

# How the BOJ Has Affected Domestic Equity Markets by Its ETF Purchasing Program <sup>1</sup>

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## Abstract

The Bank of Japan (BOJ) started a program to purchase domestic equity index-linked ETFs in December 2010 to stimulate the sluggish economy after the 2007-8 financial crisis. It initially set an annual limit of 0.45 trillion yen. It was also a temporary program, which would terminate by the end of 2011. The BOJ, however, has continued to purchase ETFs and dramatically increased an annual target value to 6 trillion yen since July 2016. The BOJ tended to buy ETFs when opening stock price indices declined. The Nikkei Stock Average (NSA) is the most popular stock index in Japan, and it is price-weighted. By purchasing NSA-linked ETFs massively, the BOJ seems to have affected the NSA's component stocks' pricing and created an "indexing effect."

## 1. Introduction

The Japanese ETF markets started in 2001. Since then, their net asset values (NAVs) remained around 2 to 4 trillion yen through 2012. Their NAVs, however, began to increase dramatically since 2012 and reached 43 trillion yen by the end of 2019, mainly due to an aggressive purchase of equity index-linked ETFs by the Bank of Japan (BOJ).

The BOJ started a program to purchase domestic equity index-linked ETFs in 2010, to decrease risk premia of risky assets (Barbon and Gianinazzi[2019], Charoenwong, et al.[2019]). The purpose of this program was to stimulate its domestic economy, which lacked strength after the 2007-08 financial crisis. The BOJ had set an annual limit of 0.45 trillion yen and intended to terminate this program by the end of 2011. The situation, however, dramatically changed in March 2011, when the Great East Japan earthquake occurred. The newly established second Abe Cabinet adopted hyperinflationary financial policies. Under this circumstance, the BOJ lifted its

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program's annual limits a few times to 2.1 trillion yen through October 2012. The BOJ also replaced a "limit" with a "target" under its new Governor, Haruhiko Kuroda, and lifted an annual target value to 6 trillion yen in July 2016. This program is still active as of the end of 2019.

Equity purchases by the BOJ through this program amounted to more than 28 trillion yen by the end of 2019. This value is equivalent to around 65% of total ETF NAVs of 43 trillion yen and more than 4% of the total market capitalization of 672 trillion yen for all of the listed equities on the Tokyo Stock Exchange. This paper first evaluates the size and influence of the BOJ's ETF purchasing program.

There exists a general consideration that the BOJ tends to purchase ETFs when the market is sluggish. This paper measures the timing of the BOJ's purchases and whether its trading activities contributed to a price increase. This paper also tries to analyze the effect of this program on the pricing of individual stocks. In Japan, the Nikkei Stock Average (NSA) is the most popular stock index, and investment companies have often provided NSA-based funds, including NSA-based ETFs. Since the BOJ initially made a rule to purchase equity index-linked ETFs in proportion to their market values, it concentrated its purchases on NSA-based ETFs. The NSA is a price-weighted index comprised of 225 major Japanese companies with more weights on higher-priced stocks. As a result, the BOJ became a massive buyer/holder for high-priced stocks. This paper tries to analyze how the BOJ's trading activities affected the pricing of NSA component stocks.

I did a brief literature survey in Section 2 and described data and the analysis method in Section 3. Then I surveyed domestic ETF markets and the BOJ's ETF purchasing program in Section 4. I also analyzed the timing when the BOJ tended to initiate the program and its effect on the stock market in Section 5 and described the empirical works' results for its impact on NSA component stocks in Section 6. Finally, I summarized this paper in Section 7.

## **2. literature Survey**

Charoenwong et al. [2019] and Barbon and Gianinazzi[2019] provided a good summary of the BOJ's ETF program and its impact on the Japanese stock market. Charoenwong et al. [2019] suggested that the BOJ program raised prices of equity index component stocks relative to non-component ones but failed to stimulate aggregate

demand by boosting corporate investment as intended. On the other hand, Barbon and Gianinazzi[2019] showed that the NSA's price-weighted nature distorted Japanese equities' pricing. In particular, the BOJ turned out to purchase high-priced NSA component stocks heavily, resulting in their irreversible excess returns.

Toshino[1998] analyzed the influence of the introduction of equity-index futures markets in 1988. Since the inception of index futures markets, index transactions to buy/sell index component stocks prevailed, partly to earn arbitrage profits when the theoretical relationship between futures prices and cash equity prices is out of order. As a result, Toshino[1998] shows, betas of NSA component stocks became closer to 1; average and median betas of NSA component stocks were 0.722 and 0.735, respectively, before the inception of futures markets, while it became 1.142 and 1.113, respectively, after futures markets started. Such an effect was particularly significant for small-capitalization stocks.

Toshino[2019] also tried to analyze the impact of NSA-indexed funds' net issuances, including ETFs and other investment trust funds. A daily regression analysis with net distributions of NSA-indexed funds as an independent variable and with some risk-related parameters of NSA component stocks as dependent variables suggested the existence of an "indexing effect." As a result of net purchases of component stocks regardless of their fundamental evaluation by NSA-indexed funds, betas of component stocks approached 1, and standard deviations (risks) of component stocks approached market risks by shrinking idiosyncratic risks.

### **3. Data and Method of Analysis**

#### **(1) Data**

Financial Data Solutions, Inc. provided daily NAVs and values of issuance and redemption for domestically registered ETFs in its Daily Japanese Public Mutual Fund Return database. I downloaded information on the BOJ's ETF purchase program and its daily ETF purchase values from its homepage. Regarding ETF purchase values, the BOJ discloses daily purchase records for a total of equity index-linked ETFs, including NSA-, TOPIX (Tokyo Stock Price Index)-, and JPX-Nikkei-400-based ETFs, and Capital/Human Investment ETFs separately.

I downloaded a list of NSA component stocks as of December 30, 2019, and a past replacement record of component stocks from the Nikkei Average Profile Section of the

Nikkei's homepage. I used only 192 consistent NSA component stocks from 2010 through 2019 since I excluded 33 component stocks added to the NSA after January 2010. The Quick provided daily price data of NSA and TOPIX. Financial Data Solutions, Inc. provided daily modified stock price data of NSA component stocks in its Japanese Listed Stock Daily Return database. The company adjusts stock prices both for stock splits and cash dividends. For the period when modified stock prices are not available, I downloaded stock prices just adjusted for stock splits from the Time-series Stock Price Download Service of Yahoo Japan.

## (2) Method of Analysis

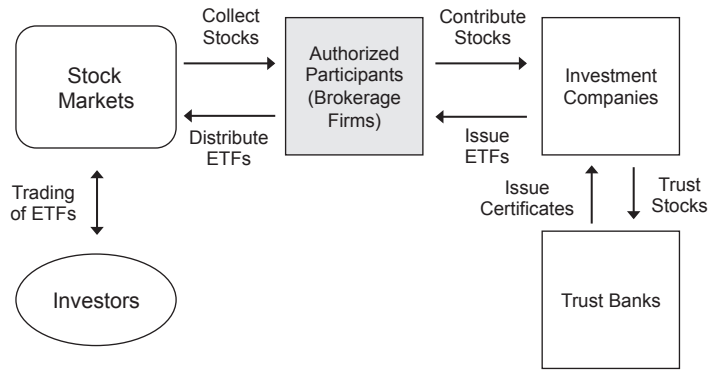
I aggregated NAVs, and values of issuance and redemption by asset class and compared them with accumulated values of the BOJ's ETF purchase. The BOJ has just continued to purchase ETFs and has never sold them since the inception of the program.

To analyze the timing of the BOJ's ETF purchase and its impact on stock prices, I calculated correlation matrices between the BOJ's equity index-linked ETF purchase values and NSA and TOPIX returns with  $-3$  through  $+3$  daily lags. For the same days when the BOJ purchased ( $t=0$ ), I divided stock price index returns into opening returns, returns of  $t=0$  opening divided by  $t=-1$  closing prices minus one and day returns, returns of  $t=0$  closing divided by  $t=0$  opening prices minus one. Analyses are conducted between December 15, 2010, when the BOJ started to purchase ETFs, and December 30, 2019. I divided the total period into two subperiods between December 15, 2010, and October 30, 2014, and between November 4, 2014, and December 30, 2019. In the latter period, the BOJ lifted an annual target value to 3 trillion yen initially and to 6 trillion yen later. So, the impact of the program may have strengthened in the latter period. The same subperiods are set in the analyses as follows.

I also conducted regression analyses to evaluate the timing of the BOJ's ETF purchase. I used the BOJ's purchase values of equity index-linked ETFs as dependent variables and  $t=-4, -3, -2$  closing to  $t=-3, -2, -1$  closing returns,  $t=-1$  closing to  $t=0$  opening returns of NSA and TOPIX as independent variables.

As shown in Figure 1, for ETFs to be issued, brokerage firms called authorized participants should collect index component stocks in stock markets and bring them to investment companies that manage specific ETFs. The investment companies provide ETFs to authorized participants in exchange for component stocks, which trust banks

hold until the ETFs’ redemption. When the BOJ ordered to purchase a considerable value of ETFs, brokerage firms may take a few days to collect component stocks to avoid market impacts. So, there may exist some lags between the BOJ purchase and issuances of ETFs. To make sure of the fact, I calculated correlation matrices between the values of the BOJ’s ETF purchases and the distribution of equity index-linked ETFs with lags through 5 days.



Source: Oomura and Toshino[2014] Figure 13-6 (Japanese)

**Figure 1 Scheme of Japanese ETFs**

Finally, to evaluate the BOJ program on the pricing of NSA component stocks, the existence of the “indexing effect” is examined. Firstly, market betas,  $\beta_i$ , are estimated for 192 NSA component stocks by the formula (1), assuming  $t=0$  as a BOJ purchase date.

$$R_{it} = \alpha_i + \beta_i R_{mt} + \varepsilon_{it} \tag{1}$$

$R_{it}$ : returns of a component stock  $i$  ( $i=1, \dots, 192$ ),  $t=1, \dots, 20$

$R_{mt}$ : returns of equity indices (NSA or TOPIX),  $t=1, \dots, 20$

$\varepsilon_{it}$ : idiosyncratic errors for stock  $i$  ( $i=1, \dots, 192$ ),  $t=1, \dots, 20$

$\alpha_i$ : an estimation of the constant for stock  $i$  ( $i=1, \dots, 192$ )

$\beta_i$ : an estimation of the slope, or beta, for stock  $i$  ( $i=1, \dots, 192$ )

As the BOJ purchases NSA-indexed ETFs, brokerage firms buy NSA component stocks regardless of their fundamental values as designated authorized participants. As

a result,  $\beta_i$  in (1) may become closer to 1, responding to the BOJ purchases. The BOJ discloses only aggregated equity-indexed ETF purchase values, including those for NSA-, TOPIX-, JPX-Nikkei-400-based ETFs. So, I used the BOJ purchases of equity index-linked ETFs and amounts of issuance for NSA-indexed ETFs as independent variables, and averages and medians for absolute values of beta minus one as dependent variables in the regression analysis (2). Under the “indexing effect” hypothesis, an estimation of “ $b_1$ ” is expected to be a minus sign since such a result means that betas become closer to 1 as a result of BOJ purchase of NSA-indexed ETFs.

$$Y_T = a_1 + b_1 X_T + \omega_T \quad (2)$$

$Y_T$ : averages and medians for absolute values of betas,  $\beta_i$  estimates in (1), minus one,  $T=1, \dots, 2,215$  (corresponding to  $T=1$  as December 15, 2010 and to  $T=2,215$  as December 30, 2019)

$X_T$ : the BOJ’s purchase values of equity index-linked ETFs or amounts of issuance for total NSA-indexed ETFs,  $T=1, \dots, 2,215$

$\omega_T$ : idiosyncratic errors,  $T=1, \dots, 2,215$

$a_1$ : an estimation of the constant

$b_1$ : an estimation of the slope

Secondly, if the “indexing effect” exists due to the BOJ program, a portion of idiosyncratic errors in individual returns variation will shrink. As a result, individual stocks’ risks, or standard deviations of returns, will approach market risks. I defined excess risks as (3), and their averages and medians are regressed on the BOJ’s ETF purchases and issuance of NSA-indexed ETFs, as shown in (4). A value of “ $b_2$ ” is also expected to be a minus sign. Such is the second approach of an examination for the “indexing effect.”

$$Excess\ Risk = \sigma(R_{it}) - \sigma(R_{mt}) \quad (3)$$

$R_{it}$ : returns of a component stock  $i$  ( $i=1, \dots, 192$ ),  $t=1, \dots, 20$

$\sigma(R_{it})$ : standard deviations of  $R_{it}$  ( $i=1, \dots, 192$ )

$R_{mt}$ : returns of equity indices (NSA or TOPIX),  $t=1, \dots, 20$

$\sigma(R_{mt})$ : standard deviations of  $R_{mt}$  (NSA or TOPIX)

$$Z_T = a_2 + b_2 X_T + \omega_T \quad (4)$$

$Z_T$ : averages or medians for excess risks estimates in (3),  $T=1, \dots, 2,215$

(corresponding to  $T=1$  as December 15, 2010, and to  $T=2,215$  as December 30, 2019)

$X_T$ : the BOJ's purchase values of equity index-linked ETFs or amounts of issuance for total NSA-indexed ETFs,  $T=1, \dots, 2,215$

$\omega_T$ : idiosyncratic errors,  $T=1, \dots, 2,215$

$a_2$ : an estimation of the constant

$b_2$ : an estimation of the slope

#### 4. Japanese ETF Markets and the BOJ's ETF Program

The Japanese investment trust system has adopted a trust agreement method since its inception in 1951. When an investment trust company sets an investment trust contract under this method, it becomes a trustee. On the other hand, an investor receives a certificate as a beneficiary. Investors get a refund from investment companies in exchange for certificates. A corporate-type investment trust system additionally started in 1998. Since then, an establishment of Exchange-traded funds (ETFs) was made possible.

##### (1) ETF Markets

The first ETFs appeared in July 2001, and their underlying assets were domestic major stock indices such as NSA and TOPIX. Table 1 represents NAVs for total public investment trusts and ETFs.

**Table 1 Market Size of Japanese Public Investment Trusts and ETFs**

CY	Public Investment Trusts		ETF				Others	
	NAV(A) ¥ Bil.	Number(B)	NAV(C) ¥ Bil.	C/A %	Number(D)	D/B %	NAV ¥ Bil.	Number
1981	7,229	924	--	--	--	--	7,229	924
1982	9,328	1,056	--	--	--	--	9,328	1,056
1983	14,088	1,175	--	--	--	--	14,088	1,175
1984	18,298	1,383	--	--	--	--	18,298	1,383
1985	19,972	1,578	--	--	--	--	19,972	1,578
1986	32,075	1,991	--	--	--	--	32,075	1,991

1987	42,914	2,605	--	--	--	--	42,914	2,605
1988	52,897	3,265	--	--	--	--	52,897	3,265
1989	58,649	4,073	--	--	--	--	58,649	4,073
1990	45,994	4,747	--	--	--	--	45,994	4,747
1991	41,474	5,371	--	--	--	--	41,474	5,371
1992	43,301	5,701	--	--	--	--	43,301	5,701
1993	50,738	6,086	--	--	--	--	50,738	6,086
1994	43,408	6,306	--	--	--	--	43,408	6,306
1995	47,957	6,408	--	--	--	--	47,957	6,408
1996	48,668	5,879	--	--	--	--	48,668	5,879
1997	40,650	5,203	--	--	--	--	40,650	5,203
1998	42,739	4,534	--	--	--	--	42,739	4,534
1999	51,354	3,443	--	--	--	--	51,354	3,443
2000	49,399	2,793	--	--	--	--	49,399	2,793
2001	45,281	2,867	890	2.0	9	0.3	44,391	2,858
2002	36,016	2,718	2,510	7.0	18	0.7	33,506	2,700
2003	37,436	2,617	2,962	7.9	18	0.7	34,474	2,599
2004	40,997	2,552	3,113	7.6	15	0.6	37,884	2,537
2005	55,348	2,640	3,704	6.7	13	0.5	51,644	2,627
2006	68,928	2,753	4,117	6.0	13	0.5	64,811	2,740
2007	79,761	2,997	3,879	4.9	16	0.5	75,882	2,981
2008	52,146	3,333	2,525	4.8	64	1.9	49,622	3,269
2009	61,455	3,656	2,291	3.7	72	2.0	59,164	3,584
2010	63,720	3,905	2,610	4.1	85	2.2	61,110	3,820
2011	57,327	4,196	2,729	4.8	95	2.3	54,599	4,101
2012	64,064	4,384	4,215	6.6	104	2.4	59,849	4,280
2013	81,523	4,922	8,091	9.9	110	2.2	73,432	4,812
2014	93,505	5,404	10,616	11.4	123	2.3	82,888	5,281
2015	97,756	5,843	16,165	16.5	145	2.5	81,591	5,698
2016	96,642	6,060	20,347	21.1	155	2.6	76,294	5,905
2017	111,192	6,152	30,795	27.7	180	2.9	80,397	5,972
2018	105,159	6,120	33,563	31.9	183	3.0	71,596	5,937
2019	123,172	6,034	43,345	35.2	176	2.9	79,827	5,858

Note: Net asset values (NAV) and the number of funds for Japanese public mutual funds, ETFs, and public mutual funds excluding ETFs.

Source: Investment Trusts Association, Japan

The NAVs of ETFs remained around 2 to 4 trillion yen for the first ten years, and their weights were less than 10% in the total public investment trust market. The values dramatically increased since the BOJ adopted a program to purchase equity index-linked ETFs in 2010. Table 2 describes the detail of this program.



**Table 2 The BOJ's Program to Purchase Equity Index-linked ETFs**

Decision Date	Decision (Policy)	Termination Period
10/28/2010	The BOJ decided to purchase equity index-linked ETFs. An annual limit was set as 0.45 trillion yen.	End of 2011
11/5/2010	ETFs linked to TOPIX and Nikkei Stock Average were selected.	Not mentioned.
3/14/2011	An annual limit was lifted to 0.9 trillion yen.	End of June 2012
8/4/2011	An annual limit was lifted to 1.4 trillion yen.	End of 2012
4/27/2012	An annual limit was lifted to 1.6 trillion yen.	Not mentioned.
10/30/2012	An annual limit was lifted to 2.1 trillion.	End of 2013
12/20/2013	ETF holdings were planned to increase by 1 trillion yen annually.	Not specified.
10/31/2014	ETF holdings were planned to increase by 3 trillion yen annually.	
11/19/2014	JPX Nikkei 400 was added to benchmark indices.	
3/11/2016	ETFs to support capital and human investment were added. ETF holdings were planned to increase by 3.3 trillion yen annually.	
7/29/2016	ETF holdings were planned to increase by 6 trillion yen annually.	
9/21/2016	Revised in purchasing weights; Fixed: 2.7 trillion yen for TOPIX-linked ETFs, 0.3 trillion yen for capital and human investment-related ETFs. Proportional by market values (the remainder, 3 trillion yen): ETFs linked to TOPIX, NSA, JPX Nikkei 400.	
7/31/2018	Revised in purchasing weights; Fixed: 4.2 trillion yen for TOPIX-linked ETFs, 0.3 trillion yen for capital and human investment-related ETFs. Proportional by market values (the remainder, 1.5 trillion yen): ETFs linked to TOPIX, NSA, JPX Nikkei 400.	
10/31/2019	The basic policy to purchase 6 trillion yen of ETFs annually remained, but the value could change according to market environments.	

Source: Bank of Japan

The BOJ intended to stimulate the domestic economy, which was sluggish after the 2007-8 financial crisis. The policy statement mentioned this program's purpose was a cut in risk premia of corporate equities to urge companies to spend more on capital expenditures. The BOJ initially set an annual limit of 0.45 trillion yen and intended this program to terminate by the end of 2011. The Japanese central bank announced this program on October 28, 2010, and started to purchase ETFs linked to NSA and TOPIX on December 15, 2010. The situation changed dramatically in March 2011, when the domestic economy turned into turmoil due to the Great East Japan earthquake. The annual limits were lifted several times, finally to 2.1 trillion yen. When the second Abe Cabinet started in December 2012, a hyper quantity easing policy was adopted by the BOJ under a new Governor, Haruhiko Kuroda. Currently, the BOJ plans to purchase

ETFs by 6 trillion yen annually, and there seems to be no specific description of the termination schedule for this program.

Table 3(A) represents the distribution of NAVs among the domestically registered ETFs. Currently, more than 100 ETFs exist, and their sectors spread over a variety of asset classes, including domestic and overseas equity, fixed-income, real estate, and commodities. Domestic equity-indexed ETFs enjoy the lion's share with more than 92%, or 40.1 out of 43.3 trillion yen as of the end of 2019, of the total NAVs. Table 3(B) shows the distribution of equity index-linked ETFs, where NAVs of NSA- and TOPIX-linked ETFs represent more than 90%.

Among other domestic equity ETFs, leveraged ETFs, which provide investors with multiple times of index returns, both positively and negatively, are popular among individual investors, as shown in Table 3(C). For example, when the NSA returned 5%, NSA-linked double and triple bullish ETFs would roughly provide 10% and 15% returns, respectively. In comparison, NSA-linked bearish and double bearish ETFs would approximately provide -5% and -10 %, respectively, for a 5% of NSA return. So, bullish ETFs tend to be preferred by bullish investors, and bearish ETFs tend to be selected by bearish investors. Investment companies manage these funds using equity-index futures.

**Table 3 Net Asset Values of ETFs**

**(A) Composition of Total ETFs by Asset Class Sector**

CY	Domestic Equity Index		Other Domestic Equity		Overseas Equity		Fixed Income		Real Estate		Miscellaneous		Total	
	NAV ¥ Bil.	Number	NAV ¥ Bil.	Number	NAV ¥ Bil.	Number	NAV ¥ Bil.	Number	NAV ¥ Bil.	Number	NAV ¥ Bil.	Number	NAV ¥ Bil.	Number
2001	886	8	4	1	0	0	0	0	0	0	0	0	890	9
2002	2,481	8	29	10	0	0	0	0	0	0	0	0	2,510	18
2003	2,937	8	25	10	0	0	0	0	0	0	0	0	2,962	18
2004	3,087	7	26	8	0	0	0	0	0	0	0	0	3,113	15
2005	3,540	7	163	6	0	0	0	0	0	0	0	0	3,704	13
2006	3,956	7	160	6	0	0	0	0	0	0	0	0	4,117	13
2007	3,628	7	207	7	21	1	0	0	0	0	22	1	3,879	16
2008	2,290	7	178	46	22	5	0	0	5	2	30	4	2,525	64
2009	2,043	9	148	48	67	7	1	1	6	2	26	5	2,291	72
2010	2,276	10	222	49	73	15	3	1	12	2	25	8	2,610	85
2011	2,544	10	84	54	55	18	5	1	15	3	25	9	2,729	95
2012	3,960	10	120	58	61	20	6	2	37	3	31	11	4,215	104

2013	7,497	11	365	63	60	20	7	2	132	3	29	11	8,091	110
2014	9,586	16	639	69	90	20	11	2	251	5	40	11	10,616	123
2015	14,296	21	1,300	85	79	20	13	2	362	7	116	10	16,165	145
2016	18,354	21	1,152	91	76	20	35	5	598	8	132	10	20,347	155
2017	28,613	21	1,161	100	90	25	60	11	764	12	107	11	30,795	180
2018	30,754	21	1,417	100	97	26	71	12	1,153	13	71	11	33,563	183
2019	40,121	25	1,215	82	115	28	125	13	1,681	18	87	10	43,345	176

**(B) Composition of Domestic Equity Index-linked ETFs**

CY	Nikkei Stock Average		TOPIX		JPX Nikkei 400		Nikkei 300		Total	
	NAV ¥ Bil.	Number	NAV ¥ Bil.	Number	NAV ¥ Bil.	Number	NAV ¥ Bil.	Number	NAV ¥ Bil.	Number
2001	282	4	604	4	0	0	0	0	886	8
2002	413	4	2,068	4	0	0	0	0	2,481	8
2003	683	4	2,253	4	0	0	0	0	2,937	8
2004	1,020	4	2,067	3	0	0	0	0	3,087	7
2005	1,507	4	2,034	3	0	0	0	0	3,540	7
2006	1,960	4	1,997	3	0	0	0	0	3,956	7
2007	1,756	4	1,873	3	0	0	0	0	3,628	7
2008	1,164	4	1,125	3	0	0	0	0	2,290	7
2009	1,099	5	944	4	0	0	0	0	2,043	9
2010	1,120	5	1,148	4	0	0	8	1	2,276	10
2011	1,326	5	1,211	4	0	0	7	1	2,544	10
2012	2,160	5	1,791	4	0	0	8	1	3,960	10
2013	4,136	6	3,349	4	0	0	12	1	7,497	11
2014	5,197	6	4,045	4	331	5	13	1	9,586	16
2015	7,552	8	6,158	6	576	6	11	1	14,296	21
2016	9,476	8	8,013	6	855	6	10	1	18,354	21
2017	12,832	8	14,400	6	1,371	6	11	1	28,613	21
2018	12,839	8	16,401	6	1,506	6	9	1	30,754	21
2019	14,968	9	23,006	8	2,138	7	10	1	40,121	25

**(C) Composition of Other Domestic Equity ETFs**

CY	Capital/Human Investment		Industrial		Leveraged		Miscellaneous		Total	
	NAV ¥ Bil.	Number	NAV ¥ Bil.	Number	NAV ¥ Bil.	Number	NAV ¥ Bil.	Number	NAV ¥ Bil.	Number
2001	0	0	0	0	0	0	4	1	4	1
2002	0	0	16	6	0	0	13	4	29	10
2003	0	0	14	6	0	0	11	4	25	10
2004	0	0	21	6	0	0	5	2	26	8
2005	0	0	134	4	0	0	30	2	163	6
2006	0	0	125	4	0	0	35	2	160	6

2007	0	0	150	4	0	0	57	3	207	7
2008	0	0	116	38	0	0	62	8	178	46
2009	0	0	81	38	0	0	67	10	148	48
2010	0	0	71	38	0	0	151	11	222	49
2011	0	0	40	38	0	0	44	16	84	54
2012	0	0	49	38	34	4	38	16	120	58
2013	0	0	90	38	204	6	71	19	365	63
2014	0	0	92	38	396	10	150	21	639	69
2015	0	0	92	38	1,063	27	145	20	1,300	85
2016	177	6	92	38	743	27	141	20	1,152	91
2017	190	6	118	38	589	27	264	29	1,161	100
2018	118	6	90	38	880	27	329	29	1,417	100
2019	123	6	45	19	680	27	367	31	1,215	83

Note: Net asset values (NAV) and the number of funds for total domestic ETFs, their asset class sectors, and subsectors of domestic equity index-linked ETFs and other domestic equity ETFs. Nikkei 300 Index is a value-weighted stock index, introduced in October 1993. The Nikkei-300-linked ETF, which started in April 1995, initially lacked some basic features of ETFs. So, the Investment Trusts Association, Japan had excluded it from the ETF category until 2010. Leveraged ETFs enable investors to achieve twice or triple index returns (called bullish-type ETFs), or the opposite signs of index returns (called bearish-type ETFs), using equity index futures.

Source: Financial Data Solutions, Inc.

## (2) The BOJ's Activities and Presence in ETF markets

The BOJ discloses daily ETF purchase records on its homepage. Table 4 shows its monthly summary of purchased values and the number of days purchased for equity index-linked ETFs and capital/human investment ETFs, respectively. Amounts and the number of days are varied for the former, while the value is a constant of 1.2 billion yen for every business day for the latter.

**Table 4 ETF Purchase Records of the BOJ**

### (A) Values for Equity Index-linked ETFs

¥ Bil.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
2010												28.4	28.4
1	43.8	14.1	117.9	55.2	38.8	20.1	22.1	173.2	156.1	74.2	49.2	35.6	800.3
2	18.8	0.0	26.2	85.5	238.2	78.9	20.4	70.2	51.0	31.4	19.1	0.0	639.7
3	22.7	23.8	57.4	126.6	75.2	157.4	74.4	166.4	105.6	91.7	48.5	145.6	1,095.3
4	110.4	98.9	94.9	69.6	47.6	39.0	72.0	123.6	43.8	132.3	228.0	224.4	1,284.5
5	344.3	132.2	246.4	290.7	217.0	443.1	259.2	302.0	255.6	33.6	287.0	258.3	3,069.4

6	318.5	264.0	67.2	300.0	207.3	419.8	268.8	352.2	806.3	282.8	353.1	742.0	4,382.0
7	562.4	492.7	506.8	507.5	363.5	364.0	424.2	659.7	443.4	141.8	573.6	567.3	5,606.9
8	441.0	584.8	808.1	214.2	576.0	703.0	211.5	140.6	421.8	843.6	492.1	773.3	6,210.0
9	281.6	211.2	491.4	282.0	707.0	211.5	492.8	636.3	140.2	281.6	140.6	211.8	4,088.0
Total													27,204.5

**(B) Number of Days for Equity Index-linked ETFs**

Days

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
2010												2	2
1	3	1	7	3	2	1	1	7	7	4	3	2	41
2	1	0	1	3	6	3	1	3	2	1	1	0	22
3	1	1	2	5	4	8	4	8	6	7	4	7	57
4	8	8	8	6	4	3	5	8	3	9	6	6	74
5	10	4	7	8	6	12	8	9	8	1	8	7	88
6	9	8	2	9	6	12	8	6	11	4	5	10	90
7	8	7	7	7	5	5	6	9	6	2	8	9	79
8	6	8	11	3	8	10	3	2	6	12	7	11	87
9	4	3	7	4	10	3	7	9	2	4	2	3	58
Total													598

**(C) Values for Capital/Human Investment ETFs**

¥ Bil.

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
2016				22.8	22.8	26.4	24.0	26.4	24.0	24.0	24.0	25.2	219.6
7	22.8	24.0	26.4	24.0	24.0	26.4	24.0	26.4	24.0	25.2	24.0	25.2	296.4
8	22.8	22.8	25.2	24.0	25.2	25.2	25.2	27.6	21.6	26.4	25.2	22.8	294.0
9	22.8	22.8	24.0	24.0	22.8	24.0	26.4	25.2	22.8	25.2	24.0	25.2	289.2
Total													1,099.2

**(D) Number of Days for Capital/Human Investment ETFs**

Days

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Year
2016				19	19	22	20	22	20	20	20	21	183
7	19	20	22	20	20	22	20	22	20	21	20	21	247
8	19	19	21	20	21	21	21	23	18	22	21	19	245
9	19	19	20	20	19	20	22	21	19	21	20	21	241
Total													916

Note: Equity Index-linked ETFs include ETFs linked to Nikkei Stock Average (NSA), TOPIX, JPX Nikkei 400. Capital/Human Investment ETFs are purchased regularly by 1.2 billion yen per day.

Source: Bank of Japan

Table 5 shows the monthly returns of NSA and TOPIX. The values of the BOJ's purchases of equity index-linked ETFs negatively correlated with both of their returns;  $-0.34$  with NSA and  $-0.33$  with TOPIX. These statistics suggest that the BOJ tends to purchase equity index-linked ETFs when stock markets are sluggish to maintain stock prices. The BOJ, however, has not officially revealed the existence of such a policy.

**Table 5 Monthly Returns of Major Domestic Equity Indices**

**(A) Nikkei Stock Average (NSA)**

%

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2010												2.94
1	0.09	3.77	-8.18	0.97	-1.58	1.26	0.17	-8.93	-2.85	3.31	-6.16	0.25
2	4.11	10.46	3.71	-5.58	-10.27	5.43	-3.46	1.67	0.34	0.66	5.80	10.05
3	7.15	3.78	7.25	11.80	-0.62	-0.71	-0.07	-2.04	7.97	-0.88	9.31	4.02
4	-8.45	-0.49	-0.09	-3.53	2.29	3.62	3.03	-1.26	4.86	1.49	6.37	-0.05
5	1.28	6.36	2.18	1.63	5.34	-1.59	1.73	-8.23	-7.95	9.75	3.48	-3.61
6	-7.96	-8.51	4.57	-0.55	3.41	-9.63	6.38	1.92	-2.59	5.93	5.07	4.40
7	-0.38	0.41	-1.10	1.52	2.36	1.95	-0.54	-1.40	3.61	8.13	3.24	0.18
8	1.46	-4.46	-2.78	4.72	-1.18	0.46	1.12	1.38	5.49	-9.12	1.96	-10.45
9	3.79	2.94	-0.84	4.97	-7.45	3.28	1.15	-3.80	5.08	5.38	1.60	1.56

**(B) Tokyo Stock Price Index (TOPIX)**

%

	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.
2010												4.40
1	1.26	4.53	-8.61	-2.02	-1.57	1.28	-0.92	-8.41	-1.22	0.38	-4.66	0.02
2	3.66	10.68	2.20	-5.86	-10.54	7.03	-4.39	-0.63	0.79	0.67	5.27	10.02
3	9.36	3.77	6.05	12.60	-2.52	-0.17	-0.19	-2.27	7.96	0.01	5.39	3.47
4	-6.27	-0.74	-0.72	-3.36	3.35	5.09	2.13	-0.89	3.78	0.55	5.75	-0.20
5	0.54	7.69	1.26	3.22	5.08	-2.58	1.79	-7.38	-8.19	10.42	1.42	-2.09
6	-7.45	-9.37	3.80	-0.49	2.93	-9.71	6.17	0.51	-0.51	5.31	5.49	3.35
7	0.20	0.90	-1.48	1.27	2.39	2.78	0.42	-0.07	3.55	5.45	1.48	1.42
8	1.05	-3.73	-2.94	3.55	-1.68	-0.95	1.29	-1.02	4.72	-9.42	1.30	-10.40
9	4.91	2.56	-1.00	1.65	-6.53	2.57	0.90	-3.40	5.02	4.99	1.94	1.29

Source: Yahoo Japan

As shown in Figure 1, investors could buy and sell ETFs in the stock market just as they trade listed stocks. When investors trade ETFs on the stock market, the numbers of ETF shares outstanding do not change. When a great demand for specific ETFs emerges, however, investment companies would issue brand-new ETFs. Authorized participants, or registered brokerage firms, bring stock baskets specified by investment companies to get new ETFs. For example, when NSA-indexed ETFs are newly issued, brokerage firms typically buy NSA component stocks in the stock markets and bring them to investment companies. Investors trade ETFs on the stock markets, and trust banks keep underlying stocks as trustees. Authorized participants could resell the ETFs in stock markets or bring them to investment companies again and redeem them. When ETFs are redeemed, authorized participants restore component stocks, which trust banks had kept.

Table 6 represents the values of ETFs issued and redeemed on an annual basis for each asset class. Until 2010, amounts for ETF issuance and redemption are somewhat balanced. After the BOJ started to purchase ETFs, issuance tended to surpass redemption. This trend became significant when BOJ lifted the annual target values to 3 trillion yen in late 2014 and to 6 trillion yen in the middle of 2016. Accumulated ETF values of net issuance were around 33 trillion yen (96.815 minus 63.179 trillion yen) as of the end of 2019 (Table 6(A)), and the BOJ's ETF purchasing program accounts for most of them. The values of net issuance were around 10 trillion yen (41.337 minus 31.479 trillion yen) for NSA-indexed ETFs, about 19 trillion yen (34.725 minus 15.680 trillion yen) for TOPIX-indexed ETFs, and slightly less than 2 trillion yen (3.128 minus 1.260 trillion yen) for JPX-Nikkei-400-indexed ETFs. The NSA is a price-weighted index composed of Japanese major 225 stocks, and the TOPIX is a value-weighted index composed of all of the first section listed stocks on the Tokyo Stock Exchange. Finally, JPX-Nikkei-400 is a value-weighted index composed of 400 high-quality stocks. Values of net issuance for these three categories related to the BOJ program comprised more than 90% of total amounts of net ETF issuance. Other types with a considerable size in net issuance include "other domestic equity" of 1.1 trillion yen and "real estate" of 1.3 trillion yen.

**Table 6 Issuances and Redemptions of ETFs****(A) Composition of Total ETFs by Asset Class Sector**

CY	Domestic Equity Indexed		Other Domestic Equity		Overseas Equity		Fixed Income		Real Estate		Miscellaneous		Total	
	Issuance ¥ Bil.	Redemption ¥ Bil.	Issuance ¥ Bil.	Redemption ¥ Bil.	Issuance ¥ Bil.	Redemption ¥ Bil.	Issuance ¥ Bil.	Redemption ¥ Bil.	Issuance ¥ Bil.	Redemption ¥ Bil.	Issuance ¥ Bil.	Redemption ¥ Bil.	Issuance ¥ Bil.	Redemption ¥ Bil.
2001	1,000	47	5	0	0	0	0	0	0	0	0	0	1,005	47
2002	2,378	327	32	0	0	0	0	0	0	0	0	0	2,410	327
2003	1,061	1,157	0	9	0	0	0	0	0	0	0	0	1,061	1,166
2004	1,400	1,521	4	6	0	0	0	0	0	0	0	0	1,404	1,527
2005	1,854	2,436	179	75	0	0	0	0	0	0	0	0	2,032	2,512
2006	2,087	1,829	131	122	0	0	0	0	0	0	0	0	2,217	1,950
2007	4,051	3,934	288	155	22	0	0	0	0	0	21	0	4,381	4,088
2008	1,295	1,060	158	88	40	1	0	0	5	0	21	4	1,518	1,154
2009	893	1,368	58	80	28	2	1	0	3	2	4	15	988	1,467
2010	1,545	1,295	132	63	22	3	2	0	4	1	6	10	1,712	1,372
2011	1,358	662	22	132	12	14	2	0	8	1	9	7	1,411	816
2012	1,544	813	54	40	5	11	1	0	16	2	24	9	1,645	876
2013	3,272	2,082	454	325	9	21	1	1	89	11	12	7	3,838	2,448
2014	4,987	3,748	1,268	1,099	20	11	3	0	134	64	30	19	6,442	4,941
2015	7,318	3,558	2,887	2,316	20	25	3	0	204	69	217	107	10,649	6,076
2016	8,280	4,635	2,231	2,287	8	14	29	6	272	64	111	81	10,931	7,086
2017	12,095	6,282	1,563	1,649	20	21	36	11	317	85	53	55	14,084	8,103
2018	13,359	6,094	2,562	2,130	40	22	40	24	513	190	25	62	16,539	8,521
2019	9,413	5,583	2,243	2,550	38	44	73	21	756	476	25	30	12,548	8,704
Total	79,191	48,429	14,271	13,125	283	188	192	65	2,320	966	558	406	96,815	63,179

**(B) Composition of Domestic Equity Index-linked ETFs**

CY	Nikkei Stock Average		TOPIX		JPX Nikkei 400		Nikkei 300		Total	
	Issuance ¥ Bil.	Redemption ¥ Bil.	Issuance ¥ Bil.	Redemption ¥ Bil.	Issuance ¥ Bil.	Redemption ¥ Bil.	Issuance ¥ Bil.	Redemption ¥ Bil.	Issuance ¥ Bil.	Redemption ¥ Bil.
2001	370	36	630	11	0	0	0	0	1,000	47
2002	325	91	2,053	236	0	0	0	0	2,378	327
2003	320	139	741	1,018	0	0	0	0	1,061	1,157
2004	542	264	858	1,257	0	0	0	0	1,400	1,521
2005	1,304	1,252	549	1,184	0	0	0	0	1,854	2,436
2006	1,556	1,226	531	602	0	0	0	0	2,087	1,829
2007	3,133	3,029	918	905	0	0	0	0	4,051	3,934
2008	698	478	597	582	0	0	0	0	1,295	1,060
2009	655	907	239	461	0	0	0	0	893	1,368
2010	912	868	633	424	0	0	0	3	1,545	1,295



2011	821	407	538	254	0	0	0	0	1,358	662
2012	992	567	552	246	0	0	0	0	1,544	813
2013	2,038	1,425	1,233	657	0	0	0	0	3,272	2,082
2014	2,906	2,263	1,716	1,423	366	62	0	0	4,987	3,748
2015	4,223	2,374	2,683	972	412	209	0	4	7,318	3,558
2016	4,762	3,127	3,004	1,252	515	256	0	0	8,280	4,635
2017	5,338	4,042	6,128	1,928	628	309	1	3	12,095	6,282
2018	6,353	4,689	6,332	1,162	674	243	0	0	13,359	6,094
2019	4,091	4,296	4,788	1,104	534	182	1	1	9,413	5,583
Total	41,337	31,479	34,725	15,680	3,128	1,260	2	10	79,191	48,429

**(C) Composition of Other Domestic Equity ETFs**

CY	Capital/Human Investment		Industrial		Leveraged		Miscellaneous		Total	
	Issuance ¥ Bil.	Redemption ¥ Bil.	Issuance ¥ Bil.	Redemption ¥ Bil.	Issuance ¥ Bil.	Redemption ¥ Bil.	Issuance ¥ Bil.	Redemption ¥ Bil.	Issuance ¥ Bil.	Redemption ¥ Bil.
2001	0	0	0	0	0	0	5	0	5	0
2002	0	0	20	0	0	0	12	0	32	0
2003	0	0	0	5	0	0	0	4	0	9
2004	0	0	4	0	0	0	0	6	4	6
2005	0	0	139	53	0	0	39	22	179	75
2006	0	0	107	102	0	0	23	19	131	122
2007	0	0	196	94	0	0	92	60	288	155
2008	0	0	114	84	0	0	44	4	158	88
2009	0	0	12	38	0	0	46	42	58	80
2010	0	0	18	26	0	0	114	37	132	63
2011	0	0	12	32	0	0	10	100	22	132
2012	0	0	4	5	51	21	0	14	54	40
2013	0	0	105	90	298	195	50	40	454	325
2014	0	0	58	60	1,029	921	181	118	1,268	1,099
2015	0	0	78	86	2,745	2,150	63	80	2,887	2,316
2016	199	43	47	39	1,883	2,096	102	110	2,231	2,287
2017	84	100	54	43	1,258	1,426	168	80	1,563	1,649
2018	89	138	86	81	2,139	1,796	248	114	2,562	2,130
2019	1	14	20	62	2,116	2,371	107	103	2,243	2,550
Total	372	295	1,075	902	11,520	10,976	1,303	953	14,271	13,125

Note: New issuances and redemptions for the total domestic ETFs, their asset class sectors, and subsectors of domestic equity index-linked ETFs and other domestic equity ETFs. Classification is similar as in Table 3.

Source: Financial Data Solutions, Inc.

Table 7 represents the accumulated values of ETFs issued, compared with the BOJ purchase of ETFs. The BOJ's accumulated ETF purchases reached 28 trillion yen as of 2019. This value equals more than one-third of ETF total issuance and more than 90% of ETF total net issuance. These figures show how the BOJ's ETF purchasing program was outstanding in domestic ETF markets. The BOJ is just "a whale in a pond," which is a classical Japanese metaphor.

**Table 7 Values of the BOJ's ETF Purchases relative to ETF Issuance**

CY	ETF Total			BOJ		
	Issuance ¥ Bil.	Redemption ¥ Bil.	Net Issuance ¥ Bil.	Purchase ¥ Bil.	to Issuance %	to Net Issuance %
2001	1,005	47	958	--	--	--
2002	2,410	327	2,083	--	--	--
2003	1,061	1,166	-105	--	--	--
2004	1,404	1,527	-123	--	--	--
2005	2,032	2,512	-479	--	--	--
2006	2,217	1,950	267	--	--	--
2007	4,381	4,088	293	--	--	--
2008	1,518	1,154	365	--	--	--
2009	988	1,467	-480	--	--	--
2001-9	17,017	14,238	2,779	--	--	--
2010	1,712	1,372	340	28	1.7	8.4
2011	1,411	816	596	800	56.7	134.4
2012	1,645	876	769	640	38.9	83.2
2013	3,838	2,448	1,390	1,095	28.5	78.8
2014	6,442	4,941	1,501	1,285	19.9	85.6
2015	10,649	6,076	4,573	3,069	28.8	67.1
2016	10,931	7,086	3,845	4,602	42.1	119.7
2017	14,084	8,103	5,981	5,903	41.9	98.7
2018	16,539	8,521	8,017	6,504	39.3	81.1
2019	12,548	8,704	3,844	4,377	34.9	113.9
2010-19	79,798	48,941	30,857	28,304	35.5	91.7

Note: New issuances, redemptions, and net issuances (new issuances minus redemptions) for the total domestic ETFs. The values of the BOJ's ETFs purchases include equity index-linked ETFs and capital/human investment ETFs, and I showed their ratios relative to the total new issuances and net issuances. The 2001-9 represents a summation from 2001 through 2009, while 2010-19 represents a summation from 2010 through 2019.

Source: Financial Data Solutions, Inc., Bank of Japan

## 5. Timing of the BOJ's Purchases of ETFs and Its Impact on the Stock Market

Table 8 shows the correlation matrices between the values the BOJ purchased equity index-linked ETFs and the NSA's past and former returns. As the NSA's returns, I used -3, -2, -1, +1, +2, +3 closing-to-closing daily returns, the previous day's closing to the same day's opening (-1 close to 0 open) returns, and the same day's opening-to-closing (0 open to close) returns. There were strong negative correlations between the BOJ's ETF purchases and "-1 close to 0 open" returns for the total period and both subperiods. These statistics suggest the BOJ tended to purchase ETFs when opening NSAs declined from the previous day's closing NSAs. It is consistent with market participants' general views that the BOJ utilizes its ETF program to sustain stock prices. Correlation matrices between the BOJ's purchases of ETFs and TOPIX returns showed similar results, although I did not show actual data.

**Table 8 NSA Returns and the BOJ's Purchases of Equity Index-linked ETFs**

### (A) 12/15/2010 to 12/31/2019

	BOJ	-3	-2	-1	-1 Close to 0 Open	0 Open to Close	+1	+2	+3
BOJ	1.000								
-3	-0.017	1.000							
-2	-0.045	-0.047	1.000						
-1	-0.065	0.026	-0.047	1.000					
-1 Close to 0 Open	-0.422	0.022	0.038	-0.027	1.000				
0 Open to Close	-0.165	-0.045	0.006	-0.042	0.153	1.000			
+1	-0.046	-0.050	-0.019	0.026	0.004	-0.069	1.000		
+2	-0.001	0.014	-0.050	-0.019	0.025	0.016	-0.047	1.000	
+3	-0.009	-0.008	0.014	-0.050	0.024	-0.047	0.027	-0.048	1.000

### (B) 12/15/2010 to 10/31/2014

	BOJ	-3	-2	-1	-1 Close to 0 Open	0 Open to Close	+1	+2	+3
BOJ	1.000								
-3	0.027	1.000							
-2	-0.085	-0.055	1.000						
-1	-0.045	0.051	-0.054	1.000					
-1 Close to 0 Open	-0.523	0.043	0.072	-0.043	1.000				
0 Open to Close	-0.246	-0.059	0.016	-0.035	0.153	1.000			
+1	-0.014	-0.094	-0.013	0.055	-0.027	-0.040	1.000		
+2	-0.011	0.057	-0.094	-0.013	0.044	0.040	-0.044	1.000	
+3	-0.042	0.003	0.056	-0.094	0.033	-0.050	0.054	-0.044	1.000

**(C) 11/4/2014 to 12/30/2019**

	BOJ	-3	-2	-1	-1 Close to 0 Open	0 Open to Close	+1	+2	+3
BOJ	1.000								
-3	-0.030	1.000							
-2	-0.047	-0.040	1.000						
-1	-0.086	0.003	-0.040	1.000					
-1 Close to 0 Open	-0.521	0.001	0.004	-0.011	1.000				
0 Open to Close	-0.194	-0.032	-0.004	-0.048	0.153	1.000			
+1	-0.062	-0.008	-0.025	-0.001	0.035	-0.097	1.000		
+2	0.007	-0.028	-0.008	-0.025	0.005	-0.008	-0.050	1.000	
+3	0.001	-0.018	-0.028	-0.007	0.014	-0.044	0.000	-0.051	1.000

Note: Correlation matrices between the values of the BOJ's equity index-linked ETF purchases and NSA returns. The “-3” means NSA close-to-close returns from 4 days to 3 days before the BOJ's ETF purchases, while “+3” means NSA close-to-close returns from 2 days to 3 days after the BOJ's ETF purchases. The “-1 Close to 0 Open” means NSA close-to-open returns from the previous day to the same day of the BOJ's ETF purchases, while “0 Open to Close” means NSA open-to-close returns of the same day of the BOJ's ETF purchases. The total period (A) is from December 15, 2010, to December 30, 2019, and separated into two sub-periods. During the first sub-period (B) from December 15, 2010, to October 31, 2014, the BOJ's ETF purchase values were moderate, while during the second sub-period (C) from November 4, 2014, to December 30, 2019, the BOJ's annual target ETF purchase values lifted to at least 3 trillion yen.

Table 9 shows the regression analysis results with the values the BOJ purchased equity index-linked ETFs as dependent variables and NSA and TOPIX past returns as independent variables. The results are consistent with the view that the BOJ tends to buy ETFs when past stock index returns are negative. The BOJ's ETF purchases negatively correlated with -3 close to -2 close NSA returns, with at least a significance level of 10%. A negative correlation was more substantial with “-2 close to -1 close” NSA returns, with a significance level of 1%. The negative relationship was the strongest with “-1 close to 0 open” NSA returns. These results also seem to strengthen in the second subperiod when the BOJ lifted its annual target value to at least 3 trillion yen.

**Table 9 Equity-index Returns and the Timing of the BOJ's ETF Purchases**

	12/15/2010 - 12/30/2019		12/15/2010 - 10/31/2014		11/4/2014 - 12/30/2019	
	NSA	TOPIX	NSA	TOPIX	NSA	TOPIX
-4 close to -3 close						
coefficient	-1.277	-0.273	2.850	3.127	-7.307	-6.329
t-value	-0.365	-0.074	1.840	1.904	-1.302	-1.070
significance			*	*		
-3 close to -2 close						
coefficient	-6.035	-4.553	-2.741	-2.356	-11.643	-9.872
t-value	-1.722	-1.232	-1.768	-1.434	-2.072	-1.667
significance	*		*		**	*
-2 close to -1 close						
coefficient	-14.190	-11.178	-4.110	-2.806	-22.018	-18.440
t-value	-4.054	-3.025	-2.656	-1.712	-3.921	-3.114
significance	***	***	***	*	***	***
-1 close to 0 open						
coefficient	-127.173	-137.842	-47.808	-53.173	-205.744	-212.053
t-value	-22.005	-22.717	-19.010	-19.744	-21.821	-21.760
significance	***	***	***	***	***	***
Adjusted R <sup>2</sup>	0.184	0.193	0.280	0.295	0.281	0.278
number of sample	2,215	2,215	954	954	1,261	1,261

Note: The regression analyses of the values the BOJ purchased ETFs as a dependent variable with past NSA and TOPIX returns as independent variables. As equity index past returns, I used  $t=-4$  to  $-3$  closing returns,  $t=-3$  to  $-2$  closing returns,  $t=-2$  to  $-1$  closing returns, and  $t=-1$  closing to  $t=0$  opening returns. As the significance level, each coefficient is significant at 10% for \*, 5% for \*\*, and 1% for \*\*\*. The description of the three periods is the same as in Table 8

Regarding the impact of the BOJ's ETF purchases for stock index returns, the sign of correlation was negative in all cases for the same day's open to close (0 open to close) returns, as shown in Table 8. We should not interpret these results that the BOJ's ETF purchases led to stock price declines. The BOJ tended to purchase ETFs when opening stock index prices declined. So, its activities may have avoided further price declines, and we cannot evaluate the effectiveness of the BOJ's ETF purchases solely from these statistics.

Table 10 shows correlation matrices between the values the BOJ purchased equity index-linked ETFs and actual issuances of these ETFs with 0- through 5-day lags. In all cases, coefficients of correlations were positive, but the strongest correlation was three days after the BOJ's purchases. These statistics may relate to the ETF scheme, as shown

in Figure 1. After the BOJ orders ETFs' purchases, brokerage firms start to buy component stocks, and it may take a few days to complete the purchase. This scheme may alleviate the market impact due to hefty buy orders under the BOJ's program to purchase equity index-linked ETFs.

**Table 10 The BOJ's ETF Purchases and Issuances of Equity Indexed-linked ETFs**

**(A) 12/15/2010 to 12/23/2019**

	BOJ	Issuance	+1	+2	+3	+4	+5
BOJ	1.000						
Issuance	0.185	1.000					
+1	0.200	0.333	1.000				
+2	0.202	0.295	0.333	1.000			
+3	0.283	0.205	0.294	0.333	1.000		
+4	0.272	0.187	0.205	0.294	0.333	1.000	
+5	0.200	0.169	0.187	0.205	0.294	0.333	1.000

**(B) 12/15/2010 to 10/31/2014**

	BOJ	Issuance	+1	+2	+3	+4	+5
BOJ	1.000						
Issuance	0.022	1.000					
+1	0.050	0.140	1.000				
+2	0.084	0.070	0.141	1.000			
+3	0.126	0.011	0.070	0.141	1.000		
+4	0.112	0.051	0.011	0.069	0.141	1.000	
+5	0.098	0.019	0.055	0.019	0.070	0.137	1.000

**(C) 11/4/2014 to 12/23/2019**

	BOJ	Issuance	+1	+2	+3	+4	+5
BOJ	1.000						
Issuance	0.078	1.000					
+1	0.094	0.236	1.000				
+2	0.093	0.196	0.236	1.000			
+3	0.194	0.082	0.196	0.236	1.000		
+4	0.181	0.047	0.082	0.197	0.236	1.000	
+5	0.090	0.030	0.048	0.082	0.198	0.238	1.000

Note: Correlation matrices between the values of the BOJ purchased ETFs and actual ETF issuances. The "Issuance" represents issuances of equity index-linked ETFs on the same day of the BOJ's ETF purchases, and figures of "+1" through "+5" represent issuances of ETFs on 1 to 5 days after the BOJ's purchases. The description of the three periods is the same as in Table 8, but the last date for (A) and (C) is December 23, 2019, which is five trading days before December 30, 2019.

## 6. The Impact of the BOJ's ETF Purchases on the Pricing of NSA Component Stocks

Table 11 shows the results for empirical tests on the “indexing effect.”

**Table 11 Influences of the BOJ's ETF Purchasing Program on the Pricing of NSA Components Stocks**

### (A) Absolute Values of “ $\beta-1$ ”

	BOJ Purchase				Issuance of NSA-indexed ETF			
	for NSA		for TOPIX		for NSA		for TOPIX	
	Average	Median	Average	Median	Average	Median	Average	Median
12/15/2010 - 12/30/2019								
coefficient	-0.314	-0.318	-0.501	-0.518	-0.200	-0.266	-0.429	-0.533
t-value	-3.018	-3.326	-4.411	-5.111	-1.739	-2.512	-3.410	-4.751
significance	***	***	***	***	*	**	***	***
Adjusted R <sup>2</sup>	0.004	0.005	0.008	0.011	0.001	0.005	0.005	0.010
12/15/2010 - 10/31/2014								
coefficient	-0.960	-0.708	-1.201	-0.982	-1.723	-1.665	-1.996	-1.908
t-value	-1.913	-1.416	-2.203	-1.818	-4.832	-4.685	-5.156	-4.976
significance	*		**	*	***	***	***	***
Adjusted R <sup>2</sup>	0.003	0.001	0.004	0.002	0.023	0.022	0.026	0.024
11/4/2014 - 12/30/2019								
coefficient	-0.259	-0.191	-0.343	-0.241	0.056	0.069	-0.049	-0.032
t-value	-2.369	-2.069	-2.870	-2.580	0.448	0.650	-0.356	-0.293
significance	**	**	***	**				
Adjusted R <sup>2</sup>	0.004	0.003	0.006	0.004	-0.001	0.000	-0.001	-0.001

### (B) Excess Risks

	BOJ Purchase				Issuance of NSA-indexed ETF			
	for NSA		for TOPIX		for NSA		for TOPIX	
	Average	Median	Average	Median	Average	Median	Average	Median
12/15/2010 - 12/30/2019								
coefficient	-0.634	-0.661	-0.634	-0.661	-0.271	-0.335	-0.218	-0.282
t-value	-3.478	-3.906	-3.911	-4.525	-1.340	-1.784	-1.214	-1.741
significance	***	***	***	***		*		*
Adjusted R <sup>2</sup>	0.005	0.006	0.006	0.009	0.000	0.001	0.000	0.001
12/15/2010 - 10/31/2014								
coefficient	-0.509	-0.109	-0.260	0.140	-3.459	-3.233	-2.755	-2.529
t-value	-0.607	-0.141	-0.357	0.218	-5.842	-5.937	-5.349	-5.572
significance					***	***	***	***
Adjusted R <sup>2</sup>	-0.001	-0.001	-0.001	-0.001	0.034	0.035	0.028	0.031

11/4/2014 - 12/30/2019								
coefficient	-0.793	-0.786	-0.597	-0.590	0.050	0.010	0.269	0.229
t-value	-3.986	-4.229	-3.319	-3.599	0.218	0.045	1.296	1.208
significance	***	***	***	***				
Adjusted R <sup>2</sup>	0.012	0.013	0.008	0.009	-0.001	-0.001	0.001	0.000

Note: Results of regression analysis with averages and medians of “absolute values of  $\beta-1$ ” (A) and “Excess Risk” (B) of NSA component stocks as dependent variables and with the values of the BOJ’s ETF purchases or issued values of NSA-indexed ETFs as independent variables. I used only 192 NSA component stocks, which were consistently components through empirical periods. As benchmark equity indices in estimating betas and excess risks, I used NSA and TOPIX. Units of “BOJ Purchase” and “Issuance of NSA-indexed ETF” are trillion yen. As the significance level, each coefficient is significant at 10% for \*, 5% for \*\*, and 1% for \*\*\*. The description of the three periods is the same as in Table 8.

Regression coefficients for absolute values of “ $\beta-1$ ” as dependent variables with the BOJ’s purchases of equity index-linked ETFs as independent variables were mostly negative and statistically significant, as shown in Table 11(A). These statistics suggest that NSA component stocks’ betas became closer to one due to the BOJ’s purchases of equity index-linked ETFs. Coefficients for the total period were  $-0.314$  for NSA-based betas and  $-0.518$  for TOPIX-based betas, meaning that 1 trillion yen of the BOJ’s ETF purchases would move  $\beta$ s of NSA component stocks closer to 1 by such a pace. Such a relationship seems to have strengthened after the annual target values lifted to 3 trillion yen and more after November 2014.

Regression coefficients for absolute values of “ $\beta-1$ ” as dependent variables with issuances of NSA-indexed ETFs as independent variables were also negative and statistically significant for the total period and through the first subperiod, but such relationship disappeared after November 2014. Such a result may reflect that a massive purchase of ETFs by the BOJ urged investment companies to issue ETFs too frequently. Table 12 shows the number of days for the BOJ’s purchases of equity index-linked ETFs and issuances of NSA-indexed ETFs. After the BOJ lifted an annual target value to 3 trillion yen, NSA-indexed ETFs were issued in 1,110 days (88%) out of 1,261 days by either of 9 investment companies, although the BOJ purchased in only 414 days (33%). As a result, the relationship with issuances of ETFs and the indexing effect may have obscured.



**Table 12 Number of Days for the BOJ's Purchases  
and Issuances of NSA-indexed ETFs**

	BOJ Purchase		Issuance of NSA ETF		Total Days
	Yes	No	Yes	No	
12/15/2010 - 12/30/2019	598	1,617	1,649	566	2,215
(Percentage Composition)	27.0	73.0	74.4	25.6	100.0
12/15/2010 - 10/31/2014	184	770	539	415	954
(Percentage Composition)	19.3	80.7	56.5	43.5	100.0
11/4/2014 - 12/30/2019	414	847	1,110	151	1,261
(Percentage Composition)	32.8	67.2	88.0	12.0	100.0

Note: The “BOJ Purchase” represents the number of days when the BOJ purchased equity index-linked ETFs (Yes), and it did not (No). The “Issuance of NSA ETF” represents the number of days when NSA-indexed ETFs were issued by either of 9 investment companies (Yes) and were not (No).

Table 11(B) shows the results of empirical results for excess risks. The relationship was similar to that of the absolute values of “ $\beta-1$ .” After the BOJ purchased equity index-linked ETFs, risks of NSA component stocks got closer to market risks. This result is consistent with the hypothesis that idiosyncratic errors in the formula (1) reduced due to the BOJ’s massive purchases of NSA component stocks regardless of their fundamental factors. This result is another aspect of the “indexing effect.” A reduction of “excess risk” was not shown in regression analysis with NSA-indexed ETFs’ issuances as dependent variables, particularly in the second subperiod. Such a result may reflect the same factor for the former test.

## 7. Conclusion

In this paper, I surveyed Japanese ETF markets and the BOJ’s ETF purchase program and examined how it affected the stock market.

The BOJ started to purchase equity index-linked ETFs on December 15, 2010, under this program and has continued this activity by 6 trillion yen per annum. Its accumulated purchase values amounted to more than 28 trillion yen, which accounted for more than one-third of ETFs’ total issuances during the same period and more than 90% of net figures after deducting redemption values. We can conclude that the presence of the BOJ is enormous in domestic ETF markets.

The BOJ tended to purchase ETFs on the day when opening stock price indices

declined from the previous day's closing prices. This fact is consistent with the view that the BOJ utilizes the ETF program to sustain stock prices. The correlation coefficients with the BOJ's ETF purchases and stock index returns on the days of the buy orders were slightly negative. It seems to take a few days for ETFs to be issued after the BOJ decided to purchase ETFs. Authorized participants collect component stocks and bring them to investment companies to get ETFs, as shown in Figure 1. This scheme may contribute to the alleviation of the market impact of the BOJ's massive ETF purchases.

The BOJ so heavily purchased NSA-indexed ETFs that its program seems to have produced an "indexing effect," in which betas of component stocks get closer to one, and their risks approached market risks. Such an effect seems to have distorted the market because individual stocks' prices may not fully reflect their fundamental values.

The BOJ continues to purchase ETFs under its program and has never sold them. So, we should examine its impact or distortion from now on. Also, how such a program can terminate should be another big concern in the Japanese stock market.

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