# Asset Price and Corporate Responses to Bank of Japan ETF Purchases

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# Research Question

- Do central bank stock purchases have a stock price impact?
- If so, how do firms respond?
- Contribution: Potential roadmap for other central banks that may need to consider “alternative” tools in their arsenal.

# Why study Japan?

- The monetary policy launched by the Bank of Japan (BOJ) provides a rare research setting.

    1. BOJ is the first major central bank that has bought domestic stocks in a massive scale for a pro-longed period of time.

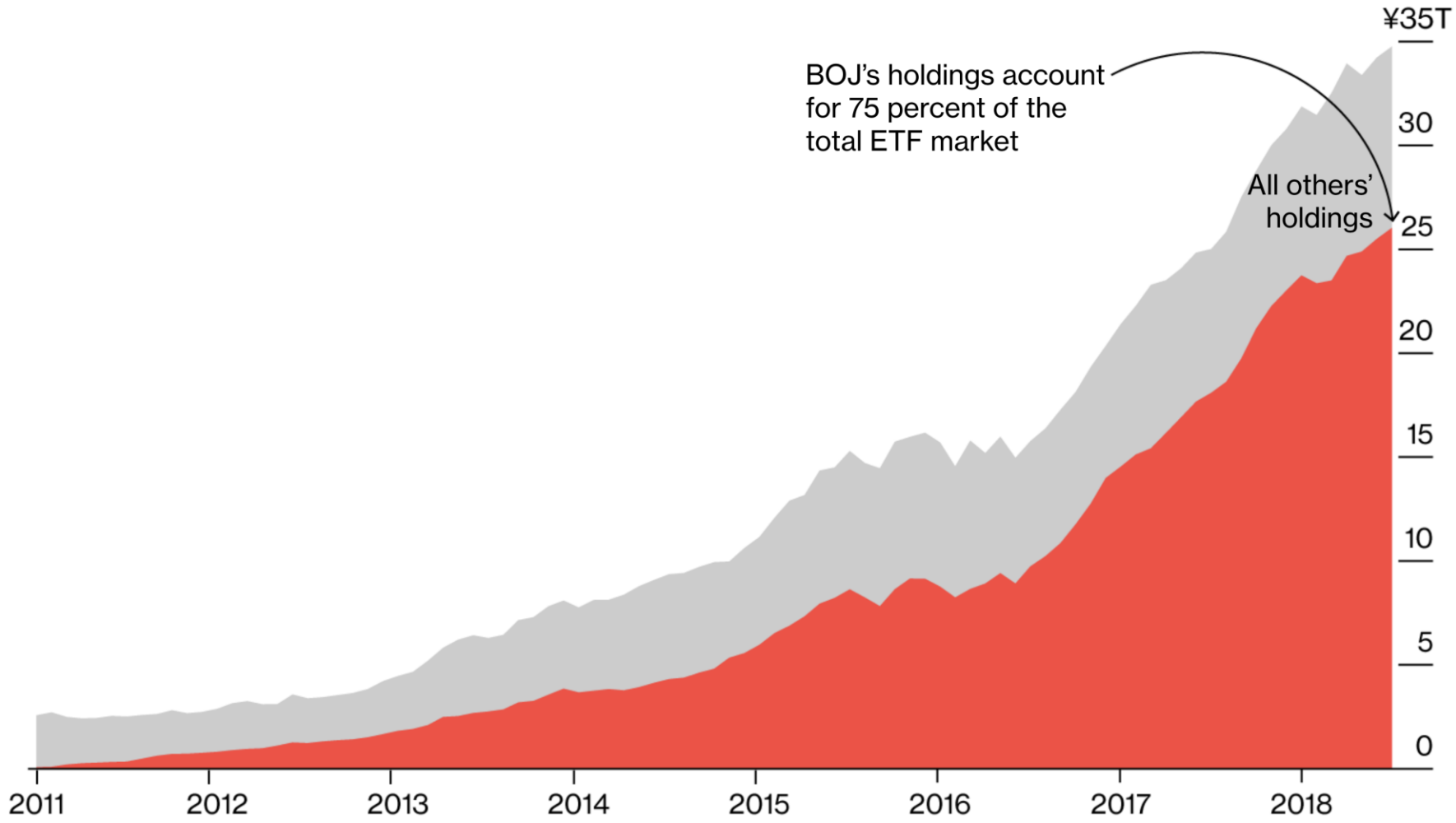
    2. Unique features of the purchase policy allow us to identify a causal effect from monetary policy on corporate investment.

- We study the effectiveness of BOJ monetary policy focusing on <u>domestic equity purchases</u> through ETF purchases on the firms:
    - Financing
    - Investment

*“Only in Japan does the central bank show its face in the stock market this much”*

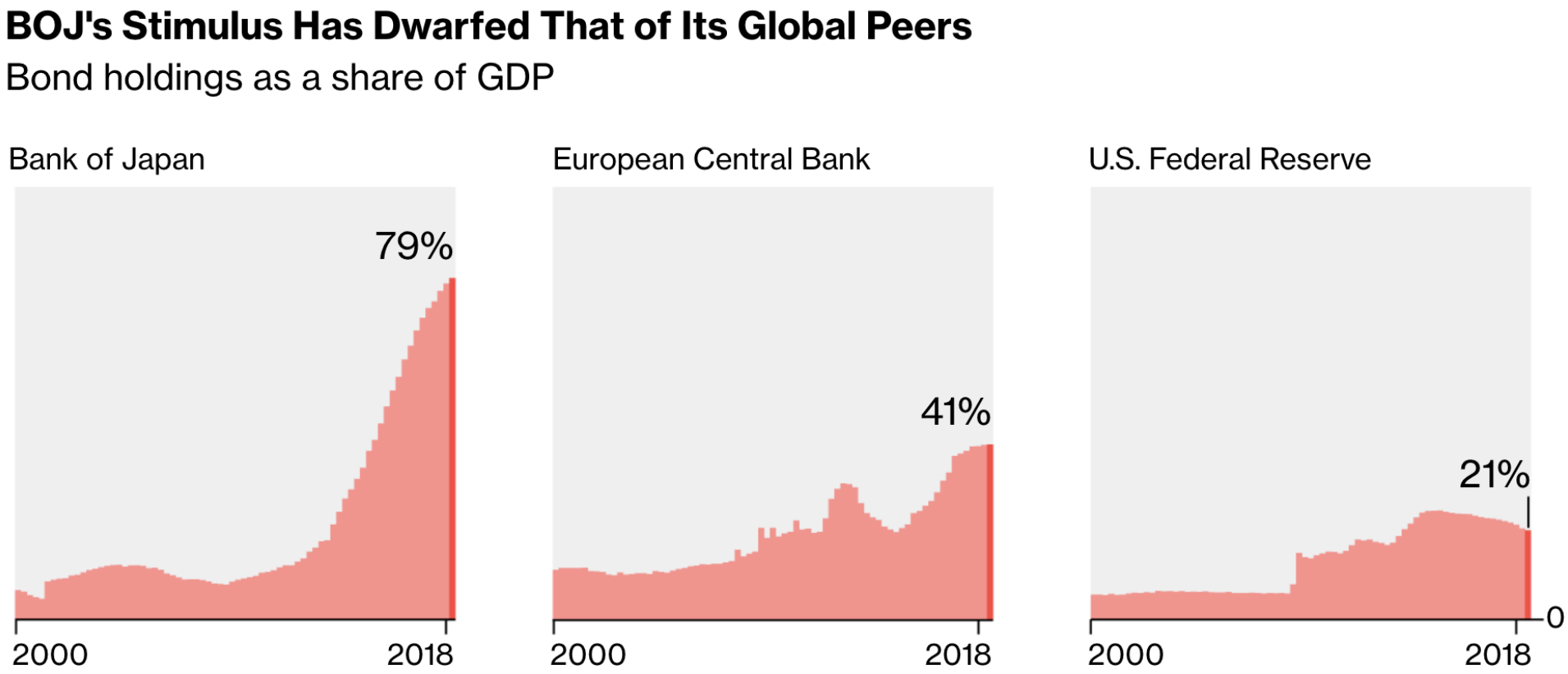
**Market Cornered**

The central bank has exerted a big influence on the Japanese stock market



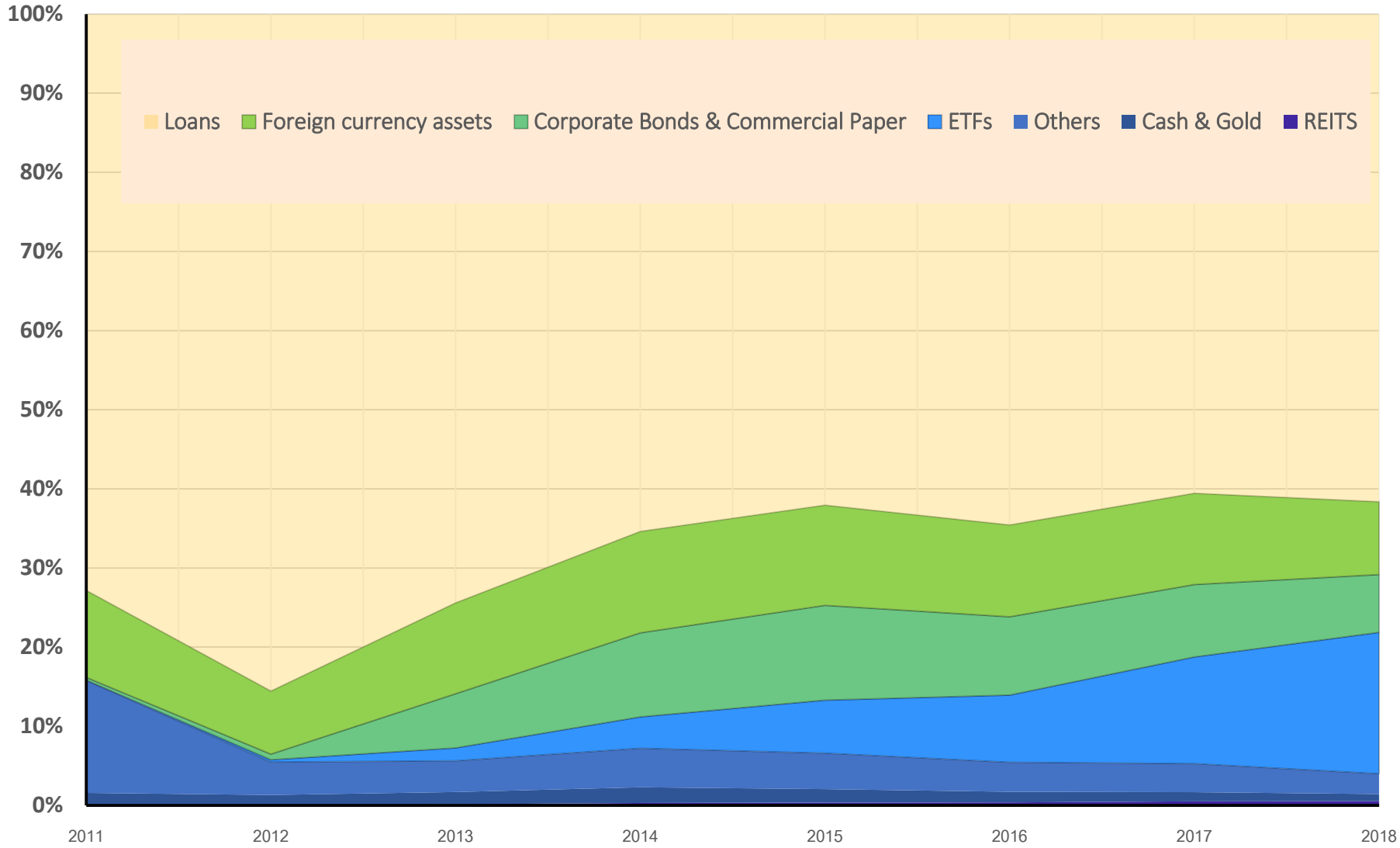

Sources: Banks of Japan, The Investment Trusts Association

# Major Central Banks: Total Assets/GDP (%)




Sources: Bank of Japan, Japan's Economic and Social Research Institute, U.S. Federal Reserve, U.S. Bureau of Economic Analysis, data compiled by Bloomberg

# Bank of Japan Breakdown of Holdings of Non-government Securities



# BOJ Monetary Policy Goals

- Objectives: reduce long-term interest rates, reach the 2% inflation target, increase corporate investment, and economic growth.

- ETF Policy Goals:
  - Goal 1: ETF Purchases Boost Stock Prices
  - Goal 2: Firms Raise More Capital
  - Goal 3: Corporate Investment Increases

# Preview of Results

- Goal 1: Satisfied: BOJ ETF purchases had a small increase in stock returns on the day of purchase and decreased monthly down-side volatility.
- Goal 2: Satisfied: Firms increase issuances.
  - Firms are more likely to have SEOs and sell treasury shares
  - Corporate owners of the firm also decrease their ownership
- Goal 3: Not Satisfied:
  - Quarterly, a firm whose BOJ purchase to total assets of 1%:
    - Returns increase by 1.65%
    - Market-to-book increases by 0.195, approximately 14%
    - Expands balance sheets by around 1.36%
      - 86% of the increase is in current assets
      - 42% of the increase is in cash & short-term investments
  - Annually, a firm whose BOJ purchase to total assets is 1% expands its balance sheet by 1.12%.
    - 49% of the increase is in cash

# Related Literature

- An extensive number of papers studies various monetary policy tools conducted by various central banks over different periods.
  - The FED's large-scale asset purchases (LSAPs); Mortgage backed Securities purchase program (MBS)
  - The Bank of England's Asset Purchase Facility (APF)
  - The ECB's lending program on lending rates, negative interest policy
  - The BOJ's QE policy, negative interest policy
- The impact of FED meeting monetary policy surprise announcements on asset prices
  - Bernanke and Blinder (1992), Bernanke and Mihov (1998), Kuttner (2001), Cochrane and Piazzesi (2002), Campbell et al. (2012), and Gertler and Karadi (2015)
- The effects on short-term and long-term yields or other targeted assets
  - Hamilton and Wu (2011), Krishnamurthy and Vissing-Jorgenson (2011), D' Amico et al. (2012), Wright (2012) and D' Amico and King (2013)
- The impact of the monetary policy on the macroeconomic level, employment, inflation, and economic growth.
  - (Kapetanios et al. (2012), Gambacorta et al. (2014), and Gambetti and Alberto Musso (2017))

# Background: Monetary Policy in Japan

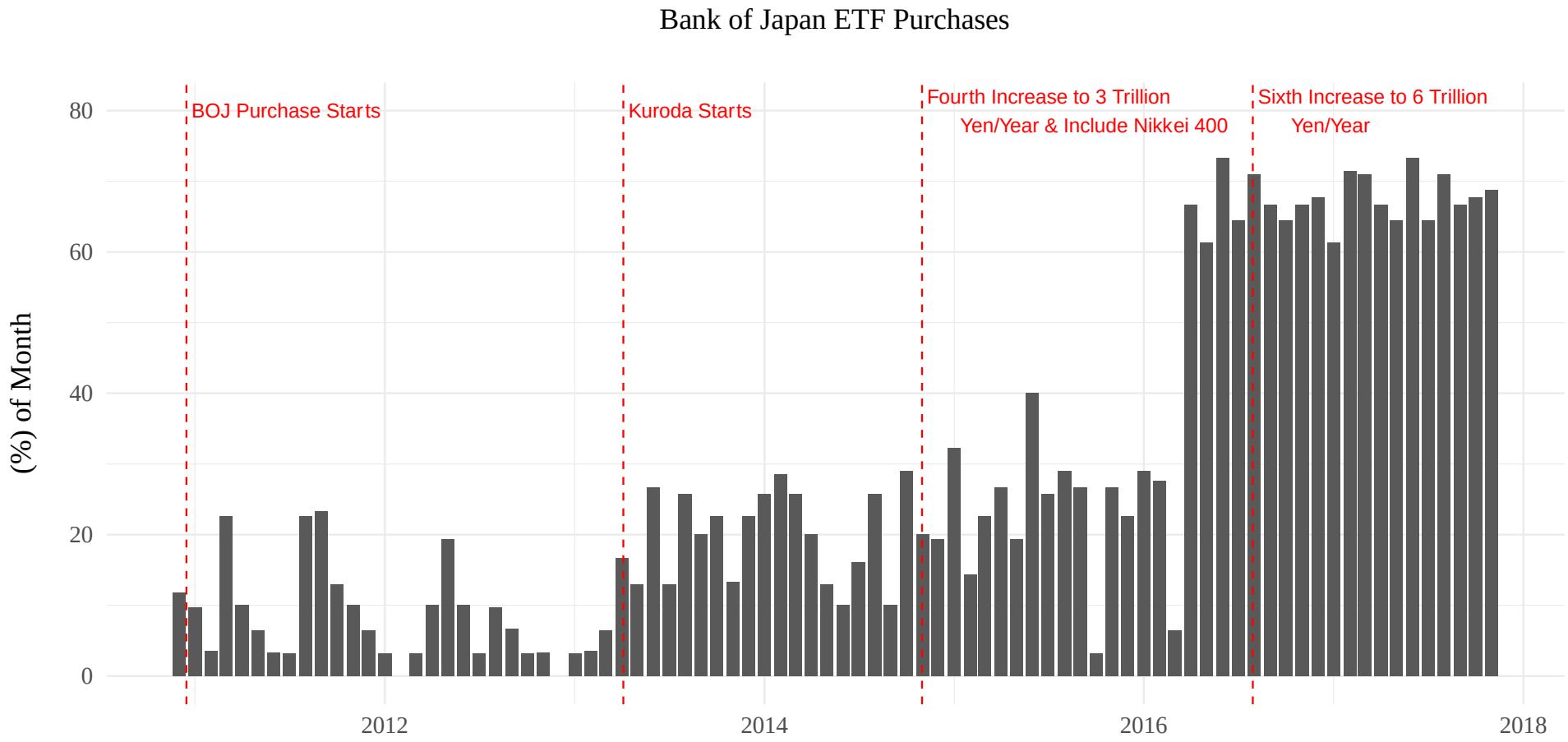
- The Bank of Japan (BOJ) is in the global vanguard of extraordinary monetary policy making.
- The BOJ pioneered quantitative easing (QE) in the 1930s, and more recently in 2001 and 2010.
- 2001-2006: BOJ had incrementally increased the target for bank reserves by purchasing public and private debt (lending to banks) to achieve the zero interest rate policy (ZIRP).
- The ECB, FED, Bank of England (BOE) applied QE in response to the Lehman crisis (November 2008).
  - FED implemented purchasing programs to buy government-sponsored enterprise (GSE) debt and billion in mortgage-backed securities (MBS)
  - BOE lunched large-scale asset purchasing program
  - ECB expanded bank lending operations at very low rates (May 2009)

# BOJ ETF Policy: Part of Abenomics

- October 28, 2010: start ETF purchases, tracking Nikkei 225 and Topix
- October 30, 2012: increase ETF purchase cap to 2.1 trillion yen/year
- November 19, 2014: include Nikkei 400
- March 15, 2016: increase ETF purchases cap to 3.3 trillion yen/year
- July 20, 2016: increase ETF purchase cap up to 6 trillion yen/year
- September 21, 2016: increase weight towards Topix over Nikkei 225

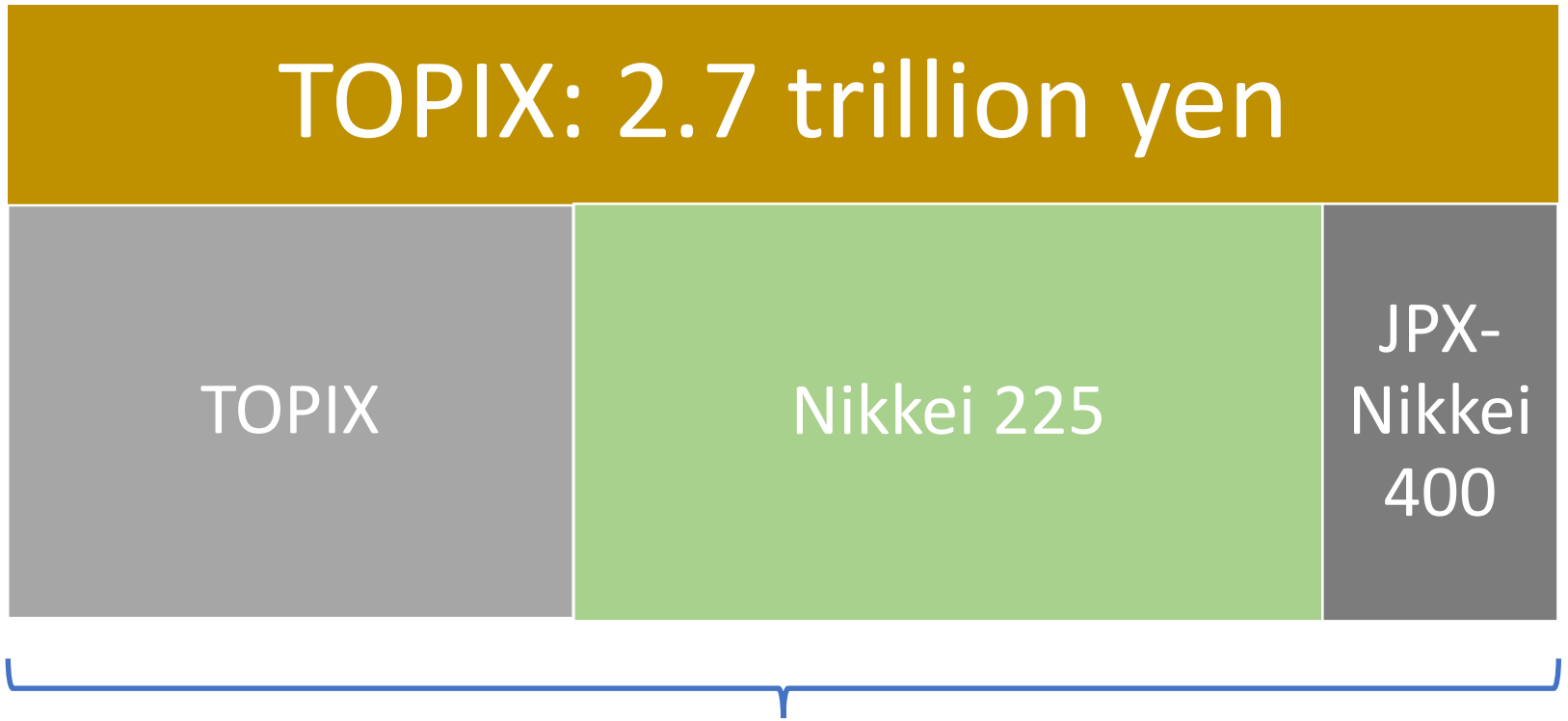
- Purchase amount was proportional to index-tracking ETF AUM (market value of total assets)

# BOJ's ETF Purchases



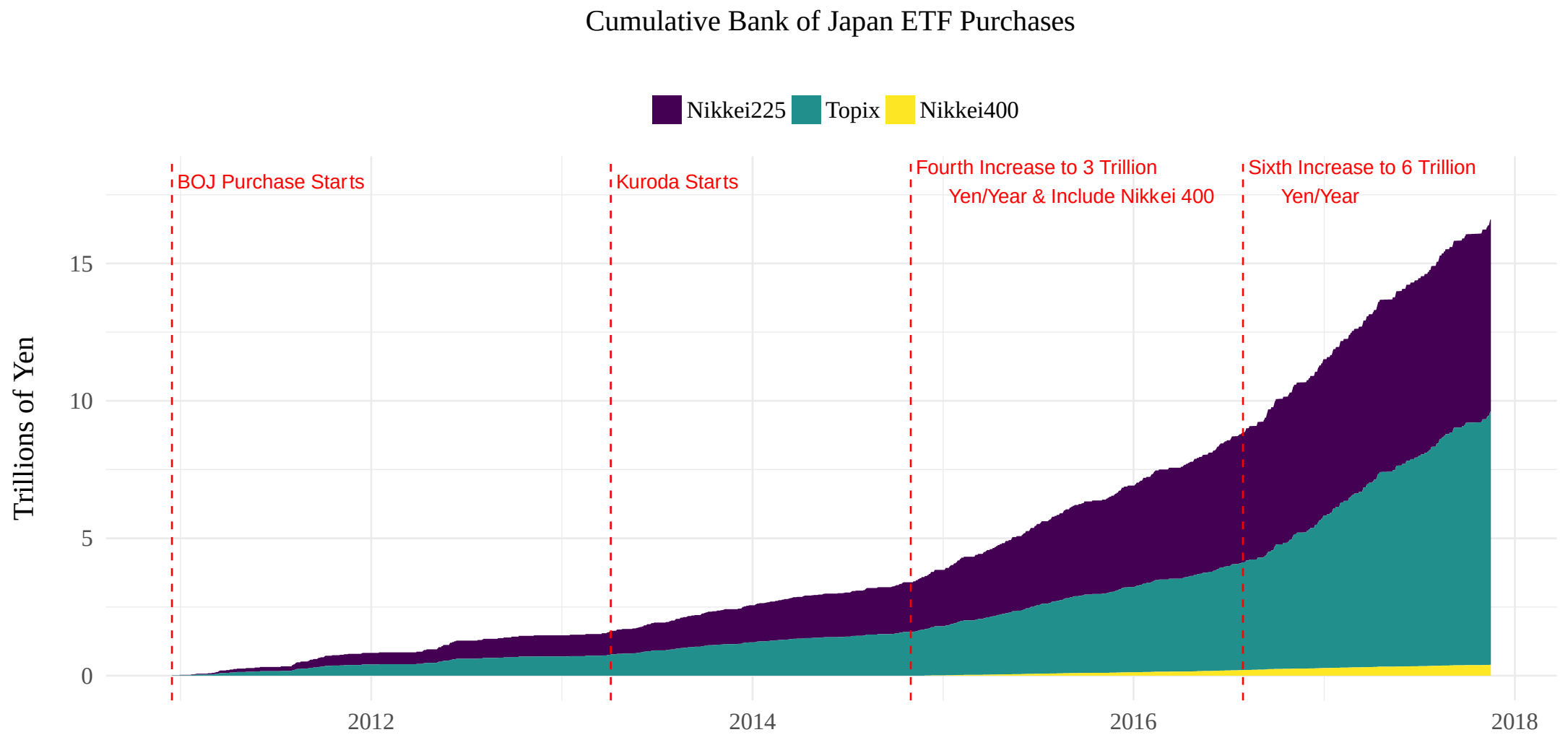

Maximum purchase per year is known, but purchase schedule undisclosed.
BOJ uploads purchase amount after 4:20 PM Japan time daily

# The ETF purchasing program (since 09/2016)




5.7 trillion yen to TOPIX,
Nikkei 225, Nikkei 400 Indices

The purchase amount is roughly in proportion to ETF AUM




As of 03/2018, the BOJ has bought 18.93 trillion yen = 173.4 bn USD (4% of the BOJ's total assets)

# BOJ's purchase at the firm level

- (1) Weights of ETFs: N225=53-55%, Topix=45-47%, and N400 = 2-3%
- (2) Total BOJ Demand of a Stock $i$ on day $t$

- $BOJ\ Purchases_{it} = \left(w_{it}^{N225} \times w_{BOJ,t}^{N225} + w_{it}^{Topix} \times w_{BOJ,t}^{Topix} + w_{it}^{N400} \times w_{BOJ,t}^{N400}\right) ETF_t$

- where ETF is the amount of BOJ purchases on day $t$

- Stock index weights:
  - Announcement dates and implementation dates are known
  - Nikkei 225 is (adjusted) price-weighted (the "Dow adjustment")
  - Topix & Nikkei 400 are public float-market cap-weighted

# Nikkei 225 Index: A price-weighted index

- Nikkei 225 is the most widely followed stock index in Japan, analogous to the U.S.'s Dow Jones Industrial Average
- The index is calculated as a price-weighted index of more liquid 225 companies traded on the First Section of the Tokyo Stock Exchange (TSE).
- The constituents of 225 stocks are selected according to composition criteria set by the newspaper, Nikkei (Nihon Keizai Shimbun) who has published and maintained the index since 1950.
  - According to the index guidelines, the 225 stocks are selected based on liquidity requirements and the industry composition such that the index represents a wide range of companies from various industries.
  - The constituents are revised annually in October.
- Due to the price weighting scheme, allocation of the BOJ's amount purchasing in Nikkei 225 firms is proportionally to their price and does not accounting for driven by the firm's fundamentals

# TOPIX & JPX-Nikkei Index 400

Free float adjusted market capitalization weighted index.
Weights updated at or after 4:20 pm Japan time on the last business day of the month using market-cap from the previous month.

## TOPIX

- TOPIX tracks all listed firms traded on the First Section of Tokyo Stock Exchange
- Comprises 2,083 companies as of March 2018.
- TOPIX is published by the Japan Exchange Group (JPX) who is running the Tokyo Stock Exchange.

## JPX-Nikkei Index 400

- Top 400 stocks on Tokyo Stock Exchange that are relatively large, have good performance, and corporate governance.
- Complicated criteria determine the weight of each firm in the index.
- The constituents of JPX-Nikkei Index 400 are reviewed annually by *Nihon Keizai Shimbun* and Japan Exchange Group (JPX).
- 1.5% cap on weight of 1 stock

# Correlation of Weights and Firm Fundamentals

Regressions explaining calculated weight of individual stocks in BOJ-linked ETF demand ($\overline{w}_{i,t}$) from equation [1] and of their weights in the Nikkei 225, TOPIX, and Nikkei-400 indexes on firm characteristics with firm characteristics. Standard errors are clustered at the firm level, and p-values are shown in parentheses. Boldface represents 5% statistical significance or better.

| Explained variable: | BOJ-linked ETF demand (1) | Nikkei 225 Weight (2) | TOPIX Weight (3) | JPX-Nikkei 400 Weight (4) |
|---|---|---|---|---|
| $\Delta$Market Cap$_{t-1}$ | **0.000** | 0.000 | 0.000 | **-0.000** |
| | **(0.044)** | (0.351) | (0.142) | **(0.019)** |
| $\Delta$Assets$_{t-1}$ | **2.389** | -1.592 | **5.426** | **2.010** |
| | **(0.048)** | (0.447) | **(0.000)** | **(0.000)** |
| $\Delta$ROA$_{t-1}$ | 0.007 | 1.086 | 0.004 | -0.001 |
| | (0.292) | (0.145) | (0.467) | (0.341) |
| $\Delta$Market-to-Book$_{t-1}$ | -0.042 | -0.024 | -0.024 | **-0.043** |
| | (0.097) | (0.859) | (0.236) | **(0.002)** |
| $\Delta$Book Leverage$_{t-1}$ | **-0.026** | -0.150 | -0.001 | 0.007 |
| | **(0.026)** | (0.121) | (0.852) | (0.180) |
| $N$ | 8,333 | 919 | 7,243 | 8,616 |
| $R^2$ | 0.747 | 0.643 | 0.434 | 0.353 |

# Data

- Sample:
  - All publicly listed firms in Japan with available data from January 2011 to November 2017
- Additional  Data Sources:
  - BOJ: Daily BOJ purchases
  - Japan Exchange Group (JPX): ETFs listed on the Tokyo Stock Exchange (TSE) tracking Nikkei 225, TOPIX, and JPX-NIKKEI 400
  - Bloomberg: Assets Under Management for each ETF at the monthly-level.
  - Nikkei Inc. & JPX: Weights of Nikkei 225, Topix, and JPX-NIKKEI 400
- Thomson Reuters:
  - DataStream: Daily stock returns, shares outstanding, and free float
  - WorldScope : Financial data (quarterly and annual data)
  - Fundamentals: Share issuances

## Table 2. Summary Statistics of Main Variables

Panel A presents summary statistics for the daily-level panel for the BOJ purchase basket with 1,675,132 firm-day observations on BOJ purchase days. Panel B presents summary statistics of quarterly variables over 48,322 firm-quarter observations. Tangible capital is net property, plant. and equipment. Changes in balance-sheet variables are scaled by the previous quarter's total assets, expressed as percentages and winsorized at the 1% level.

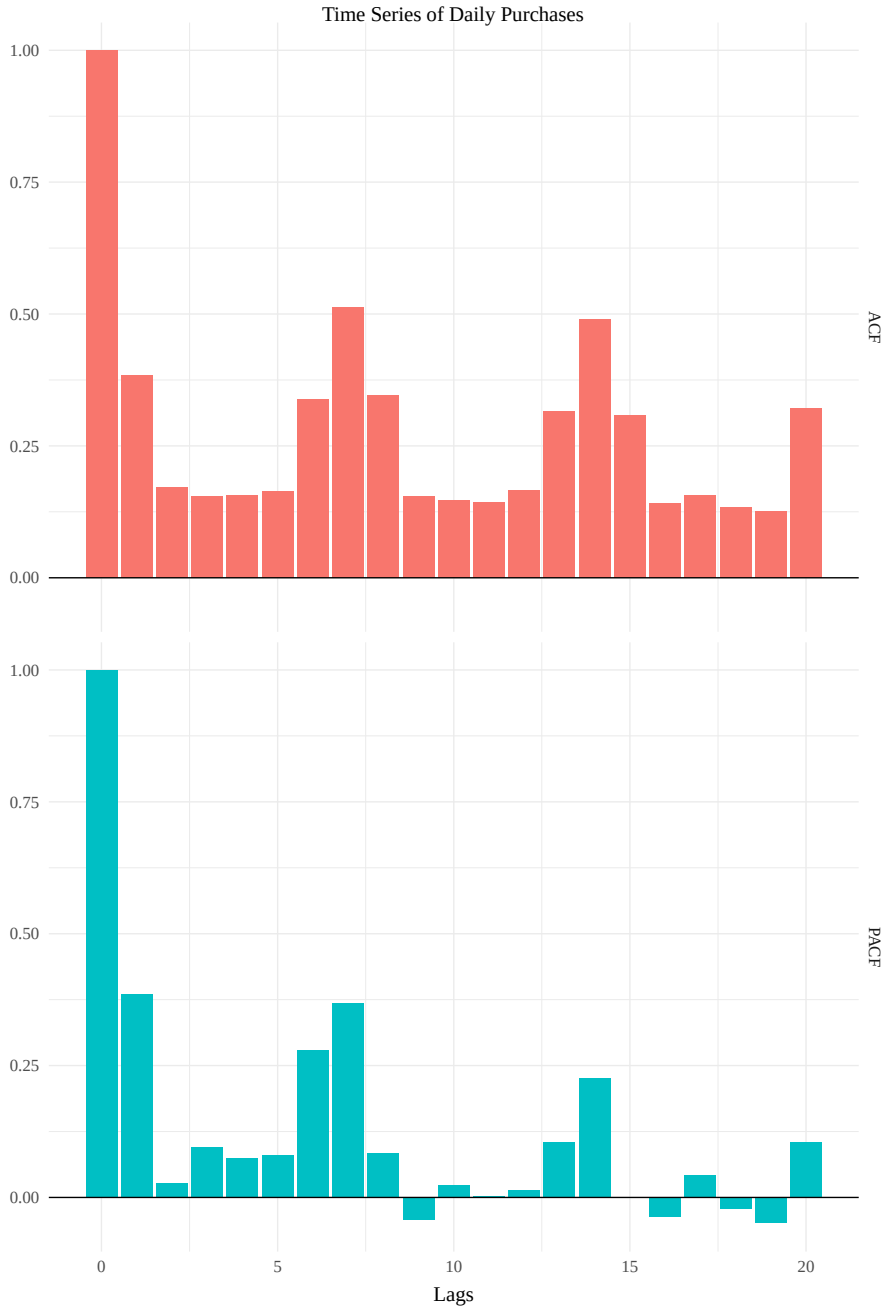
| | | Percentiles | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **Panel A. Daily Variables** | **Min** | **10th** | **25th** | **Median** | **75th** | **90th** | **Max** | **Mean** | **Std. Dev.** |
| Stock return (%) | -100.00 | -2.69 | -1.26 | -0.15 | 0.71 | 1.94 | 211.76 | -0.27 | 2.62 |
| BOJ Purchases (¥ Thousands) | 0.01 | 0.19 | 1.13 | 7.36 | 42.15 | 162.62 | 32,158.45 | 113.83 | 618.88 |
| BOJ Purchases/market cap (b.p.) | 0.00 | 0.01 | 0.03 | 0.24 | 1.49 | 4.21 | 362.81 | 1.54 | 3.23 |
| **Panel B. Quarterly Variables** | | | | | | | | | |
| Sales (¥ B) | 0.0 | 2.0 | 5.0 | 15.1 | 49.6 | 164.1 | 7,442.5 | 82.3 | 280.7 |
| Total Assets (¥ B) | 0.0 | 8.0 | 19.9 | 56.7 | 175.3 | 661.0 | 49,456.0 | 384.5 | 1,636.8 |
| Current Assets (¥ B) | 0.0 | 4.0 | 10.1 | 29.4 | 92.4 | 295.3 | 18,825.1 | 165.5 | 644.3 |
| Cash & Short-term Investment | 0.0 | 1.1 | 2.6 | 7.6 | 23.7 | 77.3 | 12,311.9 | 46.2 | 264.3 |
| Accounts Receivable (¥ B) | -0.1 | 0.7 | 2.7 | 10.2 | 34.7 | 121.5 | 8,827.4 | 70.4 | 336.2 |
| Inventory (¥ B) | 0.0 | 0.2 | 1.5 | 5.9 | 22.1 | 73.0 | 4,190.6 | 38.7 | 132.6 |
| Tangible Capital (¥ B) | 0.0 | 1.3 | 4.8 | 15.4 | 53.6 | 214.6 | 10,237.7 | 129.4 | 549.9 |
| ΔTotal Assets (%) | -14.32 | -4.83 | -1.80 | 0.80 | 3.74 | 7.66 | 25.24 | 1.27 | 5.87 |
| ΔCurrent Assets (%) | -14.10 | -4.48 | -1.69 | 0.49 | 3.01 | 6.61 | 22.16 | 0.89 | 5.33 |
| ΔCash & ST Investment (%) | -10.66 | -3.31 | -1.30 | 0.11 | 1.71 | 4.10 | 15.40 | 0.35 | 3.67 |
| Δ Accounts Receivable (%) | -12.66 | -2.56 | -0.45 | 0.00 | 0.87 | 3.41 | 13.94 | 0.24 | 3.41 |
| ΔInventory (%) | -7.70 | -1.70 | -0.49 | 0.05 | 0.80 | 2.11 | 9.27 | 0.17 | 2.14 |
| ΔTangible Capital (%) | -3.99 | -0.75 | -0.32 | -0.03 | 0.44 | 1.42 | 6.48 | 0.19 | 1.30 |
| ΔSale (%) | -10.65 | -3.31 | -1.30 | 0.11 | 1.71 | 4.10 | 15.40 | 0.35 | 3.67 |
| Book Leverage Ratio (%) | 0.01 | 2.43 | 7.87 | 18.85 | 32.39 | 45.67 | 98.22 | 21.81 | 16.68 |
| Market-to-Book | 0.12 | 0.43 | 0.6 | 0.89 | 1.46 | 2.53 | 49.65 | 1.40 | 2.02 |
| Return on Assets (%) | -48.62 | -0.39 | 1.45 | 3.03 | 5.16 | 7.80 | 156.14 | 3.18 | 5.42 |
| Returns (%) | -95.78 | -14.34 | -5.73 | 2.32 | 12.23 | 24.97 | 1,010.47 | 5.00 | 21.77 |
| BOJ Purchases (¥ M) | 0.1 | 3.9 | 10.4 | 39.7 | 154.2 | 617.8 | 57,742.3 | 351.8 | 1573.8 |
| BOJ Purchases/assets (%) | 0.0 | 0.0 | 0.0 | 0.1 | 0.2 | 0.7 | 100.4 | 0.3 | 1.5 |
| BOJ No. of Purchase Days | 0 | 2 | 9 | 18 | 32 | 62 | 62 | 25.34 | 21.34 |

# Empirical Specification

- $BOJ\ Purchases_{it} = \left(w_{it}^{N225} \times w_{BOJ,t}^{N225} + w_{it}^{Topix} \times w_{BOJ,t}^{Topix} + w_{it}^{N400} \times w_{BOJ,t}^{N400}\right) \times ETF_t$
- Daily Specification:
  - $Demand_{it} = \frac{BOJ\ Purchase_{it}}{Market\ Capitalization_{it-22}}$
  - $r_{ijt} = \alpha_i + \alpha_{jt} + Demand_{ijt} + \varepsilon_{ijt}$
- Fundamentals Specification:
  - $Demand_{iq} = \frac{\sum_{t \in q} BOJ\ Purchases_{it}}{A_{i,q-1}}$
  - $Y_{i,q} = \alpha_i + \alpha_{j(i,q),q} + \xi Demand_{iq} + \mathbf{\Gamma'X}_{i,q-1} + \varepsilon_{i,q}$

  where *i* denotes a stock, *j* denotes the industry related to the stock, and *t* denotes the day of the purchase. We including firm fixed effects to control for differences in static risk loadings across stocks, and the industry-day fixed effects, to control for sector-specific trends on a particular day, as well as differential news or macroeconomic conditions.

# BOJ Purchases are not perfectly forecastable




日銀ETF買い入れ

今日の日銀ETF買い入れを予想します。

今日の日銀ETF買い入れ予想　11/22 11時30分時点

買い入れなし　当

日銀ETF買い入れ結果 なし

TOPIX（前日比）　+0.56%（11/22 11時30分時点）

関連リンク

外国人投資家動向

スポンサードリンク

日銀ETF買い入れ確率（ 9/20以降）

**日銀ETF買い入れ確率**

| TOPIX前日の終値と前引け | ETF買入確率 |
|---|---|
| -0.05%以上 | 0.6% |
| -0.05%～-0.1% | 35.7% |
| -0.1%～-0.15% | 50.0% |
| -0.15%～-0.2% | 45.5% |
| -0.2%～-0.25% | 75.0% |
| -0.25%～-0.3% | 57.1% |
| -0.3%～-0.35% | 87.5% |
| -0.35%～-0.4% | 100.0% |
| -0.4%～-0.45% | 80.0% |
| -0.45%～-0.5% | 100.0% |
| -0.5%～ | 97.2% |

2017年 日銀ETF買い入れ実績と残高

| | 買入総額 | 残高 |
|---|---|---|
| ETF | 4兆8263億円 | 9121億円 |
| 企業支援ETF | 2616億円 | |
| J-REIT | 862億円 | 37億円 |

**2017年**

| 購入年月 | ETF | 企業支援ETF | ETF残額 | J-REIT | J-REIT残額 | 前日比 |
|---|---|---|---|---|---|---|
| 11/17 | - | 12億円 | 9121億円 | - | 37億円 | +0.09% |
| 11/16 | - | 12億円 | 9133億円 | - | 37億円 | +0.58% |
| 11/15 | 717億円 | 12億円 | 9145億円 | - | 37億円 | -1.40% |
| 11/14 | 717億円 | 12億円 | 9874億円 | - | 37億円 | -0.14% |

# BOJ Basket Portfolio return increases with BOJ ETF purchases

Based on value-weighted BOJ and non-BOJ baskets. Numbers in parentheses are p-levels for rejecting zero coefficients, using Newey-West standard errors with 5 lags. Boldface indicates significance at 10 percent or better.

On BOJ purchase days, the BOJ portfolio has a 0.6 basis point increase in returns relative to the non-BOJ basket.

25 days per quarter on average -> 15-basis point increase.

(0.6% annualized)

| Explained variable (%) | $r_t^{BOJ} - r_t^{non-BOJ}$ | | | | $r_t^{non-BOJ}$ | $r_t^{BOJ}$ |
|---|---|---|---|---|---|---|
| | (4.1) | (4.2) | (4.3) | (4.4) | (4.5) | (4.6) |
| $1_{BOJ\ ETF\ purchases > 0}$ | | | **0.006** | **-0.004** | 0.788 | 0.831 |
| | | | **(0.001)** | **(0.001)** | (0.147) | (0.139) |
| $\log(1 + BOJ\ ETF\ purchases)$ | **0.002** | **0.001** | | **0.002** | **-0.363** | **-0.372** |
| | **(0.000)** | **(0.000)** | | **(0.000)** | **(0.034)** | **(0.032)** |
| Intercept | **-0.006** | **-0.003** | **-0.003** | **-0.003** | **0.419** | **0.422** |
| | **(0.001)** | **(0.000)** | **(0.000)** | **(0.000)** | **(0.036)** | **(0.036)** |
| Sample | Purchase Days | All Days | All Days | All Days | All Days | All Days |
| Observations | 553 | 1,350 | 1,350 | 1,350 | 1,350 | 1,350 |
| $R^2$ | 0.104 | 0.138 | 0.091 | 0.145 | 0.217 | 0.221 |

# Daily Return Analysis

All regressions SIC4-by-day fixed effects. Standard errors clustered by firms and day are in parentheses. Returns are in percentage points.

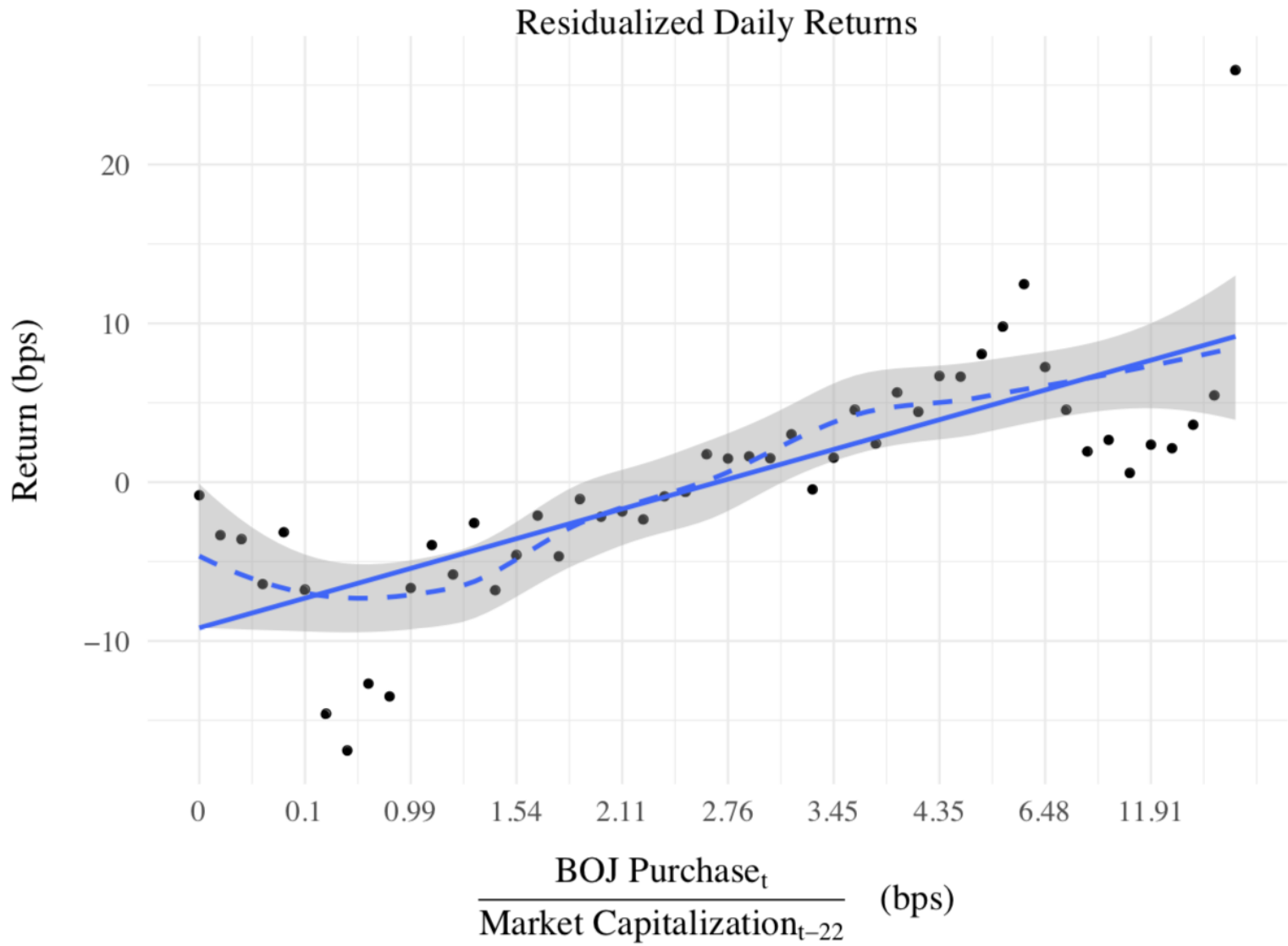
A 1-basis point increase in BOJ demand relative to past 22-day market capitalization leads to approx. 2-basis point increase in daily returns.

Mean BOJ demand = 1.54 bp
SD of return = 2.62%

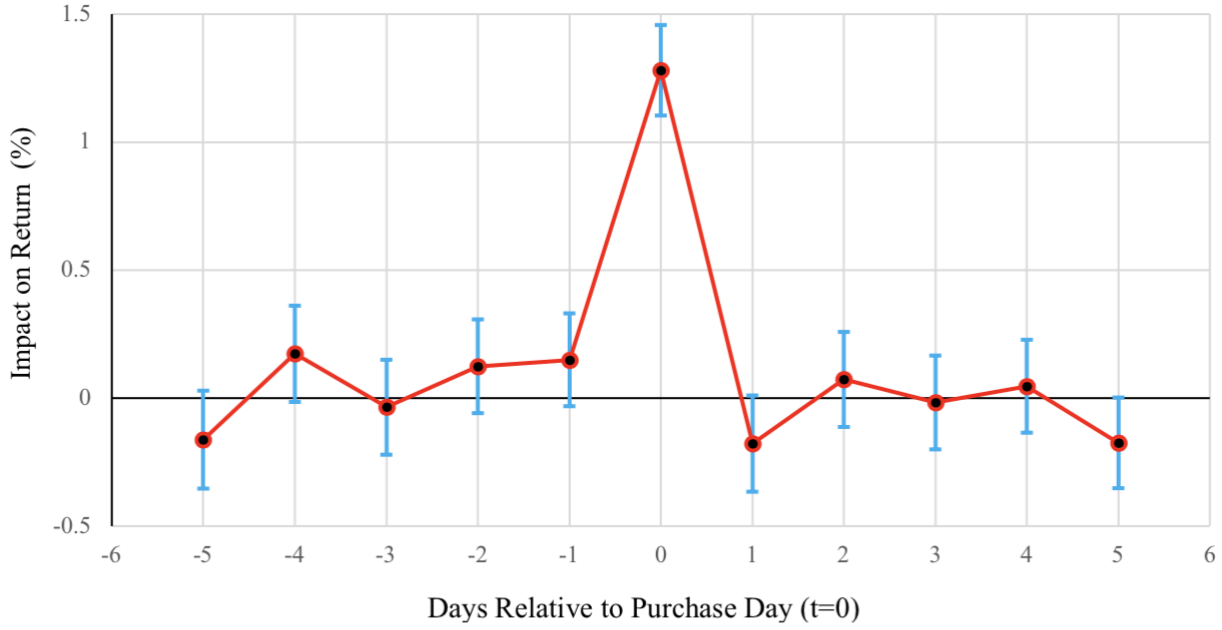
(1.1% of a standard deviation)

| Return horizon | 1 day | 2 days | 3 days | 1 week | 2 weeks | 1 month |
|---|---|---|---|---|---|---|
| Return window | $[t, t]$ | $[t, t+1]$ | $[t, t+2]$ | $[t, t+4]$ | $[t, t+9]$ | $[t, t+22]$ |
| **Panel A. All trading days and all stocks** | | | | | | |
| $BOJ_{it}$ | **1.788 (0.000)** | **2.764 (0.000)** | **3.896 (0.000)** | **6.036 (0.000)** | **10.571 (0.000)** | **14.680 (0.000)** |
| Observations | 4,690,250 | 4,687,230 | 4,684,210 | 4,678,174 | 4,663,104 | 4,627,048 |
| $R^2$ | 0.360 | 0.374 | 0.380 | 0.376 | 0.365 | 0.351 |
| **Panel B. All trading days and only stocks in BOJ ETF-tracked indexes** | | | | | | |
| $BOJ_{it}$ | **1.996 (0.000)** | **2.917 (0.000)** | **3.937 (0.000)** | **5.747 (0.000)** | **9.685 (0.000)** | **14.200 (0.000)** |
| Observations | 1,675,132 | 1,674,295 | 1,673,442 | 1,671,777 | 1,668,119 | 1,658,068 |
| $R^2$ | 0.403 | 0.407 | 0.404 | 0.383 | 0.361 | 0.333 |
| **Panel C. Trading days with isolated (no others within k trading days) BOJ ETF purchases and only stocks in BOJ ETF-tracked indexes** | | | | | | |
| $BOJ_{it}$ | **1.996 (0.000)** | **4.742 (0.000)** | **9.319 (0.000)** | **20.285 (0.000)** | **43.389 (0.000)** | **75.983 (0.000)** |
| $k$ | 0 | 1 | 2 | 4 | 9 | 21 |
| Observations | 1,675,132 | 678,756 | 281,882 | 127,072 | 33,415 | 6,888 |
| Number of Events | 2,675 | 334 | 144 | 67 | 19 | 4 |
| $R^2$ | 0.403 | 0.409 | 0.447 | 0.334 | 0.316 | 0.066 |

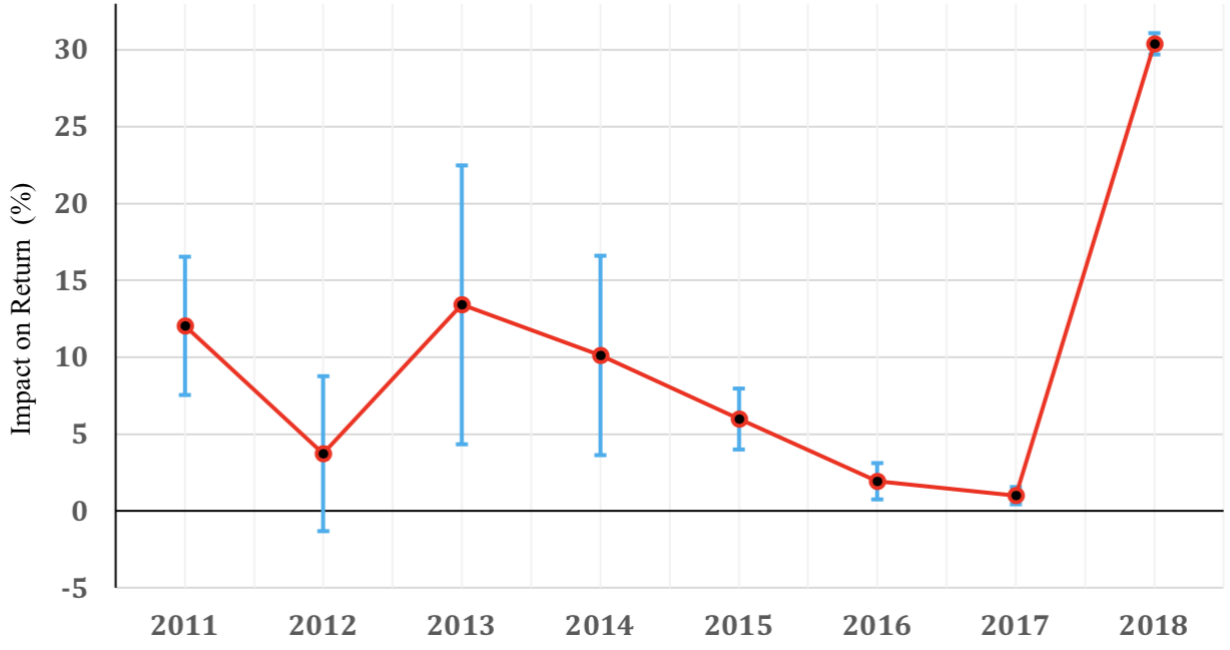
This figure show a scatter plot of residualized returns with respect to SIC-4-by-day fixed effects and BOJ purchases. To more clearly visualize the relation between BOJ purchases and stock returns, we group the data into 50 bins based on BOJ purchases relative to the past 22 days' market capitalization. The solid line represents a linear fit. The dotted line represents a non-parametric LOESS estimator, and the grey is a one-standard-error bar. We see that for most of the whole distribution of BOJ demand, the non-parametric fit does not appear to be significantly different from the linear fit.



**Panel A. Event-Time Impact of BOJ Purchases**




**Panel B. Mean impact on Daily Return (%) by Year**



# Monthly Volatility

All regressions include firm and SIC4-by-month fixed effects. Standard errors clustered by firms are in parentheses. Returns are in percentage points.

| Explained variable: | Log Monthly volatility $\log[1+\sigma_{i,m}(r_{i,t})]$ | Upside volatility $\log[1+\sigma_{i.m}(r_i \mid r_{it}>0)]$ | Downside volatility $\log[1+\sigma_{i,m}(r_i \mid r_{it}<0)]$ |
|---|---|---|---|
| | (6.1) | (6.2) | (6.3) |
| $\log BOJ_{i,m}$ | **0.011** | **0.032** | **-0.019** |
| | **(0.001)** | **(0.000)** | **(0.000)** |
| Explained variable lagged 1 month | **0.360** | **0.212** | **0.155** |
| | **(0.000)** | **(0.000)** | **(0.000)** |
| Firm-month observations | 173,404 | 172,709 | 172,632 |
| $R^2$ | 0.590 | 0.388 | 0.451 |

A 1% increase in BOJ demand relative to month's market capitalization leads to a 1.1% increase in monthly volatility.

+ 3.2% up-side volatility

-1.9% down-side volatility

# Firms Issue More Equity

A 1% increase in BOJ demand, through a 4.1 increase in M/B, increases the probability of SEOs by 1.5% relative to 7.5% unconditional probability.

**Panel A: Issuances Due to BOJ Purchases**

| Indicator variable set to one for | Any Issuances | Equity Increases | SEO | Stock Buyback | Debt Issuance |
|---|---|---|---|---|---|
| | (6A.1) | (6A.2) | (6A.3) | (6A.4) | (6A.5) |
| $BOJ_{i,t}$ | **0.005** | **0.009** | **0.015** | **-0.008** | -0.002 |
| | **(0.038)** | **(0.009)** | **(0.002)** | **(0.030)** | (0.493) |
| $N$ | 42,919 | 42,919 | 42,919 | 42,919 | 42,919 |
| $R^2$ | 0.335 | 0.384 | 0.309 | 0.384 | 0.322 |

**Panel B: Instrumented Changes in Issuance by Valuation Ratio ($M/B_{i,q}$)**

| Explained variable | $\Delta M/B_{i,y}$ | Any Issuance | Equity Increases | SEO | Stock Buyback | $\frac{D}{D+M_{it}}$ | Debt Issuance |
|---|---|---|---|---|---|---|---|
| | (6B.1.1) | (6B.1) | (6B.2) | (6B.3) | (6B.4) | (6B.5.1) | (6B.5) |
| $BOJ_{i,t}\|\Delta M/B_{i,y}$ | | **0.001** | **0.002** | **0.004** | **-0.002** | | 0.074 |
| | | **(0.034)** | **(0.029)** | **(0.050)** | **(0.030)** | | (0.113) |
| $BOJ_{i,t}$ | **4.138** | | | | | **-0.032** | |
| | **(0.091)** | | | | | **(0.002)** | |
| $N$ | 42,919 | 42,919 | 42,919 | 42,919 | 42,919 | 42,919 | 42,919 |
| 1st stage F-stat | | 0.662 | 0.662 | 0.662 | 0.662 | | 1.926 |
| $R^2$ | 0.175 | 0.285 | 0.273 | -0.355 | 0.291 | 0.437 | 0.306 |

# Firm Response Analysis

- $Corporate\ Actions_{iq} = \alpha_i + \alpha_{jq} + \beta Demand_{iq} \times 100 + \eta_{ijq}$,
- i is firm
- q is year or year-quarter,
- jq denotes the industry-by-year (or industry-year-quarter)  fixed effects,
- Balance Sheet items decomposed into:
  - $\frac{\Delta Assets_{iq}}{Assets_{i,q-1}} = \frac{\Delta PP\&E_{iq}}{Assets_{i,q-1}} + \frac{\Delta Current\ Assets_{i,q-1}}{Assets_{i,q-1}}$
  - $\frac{\Delta Current\ Assets_{i,q-1}}{Assets_{i,q-1}} = \frac{\Delta Cash_{i,q}}{Assets_{i,q-1}} + \frac{\Delta Short{-}Term\ Investments_{i,q}}{Assets_{i,q-1}} + \frac{\Delta Other_{i,q}}{Assets_{i,q-1}}$

    (and multiplied by 100).

# Firm Responses

This table explains changes in various corporate policy variables with BOJ-driven ETF purchases of the corporation's stock. Panel A and Panel B present the OLS regression results using quarterly and annual data, respectively. $BOJ_{it}$ is defined as total BOJ purchases in the fiscal period, adjusting for firms entering or leaving indexes within the period. All variables are scaled by prior fiscal-period-end total assets except returns in regressions 7A.1 and 7B.1, which are raw percentage stock returns, and employees in 7B.7, which is scaled by prior fiscal-period-end employees. All regressions also include a set of control variables: lagged changes in market-to-book, lagged changes in return on assets, lagged changes in log of total assets, lagged changes in leverage, and SIC4-by-fiscal-period fixed effects. Regressions 7A.1 and 7B.1 cluster bidirectionally by firm and quarter; all other regressions cluster by firm. Numbers in parentheses are p-values with boldface indicating significance at 10% or better.

**Panel A: Firm-quarter panel regressions**

| Explained variable | Returns | ΔTotal Assets | ΔTangible Capital | ΔCurrent Assets | ΔCash & Short-Term Investments | ΔSales | ΔInventory | ΔAccounts Receivable | ΔGoodwill |
|---|---|---|---|---|---|---|---|---|---|
| | (7A.1) | (7A.2) | (7A.3) | (7A.4) | (7A.5) | (7A.6) | (7A.7) | (7A.8) | (7A.9) |
| $BOJ_{it}$ | **1.022** | **0.274** | **0.023** | **0.301** | **0.144** | **0.005** | **0.050** | **0.066** | -0.002 |
| | **(0.058)** | **(0.001)** | **(0.026)** | **(0.001)** | **(0.007)** | **(0.008)** | **(0.008)** | **(0.001)** | (0.263) |
| $N$ | 42,993 | 42,993 | 42,993 | 42,993 | 42,993 | 42,993 | 42,993 | 42,993 | 42,993 |
| $R^2$ | 0.430 | 0.401 | 0.339 | 0.404 | 0.311 | 0.505 | 0.437 | 0.470 | 0.258 |

**Panel B: Firm-year panel regressions**

| Explained variable | Returns | ΔTotal Assets | ΔTangible Capital | ΔCash | ΔShort-Term Investments | ΔSales | ΔEmployees | ΔR&D | ΔAccounts Receivable |
|---|---|---|---|---|---|---|---|---|---|
| | (7B.1) | (7B.2) | (7B.3) | (7B.4) | (7B.5) | (7B.6) | (7B.7) | (7B.8) | (7B.9) |
| $BOJ_{it}$ | 0.340 | **0.226** | -0.002 | **0.084** | -0.006 | **0.078** | **0.329** | 0.004 | 0.020 |
| | (0.342) | **(0.090)** | (0.867) | **(0.096)** | (0.699) | **(0.074)** | **(0.013)** | (0.430) | (0.469) |
| $N$ | 6,114 | 6,114 | 5,979 | 6,114 | 6,114 | 6,114 | 5,128 | 3,543 | 6,114 |
| $R^2$ | 0.387 | 0.357 | 0.361 | 0.322 | 0.379 | 0.282 | 0.404 | 0.238 | 0.343 |

# Firm Responses through M/B

This table explains changes in various corporate policy variables with changes in firms' market-to-book ratios attributable to BOJ-driven ETF purchases of the corporation's stock. Panel A and Panel B present results using quarterly and annual data, respectively. $BOJ_{it}$ is defined as total BOJ purchases in the fiscal period, adjusting for firms entering or leaving indexes within the fiscal period. All variables are scaled by prior fiscal-period-end total assets except change in market-to-book ratio in regressions 8A.1 and 8B.1, where $\Delta M/B$ is defined as fiscal-period market-capitalization growth in yen scaled by prior-fiscal-period-end book value in yen, and employees in 8B.7, which is scaled by prior quarter-end employees. All regressions also include a set of control variables: lagged changes in market-to-book, lagged changes in return on assets, lagged changes in log of total assets, lagged changes in leverage, and SIC4-by-fiscal-period fixed effects. Regressions 8A.1 and 8B.1 are 1st stage OLS regressions using bidirectional clustering by firm and time. Other regressions are second-stage instrumental-variable regressions clustering by firm, in which $BOJ_{it}$, is instrumented with $\Delta M/B$. Numbers in parentheses are p-values, with boldface indicating significance at 10% or better.

**Panel A: Firm-quarter panel instrumental-variable regressions**

| Explained variable | $\Delta M/B$ | ΔTotal Assets | ΔTangible Capital | ΔCurrent Assets | ΔCash & Short-Term Investments | ΔSales | ΔInventory | ΔAccounts Receivable | ΔGoodwill |
|---|---|---|---|---|---|---|---|---|---|
| | (8A.1) | (8A.2) | (8A.3) | (8A.4) | (8A.5) | (8A.6) | (8A.7) | (8A.8) | (8A.9) |
| $BOJ_{it}\|\Delta M/B$ | | **0.067** | **0.006** | **0.073** | **0.035** | **0.001** | **0.012** | **0.016** | -0.0005 |
| | | **(0.007)** | **(0.072)** | **(0.009)** | **(0.008)** | **(0.006)** | **(0.052)** | **(0.010)** | (0.400) |
| $BOJ_{it}$ | **4.119** | | | | | | | | |
| | **(0.091)** | | | | | | | | |
| $N$ | 42,993 | 42,993 | 42,993 | 42,993 | 42,993 | 42,993 | 42,993 | 42,993 | 42,993 |
| $R^2$ | 0.176 | -0.081 | 0.271 | -0.308 | -0.023 | 0.386 | 0.317 | 0.388 | 0.233 |

**Panel B: Firm-year panel instrumental-variable regressions**

| Explained variable | $\Delta M/B$ | ΔTotal Assets | ΔTangible Capital | ΔCash | ΔShort-Term Investments | ΔSales | ΔEmployee | ΔR&D | ΔAccounts Receivable |
|---|---|---|---|---|---|---|---|---|---|
| | (8B.1) | (8B.2) | (8B.3) | (8B.4) | (8B.5) | (8B.6) | (8B.7) | (8B.8) | (8B.9) |
| $BOJ_{it}\|\Delta M/B$ | | 0.085 | -0.003 | 0.032 | -0.002 | 0.029 | 0.049 | 0.003 | 0.007 |
| | | (0.582) | (0.931) | (0.612) | (0.746) | (0.612) | (0.337) | (0.867) | (0.680) |
| $BOJ_{it}$ | 2.664 | | | | | | | | |
| | (0.641) | | | | | | | | |
| $N$ | 6,114 | 6,114 | 5,979 | 6,114 | 6,114 | 6,114 | 5,128 | 3,543 | 6,114 |
| $R^2$ | 0.395 | -19.676 | 0.057 | -4.938 | 0.335 | -9.332 | -6.921 | -25.803 | -1.110 |

# Firm Responses

- 1% increase of BOJ demand  (relative to total assets) corresponds to:
- Quarterly
  - + 4.119 in M/B
  - + 0.274% of total assets
    - +0.3% of current assets
      - +0.14% of cash & short-term investments
      - +0.05% of inventory
    - +0.02% of net tangible capital
  - +0.5% P(Equity increases), (approx. 7% relative to unconditional probability)
    - +1.5% increase in P(SEO)
    - -0.8% decrease in P(Buybacks)
- Annually:
  - + 0.226% of total assets
    - +0.08% of cash
    - No effect on short-term investments
  - No effect on tangible capital.
  - +0.33% increase in employment

# Conclusion

- It seems the BOJ ETF intervention
  - Lowered the cost of equity capital
  - Lowered the down-side volatility of the market
  - Increased the valuation ratios of companies
  - May have lowered market leverage
  - Firms raised cash by issuing more equity and sold shares
  - But do not appear to significantly increase tangible capital investment or R&D spending,
  - And no effect on sales or expected sales as proxied by inventory build-ups
- Overall, this alternative method of “stimulating” the economy does not seem to work through increasing investment
  - But may have other channels.
    For example, the household portfolio channel

# Appendix

# 2010: Sluggish economies (Japan, U.S. Europe)

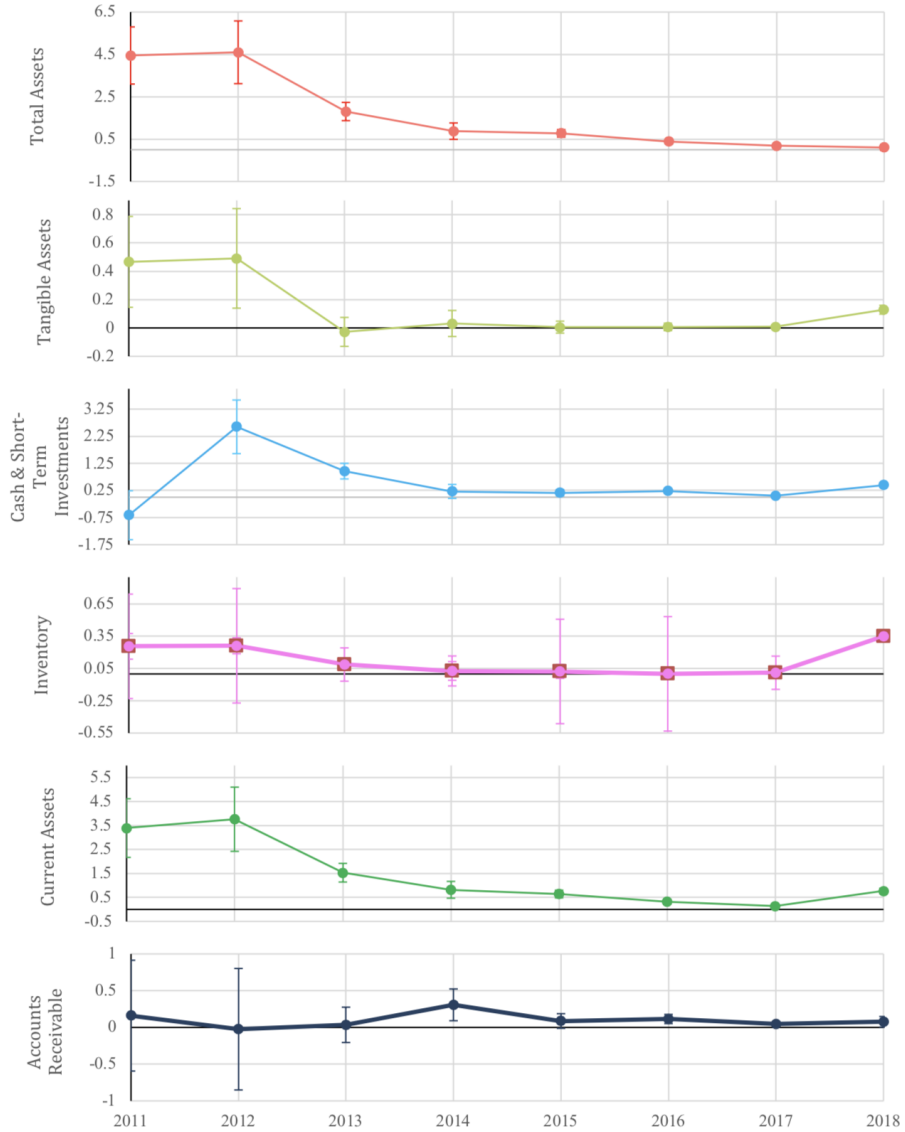
- On October 5, 2010, the BOJ Announces Comprehensive Monetary Easing
- (1) Lowering the target for the uncollateralized overnight call rate from 0.10 percent to 0-0.10
- (2) Increased the monetary base by 35 trillion yen or 7% of GDP
- (3) Introduced the the Asset Purchase Program (APP) (5 trillion yen)
  - Public debt: short-term and long-term government bonds
  - Private assets: commercial paper, corporate bonds, equities (exchange-traded funds (ETFs), and Japanese real estate investment trusts (J-REITs))
  - The BOJ's target: to "encourage the decline in longer-term interest rates and various risk premia to further enhance monetary easing."
  - The BOJ's targeting of private risk premia is in contrasted with the Fed's QE2 focus on long-term Treasuries to affect term premia

# Stock Return: Robustness

The table below shows the relation of returns and BOJ purchases. Returns are in percentage points. BOJ Demand it is a percentage of BOJ purchases of a stock $i$ relative to its market capitalization from 22 trading days ago. In Panel B, all regressions in Panel B include firm and 4-digit SIC-by-day fixed effects, W( · ) stands for winsorization at the 1% level, and z( · ) stands for normalizing the variable. Except when normalizing in columns (4) and (7) in Panel B, returns are in percentage points. Standard errors are clustered by firm, and p-values are shown in parentheses with boldface indicating significance at 2% or better.

| **Panel A: Robustness to Fixed Effects** | | | | | | |
|---|---|---|---|---|---|---|
| Explained Variable: | Returns | | | | | |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $BOJ_{it}$ | **-2.391** | **-2.738** | **1.900** | **2.032** | **2.126** | **2.386** |
| | **(0.000)** | **(0.000)** | **(0.000)** | **(0.000)** | **(0.000)** | **(0.000)** |
| Constant | **-0.232** | | | | | |
| | **(0.000)** | | | | | |
| Fixed Effects | | Stock | Day | Industry-Day | Stock & Day | Stock & Industry-Day |
| $N$ | 1,675,132 | 1,675,132 | 1,675,132 | 1,675,132 | 1,675,132 | 1,675,132 |
| $R^2$ | 0.001 | 0.010 | 0.213 | 0.403 | 0.217 | 0.405 |
| **Panel B: Transformation of Both Explained and Explanatory Variables** | | | | | | |
| Transformations = | W(y) | W(y) | W(z(y)) | W(y) | W(y) | W(z(y)) |
| | (1) | (2) | (3) | (4) | (5) | (6) |
| $BOJ_{it}$ | **0.651** | **0.004** | **0.016** | **0.006** | **0.006** | **0.010** |
| | **(0.000)** | **(0.009)** | **(0.000)** | **(0.017)** | **(0.017)** | **(0.001)** |
| Observations | 1,675,132 | 1,675,132 | 1,675,132 | 1,675,132 | 1,675,132 | 1,675,132 |
| $R^2$ | 0.446 | 0.446 | 0.447 | 0.446 | 0.446 | 0.446 |

# Firm Responses by Industry & Year

# Split on Q

| Panel A: Quarterly Responses | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | Returns | ΔTotal Assets | ΔTangible Capital | ΔCurrent Assets | ΔCash & Short-Term Investments | ΔSales | ΔInventory | ΔGoodwill |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| 1{Q>1} | -4.345 | 0.263 | -0.008 | 0.258 | 0.045 | 0.058 | 0.008 | 0.027 |
| | (0.000) | (0.252) | (0.915) | (0.150) | (0.687) | (0.318) | (0.531) | (0.316) |
| $BOJ_{it}$ | 4.547 | 0.676 | 0.073 | 0.683 | 0.574 | -0.004 | 0.038 | -0.077 |
| | (0.006) | (0.014) | (0.193) | (0.006) | (0.001) | (0.929) | (0.248) | (0.081) |
| $BOJ_{it}$ ×1{Q>1} | -2.998 | 0.708 | -0.019 | 0.504 | -0.001 | 0.060 | 0.018 | 0.049 |
| | (0.012) | (0.063) | (0.718) | (0.137) | (0.994) | (0.214) | (0.621) | (0.314) |
| $N$ | 48,173 | 48,173 | 48,173 | 48,173 | 48,173 | 48,173 | 48,168 | 48,173 |
| $R^2$ | 0.438 | 0.382 | 0.332 | 0.350 | 0.298 | 0.438 | 0.231 | 0.249 |
| Panel B: Annual Responses | | | | | | | | |
| | Returns | ΔTotal Assets | ΔTangible Capital | ΔCash | ΔShort-Term Investments | ΔSales | ΔEmployee | ΔR&D |
| | (1) | (2) | (3) | (4) | (5) | (6) | (7) | (8) |
| 1{Q>1} | -15.459 | 2.661 | -0.479 | -0.518 | 0.509 | 8.355 | -11.497 | 0.073 |
| | (0.0004) | (0.443) | (0.525) | (0.656) | (0.591) | (0.178) | (0.322) | (0.543) |
| $BOJ_{it}$ | 4.052 | 3.963 | -0.381 | 0.451 | 0.248 | 10.226 | -10.434 | 0.004 |
| | (0.025) | (0.212) | (0.264) | (0.301) | (0.545) | (0.069) | (0.331) | (0.941) |
| $BOJ_{it}$ ×1{Q>1} | -4.010 | -2.919 | 0.371 | 0.093 | -0.273 | -8.765 | 10.697 | 0.073 |
| | (0.025) | (0.344) | (0.272) | (0.845) | (0.504) | (0.120) | (0.303) | (0.318) |
| $N$ | 7,168 | 7,168 | 7,072 | 7,168 | 7,166 | 7,168 | 7,168 | 4,426 |
| $R^2$ | 0.595 | 0.740 | 0.621 | 0.968 | 0.974 | 0.499 | 0.476 | 0.435 |

# Announcement Effect

## October 31, 2014 and July 29, 2016

This figure plots event-study cumulative returns by calendar day, where time-event zero represents the two announcement dates, October 31, 2014, and July 29, 2016. The high-exposure and low-exposure baskets are calculated from only stocks in the BOJ purchase basket based on 10% extremes. The results are shown for value-weighted portfolios, and 95% confidence error bars are shown. Event-time values (on the x-axis) with no corresponding data point or error bars signify a non-trading day. These results corroborate the impact of BOJ ETF purchase announcements found in Barbon and Gianinazzi (2017).