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KATAGIRI, Mitsuru
*Department of Business Administration, Hosei University*

SHINO, Junnosuke
*School of International Liberal Studies, Waseda University*

TAKAHASHI, Koji
*Monetary and Economic Department, Bank for International Settlements*

WIAS 早稲田大学高等研究所 Waseda Institute for Advanced Study

1-21-1 Nishi Waseda, Shinjuku-ku, Tokyo 169-0051, Japan
Tel: 03-5286-2460 ; Fax: 03-5286-2470

# The announcement effects of a change in the Bank of Japan's ETF purchase program: An event study*

Mitsuru Katagiri † Junnosuke Shino ‡ Koji Takahashi §

**Abstract**

This study investigates the announcement effects of the Bank of Japan's (BOJ) ETF purchase program on equity prices, focusing on the policy change made on March 19, 2021 when the BOJ announced that it would no longer purchase Nikkei225-tracking and JPX400-tracking ETFs but would purchase more TOPIX-tracking ETFs. A regression of intraday stock returns revealed that the announcement of a future decrease (increase) in the amount of BOJ purchases has the instantaneous effect of decreasing (increasing) stock prices and that this effect is particularly evident for stocks the BOJ stopped purchasing.

**Keywords**: ETF purchase program, Bank of Japan, Event study, Announcement effects, Intraday stock returns

**JEL Classification codes**: E58, G12, G14

## 1 Introduction

Since December of 2010, the Bank of Japan (BOJ) has implemented and extended an exchange-traded funds (ETFs) purchasing program designed to lower equity risk premiums.[1] This study investigates the effects of the program on stock prices. However, in general, it is not easy to identify the effects of an asset purchasing program on associated asset prices, especially when the program is systematically conducted. It is widely known that the BOJ purchases ETFs when stock

*The views expressed in this paper are those of the authors and do not necessarily reflect the official views of the Bank for International Settlements.

†Department of Business Administration, Hosei University; mitsuru.katagiri@hosei.ac.jp

‡Corresponding author. School of International Liberal Studies, Waseda University, 1-6-1 Nishiwaseda, Shinjuku–ku, Tokyo, Japan 169-8050; junnosuke.shino@waseda.jp

§Monetary and Economic Department, Bank for International Settlements; koji.takahashi@bis.org

[1]The BOJ's governor, Haruhiko Kuroda, stated that the ETF purchases "aim at exerting positive effects on economic activity and prices by lowering risk premia in the markets." (Kuroda [7])

prices decline, rather than purchasing them randomly (Harada and Okimoto [4] and Financial Times [3][2]). Therefore, BOJ ETF purchases are strongly and positively correlated to negative stock returns, which makes difficult to detect the possible effects of the purchasing policy.

An effective approach to addressing such an endogeneity problem is to utilize cross-sectional variations in the amount of purchases for individual stocks. The BOJ program purchases different types of index-tracking ETFs – TOPIX-tracking, Nikkei225-tracking and JPX400-tracking ETFs – and this naturally generates substantial cross-sectional variations across individual stocks.[3] Furthermore, the cross-sectional variations have changed as the BOJ have made changes in the purchasing scheme. This study utilizes a change in the cross-sectional variations to derive the effects of the program on stock returns, focusing on a day during which the BOJ announced a change in the policy.

Specifically, we focus on the policy change made on March 19, 2021. At the Monetary Policy Meeting (MPM) held on that day, the BOJ announced it would no longer purchase Nikkei225- and JPX400-tracking ETFs but would purchase more TOPIX-tracking ETFs. We argue that this policy change presents an appropriate opportunity to investigate the announcement effects of the program for the following reasons. First, the decision entailed a change in cross-sectional variations in the amounts of individual stocks the BOJ would purchase. Second, the policy change surprised investors, as evidenced by news articles, such as [5].[4] If investors had not been surprised, that is, if they had expected the change, the effects of the change would have been priced in before the announcement; in this case, it would not be worth examining intraday price changes before and after the announcement. Finally, stock prices seemed to substantially react to the announcement. Figure 1 shows a clear difference between the daily returns of relevant indexes before and after the BOJ announced that it would stop purchasing Nikkei225-tracking ETFs.

Some existing researches have already examined the effects of the program on stock returns (Charoenwong et al. [2], Harada and Okimoto [4], Katagiri et al. [6] [5]). Generally, these studies

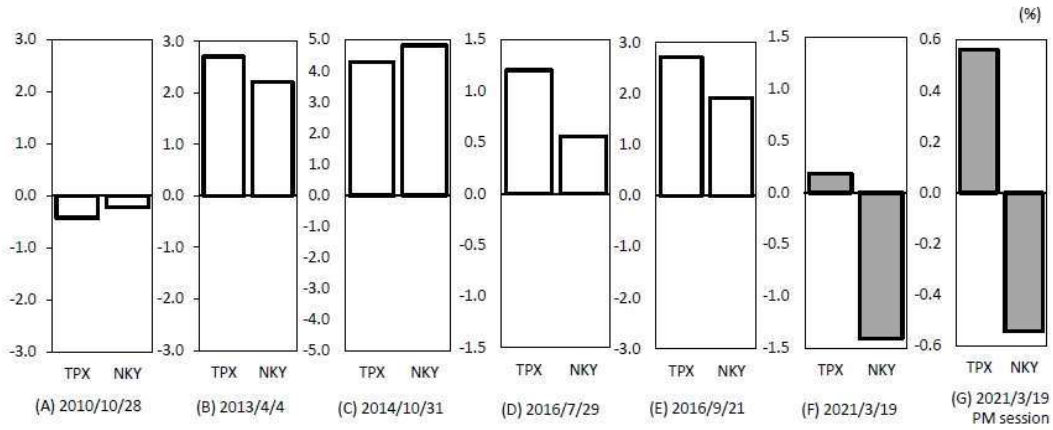
[2] *"Although it is not an explicit rule, the central bank has tended to step in whenever the TOPIX index has lost more than 0.5 per cent in the morning session,..."*

[3] Other than these index-tracking ETFs, the BOJ has also purchased ETFs that support firms investing in human and physical capital. However, because the amount of these purchases is trivially small, the following analysis excludes these ETFs.

[4] *"the BOJ's decision on other steps ... were within the market's expectations... But the central bank's decision to focus its purchases of ETFs only on those linked to the TOPIX index caught investors by surprise."*

[5] Charoenwong et al. [2] show that the program has increased stock prices, but that this effect is short-lived. Harada and Okimoto [4] utilized cross-sectional variations in purchase amount and concluded that the program cumulatively boosted the Nikkei225 by around 20%. Regarding the effects of the program on other market variables, see Shirota [9] for liquidity effects and Maeda et al. [8] for the effects on stock lending market.

Figure 1: Daily stock returns on days when the BOJ made major changes to its ETF purchase program




Notes: Panels (A) through (F) show the daily returns of TOPIX (left) and Nikkei225 (right) on the day of a major policy change in the ETF purchase program. (A) indicates the date of the decision to introduce the program. (B) indicates the date of the introduction of the "Quantitative and Qualitative Monetary Easing" and the decision to expand total ETF purchases to 1 trillion yen. (C) and (D) indicate the dates of the expansions of the program to 3 trillion yen and to 6 trillion yen, respectively. (E) indicates the date of the decision to raise the ratio of TOPIX-tracking ETFs and to reduce that of Nikkei225-tracking ETFs. (F) indicates the date of the decision to stop purchasing Nikkei225-tracking ETFs. Panel (G) represents the same day as (F), but shows intraday returns from the start of the PM session (12:30) to the end of the session (15:00).
Sources: Nikkei NEEDS, Bloomberg.

primarily focus on the effects of the BOJ's actual ETF purchases on equity prices.[6] In addition to such direct "flow effects," we can naturally expect that when a change in the BOJ's purchasing pattern is pre-announced and associated markets are reasonably efficient, the effects of the change will be immediately baked into stock prices. The following analysis investigates the announcement effects of the BOJ's purchasing policy change on intraday stock returns on March 19, 2021.

## 2 An intraday analysis on the announcement effects of ETF purchases

Let $Flow\_etf_{i,\tau}$ be the amount of BOJ indirect purchases in time $\tau$ for stock $i$ via the program normalized by its market value. Then, the expected total amount of ETFs ($\mathbf{etf}_{i,t}$) purchased in time $\tau \geq t$ is expressed as follows,

$$\mathbf{etf}_{i,t} = E_t \left[ \sum_{\tau \geq t} Flow\_etf_{i,\tau} \right].$$

[6]One exception is a study by Barbon and Gianinazzi [1], which, like our analysis, examines announcement effects; however, unlike our study, their study does not consider intraday stock returns.

Let $z_{i,t}$ be a state variable to determine $i$'s (counter-factual) stock price without the ETF purchase program $\tilde{p}_{i,t}$, i.e., $\tilde{p}_{i,t} = f(z_{i,t})$. Then, we assume that the log of $i$'s stock price under the ETF purchase program, denoted by $p_{i,t}$, is expressed as follows:

$$p_{i,t} = f(z_{i,t}) + g(\mathbf{etf}_{i,t}) \tag{1}$$

where $g(.)$ is a decreasing function and approximated by a linear function, that is, $g(\mathbf{etf}_{i,t}) = \lambda \mathbf{etf}_{i,t}$. Equation (1) means that the effect is expressed as a function of the expected discounted sum of the future flow of purchases for $i$.

In this paper, we exploit changes in the purchasing amount, $\mathbf{etf}_{i,t}$, due to the change in the framework of the purchasing policy. More specifically, we assume that the policy change was announced between $t$ and $t + \Delta$. The price change from $t$ to $t + \Delta$ is calculated as follows:

$$p_{i,t+\Delta} - p_{i,t} \quad = \quad f(z_{i,t+\Delta}) - f(z_{i,t}) + \lambda(\mathbf{etf}_{i,t+\Delta} - \mathbf{etf}_{i,t}).$$

Therefore, the following testable equation is derived:

$$p_{i,t+\Delta} - p_{i,t} = \alpha + \lambda(\mathbf{etf}_{i,t+\Delta} - \mathbf{etf}_{i,t}) + \epsilon_{it} \tag{2}$$

where the dependent variable is the gross stock return or the rate of change in stock prices before and after the policy change announcement. Because such an announcement took place on March 19, 2021, we analyze changes on this date. At the MPM held on that day, the BOJ changed its purchasing scheme; it announced that it would purchase only TOPIX-tracking ETFs. Previously, (i) 25% of BOJ ETF purchases were ETFs tracking the three indices of the TOPIX, Nikkei225, and JPX400 proportional to the amount outstanding in circulation and (ii) the remaining 75% of BOJ ETF purchases comprised TOPIX-tracking ETFs.

To construct a variable representing the change in policy expectation term in (2), we first let the sum of the amount outstanding in circulation for ETFs tracking the TOPIX, Nikkei225, and JPX400 at $t$ be $T_t$, $N_t$, and $J_t$, respectively and $S_t = T_t + N_t + J_t$. For firm $i$, let the weight in TOPIX, Nikkei225, and JPX400 at $t$ be $w^T_{i,t}$, $w^N_{i,t}$ and $w^J_{i,t}$, respectively. In the face of the policy change announcement, investors' expectation of the purchasing amount for stock $i$, normalized by its market value $MKT_{i,t}$,

that is, $\mathbf{etf}_{i,t}$, should be changed as follows:

$$\begin{aligned}\mathbf{etf}_{i,t} &= \left[\left(0.75 + 0.25 \cdot \frac{T_t}{S_t}\right) w_{i,t}^T + 0.25 \cdot \frac{N_t}{S_t} w_{i,t}^N + 0.25 \cdot \frac{J_t}{S_t} w_{i,t}^J\right] \cdot \frac{ETF_t}{MKT_{i,t}} \\ \mathbf{etf}_{i,t+\Delta} &= w_{i,t+\Delta}^T \cdot \frac{ETF_{t+\Delta}}{MKT_{i,t+\Delta}}\end{aligned}$$

where $ETF_t$ is the expected total amount of ETF purchases made by the BOJ in period $\tau \geq t$. Since the policy change on March 19 entailed no change in the targeted purchasing amount, we can naturally assume that there was no change in market expectation, $ETF_{t+\Delta} = ETF_t$. We also assume $MKT_{i,t+\Delta} = MKT_{i,t}$ and $w_{i,t+\Delta} = w_{i,t}$. This implies that market participants take market value as constant in evaluating the effects of the change in the purchase program, which is a reasonable assumption as we investigate the expectation change in a narrow time window, $\Delta$. Therefore, the change in the expected purchasing amount for stock $i$ is written as follows,

$$\mathbf{etf}_{i,t+\Delta} - \mathbf{etf}_{i,t} = 0.25\left[\frac{N_t}{S_t}(w_{i,t}^T - w_{i,t}^N) + \frac{J_t}{S_t}(w_{i,t}^T - w_{i,t}^J)\right] \cdot \frac{ETF_t}{MKT_{i,t}}.$$

Define $x_{i,t}$ as

$$x_{i,t} = \left[\frac{N_t}{S_t}(w_{i,t}^T - w_{i,t}^N) + \frac{J_t}{S_t}(w_{i,t}^T - w_{i,t}^J)\right] \cdot \frac{100}{MKT_{i,t}}. \tag{3}$$

Note that $x_{i,t}$ determines the sign of $\mathbf{etf}_{i,t+\Delta} - \mathbf{etf}_{i,t} > 0$ iff $x_{i,t} > 0$ and vice versa. Intuitively, with the policy change, the BOJ's purchase amount for stock $i$ is expected to increase if $i$'s weight in TOPIX is "relatively larger"than in Nikkei225 or JPX400. Then, with $x_{i,t}$, we can rewrite equation (2) as follows,

$$p_{i,t+\Delta} - p_{i,t} = \alpha + \beta x_{i,t} + \varepsilon_{i,t}. \tag{4}$$

where $\beta = 0.25/100\lambda ETF_t$.

Alternatively, we can start by assuming that the BOJ's purchasing under the program affects the risk premium $RP_{i,t}$ rather than the stock price $p_{i,t}$. In this case, the same argument can be applied and thus we can derive a similar equation to (2) where the dependent variable is $RP_{i,t+\Delta} - RP_{i,t}$ rather than $p_{i,t+\Delta} - p_{i,t}$. Furthermore, under certain conditions,[7] the change in the risk premium is converted to changes in the stock price with the following relationship: $p_{i,t+\Delta} - p_{i,t} = -(RP_{i,t+\Delta} - RP_{i,t}) \times PER_{i,t}$.

[7]Based on the discount dividend model, $p_{i,t} = D_{i,t}/r_{i,t}$ ($D_{i,t}$: dividend payment, $r_{i,t}$: discount rate) which follows $dp_{i,t}/P_{i,t} = -(p_{i,t}/D_{i,t})\, dr_{i,t}$. This implies that changes in risk premiums can be translated into percent changes in the stock price by multiplying the inverse of the divided yield, which is proxied by the forecast-based PER in practice.

Therefore, we also estimate the following model,

$$p_{i,t+\Delta} - p_{i,t} = \pi + \theta \left( PER_{i,t} \cdot x_{i,t} \right) + \epsilon_{i,t}. \tag{5}$$

By estimating $\beta$ in (4) and $\theta$ in (5), in which intraday gross stock returns on March 19 are taken as dependent variables, we examine the announcement effects of the policy change on stock prices. In other words, we exploit the cross-sectional variation in $x_{i,t}$ by setting $t$ as the time right before the policy change and $t + \Delta$ as the time after the change. More specifically, if the estimated coefficients are significantly positive, then the announcement of a future increase (decrease) in the amount of BOJ purchases for stock $i$ has the instantaneous effect of increasing (decreasing) $i$'s stock price.

Table 1 shows descriptive statistics for the variable $x_{i,t}$. For all stocks, the median and the 25 percentile point are strictly positive, meaning that for more than 75 percent of stocks, the BOJ's indirect purchase amount increased with the policy change. For stocks in the Nikkei225, its median is negative, reflecting that more than half (127 among 225) of the stocks satisfy the condition of $x_{i,t} < 0$, mainly because the weight for the Nikkei225 is larger than that for the TOPIX (see (3)). For stocks in the JPX400, its median is strictly positive, even though JPX400-tracking ETFs were excluded from the target.[8] This is because, while $w^J_{i,t}$ is larger than $w^T_{i,t}$ for most stocks, $w^T_{i,t} > w^N_{i,t}$ also holds; thus, the RHS of (3) becomes positive. Note that all the 98 stocks in the JPX400 with negative $x_{i,t}$ were also included in the Nikkei225.

Table 1: Descriptive statistics for $x_{i,t}$

| $x_{i,t}$ ($\times 10^3$) | No. obs | p1 | p25 | median | p75 | p99 | mean | sd |
|---|---|---|---|---|---|---|---|---|
| All stocks | 2186 | -2.11 | 0.51 | 0.69 | 0.88 | 1.25 | 0.61 | 0.61 |
| Stocks in Nikkei225 | 225 | -3.91 | -0.95 | -0.17 | 0.30 | 0.84 | -0.50 | 1.13 |
| Stocks in JPX400 | 393 | -3.76 | 0.01 | 0.41 | 0.57 | 0.82 | 0.05 | 0.94 |
| Stocks in Nikkei225 or JPX400 | 445 | -3.68 | -0.17 | 0.37 | 0.56 | 0.84 | 0.01 | 0.96 |
| Stocks with $x_{i,t} < 0$ | 127 | -4.83 | -1.83 | -0.86 | -0.27 | -0.02 | -1.17 | 1.10 |

Note: $x_{i,t}$ is defined in (3).
Sources: Nikkei NEEDS, Bloomberg, QUICK.

Table 2 shows the estimation results. The table has three panels, (A), (B), and (C). (A) presents the results for all stocks, (B) confines the samples to stocks included in the Nikkei225 or the JPX400, and (C) presents the results for stocks satisfying $x_{it} < 0$. Each panel has six columns comprising (a) through (f), where the first three columns of (a) to (c) correspond to model (4) while (d) to (f)

[8] More specifically, Among the 393 stocks in the index, 295 stocks had positive $x_{i,t}$ while 98 stocks were negative.

correspond to model (5).[9] Each of the three columns correspond to different intraday gross stock returns on March 19 from the start of the PM session to 13:00 (*return*1300), 14:00 (*return*1400), and 15:00 (*return*1500). Note that for Tokyo Stock Exchange, the AM session extends from 9:00 to 11:30 and the PM session from 12:30 to 15:00. The policy change made on March 19 was announced at 12:39. Thus, the above stock returns reflect the markets reaction to the announcement.

The estimation results in Table 2 imply some intriguing facts regarding the effects of the policy change announcement. First, in most cases in Panels (A) through (C), the estimated $\beta$s and $\theta$s are positive and statistically significant, implying that the announcement of a future increase (decrease) in BOJ purchases for stock $i$ has the instantaneous effect of increasing (decreasing) $i$'s return. Second, for each fixed column, we found that the estimated coefficient $\beta$ or $\theta$ becomes larger in the order of Panel (A) $\rightarrow$ (B) $\rightarrow$ (C), suggesting that the relative size of the announcement effect becomes larger with this order. Notably, Panel (C) shows the largest estimated $\beta$ and $\theta$ for every column; this suggests that the announcement had the substantial effect of exerting downward pressure on the returns of stocks for which the BOJ announcement suggested the BOJ would pull back its purchases. This asymmetric nature of the effects may need special attention when the BOJ implements so-called "exit policies" for the program. Third, for each panel in the table, we found that the estimated $\beta$ and $\theta$ for *return*1500 (column (c) and (f)) are larger than those for *return*1300 (column (a) and (d)). This suggests that the expected effects of the announcement were gradually baked into stock prices over time.

Related to the above observation and in order to check persistence of the announcement effects, we then consider cumulative stock returns from the opening of the PM session on March 19 to the end of each business day over the next week and regress them on $x_{i,t}$. Table 3 shows the estimation results in which Panel (A) represents all stocks and (B) represents stocks in the Nikkei225 or JPX400. In both panels, column (b), associated with returns on March 22, comprises the largest estimated coefficients. Since March 22 was a Monday, this implies that the policy effects were further priced in over the weekend. Moreover, the results also show that the estimated coefficients in Panel (B) are statistically positive and larger than those in Panel (A) for every column. Meanwhile, the estimated coefficient in Panel (A) becomes insignificant from March 24, implying that the announcement effects for all stocks were less persistent. This is consistent with the view that the announcement effects are particularly evident for stocks included in the Nikkei225 or JPX400.

[9] In order to consider possible correlations between PER and future stock returns, we also estimate the model in which $PER_{i,t}$ is added to (5). Estimation results are largely unchanged from those for (5).

Table 2: The effects of the announcement of the change in ETF purchases on intraday stock returns

Panel (A): All stocks

| | (a) return1300 | (b) return1400 | (c) return1500 | (d) return1300 | (e) return1400 | (f) return1500 |
|---|---|---|---|---|---|---|
| $x_{i,t}$ | 0.730* | -0.275 | 1.190** | | | |
| | (0.439) | (0.499) | (0.557) | | | |
| $PER_{i,t} \cdot x_{i,t}$ | | | | 0.00921** | -0.00169 | 0.0246** |
| | | | | (0.00441) | (0.00684) | (0.0102) |
| _cons | 0.000539* | 0.00530*** | 0.00753*** | 0.000883*** | 0.00512*** | 0.00766*** |
| | (0.000292) | (0.000358) | (0.000425) | (0.000157) | (0.000214) | (0.000287) |
| $N$ | 2186 | 2186 | 2186 | 1797 | 1796 | 1798 |
| $R^2$ | 0.006 | 0.000 | 0.004 | 0.002 | 0.000 | 0.004 |

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Panel (B): Stocks in the Nikkei225 or JPX400

| | (a) return1300 | (b) return1400 | (c) return1500 | (d) return1300 | (e) return1400 | (f) return1500 |
|---|---|---|---|---|---|---|
| $x_{i,t}$ | 2.065*** | 1.832** | 2.656*** | | | |
| | (0.535) | (0.758) | (0.837) | | | |
| $PER_{i,t} \cdot x_{i,t}$ | | | | 0.0365*** | 0.0286*** | 0.0500*** |
| | | | | (0.00694) | (0.0106) | (0.0122) |
| _cons | 0.00111*** | 0.00771*** | 0.00749*** | 0.00130*** | 0.00764*** | 0.00762*** |
| | (0.000218) | (0.000304) | (0.000402) | (0.000213) | (0.000287) | (0.000408) |
| $N$ | 445 | 445 | 445 | 385 | 384 | 385 |
| $R^2$ | 0.156 | 0.069 | 0.082 | 0.097 | 0.030 | 0.052 |

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Panel (C): Stocks with $x_{i,t} < 0$

| | (a) return1300 | (b) return1400 | (c) return1500 | (d) return1300 | (e) return1400 | (f) return1500 |
|---|---|---|---|---|---|---|
| $x_{i,t}$ | 2.458** | 3.230** | 3.175* | | | |
| | (1.060) | (1.461) | (1.640) | | | |
| $PER_{i,t} \cdot x_{i,t}$ | | | | 0.0531** | 0.0713** | 0.0664* |
| | | | | (0.0257) | (0.0353) | (0.0386) |
| _cons | 0.00173* | 0.0101*** | 0.00844*** | 0.00118 | 0.00930*** | 0.00730*** |
| | (0.00100) | (0.00138) | (0.00158) | (0.000936) | (0.00125) | (0.00142) |
| $N$ | 127 | 127 | 127 | 110 | 110 | 109 |
| $R^2$ | 0.203 | 0.183 | 0.133 | 0.246 | 0.248 | 0.172 |

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: The effects of the announcement on subsequent cumulative return on intraday stock returns

Panel (A): All stocks

| | (a) return0319 | (b) return0322 | (c) return0323 | (d) return0324 | (e) return0325 | (f) return0326 |
|---|---|---|---|---|---|---|
| $x_{i,t}$ | 1.190** | 6.440*** | 4.008*** | 1.380 | 1.856 | 1.210 |
| | (0.557) | (1.171) | (0.927) | (1.237) | (1.191) | (1.300) |
| _cons | 0.00753*** | 0.00252*** | -0.00974*** | -0.0327*** | -0.0174*** | -0.00513*** |
| | (0.000425) | (0.000856) | (0.000812) | (0.00107) | (0.00107) | (0.00114) |
| $N$ | 2186 | 2186 | 2186 | 2186 | 2186 | 2186 |
| $R^2$ | 0.004 | 0.031 | 0.008 | 0.001 | 0.001 | 0.000 |

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Panel (B): Stocks in Nikkei225 or JPX400

| | (a) return0319 | (b) return0322 | (c) return0323 | (d) return0324 | (e) return0325 | (f) return0326 |
|---|---|---|---|---|---|---|
| $x_{i,t}$ | 2.656*** | 7.876*** | 6.450*** | 5.871*** | 5.982*** | 5.662*** |
| | (0.837) | (1.276) | (1.266) | (1.815) | (1.594) | (1.774) |
| _cons | 0.00749*** | -0.000929 | -0.0131*** | -0.0346*** | -0.0193*** | -0.00651*** |
| | (0.000402) | (0.000833) | (0.000997) | (0.00142) | (0.00144) | (0.00145) |
| $N$ | 445 | 445 | 445 | 445 | 445 | 445 |
| $R^2$ | 0.082 | 0.159 | 0.083 | 0.037 | 0.036 | 0.031 |

Standard errors in parentheses
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

# 3 Conclusion

This study investigated the announcement effects of the BOJ's ETF purchasing program on stock returns by focusing on the BOJ's March 19, 2021 decision to stop purchasing Nikkei225- and JPX400-tracking ETFs, which surprised the market. We found that the announcement of a future decrease (increase) in the amount of BOJ purchases has the instantaneous effect of decreasing (increasing) stock returns. Additionally, these effects are particularly evident for stocks included in the Nikkei225 or JPX400. Future researchers may do well to 1) clarify the channel through which ETF purchases influence stock returns by, for example, applying a specific asset pricing model, such as CAPM, to identify the effects of the program on market beta or risk premiums or 2) explore the persistence of the effects of such policy changes.

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