000	0.360	0.000	1.000

First-stage regressions

	(1)	(2)
	Full sample	Subsample
Index weight ratio	0.0191** (11.13)	0.0181** (19.68)
Beta	0.0007	-0.0061
Firm size	0.0033**	0.0065**
Book to market ratio	-0.0019	-0.0096
Profitability	-0.0048	-0.0202
Asset growth	-0.0069	-0.0058
Lagged returns	-0.0038	-0.0084
Nikkei 225 member	-0.0041	
Observations	1,158	177
<i>R</i> -squared	0.772	0.780
Keibergen-Paap <i>F</i> -stat.	123.8	387.2

Summary of regression results

	(1)	(2)	(3)	(4)	(5)	(6)
	Raw	1 factor	3 factors	4 factors	5 factors	6 factors
<i>Panel A: Baseline IV regressions</i>						
Full sample	5.73** (4.98)	5.95** (4.19)	6.40** (4.70)	6.74** (4.82)	5.21** (3.83)	5.54** (3.89)
Subsample	5.56** (5.90)	6.03** (5.24)	5.89** (5.29)	6.26** (5.58)	4.94** (4.20)	5.27** (4.23)
<i>Panel B: OLS regressions</i>						
Full sample	6.76** (7.01)	6.72** (6.04)	6.48** (5.97)	6.88** (6.14)	5.49** (5.20)	5.93** (5.31)
Subsample	5.47** (5.62)	5.91** (4.97)	5.57** (4.93)	5.91** (5.04)	4.71** (4.08)	5.07** (4.01)
<i>Panel C: Normalizing BoJ holdings by shares outstanding</i>						
Full sample	7.69** (4.77)	8.22** (4.10)	8.90** (4.62)	9.38** (4.73)	7.30** (3.76)	7.76** (3.83)
Subsample	7.84** (5.29)	8.82** (4.84)	8.79** (4.88)	9.39** (5.12)	7.39** (3.95)	8.01** (4.10)

Normalizing BoJ holdings using shares outstanding

- Many studies using U.S. data employ the market capitalization of shares outstanding instead of the free float to normalize demand shocks.
- The market capitalization of shares outstanding on 03/31/2021 is estimated by multiplying one minus the ratio of treasury stocks to issued stocks in financial year 2020 by the market capitalization of issued stocks as of 03/31/2021.
- The ratio of the Nikkei 225 weight to the market capitalization of shares outstanding on 09/30/2010 is used as the IV.

Normalizing BoJ holdings by different market cap

	(1)	(2)	(3)	(4)	(5)	(6)
	Raw	1 factor	3 factors	4 factors	5 factors	6 factors
<i>Panel A: Baseline IV regressions</i>						
Full sample	5.73** (4.98)	5.95** (4.19)	6.40** (4.70)	6.74** (4.82)	5.21** (3.83)	5.54** (3.89)
Subsample	5.56** (5.90)	6.03** (5.24)	5.89** (5.29)	6.26** (5.58)	4.94** (4.20)	5.27** (4.23)
<i>Panel B: Normalizing BoJ holdings by Bloomberg free float weights</i>						
Full sample	6.33** (4.63)	6.61** (4.01)	7.02** (4.53)	7.42** (4.67)	5.73** (3.70)	6.15** (3.81)
Subsample	6.13** (5.19)	6.64** (4.64)	6.53** (4.77)	6.95** (5.02)	5.49** (3.87)	5.93** (3.94)
<i>Panel C: Normalizing BoJ holdings by shares outstanding</i>						
Full sample	7.69** (4.77)	8.22** (4.10)	8.90** (4.62)	9.38** (4.73)	7.30** (3.76)	7.76** (3.83)
Subsample	7.84** (5.29)	8.82** (4.84)	8.79** (4.88)	9.39** (5.12)	7.39** (3.95)	8.01** (4.10)

Distributional effects

- The impact of BoJ holdings on relative returns is examined.
 - The cross-sectional regression fails to capture part of the policy effect by which returns on all stocks change in parallel.
 - The abnormal returns regressions also do not capture the impact through the factors; that said, this impact appears to play a limited role.
- The analysis focuses on 211 stocks that were Nikkei 225 members as of 03/31/2021 and that were listed on the 1st section of the TSE throughout the entire period from 09/30/2010.
- The 1st percentile, the median, and the 99th percentile of the BoJ holding ratio are 7.5%, 11.2%, and 29.8%, respectively.
- Multiplying the difference between the 1st and 99th percentiles by 6 gives 133.7 pp (12.7 pp per annum).

Macro effects

- Gabaix and Koijen (2022) argue that the macro multiplier (around 5) is larger than the micro one (around 1)
- Suppose the macro multiplier is 6 as our estimate of micro one
- I estimate the impact of BoJ holdings based on 1,409 stocks that are included in the TOPIX on 09/30/2010 and whose prices are available up to 03/31/2021
- Can the macro multiplier be lower than the micro one due, for example, to resource distortions or reduced liquidity?

	Multiple		Return (log %)	
	TOPIX	Nikkei 225	TOPIX	Nikkei 225
Index by TSE	2.96	-	108.7	-
Simulation with the sample	2.98	3.82	109.3	134.2
Without BoJ holdings	1.63	1.37	48.9	31.4
If the BoJ purchased only TOPIX ETFs	2.88	2.55	105.8	93.5

Potential estimation bias

- In the baseline IV regression, it is assumed that the index weight ratio contained information beyond the controls to predict the return only through the BoJ holding ratio.
 - But, stocks with high Nikkei 225 weights may have been overvalued on September 30, 2010, possibly due to demand from index traders.
 - Such stocks may have yielded lower ex-post returns.
 - The regression may underestimate the effect of BoJ holdings.
- Investors other than the BoJ may have increased their exposure to the Nikkei 225 index during the period of interest.
 - The regression may overestimate the effect of BoJ holdings.

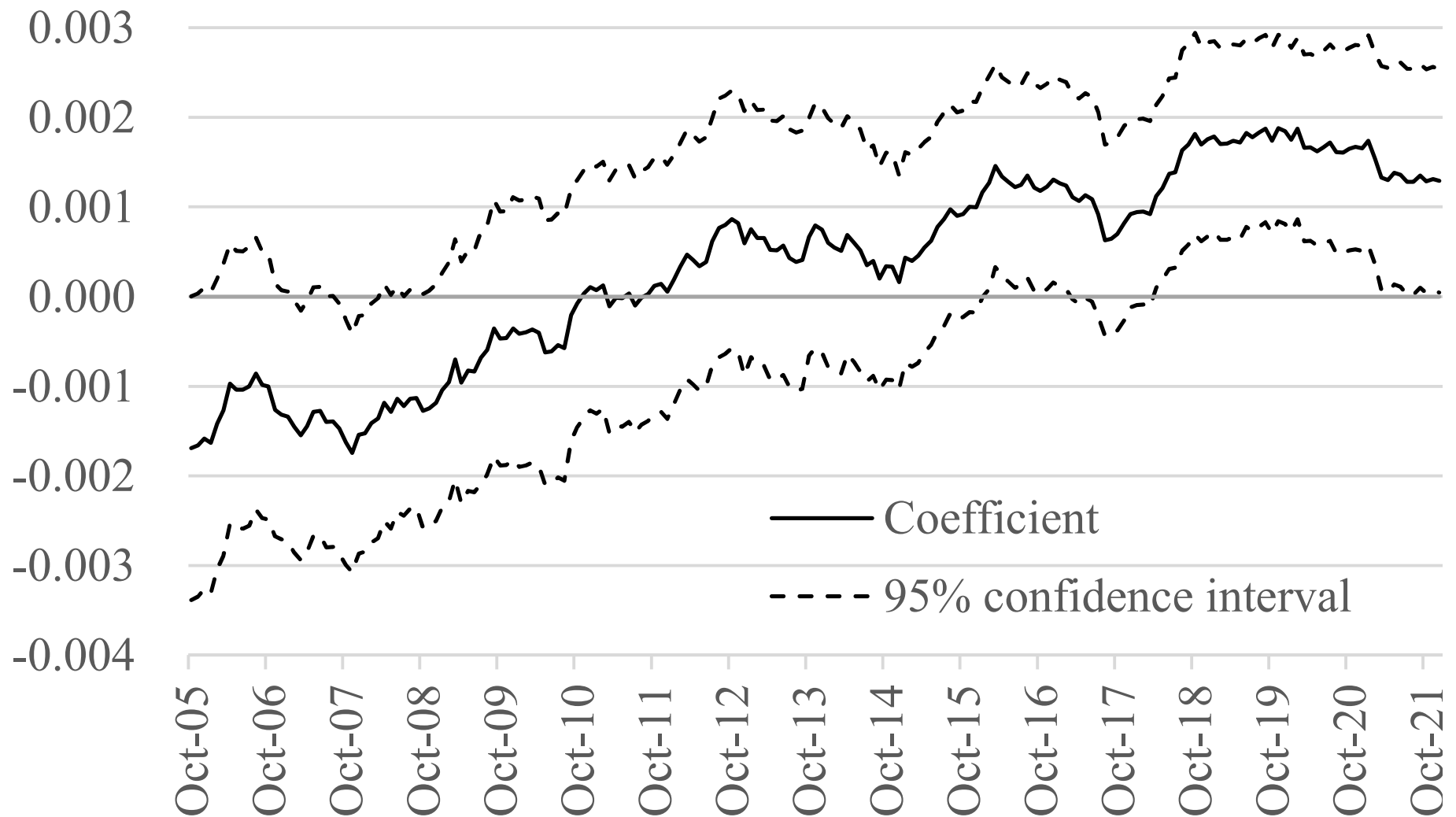
OLS regression of the return on the index weight ratio

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Raw	1 factor	3 factors	4 factors	5 factors	6 factors	Observations
<i>Panel A: Baseline sample (September 30, 2010, to March 31, 2021)</i>							
Full sample	0.1095** (4.53)	0.1138** (3.91)	0.1224** (4.60)	0.1290** (4.78)	0.0997** (3.72)	0.1059** (3.85)	1,158
Subsample	0.1005** (5.68)	0.1090** (4.97)	0.1065** (5.09)	0.1131** (5.45)	0.0892** (4.08)	0.0953** (4.20)	177
<i>Panel B: Alternative sample (September 30, 2000, to September 30, 2010)</i>							
Full sample	-0.0050 (-0.30)	0.0035 (0.20)	0.0049 (0.28)	0.0121 (0.63)	0.0360 (1.98)	0.0404* (2.14)	742
Subsample	-0.0499 (-1.91)	-0.0409 (-1.42)	-0.0402 (-1.40)	-0.0332 (-1.10)	-0.0084 (-0.24)	-0.0059 (-0.17)	166

Post vs Pre-first announcement

	(1)	(2)	(3)	(4)
	Oct. 2010-Mar. 2021		Oct. 2000-Sep. 2010	
	Full sample	Subsample	Full sample	Subsample
Index weight ratio	0.00108** (2.64)	0.00124** (3.00)	-0.00032 (-0.66)	-0.00101 (-1.82)
Beta	-0.00370	-0.00439	-0.01062	-0.00511
Firm size	0.00012	0.00053	-0.00043	-0.00226
Book to market ratio	0.00118	0.00301	0.00468**	0.00319
Profitability	0.01237**	0.01536*	0.00429	-0.00097
Asset growth	0.00130	-0.00626	-0.00679*	0.00606
Lagged returns	-0.02272	0.00342	-0.04882	-0.08680
Nikkei 225 member	-0.00244		0.00418	
Observations	198,977	24,575	129,688	20,819
Number of months	126	126	120	120
<i>R</i> -squared	0.088	0.160	0.115	0.198

5Y rolling FM regressions (subsample)



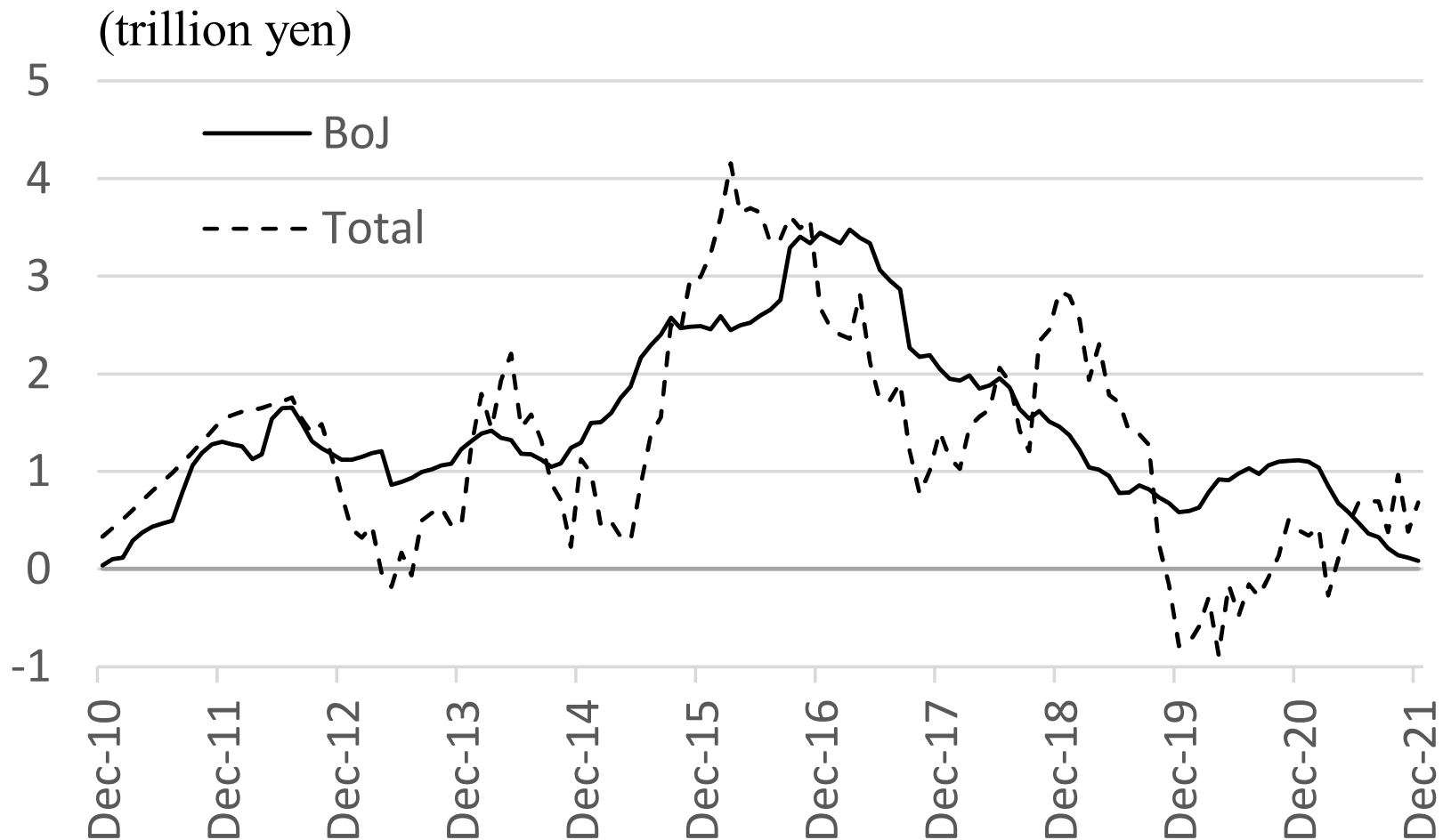
An interpretation of the rolling FM regressions

- In the period between the first half of 2013 and early 2021, stocks with a high index weight ratio benefited the most.
- During this period, the BoJ dramatically increased the pace of purchases.
- Observing that the BoJ continued to fail to meet its 2% inflation target, market participants probably expected the purchases for longer.
- The increase in the size of purchases was suggested to be more of a surprise than the decrease in the share of Nikkei 225 ETFs, since many regarded the BoJ' ability to take on equity risk to be limited and the purchases of Nikkei 225 ETFs to have serious side effects.
- The BoJ announced at the December 2020 MPM that it would conduct an assessment for further effective and sustainable monetary easing and would make its findings public likely at the March 2021 MPM.
- In his speech in February 2021, Board member Nakamura stated that it was “necessary to bear in mind that large-scale purchases and prolonged holding of assets—not limited to ETFs—could affect market functioning.”

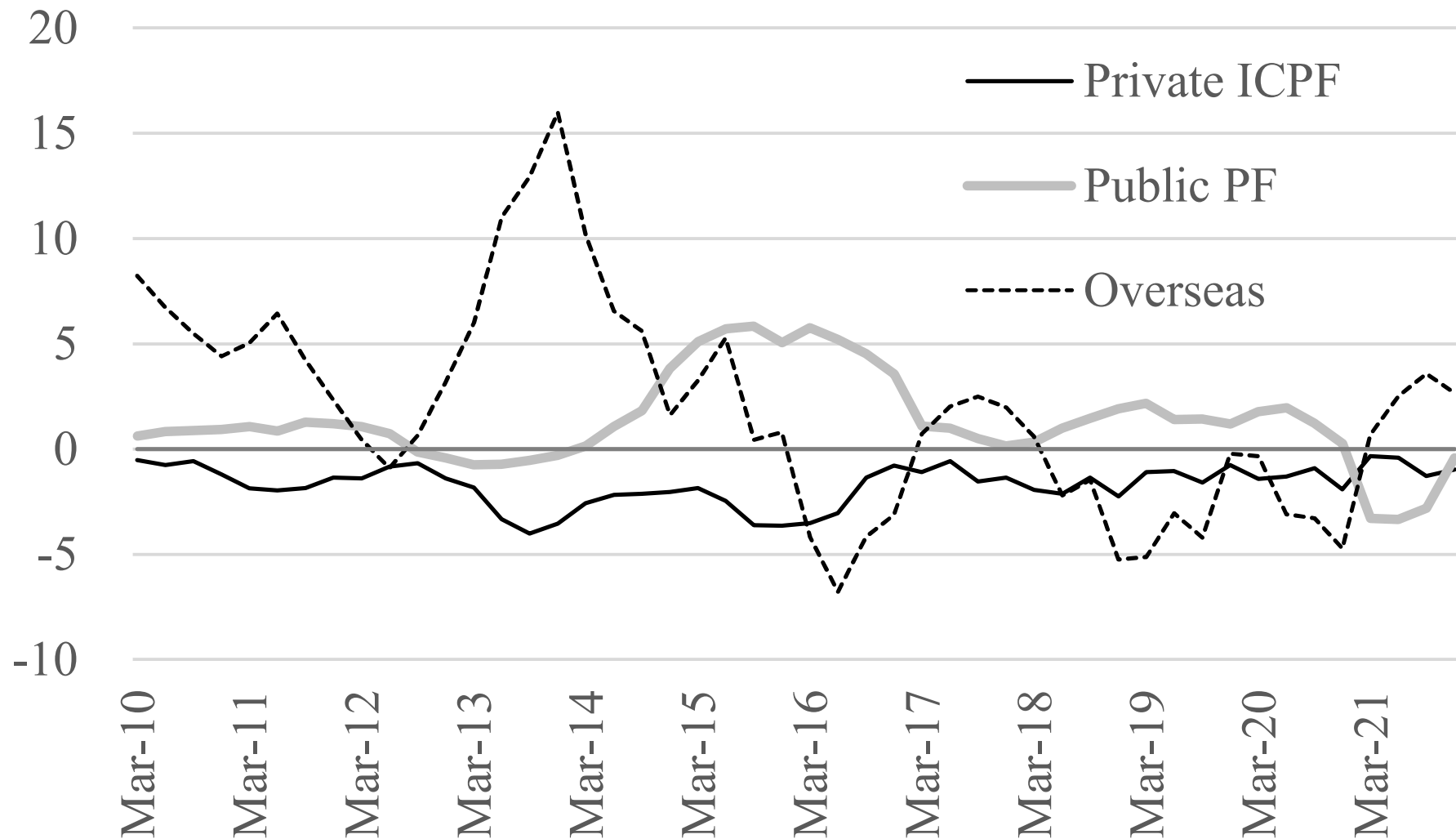
Do other investors' stock holdings contaminate the baseline results?

- The baseline regression could overstate the impact of BoJ holdings, if stocks purchased by other long-term investors are similar to those purchased by the BoJ.
- Plausible candidates
 - Nikkei 225 index funds other than ETFs held by the BoJ
 - Long-term institutional investors (primarily, ICPFs) may have invested in portfolios that track the Nikkei index, without purchasing index funds, although they tend to keep the allocation weight for domestic stocks constant.

Flows to Nikkei 225 index funds (present values on 03/31/2021, 4Q MA)



Flows from other investors to listed stocks (trillion yen, 4Q MA)



Do foreign investors matter?

- Since their size of investment is large, behavior of foreign investors are often regarded as a major driver of stock prices in Japan.
- Although a large part of foreign investors, such as hedge funds, are short-term, other institutional investors may be long-term.
- To see whether foreign investors increased their exposures to the Nikkei index, foreign investors' holdings (in trillion yen) of each TSE 1st Section stock are regressed on the index weights in the end of March 2010 and 2021.
- Two different samples for robustness checks.
 - Only firms whose financial year ended in March
 - Full sample by assuming that the foreign investor share did not change up to the next March.

Estimated Exposures of Foreign investors to Indexes

	(1)	(2)	(3)	(4)
	Only March-end firms		Full sample	
	March-10	March-21	March-10	March-21
TOPIX	87.66** (74.47)	228.15** (48.70)	88.67** (83.47)	218.90** (36.53)
Nikkei 225	6.20** (6.47)	1.37 (1.03)	6.05** (7.64)	6.39** (5.12)
JPX-Nikkei 400		4.34 (0.94)		13.23* (2.27)
Constant	-0.01* (-2.08)	-0.01** (-2.79)	-0.01* (-2.49)	-0.01* (-2.24)
Total (from FoF)	88.21	222.69	88.21	222.69
Observations	1,115	1,448	1,381	2,119
<i>R</i> -squared	0.879	0.927	0.881	0.852

Estimated Exposures of the GPIF Portfolio to Indexes

	(1)	(2)	(3)	(4)	(5)	(6)
Year	2015	2016	2018	2019	2020	2021
TOPIX	29.95** (436.43)	30.07** (286.40)	38.52** (216.91)	40.95** (165.69)	36.89** (93.45)	43.34** (182.85)
Nikkei 225	-0.28** (-11.59)	-0.29** (-9.24)	-0.45** (-9.86)	-0.30** (-6.09)	0.42** (4.78)	0.18** (3.81)
JPX-Nikkei 400	1.74** (23.26)	0.70** (6.77)	2.13** (12.79)	-1.91** (-8.45)	-2.53** (-6.67)	2.79** (12.05)
Constant	-0.00 (-0.16)	-0.00 (-1.17)	0.00 (0.27)	-0.00 (-1.89)	-0.00 (-0.75)	0.00 (0.87)
Total	31.67	30.58	40.70	38.66	35.56	47.23
Other than TOPIX	1.72	0.51	2.18	-2.30	-1.33	3.89
Other than 3 indexes	0.27	0.10	0.50	-0.09	0.78	0.92
Observations	1,858	1,937	2,061	2,124	2,159	2,185
R-squared	0.998	0.995	0.993	0.990	0.966	0.993

Do public PFs matter?

- It appears that the GPIF's exposure focuses mostly on the TOPIX, while its exposures to the Nikkei 225 and JPX-Nikkei 400 indexes are relatively small and short-term.
- The FoF Account data suggest that the aggregate amount of stocks purchased by public PFs during the period of interest was ¥17.0 trillion in terms of the value as of 03/31/2021.
 - This is considerably smaller than the total holdings of ¥61.9 trillion, because PFs already held ¥19.8 trillion on 09/30/2010, and this value more than doubled to 03/31/2021.

Effects on profitability, investment, and governance

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Profitability	Current profits	Book value	Total assets	Tangible assets	Cash	Outside directors
<i>Panel A: Baseline IV regressions</i>							
Full sample	-0.06 (-0.73)	-0.46 (-0.22)	-0.54 (-0.82)	1.80** (2.92)	2.28* (2.15)	0.07 (0.05)	-0.36 (-1.20)
Subsample	-0.03 (-0.37)	0.62 (0.37)	-0.60 (-1.17)	2.13** (3.62)	2.66** (3.33)	0.58 (0.45)	-0.75* (-2.41)
<i>Panel B: OLSs on the index weight ratio for the baseline sample (September 30, 2010, to March 31, 2021)</i>							
Full sample	-0.0012 (-0.75)	-0.0085 (-0.22)	-0.0104 (-0.85)	0.0343* (2.61)	0.0436 (2.02)	0.0013 (0.05)	-0.0069 (-1.15)
Subsample	-0.0005 (-0.37)	0.0111 (0.37)	-0.0108 (-1.16)	0.0385** (3.76)	0.0476** (3.40)	0.0104 (0.44)	-0.0136* (-2.37)
<i>Panel C: OLSs on the index weight ratio for the alternative sample (September 30, 2000, to September 30, 2010)</i>							
Full sample	-0.0039 (-1.92)	0.0143 (0.26)	-0.0177 (-1.16)	0.0252 (1.76)	0.0319* (2.31)	0.0126 (0.48)	
Subsample	-0.0107** (-3.63)	-0.0133 (-0.22)	-0.0506** (-2.80)	0.0223 (1.08)	0.0263 (1.67)	0.0320 (0.94)	

Definitions

- “Profitability” is average current profits per book values from FY2011-2020 or FY2001-2009
- “Outside directors” are the change in the share of outside directors in the board from Jan. 2011 to Feb. 2022
- The others are the cumulative growth rate in FY 2009-2020 or FY1999-2009

Are the effects permanent?

- This study also examines whether the effects of BoJ holdings have been persistent after the termination of Nikkei 225 ETF purchases.
- This exercise is important also as a robustness check.
 - The stock effect estimated in the baseline might be overestimated by short-term price pressures.
 - From April to December 2021, the BoJ purchased ETFs only on April 21, June 21, September 29, and October 1.
- Two types of regressions.
 - An IV regression of the return between 09/30/2010 and 12/30/2021 on the BoJ holding ratio on 12/30/2021 and controls
 - An OLS regression of the return between 03/31/2021 and 12/30/2021 on the BoJ holding ratio on 03/31/2021 and controls calculated using data up to 03/31/2021

IV regressions with the extended sample

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Raw	1 factor	3 factors	4 factors	5 factors	6 factors	Observations
Full sample	6.22** (5.39)	6.38** (4.16)	6.79** (4.31)	6.97** (4.39)	5.27** (3.33)	5.67** (3.44)	1,151
Subsample	5.94** (5.88)	6.89** (4.93)	6.80** (4.58)	7.00** (4.69)	5.62** (3.68)	5.91** (3.76)	176

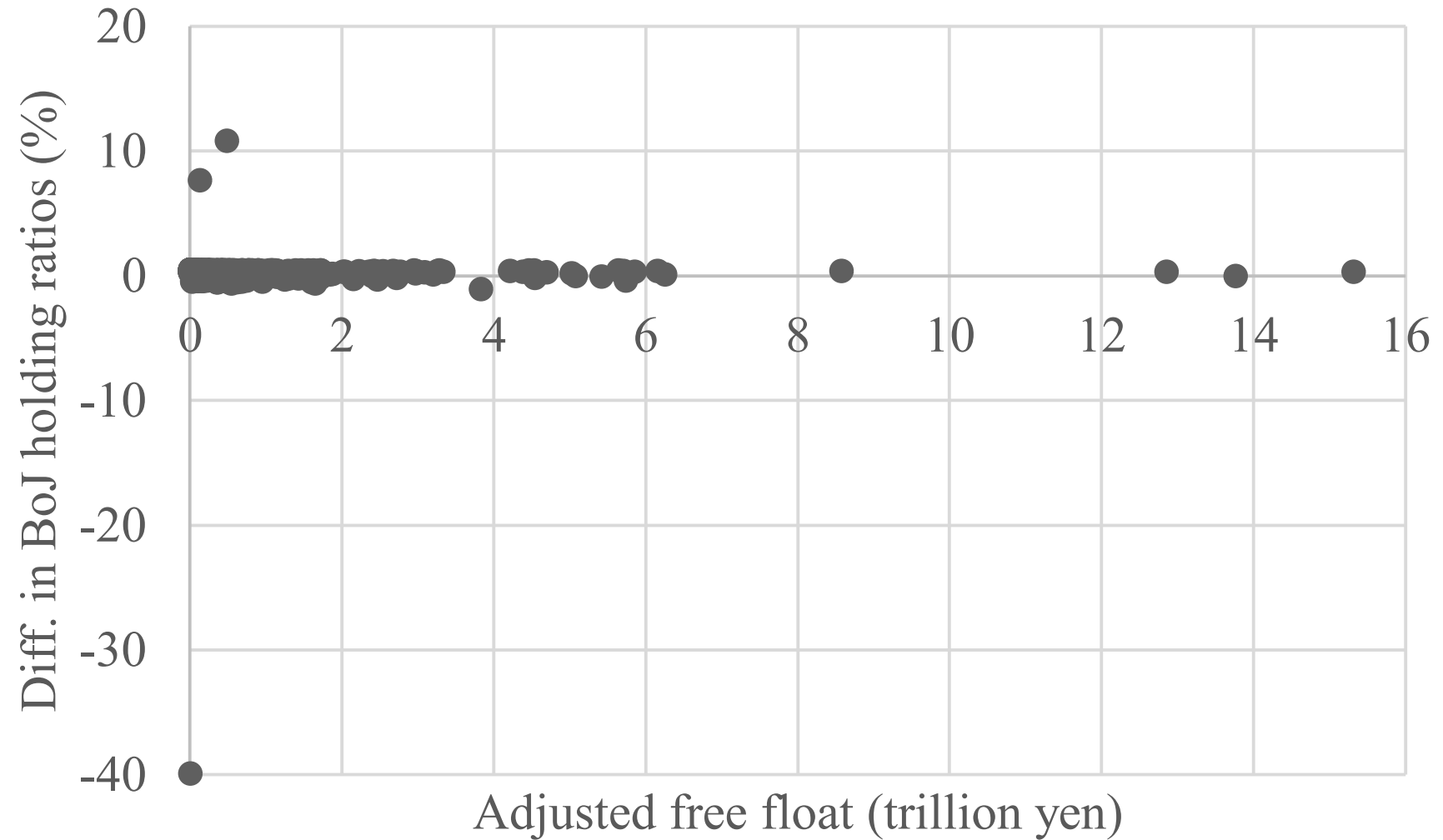
OLS regressions with ex-post returns

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Raw	1 factor	3 factors	4 factors	5 factors	6 factors	Observations
Full sample	-0.20 (-0.71)	-0.19 (-0.71)	-0.22 (-0.77)	-0.35 (-1.19)	-0.34 (-1.22)	-0.39 (-1.37)	1,299
Subsample	-0.11 (-0.24)	-0.09 (-0.20)	-0.10 (-0.21)	-0.15 (-0.33)	-0.20 (-0.45)	-0.21 (-0.47)	186

ETF weights

- The baseline analysis estimates BoJ holdings based on several assumptions.
 - E.g., index weights are assumed to be a good approximation of ETF weights.
- The analysis here uses data of ETF weights.
 - The data cannot be obtained for three small eligible ETFs.
 - Only half of the total market value of the ETFs tracking indexes composed of firms that proactively invest in physical and human capital.
 - The BoJ holding share of eligible ETFs reached 91.2%.
- The weights in the BoJ's holdings are estimated by taking a weighted average of the weights in the ETFs based on the market values of them.
- The ETF market value-weighted average of the weight of positions other than stocks is only 2.3%.

ETF weights vs. index weights



Using BoJ holdings estimated from ETF weights

	(1)	(2)	(3)	(4)	(5)	(6)
	Raw	1 factor	3 factors	4 factors	5 factors	6 factors
<i>Panel A: Normalizing BoJ holdings by Bloomberg free float weights</i>						
Full sample	6.33** (4.63)	6.61** (4.01)	7.02** (4.53)	7.42** (4.67)	5.73** (3.70)	6.15** (3.81)
Subsample	6.13** (5.19)	6.64** (4.64)	6.53** (4.77)	6.95** (5.02)	5.49** (3.87)	5.93** (3.94)
<i>Panel B: Estimating BoJ holdings using investment weights of ETFs</i>						
Full sample	5.42** (4.95)	5.63** (4.17)	6.05** (4.67)	6.38** (4.79)	4.93** (3.80)	5.24** (3.87)
Subsample	5.25** (5.86)	5.70** (5.20)	5.57** (5.25)	5.91** (5.54)	4.67** (4.18)	4.98** (4.21)

Portfolios of Nikkei 225 members sorted by the index weight ratio

	(1)	(2)	(3)	(4)	(5)	(6)
	Raw	1 factor	3 factors	4 factors	5 factors	6 factors
<i>Panel A: Baseline sample (October 2010 to March 2021)</i>						
Top 30%	118.5*	6.6	10.3	11.8	0.9	2.8
	(2.02)	(0.27)	(0.42)	(0.48)	(0.04)	(0.12)
Middle 40%	77.8	-32.3*	-25.2*	-25.2*	-26.6*	-28.4*
	(1.43)	(-2.52)	(-2.02)	(-2.01)	(-2.15)	(-2.29)
Bottom 30%	61.1	-65.0**	-41.0*	-43.5**	-38.9*	-42.8*
	(0.95)	(-3.03)	(-2.50)	(-2.69)	(-2.35)	(-2.61)
<i>Panel B: Alternative sample (October 2000 to September 2010)</i>						
Top 30%	-86.9	-10.4	-7.4	-7.4	5.8	3.5
	(-1.10)	(-0.32)	(-0.23)	(-0.22)	(0.17)	(0.10)
Middle 40%	-55.2	6.3	-1.3	2.2	14.5	17.1
	(-0.90)	(0.32)	(-0.07)	(0.11)	(0.80)	(0.93)
Bottom 30%	-79.2	-12.6	-24.8	-34.0	-21.3	-28.1
	(-1.19)	(-0.55)	(-1.20)	(-1.66)	(-1.02)	(-1.36)