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Ben Charoenwong
Randall Morck
Yupana Wiwattanakantang

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ABSTRACT

Since 2010, the Bank of Japan (BOJ) has purchased stocks to boost domestic firms' valuations to increase GDP growth. The stock return elasticity with respect to BOJ purchases relative to the previous month's market cap is around 2 and increases across longer horizons. Over one quarter, BOJ share purchases worth 1% of assets correspond to an increase of 1% in share valuation and a .27% increase in assets. Consistent with elevated valuations letting firms "cash out," BOJ share purchases predict equity issuances and fewer stock buybacks. However, less than 9% of increased assets reflect net tangible capital investments, whereas cash and short-term investments account for over 50%. This unconventional monetary stimulus thus boosts share prices but is largely not transmitted into real investment growth.

Ben Charoenwong
National University of Singapore
Business School
15 Kent Ridge Dr #07-69
Singapore 119245
Singapore
bizbgc@nus.edu.sg

Yupana Wiwattanakantang
National University of Singapore
Business School
BIZ 1 2-7, 15 Kent Ridge Drive,
Singapore 119245
Singapore
bizyw@nus.edu.sg

Randall Morck
Faculty of Business
University of Alberta
Edmonton, AB T6G 2R6
Canada
and NBER
randall.morck@ualberta.ca

1. Introduction

The Bank of Japan (BOJ) is pioneering a unique form of quantitative easing: the large-scale ongoing accumulation of equity blocks in domestic corporations by the central bank. From the policy's advent in December 2010 through March 2018, the BOJ has accumulated index-linked exchange-traded fund (ETF) holdings worth almost ¥22 trillion, some 5% of the market capitalization of the Tokyo Stock Exchange, 4% of Japan's GDP, and over 75% of total ETF holdings.

To avoid "stock picking," the BOJ purchases only index-linked ETFs, and does so using pre-set rules. The BOJ's purchases of ETFs tracking the different major indexes are strictly proportional to index market values. Because the indexes that the purchased ETFs track are price-weighted or public-float-capitalization-value-weighted indexes, the ETFs' combined BOJ-linked purchases of any given stock are defensibly exogenous to a first approximation. This identification assumption allows tests to identify effects of BOJ purchases on share prices and on corporate decision-making.

BOJ policy reports explain ETF purchases as an intervention to boost equity valuations to reduce firms' costs of capital and stimulate their investment. Consistent with the former, the BOJ appears to time its ETF purchases to occur on days when the market drops.

Success in the BOJ's experiment would be evident (1) if its ETF purchases indeed lifted share prices relative to a market-weighted benchmark, (2) if higher share prices led firms to raise more capital, and (3) if firms used this capital to undertake more investment. Empirical tests confirm only the first two parts in this mechanism: Larger BOJ-linked ETF share purchases lift stock

prices and predict equity issuance. However, the third essential part of the mechanism appears non-functional: Larger BOJ-linked ETF share purchases do not predict substantially increased corporate investment, but rather predict increased holdings of cash and other current assets.

Validating the first part of the mechanism, a one-standard-deviation increase in BOJ-linked ETF demand, as a fraction of a firm's market capitalization one month ago, corresponds to a 6.5-basis-point (0.02 standard deviations) higher stock return that day. No significant reversal is evident over the following week or month. In an average quarter between January 2011 and March 31, 2017, the BOJ made 18 such ETF purchases, and the data associate total quarterly BOJ purchases worth 1% more of a firm's total prior quarter assets with a 1% higher stock return that quarter.

The second link in the mechanism also appears activated. More BOJ-linked ETF purchases of a firm's equity correspond to statistically and economically significant increases in that firm's secondary equity issuances. We also find such firms are less likely to buy back their stock. Finally, despite higher valuations decreasing the market-leverage ratio of such firms, no increase in their debt issuance is evident.

The third link in the mechanism—firms investing more after BOJ-linked ETF purchases increase their share values and thereby reduce their costs of capital—is not evident. Instead, firms appear to increase current assets, especially cash holdings. The BOJ purchasing equity amounting to 1% of a firm's lagged assets predicts a 1.28-percentage-point increase in that firm's assets next quarter. However, less than 4% of this increase in total assets reflects increased capital investment. Instead, increases in current assets represent over 85% of the increase in assets, with cash and short-term investments accounting for 40% of the total increase. This finding accords

with this monetary-stimulus mechanism amounting to “pushing on a rope” to boost investment.

Lastly, we also document some diminishing impact of the BOJ ETF purchase policy over time. Although we find no differences in the immediate impact of BOJ ETF purchases on stock prices over time, the corporate responses are concentrated in 2011 and 2012 and attenuate, becoming insignificant by 2017.

2. Related Literature and Institutional Background

2.1 Conventional and Unconventional Monetary Policy

Monetary policy interventions in asset markets lead to increased aggregate demand for securities, lifting securities prices and thereby lowering securities yields and reducing costs of capital for firms and borrowing costs for households, which increases investment and consumption. A second channel posits a Pigou effect: Higher asset valuations leave households feeling wealthier, which increases consumption and housing investment. Because investment is by far the most volatile component of GDP, we follow studies of the effectiveness of monetary policy in focusing on investment.

In traditional open-market operations, central banks create money to buy T-bills to increase T-bill prices to reduce their effective yields to put downward pressure on short-term rates and costs of capital. In unconventional monetary policy, or quantitative easing, central banks create money to buy longer-duration securities to boost their prices to push down longer-term yields and costs of capital. The BOJ, having reduced yields to near zero across a flat yield curve, turned to purchasing equities to increase share prices to reduce costs of equity capital.

Prior work links central bank fixed-income securities purchases to higher market prices and lower yields.[1] Estimates of the magnitudes of this effect vary. For example, Krishnamurthy and Vissing-Jorgensen (2011) report that the US Federal Reserve's quantitative easing (large-scale long-term fixed-income securities purchases) in 2008 through 2010 reduced long-term yields by some 90 basis points. Hancock and Passmore (2015) report that the Fed's mortgage-backed securities' (MBS) quantitative-easing interventions cut mortgage rates by 100–150 basis points.

The ultimate effectiveness of central banks' asset purchases in increasing GDP growth is subject to ongoing theoretical disputes.[2] Empirical findings tend to be sharply qualified. For example, effects are reported via lending by small but not large banks (Kashyap and Stein 2000), state-run but not private-sector banks (Lukas 2016; Morck et al. 2018), and only for monetary stimuli that also constitute fiscal stimuli (Lukas 2016). The effectiveness of conventional monetary policy is especially disputed in economies, such as Japan in our sample period, whose nominal interest rates are already near zero (Bouis et al. 2013; Gambacorta et al. 2014). In these circumstances, in which long-term rates tend to be higher and thus still have scope to be pushed down, unconventional monetary policy, or quantitative easing, is advocated (Bernanke and Reinhart 2004; Bernanke (2015)).

[1] Central bank T-bill purchases are associated with reduced short rates (Baba et al. 2008; Bakshi et al. 2003; Christensen et al. 2012; Hördahl and King 2008; Taylor and Williams 2010), and central bank purchases of longer-duration fixed-income securities are associated with reduced longer-term rates (see, e.g., D'Amico and King 2013; Hamilton and Wu 2012; Joyce and Tong 2012; Neely and Weller 2001; Williamson 2012; Gagnon et al. 2011; Neely 2015; Cecioni et al. 2011). Much of this work utilizes daily frequency event-study tests (Gagnon et al. 2011; Krishnamurthy and Vissing-Jorgensen 2011; Joyce and Tong 2012; Neely 2015; Swanson et al. 2011; Wright 2012).

[2] Recent surveys of theory controversies include Ng and Wright (2013), Lagos et al. (2017), and Eusepi and Preston (2018).

2.2 The Bank of Japan's Use of Unconventional Monetary Policy

Japan has grown relatively slowly in the "lost decades" since its 1992 financial crisis. In March 2006, to counter deflation, the BOJ implemented its first round of "quantitative easing"—monetary expansion by purchasing bonds of various maturities to raise bond prices to lower bond yields and costs of debt to stimulate corporate investment and household consumption. Quantitate easing was part of a broad array of unconventional monetary policy interventions that included a zero interest rate policy, policy-duration announcements, and credit-easing policies.

Following the 2008 global financial crisis, as other major central banks adopted quantitative easing, the BOJ substantially accelerated its asset purchases. By May 2018, the BOJ's balance sheet (US$4.93 trillion or ¥540.8 trillion) exceeded Japan's GDP. By contrast, the US Federal Reserve (Fed) balance sheet totalled only US$4.23 trillion, about 22% of GDP, despite its massive expansion during and after the 2008 crisis. The BOJ's total assets thus actually exceed the Fed's despite Japan's GDP being less than 40% that of the US.

Prior work on the BOJ's quantitative-easing policies is extensive but draws mixed conclusions. Iwata and Takenaka (2012), Inoue and Okimoto (2008), Honda et al. (2013), Hayashi and Koeda (2014), Barbon and Gianinazzi (2017), Nakashima et al. (2017b) report that the BOJ's asset purchases decreased 10-year JGB yields and induced financial institutions to increase lending. By contrast, using loan data at the bank and firm level, Nakashima et al. (2017a) find perverse effects: BOJ quantitative easing leading risky banks with lower liquid asset holdings lend more to risky firms.

2.3 The Bank of Japan's ETF Purchasing Policy

Governor Masaaki Shirakawa expanded the BOJ's quantitative-easing program to include purchases of additional corporate equities via the Comprehensive Monetary Easing (CME) program, launched in October 2010. The CME aimed to stimulate the sluggish economy and counter a mild deflation and strong yen by holding to a near-zero interest rate policy and by purchasing long-duration financial assets to lower long-term interest rates and/or risk premiums. This effort entailed increasing base money by ¥35 trillion or 7% of the GDP. The bulk of the ¥30 trillion was as loans against collateral, a conventional approach to supporting financial institutions. The ¥5 trillion remaining was dedicated to purchasing Japanese T-bills, government bonds (JGBs), commercial paper (CP), corporate bonds, Japanese real estate investment trusts (J-REITs), and equity-index ETFs. Because Japanese ETFs are non-synthetic, that is, they must hold the stocks in the indexes they track (rather than index futures), this policy induced actual share purchases.

In October 2010, the BOJ added domestic equity index-linked exchange traded funds (ETFs) and, on a much smaller scale, Japanese real estate investment trusts (J-REITs) to its quantitative-easing purchase menu. This section, summarized in Table 1, describes the events in the evolution of BOJ equity-indexed ETF purchases. This event was not the first time the BOJ purchased equity. The BOJ had acquired shares in Japanese corporations in 2002 from banks unwinding their strategic (control-block) shareholdings in other firms. The BOJ's objective in buying these shares was to prevent an increase in firms' public floats from depressing their prices. By December 2017, the market value of these shares was about ¥1.1 trillion.

The BOJ conducted ETF purchases through an appointed trust bank, re-selected every year.

ETFs appear as “Pecuniary Trusts (ETFs held as Trust Property)” on the BOJ’s balance sheet. Under the CME, the BOJ set a pre-determined cap and termination date on its asset purchases but, as Table 1 shows, also repeatedly relaxed both.

[Table 1 Here]

The program initially capped equity ETF purchases at ¥450 billion and ¥50 billion for J-RIETs and was to end in December 2011. In March 2011, the BOJ raised the ETF cap to ¥900 billion and delayed the termination to June 2012. In April, the BOJ pushed the termination date back to December 2012 and raised the cap to ¥1.2, with additional increases in the cap to ¥1.6 trillion in April 2012 and to ¥2.1 trillion in October 2012. Thus, the ETF purchase program expanded more than fourfold during its first year.

Prime Minister Shinzo Abe’s December 2012 election victory brought major policy changes. His “Abenomics” included “three arrows”: quantitative easing targeting 2% inflation, fiscal stimulus, and structural reforms. In April 2013, Abe appointed Haruhiko Kuroda as BOJ governor with instructions to implement the monetary policy at the core of Abenomics. Kuroda replaced the CME with the Quantitative and Qualitative Monetary Easing (QQE) policy. Short-term nominal rates were already near zero, so the BOJ included long-term bonds and equity ETFs as major components of its asset-purchasing program (Kuroda 2013). Petrov (2017) summarizes the BOJ’s stated reason for purchasing ETFs: “to reduce the risk premium across different asset classes, encourage lower long-term interest rates and indirectly boost economic activity.”

Targeting 2% inflation, the QQE expanded the monetary base by ¥60 trillion to ¥70 trillion

annually via asset purchases. These purchases included large-scale purchases of JGBs (initially ¥80 trillion annually) and equity-index ETFs (open-ended purchases) augmented by much smaller-scale purchases of J-REITs (a target of ¥90 billion annually). The BOJ also introduced a negative interest rate of minus 0.1% in January 2016 and a yield-curve policy in September 2016.

The BOJ implemented ETF purchases under the QQE as under the CME, but with an open-ended annual budget and no termination date. The BOJ set its ETF purchase target at ¥1 trillion per year in April 2013, subsequently increasing this amount to ¥3 trillion in October 2014, to ¥3.3 trillion in March 2016, and then to ¥6 trillion annually in July 2016.[3]

The BOJ periodically changed the ETFs on its purchase menu. From 2010 until November 2014, the BOJ purchased ETFs tracking the Tokyo Stock Price Index (TOPIX) and the Nikkei 225 index. From November 2014 on, the BOJ also bought ETFs tracking the JPX-Nikkei 400, an index of firms with good performance and good corporate governance ratings. The BOJ initially weighted its ETF purchases by market capitalizations—roughly 54%, 42%, and 4% for the TOPIX, Nikkei 225, and JPX-Nikkei index 400, respectively. In September 2016, the BOJ allocated ¥7 trillion for buying ETFs tracking the TOPIX alone, leaving ¥5.7 trillion for buying ETFs tracking all three indexes weighted by their market capitalizations as in previous months.

In May 2016, the BOJ set up a small (¥300 billion annually) supplemental program to buy ETFs holding shares in companies "proactively making investments in physical and human capital." Such companies were defined as those in five indexes: the JPX-Nikkei 400, and four tailored

[3] As a robustness check for our empirical results and data quality, Appendix Figure A4 corroborates the main results in Barbon and Gianinazzi (2017) which shows the impact of the BOJ ETF purchase policy announcements on returns of stocks that have high weights in the BOJ purchase basket relative to those with less exposure.

indexes—the Daiwa MSCI Japan Human & Physical Investment index, JPX/S&P CAPEX & Human Capital index, Nomura Enterprise Value Allocation index, and iSTOXX MUTB Japan Proactive Leaders 200. Unlike the main CME and QQE programs, the supplemental program limits the BOJ to owning no more than 50% of the total market value of any ETF.

Although the largest entry in the BOJ‘s balance sheet remains Japanese Government Bonds (JGBs), its equity holdings show the greatest increase. The BOJ’s ETF purchase program has increased its equity holdings from ¥1 trillion (shares taken off the balance sheets of troubled banks) before 2011 to over ¥22 trillion in as of December 3, 2018. The BOJ’s ETF purchases, culminating at over ¥3.3 trillion annually, have left the BOJ holding over 75% of the value of Japanese ETFs and around 4% of the total market capitalization of the Tokyo Stock Exchange. The BOJ is the only major central bank to have purchased domestic equities on such a scale.[4]

3. Data and Variable Construction

3.1 Data for Financial and Stock Return Variables

The sample comprises all firms traded on the First Section of the Tokyo Stock Exchange (TSE) from January 2011 to March 2018, excluding banks and financial institutions (J-SIC code 6), whose financial statements are non-comparable to those of firms in other sectors.

Daily stock returns, market capitalizations, public floats, and shares outstanding are from Thomson-Reuters DataStream. Financial data are from Thomson-Reuters WorldScope. BOJ

[4] Equity constitutes about 20% of the Swiss National Bank’s (SNB) balance sheet. However, these stocks are foreign stocks such as Apple, Alphabet, Microsoft, Facebook, Amazon, Johnson & Johnson, and Exxon. The SNBs foreign equities serve as a profit center for the central bank and as an additional channel for influencing the exchange rate.

ETF-purchase daily data are from the Bank of Japan's website. ETFs trading on the TSE are from the website of Japan Exchange Group (JPX). Assets-under-management data for each ETF are from Bloomberg. Index components and weights of Nikkei 225 and JPX-Nikkei 400 indexes are from Nikkei Inc. TOPIX index-component weights are obtained from the Nikkei QUICK Astra Manager database, a subsidiary of Nikkei Inc.

The BOJ announces its day t ETF purchases on day $t+1$. Market participants reportedly become aware of ETF share purchases associated with BOJ ETF purchases as or shortly after they occur. We therefore look at day t stock returns as well as returns in the two-day window $[t, t+1]$. Day t returns might primarily reflect price increases associated with increased demand for equities, although the two-day window would also include price increases associated with the BOJ signalling its continued interest in stimulating the economy. Our longer windows allow tests for reversals, but trade off the number of available data points, because BOJ ETF purchases tend to be clustered, especially in more recent data.

Tests of the impact of BOJ purchases on stock returns use only stocks with a positive volume and non-missing previous-day market capitalization. The daily returns sample of over 4.2 million stock-day observations allow portfolio-level tests, which contrast the returns of portfolios of stocks in ETFs on the BOJ purchase menu with those of other stocks. Intensive-margin tests use only daily returns for stocks in BOJ-targeted ETFs and days around BOJ purchases, a sample of over 1.7 million stock-day observations.

Tests for real effects of BOJ ETF purchases use firm-quarter and firm-year observations, dropping those with either negative total assets, net sales, current assets, tangible capital, inventories, or cash and short-term investments; returns-on-assets outside -50% to 200%;

market-to-book ratios outside 0 to 50; leverage ratios outside 0 to 100%; or changes in balance sheet items below -100%.[5] These filters result in final quarterly and annual panels of 42,993 firm-quarter observations and 6,114 firm-year observations, respectively. Tests using share-issuance information use a sample of 42,919 firm-quarter observations. In addition, we winsorize changes in balance-sheet variables at the 1% level when using them as outcome variables to study firm responses. Table 2 lists the variables used and their summary statistics.

[Table 2 here]

3.2 Construction of Bank of Japan–linked ETF demand measure

Because the ETFs are non-synthetic, the BOJ's purchases of ETF units mechanically cause these ETFs to purchase actual shares of their component stocks in proportion to each stock's weight in each index and each index's weight in the BOJ's purchase menu at that time.

We denote stock *i*'s day *t* weight in the Nikkei 225, TOPIX, and JPX-Nikkei 400 by w_{it}^{N225}, w_{it}^{Topix}, and w_{it}^{N400}, respectively and each index's day *t* weight in the BOJ's purchase menu as $w_{BOJ,t}^{N225}$, $w_{BOJ,t}^{Topix}$ and w_{it}^{N400}, respectively, all expressed as percentages. The percentage weight of stock *i* in total BOJ purchases on day *t* is then

$$[1] \qquad \overline{w}_{it} \equiv w_{it}^{N225} \times w_{BOJ,t}^{N225} + w_{it}^{Topix} \times w_{BOJ,t}^{Topix} + w_{it}^{N400} \times w_{BOJ,t}^{N400}.$$

The Japan Exchange Group website updates TOPIX index weights monthly, announcing each set

[5] The mapping of these variables to actual WorldScope data codes are described in Appendix Table A1 and the subsequent tables are each explained in their headings. Moreover, Appendix Table A4 in the back of the paper show additional robustness tests to different transformations of variables and alternative sets of fixed effects. In untabulated results, we also find qualitatively and quantitatively similar results using all available data without winsorization or winsorizing the balance-sheet variables at 2% or 5%.

of updated weights after 4:20 pm (Japan time) on the last business day of the following month. Nikkei updates its Nikkei 225 and 400 weights quarterly, likewise announcing each set of updated weights with a one-month lag after the end of each quarter.

Importantly, the three indexes' three very different weight-calculation systems create substantial heterogeneity in ETFs' increased demand for each individual stock arising from a given amount of BOJ's ETF purchases.[6] The TOPIX tracks the roughly 2,000 stocks in the First Section of the Tokyo Stock Exchange. A TOPIX component firm's weight in the index is proportional to its free float, namely, its share price times the number of its shares outstanding not held by strategic investors—that is, not part of long-term control blocks.[7] The Nikkei 225 tracks 225 stocks selected to collectively reflect the health of Japan's economy. The Nikkei 225 is a price-weighted index, similar to the Dow-Jones Industrial Average in the US. The JPX-Nikkei Index 400 tracks the prices of stocks of 400 large TSE-listed firms selected based on performance and corporate governance criteria. This index, like the TOPIX, weights firms by free float-adjusted market capitalization but caps any individual firm's weight at 1.5%. Nikkei reviews and updates its component firms annually, so firms enter and exit these indexes.

The main tests assume ETF fund managers use the most recent publicly available sets of weights when they purchase shares. These weights are constant for each month for the TOPIX and for each quarter for the Nikkei indexes.

BOJ-driven ETF demand for firm i's shares is the yen cost of the BOJ's total ETF purchases on

[6] Appendix Table A2 shows the relation between each index weight with lagged changes in market capitalization, changes in log total assets, lagged changes in ROA, lagged changes in book to market ratios, and lagged changes to book leverage. Overall, the weight of a stock in the BOJ basket is positive related to lagged changes in log total assets and market capitalization, and slightly negatively related to lagged changes in book leverage.

[7] Prior to 2005, the TOPIX was value weighted by component firms' total market capitalizations, including strategic blocks.

day t, BOJ_t, times that stock's weight in BOJ purchases, $\overline{w}_{it}$ from [1]. We scale the BOJ yen demand for a stock its market capitalization, $V_{i,t-22}$, lagged one month (22 trading days) in defining the increase in demand for stock *i* associated with BOJ ETF purchases on day t as

[2] $$BOJ_{i,t} \equiv \overline{w}_{it} BOJ_t / V_{i,t-22}.$$

For example, a value of 1% for $BOJ_{i,t}$ means the BOJ's ETF purchases on day *t* imply ETF purchases of shares in firm *i* equal to 1% of the value of all shares in firm *i* outstanding the prior month.

Tests using quarterly data sum BOJ-linked demand for each stock across all days in a quarter and scale this amount by total assets as of the end of the prior quarter:

[3] $$BOJ_{i,q} \equiv \left(1/A_{i,q-1}\right) \sum_{t \in q} \overline{w}_{it} BOJ_t.$$

Tests using annual financial data analogously sum BOJ-linked demand for each stock across all days in the year and scale by total assets at the end of the prior year.

4. Empirical Findings

4.1 Portfolio-level Tests

As a preliminary first pass through the data, Table 3 contrasts the returns on market capitalization-weighted portfolios of stocks in the ETFs the BOJ purchases and of all other stocks, denoted r_t^{BOJ} and $r_t^{non-BOJ}$, respectively. Regressions (3,1) though (3.4) of Table 3 explain the return premium of the portfolio of stocks in ETFs the BOJ purchases over that of the

portfolio of other stocks, $r_t^{BOJ} - r_t^{non-BOJ}$, with either an indicator variable set to 1 on days with BOJ ETF purchases, and 0 otherwise, the log of 1 plus BOJ ETF demand in hundreds of millions of yen, or both. All regressions assess significance using Newey-West standard errors with 5 lags.

[Table 3 Here]

All four regressions indicate a small but statistically significant positive return premium with BOJ ETF purchases. Regressions (31), (3.2), and (3.4) are associated with a 1% increase in BOJ purchases with a 2-basis-point increase in the return of the BOJ purchase-basket portfolio relative to that of the portfolio of other stocks.

The negative coefficient on the ETF-purchase indicator variable in Regression (3.4) confirms the BOJ tends to buy ETFs on days when the purchase-basket portfolio drops relative to other stocks. Moreover, the negative coefficients on the log ETF purchases in Regression (3.5) and (3.6) suggest the timing and magnitudes of the BOJ's ETF purchases are likely not exogenous. This finding is consistent with the BOJ's stated purpose in intervening in the stock market being to put upward pressure on stocks (Kuroda (2016).

4.2 Daily Returns Panel Regressions

This endogeneity in timing means we must employ an exogenous source of heterogeneity in BOJ-linked share purchases in our main tests for effects of its ETF purchases on individual stocks and on corporate decision-making. This section exploits such heterogeneity, which arises from the different firms' different weights in the different indexes tracked by the ETFs that the BOJ purchases. We do so by estimating daily firm-level panel regressions of the form

[5] $$r_{i,t} = 1_{j(i),t} + 1_i + \beta\, BOJ_{i,t} + \varepsilon_{i,t},$$

where r_{it} is the return of firm *i*'s stock on day *t*, j(i) is firm i's primary industry at that time, and the $BOJj_{i,t}$ is ETF demand for shares in i associated with BOJ ETF purchases on day t, as defined in [2].

The explained variable is the stock's raw total return, because the regressions include stock fixed effects, denoted 1_i, which subsume different static risk loadings for different stocks, and industry-day fixed effects, denoted $1_{j(i,t)t}$, which subsume time-varying sector-specific risk loadings and time-varying macroeconomic risk loadings. Firm i's primary industry as of time t is denoted $j(i,t)$.[8] Standard errors cluster bidirectionally, by both stock and day, adjusting significance levels for persistence in BOJ-linked share purchases by ETFs through time and for common shocks to all firms on given days.[9]

[Table 4 Here]

Table 4 summarizes these results. The first column in each panel shows individual stocks with larger weights in the BOJ's ETF purchase menu, the $\overline{w}_{it}$ from [1], posting significantly more positive returns on days when the BOJ buys more ETFs. Panel A, which includes all stocks, investigates an extensive margin. Its first column shows a significantly more positive same-day return for stocks in the indexes these ETFs track than for other stocks and a more positive same-day return for stocks with larger weights in the BOJ's ETF purchase menu. Panel B only

[8] Appendix Table A3 shows the impact of different fixed-effects specifications on the relation of firm size, a potential confounding variable, on the BOJ purchase basket weight, and separately for the Nikkei 225, Topix, and JPX-Nikkei 400 index weights. We find that overall, the BOJ purchase basket weights are not statistically significantly related to log market capitalization using the industry-day fixed effect specification in Column (3).

[9] We include stock-level clusters to account for autocorrelated returns and also for the autocorrelation in BOJ purchases, as shown in Appendix Figure A1, which suggests the BOJ purchases exhibit some cyclicality.

includes stocks in the indexes these ETFs track, and thus investigates an intensive margin. Its first column shows stocks with greater weights in the BOJ's purchase menu gaining significantly more on days when the BOJ buys more ETFs.[10]

Jain (1987) argues that studies measuring price gains on a stock's inclusion in a major index should consider temporary price pressure. Temporary gains due to market makers' tardiness in meeting index funds abruptly increased demand for shares that are soon reversed. The remaining columns in Panels A and B examine cumulative returns over longer windows from the day the BOJ buys ETFs, day t, to the next trading day $[t, t+1]$, the trading day after that $[t, t+2]$, a week (five trading days) later $[t, t+4]$, two weeks later $[t, t+9]$, and roughly one trading month later $[t, t+21]$.

Neither panel shows any evidence of a reversal. Rather, both show accelerating price gains as the length of the window increases. This accelerating gains may reflect additional BOJ ETF purchases on days later in these windows, so Panel C repeats the exercise, dropping all event windows containing a second BOJ ETF purchase date. Restricting our sample to non-overlapping purchase days and return horizons substantially reduces the sample size; however, an accelerating price increase remains evident. Although the approach in Panel C is free from the impact of future purchases, the persistence of the accelerating returns can be because the BOJ's ETF purchases initiate positive feedback loops, with higher prices boosting market sentiment or

[10] Appendix Table A4 shows more robustness checks. In Panel A, across different fixed effects specifications, we find quantitatively and qualitative similar results when including time-based (day or industry-day) fixed effects and identifying off the cross sectional data. Meanwhile, Panel B shows that our results are robust to different transformations of returns to account for outliers. Finally, Appendix Figure A5 present a partial scatter plot of returns relative to BOJ purchase demand, grouped into 100 bins, and suggests that our estimated effect are not driven by outliers.

the expectation of more future purchases, which further boosts prices.[11] This effect would be stronger for stocks in the ETFs if market sentiment affects index ETF purchases rather than purchases of individual stocks.

4.3 Monthly Volatility Tests

The BOJ's stated purpose in buying equity-index ETFs is to reduce costs of capital. Because higher market volatility (systematic risk) increases investors' discount rates and firms' costs of capital, the BOJ might advance its purpose by intervening to reduce stock volatility for a large cross section of firms to reduce systematic risk. Therefore, we study whether BOJ ETF purchases are related to stock-specific volatility in the cross section.

Table 5 explores whether BOJ ETF purchases are related to monthly volatility by relating BOJ ETF purchases of each stock i—summed over each calendar month, m, and scaled by its previous month's market capitalization—to its daily stock return volatility, $\sigma(r_{i,m})$, calculated from daily returns in the same month. We focus on the intensive margin of BOJ stocks using the volatility measure, and allow stocks to enter into the BOJ basket throughout the month, due to updates in index-component lists. Aggregating to the monthly level yields a sample with 186,189 stock-month observations. All measures of volatility are annualized and defined based on daily returns within a month, with returns in percentages.

[11] All of the ETFs in the BOJ purchase basket are physical rather than synthetic. However, the ETFs do not explicitly state that they only trade the underlying securities always. Delayed price pressure could arise because ETFs may not buy all the underlying securities all at once. Instead, they may purchase the underlying shares over several days or also use futures in the very short term before buying the underlying securities over the next couple of days. For example, iShares Nikkei 225 ETF states that it "will at all times invest at least 90% of its assets in the securities of its Underlying Index and in depositary receipts representing securities in its Underlying Index. The Fund may invest the remainder of its assets in in other securities…including futures contracts, options on futures contracts, other types of options and swaps related to its Underlying Index, as well as cash or cash equivalents."

[Table 5 Here]

Column (1) in Table 5 finds that higher BOJ ETF purchases are linked to higher monthly volatilities. However, decomposing volatility into upside and downside volatilities shows BOJ ETF purchases are associated with more upside volatility and less downside volatility. Stock i's upside volatility in month m, $\sigma(r_{i,m}|r_{i,t} > 0)$, is the volatility using all days t in month m on which the return $r_{i,t}$ is positive and its downside volatility, $\sigma(r_{i,m}|r_{i,t} < 0)$, is the volatility using all days t in month m on which the return $r_{i,t}$ is negative. Consistent with the BOJ buying ETFs when the market drops, the table links lower downside volatility to larger BOJ ETF purchases. And consistent with BOJ ETF purchases increasing share prices, the table links higher upside volatility to higher BOJ ETF purchases.

The overall effect is BOJ ETF purchases increasing the skewness of the returns distributions. These results suggest the BOJ's ETF purchases are more focused on keeping share valuations up than on reducing systematic volatility. This rationale justifies our primary tests in Table 4 using returns rather than volatilities.[12]

4.4 External Financing Tests

This section explores whether firms whose share prices are affected by BOJ ETF purchases raise new capital. The measures of raising money include (1) net proceeds from new issues from the cash-flow statement, (2) net debt issuances from the balance sheet, and (3) decreases in treasury

[12] Standard asset-pricing models link higher returns to higher variances; however, a substantial body of research argues for models of investor preference for positive skewedness in stock returns (e.g., Brunnermeier et al. 2007; Singleton and Wingender 1986; Leland 1999). These alternative approaches to asset-pricing models suggest the BOJ's ETF purchases, by increasing the positive skewedness of stock returns, might reduce investors' discount rates and firms' costs of capital, increasing share valuations and reducing firms' costs of financing corporate investment. We leave these issues to future research.

shares, which signify the sale of shares that were bought back in the past. We further supplement the net proceeds from new-issues data with additional data on announced secondary equity issues from the Development Bank of Japan in order to verify that increases in new issues were truly due to secondary issuances.

[Table 6 Here]

In Table 6, we use an OLS specification with industry-quarter and firm fixed effects and find that firms with higher BOJ demand over a quarter have a higher probability of share issuances, both in the form of secondary equity offerings and the sale of treasury shares. In Panel A, we find a BOJ purchase of 1% of total assets leads to a 0.015 higher probability of secondary equity offerings and a decrease of 0.008 in the probability of sales of treasury shares. We find a quantitatively similar but statistically insignificant effect of BOJ purchases on debt issuances. In Panel B, we study the impact of BOJ purchases specifically through the market-to-book pricing ratios and the market-leverage ratio. This approach suggests the statistically insignificant result on debt issuances is due to the weak effect of BOJ purchases on the market-leverage ratio.

We also consider alternative logistic, probit, and Tobit specifications to account for the binary response variables in Appendix Tables A6, A7, and A8 respectively. The empirical specification in Appendix Table A6 for logistic and probit specifications and Appendix Table A8 for Tobin specifications approximate by de-meaning all independent variables at the firm and then industry-quarter levels. This specification approximates a linear fixed-effects regression in a way that avoids the incidental-parameters problem.[13] The average marginal effect of BOJ purchases is

[13] In untabulated results, we find that firms larger than median based on total assets do not a different reaction to BOJ purchases. On the other hand, firms with more than the median leverage are more likely to issue even more debt the higher the BOJ purchases.

0.3 percentage points, around 4% relative to the average issuance probability of 7.5 percentage points in a quarter. A one-standard-deviation (around 1.52 percentage points) increase in BOJ purchases relative to previous quarter's total assets increases issuance probability by 6%.[14]

Overall, we find that firms tend to increase their equity through increases in secondary equity offerings and decreases in share repurchases. These corporate responses are plausible ways for companies to raise funds in response to the BOJ ETF purchases boosting their share prices.

4.5 Policy Effectiveness of BOJ ETF Purchases

The focus in this paper is the BOJ's ETF purchases, because this form of unconventional monetary policy is unique and permits a plausibly valid empirical identification. The BOJ's ETF purchase policy can be deemed effective if it can be tied to increases in corporate investment or other changes in the real economy associated with increased economic growth.

However, the BOJ's ETF policy is part of a broader unconventional monetary policy, so attributing real effects to ETF purchases requires exploiting variation in their intensity distinguishable from that in other BOJ policies. General interest rate policies, open-market operations, and quantitative easing via purchasing T-bills and JGBs affect all firms. Quantitative easing via purchases of commercial paper and corporate bonds potentially affects different firms differently. Because detailed data on BOJ purchases of these corporate securities are not available, we are unable to pursue this issue at present.[15,16]

[14] For additional robustness, Appendix Table A7 also shows the logistic and probit results without the linear de-meaning approximation.

[15] The BOJ buys investment grade corporate bonds (rating BBB or higher), which tend to be issued by larger firms, but does not publish which firms' bonds it buys.

Table 7 presents initial exploratory estimates of the impacts of BOJ on corporate actions, measured by various alternative variables, $Y_{i,q}$, with firm-quarter panel regressions of the form:

[6] $$Y_{i,q} = 1_{j(i,q),q} + 1_i + \xi BOJ_{,iq} + \mathbf{\Gamma'X}_{i,q-1} + \varepsilon_{i,q},$$

with i indexing firms, q indexing quarters, 1_{jq} denoting industry-quarter fixed effects, and 1_i denoting firm fixed effects.[17] The coefficient of interest, ξ, gauges the impact on a corporate-action variable associated with $BOJ_{,iq}$, which measures increased demand for the firm's shares that quarter attributable to BOJ ETF purchases. The main explanatory variable, $BOJ_{,iq}$, defined in [4], is BOJ-related ETF purchases of the firm's stock each quarter scaled by the firm's prior-quarter assets. To account for serial correlation in financial-statement variables, these regressions cluster by firm. The vector $\mathbf{X}_{iq-1}$ contains control variables, including one-quarter lagged changes in returns-on-assets, changes in market-to-book ratios, changes in book leverage, and changes in total assets.

[Table 7 Here]

Additional firm-year panel regressions use an analogous specification. These regressions consider corporate-action measures based on variables disclosed annually, but not in quarterly financial reports. The most important of these outcome variables is cash holdings. Repeating the firm-quarter panel regressions using firm-year data also sidesteps issues associated with

[16] More generally, ETF component firms are large firms, so if other BOJ interventions affected larger firms more strongly, and if their intensity rises and falls with the intensity of BOJ ETF purchases, these tests might misinterpret other interventions as due to ETF purchases. To mitigate these concerns, our empirical tests include industry-by-fiscal period fixed effects and firm fixed effects.

[17] For reference, the full quarterly and annual panel results including coefficients on our control variables are shown in Appendix Table A9 and Appendix Table A10 respectively.

seasonality in quarterly data.

Table 7 presents first-pass exploratory regressions searching for these effects. Panel A associates increased BOJ-liked ETF purchases of a firm's shares with increased returns and with increased assets that quarter. The increases in assets reflect increases in inventories and current assets, but not increases in tangible investment—the primary goal of an expansionary monetary intervention. Appendix Figure A2 shows the point estimates of the same specifications annually from 2011 through 2018, showing a diminished impact of BOJ purchases on corporate balance sheet expansion.[18] Panel B, using firm-year panel data, which include variables not available quarterly, can further illuminate these policy changes. That panel links larger BOJ-linked ETF purchases of a firm's shares to increases in its cash holdings and research and development spending.[19]

This table likely overestimates the impact of BOJ ETF purchases on these variables, in that other expansionary policies are unfolding simultaneously. As the BOJ buys ETFs, it is also purchasing fixed-income securities of various maturities, and the Japanese government is implementing an expansionary fiscal policy. If these interventions affected different firms in ways correlated with their weights in the BOJ-linked ETF purchase basket in [1], simple OLS panel regressions may erroneously attribute effects of these interventions to ETF purchases.

[Table 8 Here]

[18] In Appendix Table A3, we also show the quarterly responses by different industries.

[19] Our additional analyses exploiting the cross sectional variation of firms, splitting them into those with Tobin's Q values above unity and those in the construction and real estate industries are shown in Appendix Table A11 and A12 respectively. We find that growth-like firms (those with Q higher than one) have slightly muted effects of BOJ purchases on the increase in total assets and increase in tangible capital, opposite what we would expect for financially constrained firms. We also find no differential impact of firms in construction and real estate or the manufacturing industries.

Table 8 therefore adopts an instrumental-variables approach to assessing the extent to which changes in the corporate-strategy measures in Table 7 are actually changing in response to BOJ ETF purchases increasing their share valuations. This hypothesis can be assessed using IV regressions; however, the issue here is not rejecting reverse causality or mitigating measurement error, but assessing whether the intermediate variable—firm valuation—plays any discernible role in modulating the link between BOJ ETF purchases and the corporate-response variables that might be associated with BOJ policy objectives.

These tests restrict the statistical channel through which the BOJ asset purchases can affect firm policy by considering the following two-stage least-squares estimation:

$$[7] \qquad Y_{iq} = \alpha_i + \alpha_{j(i),t} + \beta \widehat{\left(\frac{M}{B}\right)_{iq}} + \mathbf{\Gamma'X}_{i,q-1} + \varepsilon_{iq}$$

$$[8] \qquad \left(\frac{M}{B}\right)_{iq} = \gamma_i + \gamma_{j(i),t} + \xi BOJ_{iq} + \mathbf{\Gamma'X}_{i,q-1} + \eta_{iq},$$

where i indexes the firm, $j(i)$ indexes firm i's industry, and q indexes a quarter. Annual data are handled analogously.

The first stage in the quarterly tests projects changes in the market-to-book ratio on BOJ_{iq}, BOJ-linked ETF demand for firm i's stock in quarter q, defined as the total sum of BOJ purchases for all days in a fiscal quarter scaled by the previous quarter's total assets, and then studies the relation between the changes in the market-to-book ratio related to BOJ-linked ETF demand on firm policy. The first stage in the annual tests does likewise using annual data.

Table 8 shows our empirical results. Column (7.1) shows the first-stage relation, where an increase in BOJ demand of 1% relative to assets corresponds to an increased in the market-to-book ratio of 0.202, or roughly 15% relative to the average, equivalent to about 7.5% of one

standard deviation. Columns (7.2) through (7.9) suggest increases in the market-to-book ratio indeed stimulates increases in the firm's balance sheet, but mostly through current assets.[20]

5. Conclusion

The BOJ is a pioneer in unconventional monetary policy, especially with its large scale and prolonged ETF purchase program. These purchases appear to boost the share valuations of the affected firms, thus encouraging those firms to make increased use of equity financing and to increase their book assets. Although these empirical observations might suggest the BOJ's equity purchases achieve their intended effect, namely, to increase investment, we find the increase in total assets is mostly due to increased cash holdings, with increased investment being a relatively minor outcome. We find no statistically significant impact on sales or R&D expenditure, but find a slight increase in employment.

The BOJ's unconventional monetary stimulus via equity purchases, while furthering that central bank's reputation for ground-breaking innovation, did not prove to be an effective way to boost corporate investment. Buying corporate equities is not an effective way to boost corporate investment. This lesson is important because having central banks hold corporate equities on a large scale raises numerous potentially serious issues. How should a central bank vote in shareholder meetings? The BOJ buys shares through ETFs and does not currently exercise its voting rights. But those voting rights effectively constitute large government block holdings in private-sector businesses. Were the BOJ's example followed in other countries with less

[20] The first-stage F-statistics are well below standard weak-instruments thresholds applied when instrumental-variable regressions are used to infer causality. Because our purpose is to detect the existence of a transmission channel, rather than testing causality, first-stage F-tests are interpreted differently: Low values mean BOJ ETF purchases are a relatively unimportant source of variation in the instrumental variable.

developed institutions, such an arrangement might lead to undue political influence over corporations. Had the BOJ's equity purchases clearly led to increased corporate investment, these concerns would be balanced against the social welfare gains from placing an additional tool at the disposal of central bankers. The BOJ experience, however, suggests that this tool has very limited power for stimulating aggregate demand.

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Table 1. Bank of Japan Key Monetary Policy Dates and Announcements

Date	ETF amounts	Bank of Japan policy announcement
Oct. 5, 2010		Implementation of the Comprehensive Monetary Easing (CME) program to increase base money by ¥35 trillion yen (7% of GDP): ¥30 trillion for loans against collateral and ¥5 trillion for the Asset Purchase Program (APP). The assets to be purchased included government securities (JGBs), commercial paper (CP), corporate bonds, equity index ETFs, and REITs. BOJ also pursued the virtually zero interest rate policy.
Oct. 28, 2010	¥0.45 trillion	Set up the cap for ETF purchases to be conducted by Dec. 2011.
Nov. 5, 2010		Specified target ETFs tracking the Tokyo Stock Price Index (TOPIX) or the Nikkei 225 index; with ETF purchases proportional to ETF market values.
Mar. 14, 2011	¥0.9 trillion	Increased the ETF purchasing cap to ¥0.9 trillion and extended the purchasing program to Jun. 2012.
Aug. 4, 2011	¥1.4 trillion	Increased the ETF purchasing cap to ¥1.4 trillion and extended the purchasing program to Dec. 2012.
Apr. 27, 2012	¥1.6 trillion	Increased the ETF purchasing cap to ¥1.6 trillion.
Oct. 30, 2012	¥2.1 trillion	Increased the ETF purchasing cap to ¥2.1 trillion.
Jan. 22, 2013		Announced a monthly purchase policy and extended the purchasing program to Dec. 2013.
Apr. 4, 2013	¥1 trillion/year	New BOJ governor launched the Quantitative and Qualitative Easing (QQE) to increase the monetary base by ¥60-70 trillion per year; and set an annual target for ETF purchases.
Oct. 31, 2014	¥3 trillion/year	Tripled annual ETF purchases.
Nov. 19, 2014		BOJ purchases can include ETFs tracking JPX-NIKKEI 400.
Mar. 15, 2016	¥3.3 trillion/year	Increased annual ETF purchases to 3.3 trillion.
Mar. 15, 2016	¥0.3 trillion/year	Established a supplementary program to buy ETFs tracking JPX-Nikkei Index 400; and ETFs tracking firms "proactively investing in physical and human capital"
Jul. 29, 2016	¥6 trillion/year	Increased annual ETF purchases to ¥6 trillion.
Sep. 21, 2016		Revised purchasing weights: ¥2.7 trillion for ETFs tracking TOPIX only; remainder allocated proportionally by ETF market value across the other 3 indices.

Data source: Policy announcements listed on the website of the Bank of Japan.

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

Table 3. Portfolios of Stocks "In" vs. "Not In" ETFs Bank of Japan Purchases

Regressions (4.1)–(4.4) explain the premium of the daily return of the portfolio of stocks in the BOJ's ETF purchase basket, r_t^{BOJ}, over that of the portfolio of all other stocks, $r_t^{non-BOJ}$. Explanatory variables are an indicator, $1_{BOJ\ ETF\ purchases > 0}$, set to 1 on days when the BOJ purchases ETFs, and 0 otherwise, the logarithm of 1 plus BOJ ETF purchases, in hundreds of millions of yen, that day (0 if no purchases occurred), or both. Regression (4.1) uses only *days* between December 15, 2010, and March 31, 2018, when the BOJ purchased ETFs; all other regressions use all days in that interval. Numbers in parentheses are Newey-West p-values allowing heteroskedasticity and autocorrelation up to 5 lags, with boldface indicating significance at the 5% level or better.

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

Table 4. Impact on Stock Returns

Firm-day panel regressions explain stock returns in intervals, indicated by square brackets, around BOJ purchase date t. Explanatory variable BOJ_{it} is the BOJ demand for stock i associated with the BOJ's ETF purchases on trading day t as a fraction of the firm's prior month-end market capitalization. In all regressions, BOJ_{it} is winsorized at 1%. Regressions include industry-day fixed effects where industries are 4-digit SIC codes. Panel A uses all trading days and stocks; Panel B uses all trading days and stocks in the BOJ purchase basket; and Panel C uses only days with isolated BOJ purchases around the return horizon in $[t-k, t+k]$ for k = 0, 1, 2, 4, 9, 21 days and stocks in the BOJ purchase basket. Numbers in parentheses are p-values, with boldface indicating significance at the 1% level or better.

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

Table 5. Changes in Monthly Stock Volatility

Regressions explain measures of the volatility of stock i's daily returns, r_{it}, estimated over all trading days t in calendar month m, represented as percentages and denoted $\sigma_{i,m}(r_{it})$. The explanatory variables are total BOJ-driven ETF purchases of that stock over the same calendar month, denoted $BOJ_{i,m}$ – calculated to account for stocks that are ever in the BOJ purchase basket within the month and scaled by total market capitalization in yen of stock i over the previous month – and the explained variable lagged one month. Variants of the explained variable are *upside volatility*, $\sigma_{i,m}(r_{i,t}|r_{i,t} > 0)$, calculated using returns of stock i only for days t in month m on which the return $r_{i,t}$ is positive and downside volatility, $\sigma_{i,m}(r_{i,m}|r_{i,t} < 0)$, using returns of stock i only for days t in month m on which the return $r_{i,t}$ is negative. A log-log specification is used to facilitate interpretation. Numbers in parentheses are p-levels clustering by firm, with boldface indicating significance at 1% or better.

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

Table 6. Share and Debt Issuances

Regressions explain debt or equity issuances with BOJ-driven ETF purchases of firms' shares. Explained variables are indicators, set to 1 if the firm issued the type of securities in question, and 0 otherwise. Equity increases are defined as an indicator taking the value of 1 if the net total change in total shares outstanding, that is, net secondary equity offerings (SEO) minus stock buybacks, is positive. $\Delta M/B$ is defined as its fiscal-period return, the change in the market capitalization of the firm scaled by the previous fiscal period's book value. Panel A presents OLS linear-probability models. Panel B presents instrumental-variable linear-probability models, where change in the market-to-book ratio instruments for BOJ-driven ETF purchases in 6B1 through 6B4, and change in leverage instruments for BOJ-driven ETF purchases in 6B.5. The first-stage regression for the former is 6B.1.1 and that for the last is 6B.5.1. 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-quarter fixed effects. All regressions cluster by firm. Numbers in parentheses are p-values boldface indicating significance at 10% or better.

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** **(0.038)**	**0.009** **(0.009)**	**0.015** **(0.002)**	**-0.008** **(0.030)**	-0.002 (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** **(0.034)**	**0.002** **(0.029)**	**0.004** **(0.050)**	**-0.002** **(0.030)**		0.074 (0.113)
$BOJ_{i,t}$	**4.138** **(0.091)**					**-0.032** **(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

Table 7. Changes in Corporate Policies

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

Table 8. Changes in Corporate Policies via Changes in Market-to-Book Ratio

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

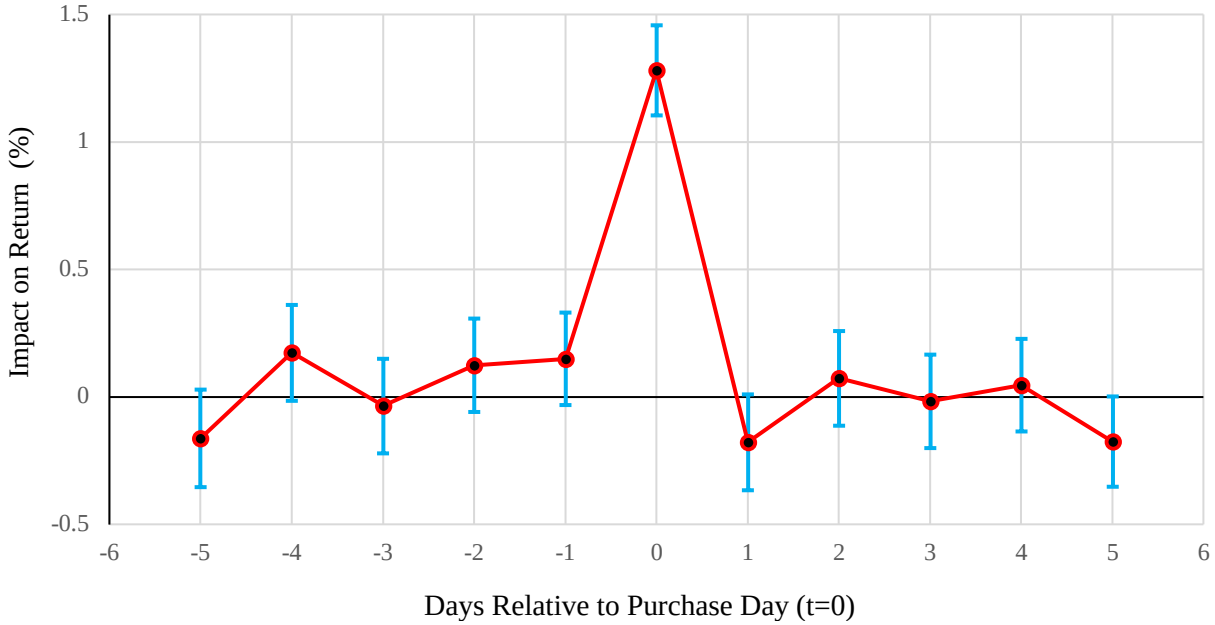
Panel B: Firm-year panel instrumental-variable regressions

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)
$BOJ_{\text{it}}\|\Delta M/B$		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

Figure 1. Stock Return Reactions to BOJ ETF Purchases

This figure shows the estimated coefficients of daily stock returns in response to the BOJ's ETF purchases. BOJ demand is a percentage of BOJ purchases of a stock relative to its market capitalization from the past 22 trading days. The OLS regressions include the firm and SIC4-by-day fixed effects. Cumulative returns are accumulated from 5 days before and after a BOJ purchasing day (defined as t = 0). Returns are in percentages. The BOJ demand is a decimal fraction of daily yen trading volume from 5 trading days ago. Standard errors are clustered by day and stock, and 95% confidence intervals are shown.

Panel A. Event-Time Impact of BOJ Purchases



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

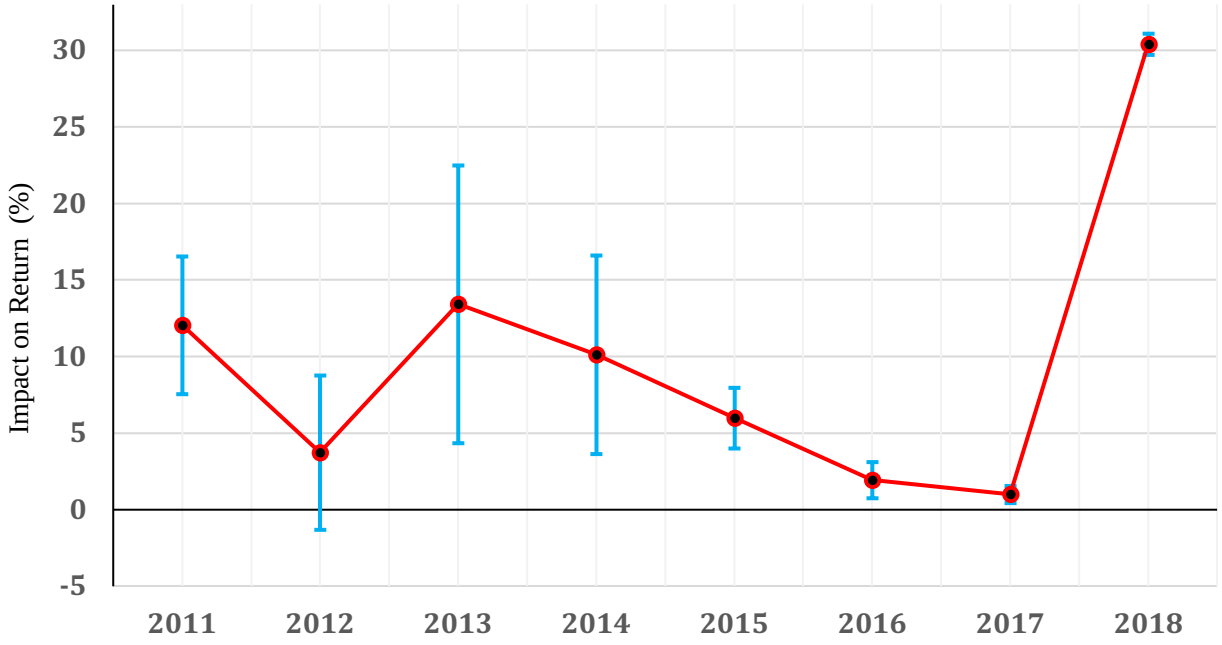
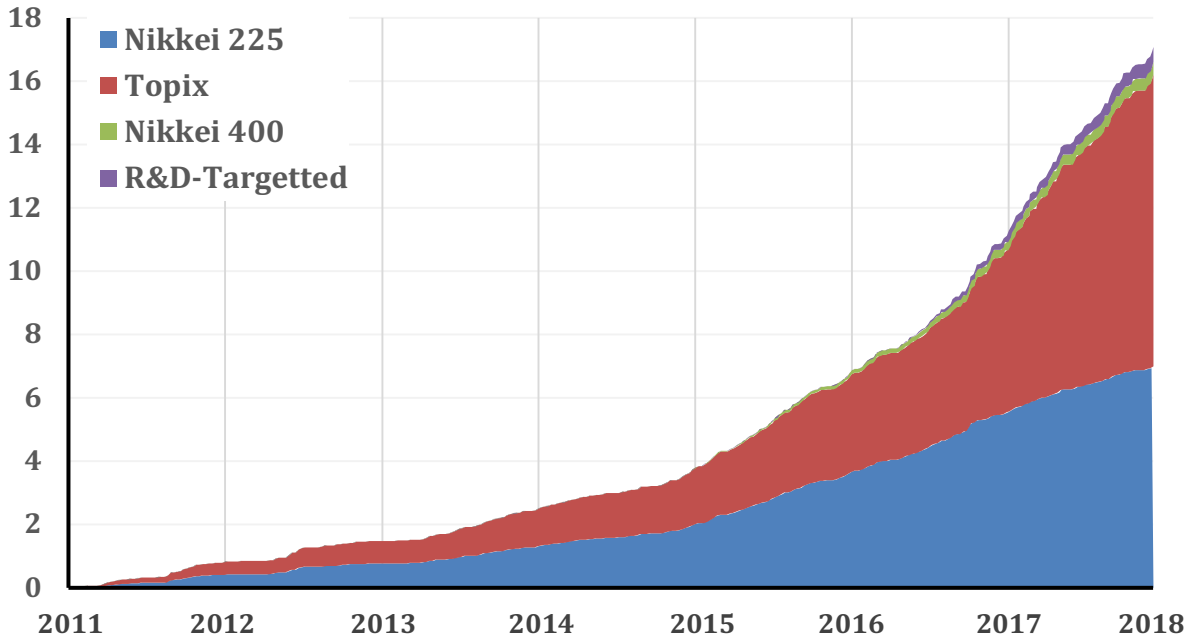
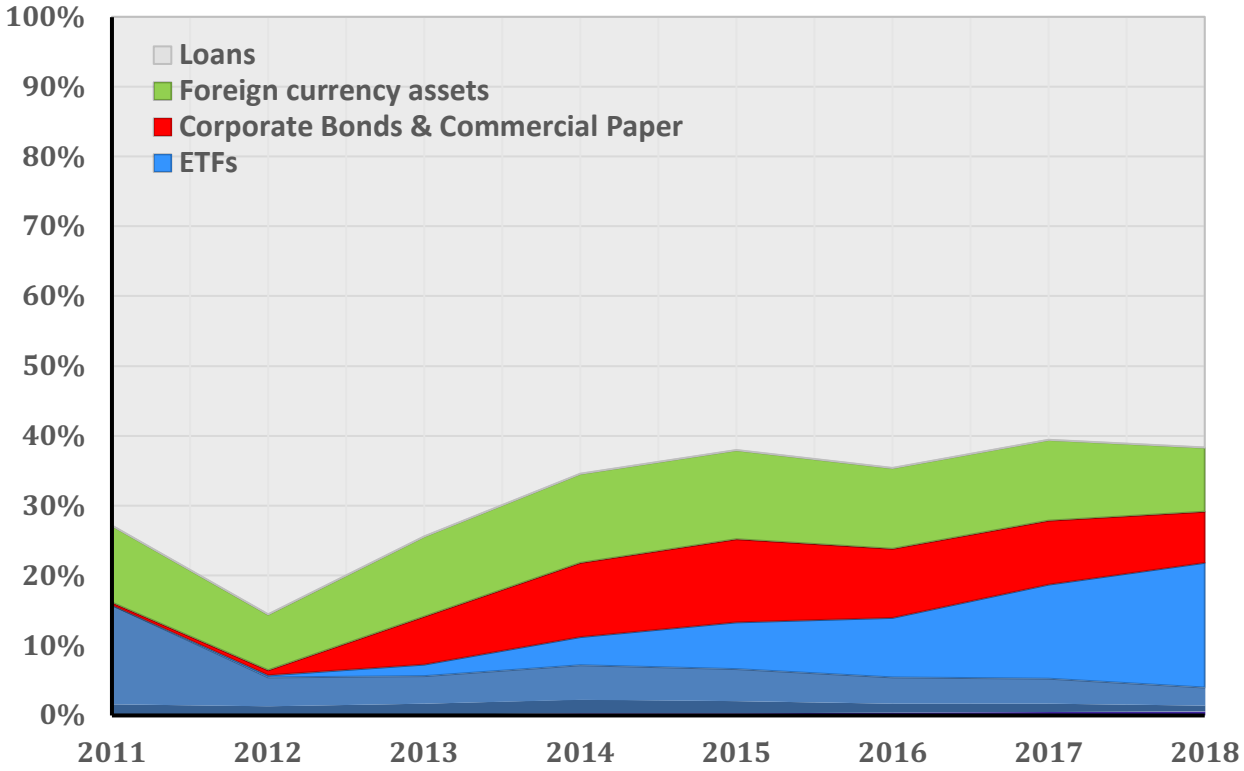


Figure 2. Amount of BOJ ETF Purchases and Returns

Panel A. Bank of Japan cumulative ETF purchases by year-end (in Trillions Yen)



Panel B. Bank of Japan breakdown of holdings of non-government securities



Appendix: Robustness and Additional Empirical Analyses

Appendix Table A1. Definitions of Main Variables

Variable	Definition
Leverage	WC08236A: Total Debt / Total Assets, represented as a percentage.
Cash	WC02003: Cash holdings (in thousands of yen).
Cash & Short-term Investments	WC02001A, WC02001: The sum of cash and short-term investments. Short-term investments defined as assets not strategically held and are non-recurring (in thousands of yen).
Current Assets	WC02201A, WC02201: Includes all standard liquid assets, inventories, and other assets with an average maturity of less than 1 year (hundreds of yen).
Employees	WC07011: Number of employees. In Japan, public firms are required to report the number of employees annually.
Market-to-Book	WC09304A, WC09304: The ratio of the market value of equity plus liabilities divided by the book value of total assets.
Goodwill	WC02502:
Long-term Debt	WC03251A: Total long-term debt of more than 1 year in maturity (in thousands of yen).
Tangible Capital	WC02501A, WC02501: Property, Plant and Equipment (in thousands of yen).
R&D	WC01201: Research and development expenditure.
Return on Assets	WC08326A: EBITDA/Total assets (in percentages).
Book-Leverage Ratio	WC08236A: Book long-term book leverage/Total assets (in percentages).
Sales	WC01001: Net sales or revenues (in thousands of yen)
Short-Term Investments	WC02008: Holdings of marketable securities (in thousands of yen).
Total Assets	WC02999A: Total book assets (in thousands of yen).
Equity Issuances	Derived from total shares outstanding, defined as an indicator of whether the total shares outstanding (not just public float) strictly increases.
Secondary Equity Offering	From Nikkei NEEDS. An indicator of whether the company completed an SEO in the quarter.
Debt Issuance	Derived from total long-term debt outstanding (WC03251A), defined as an indicator of whether it strictly increases.

Appendix Table A2. Stocks' Weights in BOJ ETF Purchase Basket and in Major Indexes

Regressions explaining calculated weight of individual stocks in BOJ-linked ETF demand ($\bar{w}_{i,t}$) 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	Nikkei 225 Weight	TOPIX Weight	JPX-Nikkei 400 Weight
	(1)	(2)	(3)	(4)
ΔMarket Cap$_{t-1}$	**0.000**	0.000	0.000	**-0.000**
	(0.044)	(0.351)	(0.142)	**(0.019)**
ΔAssets$_{t-1}$	**2.389**	-1.592	**5.426**	**2.010**
	(0.048)	(0.447)	**(0.000)**	**(0.000)**
ΔROA$_{t-1}$	0.007	1.086	0.004	-0.001
	(0.292)	(0.145)	(0.467)	(0.341)
ΔMarket-to-Book$_{t-1}$	-0.042	-0.024	-0.024	**-0.043**
	(0.097)	(0.859)	(0.236)	**(0.002)**
ΔBook 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

Appendix Table A3. Daily BOJ Weights and Market Capitalization

The table below shows the relation of BOJ purchase weights, Nikkei 225 weights, TOPIX weights, and JPX-Nikkei 400 weights. All weights are in percentage points. Constants from column (1) are suppressed for space. Standard errors are clustered by stock, and p-values are shown in parentheses with boldface indicates significance at 5% or better.

Fixed Effects		Firm	Industry-Day	Firm & Industry-Day
			$\overline{w}_{it}$	
	(1)	(2)	(3)	(4)
log(Market Capitalization)	-0.094	**13.920**	-0.435	**4.207**
	(0.858)	**(0.041)**	(0.220)	**(0.044)**
Constant	18.783			
	(0.101)			
Observations	16,260	16,260	16,260	16,260
R^2	0.0001	0.418	0.663	0.825
			$w_{it}^{Nikkei\ 225}$	
	(5)	(6)	(7)	(8)
log(Market Capitalization)	-0.058	**1.575**	-0.215	5.427
	(0.789)	**(0.033)**	(0.472)	(0.064)
Constant	**11.852**			
	(0.011)			
Observations	1,590	1,590	1,590	1,590
R^2	0.0002	0.752	0.521	0.950
			w_{it}^{Topix}	
	(9)	(10)	(11)	(12)
log(Market Capitalization)	-0.199	**5.494**	-0.228	**7.791**
	(0.236)	**(0.000)**	(0.150)	**(0.000)**
Constant	**17.244**			
	(0.000)			
Observations	14,300	14,300	14,300	14,300
R^2	0.001	0.883	0.311	0.925
			$w_{it}^{Nikkei\ 400}$	
	(13)	(14)	(15)	(16)
log(Market Capitalization)	**-0.516**	-0.549	**-0.585**	-0.232
	(0.027)	(0.053)	**(0.012)**	(0.461)
Constant	**21.911**			
	(0.000)			
Observations	17,466	17,466	17,466	17,466
R^2	0.015	0.823	0.317	0.874

Appendix Table A4. Robustness: BOJ Purchases and Stock Returns

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

Appendix Table A5. Share Issuances – Full Table

The table shows the effect of BOJ purchases on share and debt issuances using the data at the quarterly level. Outcome variables are all indicators. Any issuances include both debt and share issuance. Equity increases include both secondary equity offerings (SEO), sale of non-public float shares, and sales of treasury shares. Columns (3) and (4) break secondary equity offerings and stock buybacks separately. All regressions include firm and SIC-by-fiscal-quarter fixed effects. Standard errors are clustered by firm, and p-values are shown in parentheses, with boldface indicating significance at 10% or better.

Panel A: Issuances Due to BOJ Purchases

Explained variable:	*Any Issuance* (1)	*Equity Issuance* (2)	*SEO* (3)	*Equity Buyback* (4)	*Debt Issuance* (5)
BOJ_{it}	**0.005**	**0.000.009**	**0.015**	**-0.008**	-0.002
	(0.038)	**(0.009)**	**(0.002)**	**(0.030)**	(0.493)
$\Delta M/B_{t-1}$	-0.0004	-0.0003	-0.0004	0.0004	-0.001
	(0.576)	(0.654)	(0.254)	(0.599)	(0.083)
ΔROA_{t-1}	**-0.002**	**-0.002**	0.0003	0.002	**-0.007**
	(0.000)	**(0.003)**	(0.781)	(0.002)	**(0.000)**
Δ*Total Assets*$_{t-1}$	-0.020	0.049	**0.189**	-0.044	-0.032
	(0.446)	(0.143)	**(0.000)**	(0.198)	(0.609)
Δ*Book Leverage*$_{t-1}$	**-0.001**	0.0005	0.0005	-0.0002	**-0.011**
	(0.048)	(0.422)	(0.409)	(0.742)	**(0.000)**
Observations	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 Due to Valuation Ratios

Explained variable	*Valuation Ratio: M/B* (1.1)	*Any Issuance* (1)	*Equity Issuance* (2)	*SEO* (3)	*Equity Buyback* (4)	*Market leverage: D/V* (5.1)	*Debt Issuance* (5)
BOJ_{it}	**4.138**					**-0.032**	
	(0.091)					**(0.002)**	
Valuation Ratio: $\widehat{M/B}$		**0.001**	**0.002**	**0.004**	**-0.002**		0.074
		(0.034)	**(0.029)**	**(0.050)**	**(0.030)**		(0.113)
$\Delta M/B_{t-1}$	**1.094**	-0.002	-0.003	-0.004	0.003	0.005	**-0.001**
	(0.100)	(0.255)	(0.219)	(0.145)	(0.212)	(0.254)	**(0.001)**
ΔROA_{t-1}	-0.348	-0.002	-0.001	0.001	0.002	0.008	**-0.008**
	(0.580)	(0.036)	(0.340)	(0.456)	(0.271)	(0.011)	**(0.002)**
Δ*Total Assets*$_{t-1}$	11.508	-0.033	0.024	0.148	-0.021	**-0.641**	**0.015**
	(0.461)	(0.296)	(0.621)	(0.021)	(0.663)	**(0.000)**	**(0.094)**
Δ*Book Leverage*$_{t-1}$	-0.274	-0.001	0.001	0.001	-0.001	**0.015**	**-0.012**
	(0.446)	(0.274)	(0.314)	(0.330)	(0.460)	**(0.000)**	**(0.002)**
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919
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

Appendix Table A6. Share Issuances with Probit and Logit Model Using Pseudo–Fixed Effects

The table shows the effect of BOJ purchases on share and debt issuances using the data at the quarterly level. Outcome variables are all indicators. Any issuances include both debt and share issuance. Equity increases include both secondary equity offerings (SEO), sale of non-public float shares, and sales of treasury shares. Columns (3) and (4) break secondary equity offerings and stock buybacks separately. We de-mean all explanatory variables within firm and industry-quarter and report p-values in parentheses. P-values are shown in parentheses, with boldface indicating significance at 10% or better.

	Any Issuances	Equity Increase	SEO	Stock Buyback	Debt Issuance	Any Issuances	Equity Increase	SEO	Stock Buyback	Debt Issuance
Model	Probit	Probit	Probit	Probit	Probit	Logit	Logit	Logit	Logit	Logit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
BOJ_{it}	**0.021**	**0.017**	**0.040**	**-0.018**	**0.016**	**0.039**	**0.029**	**0.091**	**-0.031**	**0.026**
	(0.011)	**(0.009)**	**(0.010)**	**(0.009)**	**(0.008)**	**(0.022)**	**(0.017)**	**(0.018)**	**(0.017)**	**(0.013)**
$\Delta M/B_{t-1}$	**-0.002**	**-0.001**	**-0.003**	**0.001**	**-0.005**	**-0.003**	**-0.001**	**-0.007**	**0.002**	**-0.008**
	(0.002)	**(0.002)**	**(0.006)**	**(0.002)**	**(0.004)**	**(0.003)**	**(0.003)**	**(0.013)**	**(0.003)**	**(0.007)**
ΔROA_{t-1}	**-0.005**	**0.0003**	**0.009**	**-0.001**	**-0.023**	**-0.010**	**0.0005**	**0.019**	**-0.001**	**-0.038**
	(0.003)	**(0.003)**	**(0.004)**	**(0.003)**	**(0.003)**	**(0.006)**	**(0.005)**	**(0.007)**	**(0.005)**	**(0.004)**
ΔTotal $Assets_{t-1}$	-0.091	**-0.096**	1.174	0.123	0.084	-0.159	-0.155	2.424	0.200	0.213
	(0.115)	**(0.100)**	(0.123)	(0.099)	(0.092)	(0.219)	(0.173)	(0.233)	(0.170)	(0.149)
ΔBook $Leverage_{t-1}$	**-0.003**	**0.004**	**0.008**	**-0.003**	**-0.027**	**-0.006**	**0.006**	**0.017**	**-0.004**	**-0.047**
	(0.002)	**(0.002)**	**(0.003)**	**(0.002)**	**(0.002)**	**(0.005)**	**(0.004)**	**(0.005)**	**(0.004)**	**(0.003)**
Intercept	**1.212**	**0.833**	**-1.490**	**-0.801**	**-0.194**	**2.063**	**1.371**	**-2.620**	**-1.315**	**-0.311**
	(0.008)	**(0.007)**	**(0.009)**	**(0.007)**	**(0.006)**	**(0.015)**	**(0.012)**	**(0.020)**	**(0.012)**	**(0.010)**
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919	42,919	42,919	42,919

Appendix Table A7. Share Issuances with Probit and Logit Model

The table shows the effect of BOJ purchases on share and debt issuances using the data at the quarterly level. Outcome variables are all indicators. Any issuances include both debt and share issuance. Equity increases include both secondary equity offerings (SEO), sale of non-public float shares, and sales of treasury shares. Columns (3), (4) and (8), (9) break secondary equity offerings and stock buybacks separately. P-values are shown in parentheses, with boldface indicating significance at 10% or better.

	Any Issuances	Equity Increase	SEO	Stock Buyback	Debt Issuance	Any Issuances	Equity Increase	SEO	Stock Buyback	Debt Issuance
Model	Probit	Probit	Probit	Probit	Probit	Logit	Logit	Logit	Logit	Logit
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
BOJ_{it}	**0.031**	**0.047**	**0.104**	**-0.035**	**-0.017**	**0.087**	**0.121**	**0.235**	**-0.088**	**-0.030**
	(0.009)	**(0.009)**	**(0.007)**	**(0.008)**	**(0.005)**	**(0.022)**	**(0.019)**	**(0.013)**	**(0.016)**	**(0.009)**
$\Delta M/B_{t-1}$	**-0.002**	**-0.001**	**-0.005**	**0.001**	**-0.004**	**-0.003**	**-0.002**	**-0.016**	**0.002**	**-0.007**
	(0.002)	**(0.002)**	**(0.007)**	**(0.002)**	**(0.004)**	**(0.003)**	**(0.003)**	**(0.013)**	**(0.003)**	**(0.006)**
ΔROA_{t-1}	**-0.006**	**0.0001**	**0.008**	**-0.001**	**-0.022**	**-0.010**	**0.0003**	**0.014**	**-0.001**	**-0.038**
	(0.003)	**(0.003)**	**(0.004)**	**(0.003)**	**(0.003)**	**(0.006)**	**(0.005)**	**(0.007)**	**(0.005)**	**(0.004)**
ΔTotal $Assets_{t-1}$	-0.106	**-0.116**	1.087	**0.140**	**0.089**	-0.198	-0.202	2.202	0.239	0.223
	(0.116)	**(0.100)**	(0.123)	**(0.099)**	**(0.092)**	(0.220)	(0.175)	(0.233)	(0.172)	(0.150)
ΔBook $Leverage_{t-1}$	**-0.003**	**0.004**	**0.008**	**-0.003**	**-0.027**	**-0.006**	**0.006**	**0.016**	**-0.004**	**-0.047**
	(0.002)	**(0.002)**	**(0.003)**	**(0.002)**	**(0.002)**	**(0.005)**	**(0.004)**	**(0.005)**	**(0.004)**	**(0.003)**
Intercept	**1.204**	**0.820**	**-1.532**	**-0.791**	**-0.189**	**2.040**	**1.339**	**-2.711**	**-1.291**	**-0.302**
	(0.008)	**(0.007)**	**(0.010)**	**(0.007)**	**(0.006)**	**(0.016)**	**(0.013)**	**(0.020)**	**(0.013)**	**(0.010)**
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919	42,919	42,919	42,919

Appendix Table A8. Share Issuances with a Tobit Model

The table below shows Tobit regressions for issuances. Columns (1)– (5) use the raw data, whereas columns (6)–(10) differences all explanatory variables within firm and industry-quarter groups. Outcome variables are all indicators. Any issuances include both debt and share issuance. Equity increases include both secondary equity offerings (SEO), sale of non-public float shares, and increases in treasury shares. Columns (3), (4) and (8), (9) break secondary equity offerings and stock buybacks separately. P-values are shown in parentheses, with boldface indicating significance at 10% or better.

	Any Issuances	Equity Increase	SEO	Stock Buyback	Debt Issuance	Any Issuances	Equity Increase	SEO	Stock Buyback	Debt Issuance
Sample Type:	Raw	Raw	Raw	Raw	Raw	Within-Group	Within-Group	Within-Group	Within-Group	Within-Group
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
BOJ_{it}	**0.005**	**0.011**	**0.138**	**-0.010**	**-0.016**	0.004	0.005	**0.071**	-0.006	**0.015**
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.001)**	(0.081)	(0.093)	**(0.000)**	(0.064)	**(0.032)**
$\Delta M/B_{t-1}$	-0.001	-0.0004	-0.009	0.001	-0.004	-0.0005	-0.0003	-0.005	0.0004	-0.005
	(0.338)	(0.629)	(0.398)	(0.537)	(0.239)	(0.353)	(0.671)	(0.595)	(0.567)	(0.214)
ΔROA_{t-1}	-0.001	0.00004	**0.016**	-0.0002	**-0.021**	-0.001	0.0001	0.017	-0.0003	**-0.022**
	(0.110)	(0.967)	**(0.009)**	(0.843)	**(0.000)**	(0.118)	(0.922)	(0.006)	(0.804)	**(0.000)**
ΔTotal $Assets_{t-1}$	-0.022	-0.038	**1.995**	0.048	0.110	-0.019	-0.032	**2.157**	0.043	0.104
	(0.393)	(0.285)	**(0.000)**	(0.186)	(0.182)	(0.453)	(0.362)	**(0.000)**	(0.237)	(0.206)
ΔBook $Leverage_{t-1}$	-0.001	0.001	**0.014**	-0.001	**-0.025**	-0.001	0.001	**0.014**	-0.001	**-0.025**
	(0.174)	(0.109)	**(0.003)**	(0.216)	**(0.000)**	(0.175)	(0.106)	**(0.003)**	(0.212)	**(0.000)**
Log(Sigma)	**-1.036**	**-0.700**	**0.655**	**0.673**	**0.026**	**-1.036**	**-0.699**	**0.669**	**0.673**	**0.026**
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Intercept	**0.873**	**0.750**	**-2.890**	**-0.737**	**-0.060**	**0.874**	**0.754**	**-2.875**	**-0.740**	**-0.064**
	(0.000)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919	42,919	42,919	42,919

Appendix Table A9. Quarterly Firm Fundamentals – Full Table

This table shows the effect of BOJ purchases on various corporate investment variables at the quarterly level. BOJ demand is defined as total BOJ purchases in the quarter divided by past quarter's total assets. All change variables in columns (3)–(9) are scaled by the past quarter's assets. All regressions include firm and SIC4-by-fiscal-quarter fixed effects. Standard errors are clustered by firm, and p-values are shown in parentheses, with boldface indicating significance at 10% or better. In column (1), standard errors are clustered by firm and fiscal quarter.

	Returns	ΔTotal Assets	ΔTangible Capital	ΔCurrent Assets	ΔCash & Short-Term Investments	ΔSales	ΔInventory	ΔAccounts Receivable	ΔGoodwill
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(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)
$\Delta M/B_{t-1}$	-0.0001	-0.007	**-0.003**	-0.004	-0.001	-0.002	-0.002	-0.002	-0.00003
	(0.997)	(0.333)	**(0.012)**	(0.539)	(0.730)	(0.593)	(0.121)	(0.675)	(0.821)
ΔROA_{t-1}	-0.049	**0.103**	**-0.007**	**0.100**	**0.066**	0.001	**0.013**	**0.017**	0.0003
	(0.684)	**(0.001)**	**(0.077)**	**(0.000)**	**(0.000)**	(0.568)	**(0.024)**	**(0.077)**	(0.683)
ΔTotal $Assets_{t-1}$	1.797	**-5.528**	**1.230**	**-7.204**	**-1.286**	0.005	**-1.178**	**-3.815**	**0.088**
	(0.654)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.039)**	(0.910)	**(0.003)**	**(0.000)**	**(0.002)**
ΔBook $Leverage_{t-1}$	0.051	**0.080**	**0.009**	**0.047**	-0.003	**0.007**	-0.010	**0.036**	**0.001**
	(0.320)	**(0.001)**	**(0.001)**	**(0.038)**	(0.784)	**(0.000)**	(0.102)	**(0.005)**	**(0.057)**
Observations	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

Appendix Table A10. Annual Firm Fundamentals – Full Table

This table shows the effect of BOJ purchases on various corporate investment variables at the annual level. BOJ demand is defined as total BOJ purchases in the year divided by the past year's total assets. All change variables in columns (3)–(9) are scaled by the past quarter's assets except for changes in employees, which is represented as a percentage relative to the previous year's. All regressions include firm and SIC4-by-fiscal-year fixed effects. Standard errors are clustered by firm, and p-values are shown in parentheses, with boldface indicating significance at 10% or better. In column (1), standard errors are clustered by firm and fiscal year.

	Returns	ΔTotal Assets	ΔTangible Capital	ΔCash	ΔShort-Term Investments	ΔSales	ΔEmployee	ΔR&D	ΔAccounts Receivable
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(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)
$\Delta M/B_{t-1}$	-0.027	**-0.019**	**-0.008**	-0.008	0.002	-0.005	**-0.023**	-0.0001	-0.001
	(0.670)	**(0.003)**	**(0.009)**	(0.252)	(0.282)	(0.387)	**(0.000)**	(0.807)	(0.829)
ΔROA_{t-1}	**0.438**	0.057	0.004	-0.046	0.013	-0.033	0.040	0.009	0.001
	(0.093)	(0.561)	(0.806)	(0.451)	(0.548)	(0.498)	(0.606)	(0.227)	(0.989)
ΔTotal $Assets_{t-1}$	9.767	**17.857**	**5.996**	2.335	0.246	2.581	**23.611**	0.397	2.093
	(0.153)	**(0.000)**	**(0.000)**	(0.245)	(0.737)	(0.113)	**(0.000)**	(0.103)	(0.056)
ΔBook $Leverage_{t-1}$	-0.004	0.043	**-0.042**	**0.048**	0.003	**0.052**	-0.032	-0.002	-0.023
	(0.967)	(0.246)	**(0.024)**	**(0.021)**	(0.756)	**(0.001)**	(0.368)	(0.424)	(0.079)
Observations	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

Appendix Table A11. Firm Fundamental Reaction of High Q Firms

This table shows the effect of BOJ purchases on various corporate investment variables. Panel A and Panel B present the OLS regression results using the quarterly and annual data, respectively. The main independent variable, BOJ purchases, is the aggregate amount of the BOJ's purchases from January 2011 until the end of each quarter or year, scaled by total assets of the previous period. $1_{\{Q_{t-1}>1\}}$ is a dummy variable indicating high-growth firms. BOJ demand is defined as total BOJ purchases in the quarter divided by the past quarter's total assets. All change variables in columns (3)–(9) are scaled by the past quarter's assets except for changes in employees, which is represented as a percentage relative to the previous year's. 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. Standard errors are clustered by firm, and p-values are shown in parentheses, with boldface indicating significance at 10% or better. Column (1) in Panels A and B cluster standard errors by both firm and quarter and by firm and year, respectively.

Panel A: Quarterly Responses

	Returns	ΔTotal Assets	ΔTangible Capital	ΔCurrent Assets	ΔCash & Short-Term Investments	ΔSales	ΔInventory	ΔAccounts Receivable	ΔGoodwill
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$1_{\{Q_{t-1}>1\}}$	**-0.912**	**0.750**	**0.126**	**0.553**	**0.211**	**0.006**	**0.094**	**0.225**	0.001
	(0.088)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.000)**	**(0.027)**	**(0.004)**	**(0.000)**	(0.864)
BOJ_{it}	**1.724**	**0.315**	0.019	**0.481**	**0.375**	**0.003**	**0.136**	0.120	-0.005
	(0.008)	**(0.000)**	(0.615)	**(0.000)**	**(0.000)**	**(0.397)**	**(0.053)**	(0.075)	(0.370)
$BOJ_{it} \times 1_{\{Q_{t-1}>1\}}$	**-0.736**	-0.054	0.002	-0.199	-0.249	0.003	-0.093	-0.060	0.004
	(0.056)	(0.606)	(0.948)	(0.197)	(0.004)	(0.539)	(0.186)	(0.408)	(0.509)
Observations	42,993	42,993	42,993	42,993	42,993	42,993	42,993	42,993	42,993
R^2	0.430	0.403	0.340	0.405	0.312	0.505	0.437	0.471	0.258

Panel B: Annual Responses

	Returns	ΔTotal Assets	ΔTangible Capital	ΔCash	ΔShort-Term Investments	ΔSales	ΔEmployee	ΔR&D	ΔAccounts Receivable
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
$1_{\{Q_{t-1}>1\}}$	**6.755**	**3.812**	**0.898**	**1.186**	-0.242	**0.944**	**2.221**	**0.097**	**0.723**
	(0.000)	**(0.000)**	**(0.000)**	**(0.009)**	(0.521)	**(0.000)**	**(0.001)**	**(0.028)**	**(0.000)**
BOJ_{it}	0.534	**0.849**	**0.278**	-0.061	0.030	-0.031	0.377	-0.003	**0.149**
	(0.430)	**(0.001)**	**(0.061)**	(0.664)	(0.760)	(0.776)	(0.300)	(0.886)	**(0.006)**
$BOJ_{it} \times 1_{\{Q_{t-1}>1\}}$	-0.232	**-0.676**	**-0.289**	0.150	-0.037	0.113	-0.069	0.007	**-0.140**
	(0.764)	**(0.016)**	**(0.051)**	(0.316)	(0.717)	(0.308)	(0.849)	(0.743)	**(0.010)**
Observations	6,114	6,114	5,979	6,114	6,114	6,114	5,128	3,543	6,114
R^2	0.390	0.366	0.366	0.324	0.379	0.285	0.407	0.241	0.346

Appendix Table A12. Firm Fundamental Reaction across Industries

Panel A and Panel B present the OLS regression results using the quarterly and annual data, respectively. The main independent variable, BOJ purchases, is the aggregate amount of the BOJ's purchases from January 2011 until the end of each quarter or year, scaled by total assets of the previous period. Manufacturing and Construction & Real Estate are dummies variables, indicating firms operating in the manufacturing and construction & real estate industry based on J-SIC codes. BOJ demand is defined as total BOJ purchases in the quarter divided by the past quarter's total assets. All change variables in columns (3)–(8) are scaled by the past quarter's assets. 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. Standard errors are clustered by firm, and p-values are shown in parentheses, with boldface indicating significance at 10% or better. Column (1) in Panels A and B cluster standard errors by both firm and quarter and by firm and year, respectively.

Panel A: Quarterly Responses

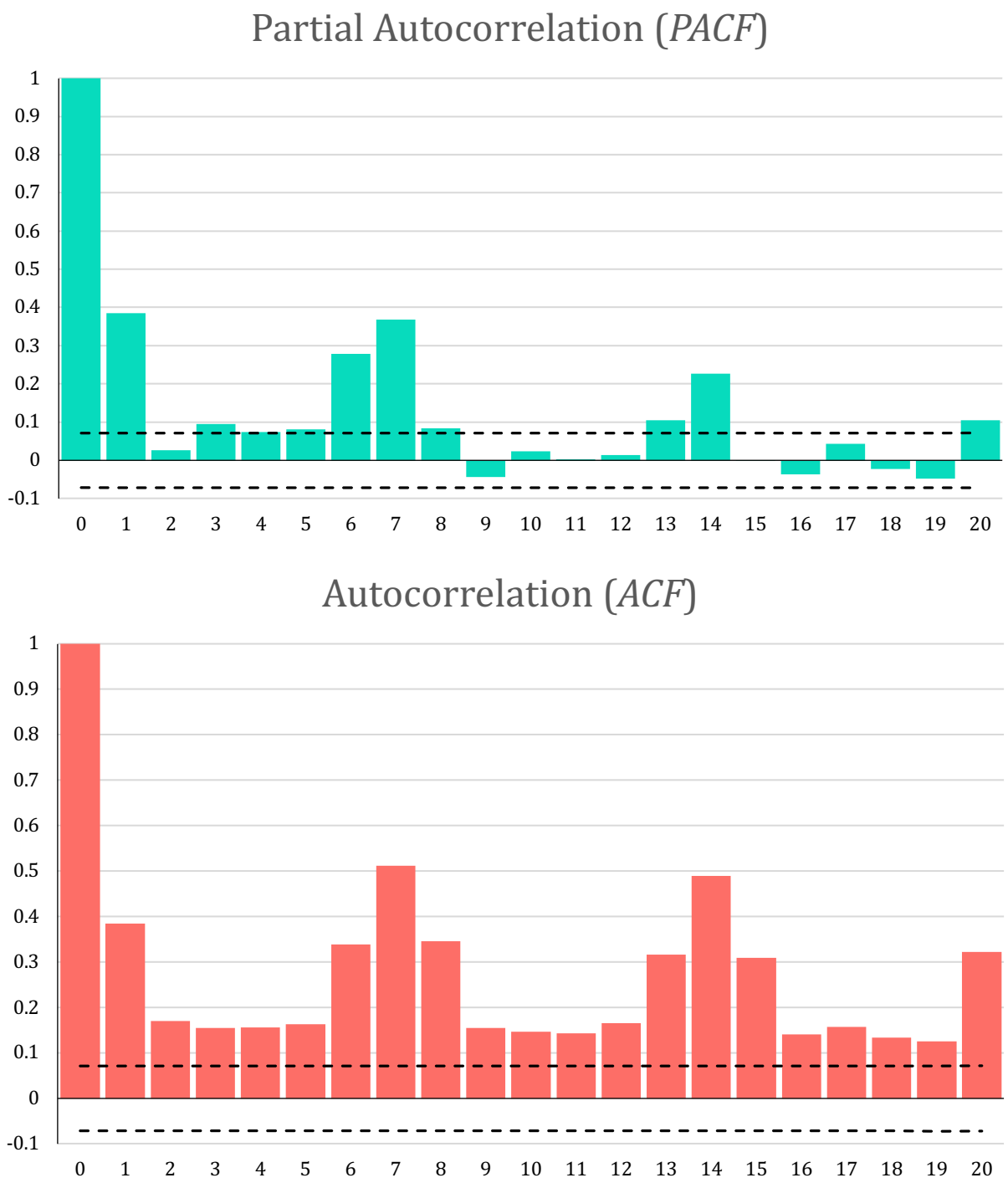
	Returns	ΔTotal Assets	ΔTangible Capital	ΔCurrent Assets	ΔCash & Short-Term Investments	ΔSales	ΔInventory	ΔAccounts Receivable	ΔGoodwill
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
BOJ_{it}	**1.114**	**0.277**	0.006	**0.255**	**0.107**	**0.107**	**0.022**	-0.002	**0.063**
	(0.085)	**(0.006)**	(0.326)	**(0.006)**	**(0.036)**	**(0.036)**	**(0.061)**	(0.319)	**(0.023)**
BOJ_{it} × Construction &	-1.160	-0.063	0.008	-0.456	0.113	-0.013	-0.161	-0.007	0.014
Real Estate	(0.482)	(0.907)	(0.952)	(0.356)	(0.539)	(0.426)	(0.522)	(0.447)	(0.114)
BOJ_{it} ×Manufacturing	-0.523	-0.012	**0.113**	**0.339**	**0.232**	0.002	**0.198**	**0.001**	**0.019**
	(0.546)	(0.936)	**(0.0001)**	**(0.006)**	**(0.004)**	(0.604)	**(0.00001)**	**(0.755)**	**(0.039)**
Observations	42,830	42,830	42,830	42,830	42,830	42,830	42,830	42,830	42,830
R^2	0.429	0.399	0.339	0.403	0.311	0.504	0.438	0.258	0.468

Panel B: Annual Responses

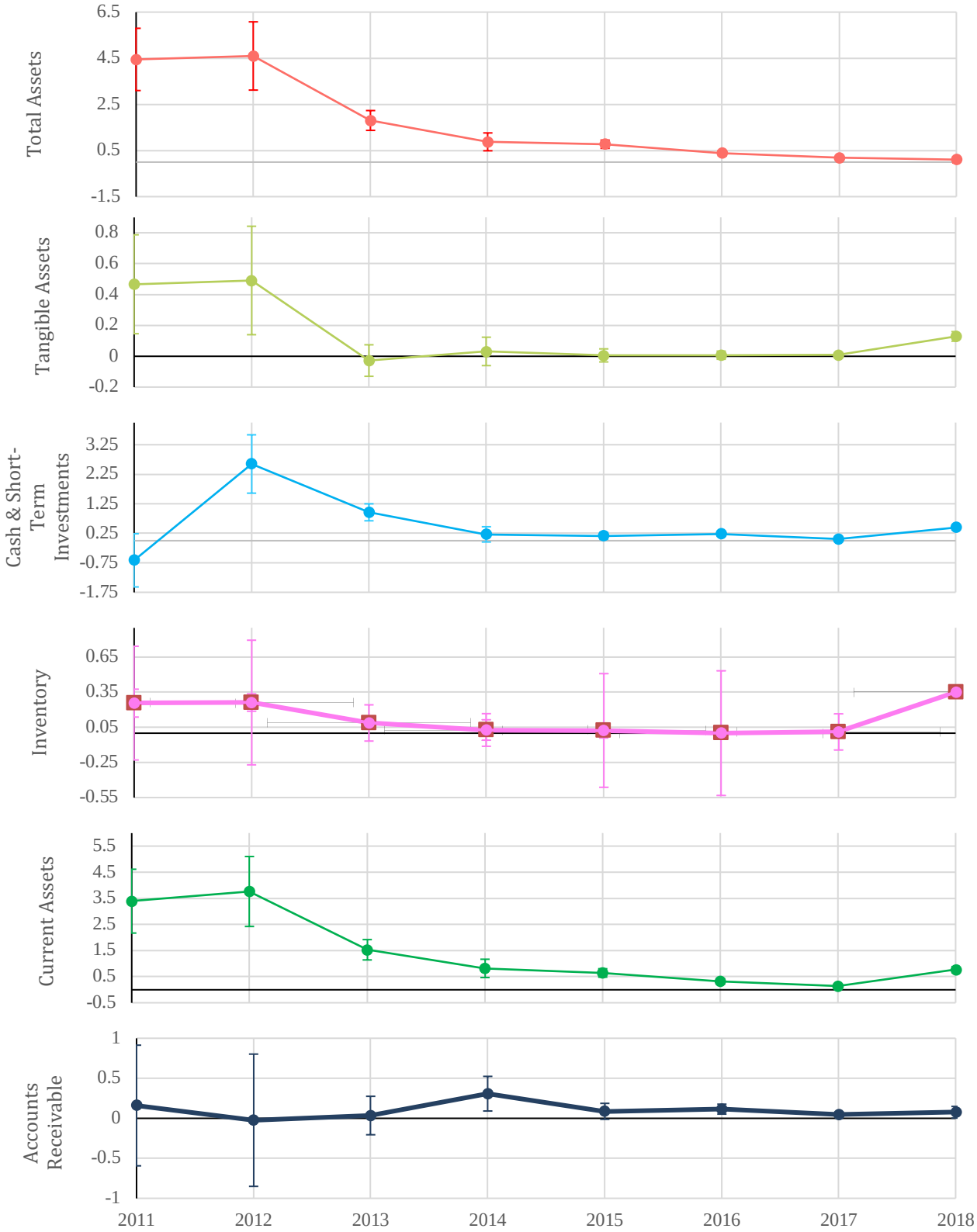
	Returns	ΔTotal Assets	ΔTangible Capital	ΔCash	ΔShort-Term Investments	ΔSales	ΔEmployee	ΔR&D	ΔAccounts Receivable
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
BOJ_{it}	0.172	0.238	-0.001	**0.098**	-0.009	**0.089**	**0.341**	0.004	0.031
	(0.593)	(0.126)	(0.948)	**(0.091)**	(0.536)	**(0.081)**	**(0.020)**	(0.488)	(0.310)
BOJ_{it} × Construction &	1.204	0.544	-0.148	-0.361	0.214	-0.148	**-2.062**	-0.012	0.019
Real Estate	(0.426)	(0.419)	(0.460)	(0.220)	(0.155)	(0.573)	**(0.0004)**	(0.216)	(0.855)
BOJ_{it} ×Manufacturing	**1.281**	-0.127	0.00002	-0.096	0.018	-0.078	0.183	-0.0001	-0.087
	(0.023)	(0.577)	(1.000)	(0.305)	(0.749)	(0.268)	(0.498)	(0.989)	(0.251)
Observations	6,096	6,096	5,961	6,096	6,096	6,096	5,116	3,529	6,096
R^2	0.389	0.357	0.359	0.322	0.379	0.281	0.402	0.238	0.344

Appendix Figure A1. Predictability of BOJ ETF Purchases

The figures show the autocorrelation (ACF) and partial autocorrelation (PACF) functions up to 20-day lags of BOJ purchases along with the 95% confidence intervals based on assumption of a white-noise distribution.



Appendix Figure A2. Impact of Quarterly Firm Responses to BOJ Purchases by Year

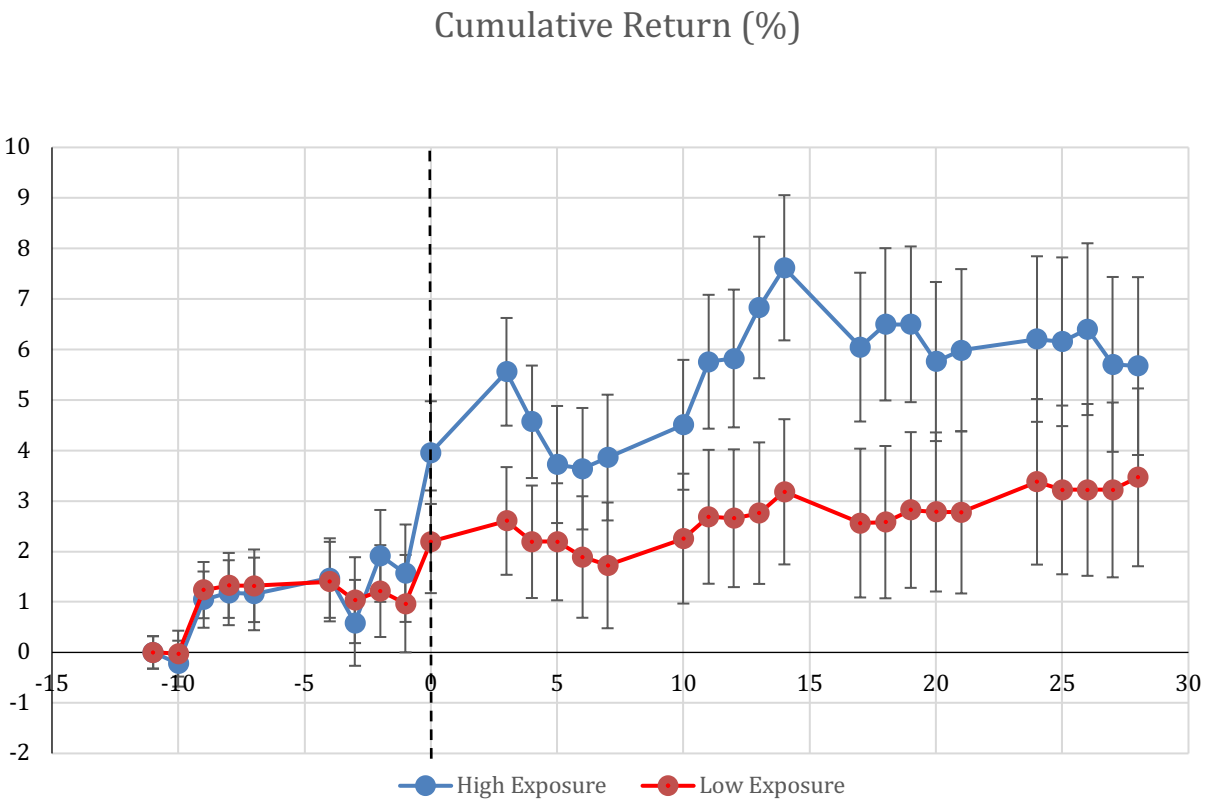


Appendix Figure A3. Firm Responses by Industry

This figure shows the estimated coefficients of quarterly corporate policy in response to the BOJ by industry based on SIC 1-digit classifications. BOJ demand is defined as total BOJ purchases in the quarter divided by the past quarter's total assets. All variables shown are in changes relative to the previous quarter's total assets. Coefficients and standard errors are from regressions of the form similar to the analysis in Table 7. 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-quarter fixed effects. Standard errors clustered by firm and 95% confidence intervals are shown in the figures below. The sample excludes firms in the agriculture, forestry, and fishing, and mining industries, which have only a handful of firms.

Appendix Figure A4. Announcement Effect of BOJ Purchases

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).



Appendix Figure A5. Residualized Scatter Plot of Stock Returns and BOJ Purchases

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.