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ASSET PRICES, CORPORATE ACTIONS, AND BANK OF JAPAN EQUITY PURCHASES

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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 capitalization is around 1.6 on the day of the purchase and decreases across longer horizons. Over a quarter, BOJ share purchases worth 1% of total assets correspond to an increase of 1% in returns and a 0.27% increase in total assets. BOJ share purchases predict equity issuances but not debt issuances. However, this largely reflects increased cash and short-term investments. This unconventional monetary stimulus thus may boost share prices and encourages equity issuances, but is ultimately not well transmitted into real tangible capital investment.

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Asset Prices, Corporate Actions, and Bank of Japan Equity Purchases

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 capitalization is around 1.6 on the day of the purchase and decreases across longer horizons. Over a quarter, BOJ share purchases worth 1% of total assets correspond to an increase of 1% in returns and a 0.27% increase in total assets. BOJ share purchases predict equity issuances but not debt issuances. However, this largely reflects increased cash and short-term investments. This unconventional monetary stimulus thus may boost share prices and encourages equity issuances, but is ultimately not well transmitted into real tangible capital investment.

Keywords: Unconventional Monetary Policy, Quantitative Easing, Corporate Valuations, Corporate Investment, Japan

JEL Classification: G31, G32, E58, E44

1. Introduction

The Bank of Japan (BOJ) is pioneering a unique form of quantitative easing: a 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 equity index-backed 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.

The BOJ's predetermined rule-driven purchases of index ETFs in strict proportion to the market capitalizations of the indexes, each of which is either price or public-float market capitalization weighted, make the weights of its purchases of individual stocks plausibly 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 interventions to boost equity values 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 in the first trading session.

Success in the BOJ's experiment would be evident (1) if its ETF purchases 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-backed ETF share purchases lift stock prices and predict equity issuance. However, the third essential part of the mechanism appears non-functional: Larger BOJ-backed 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-backed ETF demand as a fraction of a firm's market capitalization one month ago of 3.23 basis points, corresponds to a 5.4-basis-point (0.02 standard deviations) higher stock return that day. Although the effect seems to decay over the following week or month, no complete reversal is evident. In an average quarter between January 2011 and March 31, 2018, 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-backed ETF purchases of a firm's equity correspond to statistically and economically significant increases in that firm's seasoned equity issuances. However, despite higher valuations decreasing 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-backed 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 0.27-percentage-point increase in that firm's assets over the same quarter. However, only 8.5% of this increase in total assets is increased capital investment. Instead the increase in assets is overwhelmingly in short term assets, with cash and short-term investments accounting for 53%. 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 actions 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 the most volatile component of GDP, we follow studies of monetary policy effectiveness 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 the 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-Jørgensen (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

[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).

securities' (MBS) quantitative-easing interventions cut mortgage rates by 100–150 basis points.

The effectiveness of central banks' asset purchases in increasing GDP growth is subject to ongoing theoretical dispute.[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 (Lucas 2016; Morck et al. 2019), and only for monetary stimuli that also constitute fiscal stimuli (Lucas 2016). The effectiveness of conventional monetary policy is especially disputed in economies, such as Japan in our sample period, whose nominal interest rates are 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).

Finally, related to our work, Barbon and Gianinazzi (2019) study the announcement effects of the BOJ ETF purchase policy and also use the price-weighted nature of the Nikkei 225 to document a persistent effect of BOJ ETF purchases consistent with an elasticity of 1, similar to the 1.022 that we estimate at the quarterly level. Our paper corroborates their empirical evidence of the pricing effects of BOJ ETF purchases and studies a natural extension of the pricing effect to the entire BOJ ETF basket and relating corporate actions to the pricing effects. We follow Barbon and Gianinazzi (2019) and other work (Shleifer 1986; Greenwood 2005, 2008) in exploiting the price-weighted index as a source of exogenous variation in the cross section of firms. In addition, to expand our scope to include all stocks in the BOJ's purchase basket, we also include two additional public-float adjusted market-capitalization weights and provide several supporting robustness checks that produce similar results.

[2] Recent theory surveys 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. Quantitative 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), 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 to 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 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 were 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 most Japanese ETFs are non-synthetic, that is, they hold actual shares of firms in the indexes they track, rather than index futures or swaps, this policy-induced actual share purchases.[3]

The Japan Exchange Group describes Japanese ETF trading mechanisms in terms of underlying shares only.[4] However, the prospectuses of individual ETFs do not explicitly state they only hold the underlying shares alone. 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 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." To the extent that the ETFs used for BOJ purchases can be backed by derivatives, rather than actual stocks, the impact on our results would depend on the underlying decision to use derivatives. If the index fund manager decides to use derivatives solely due to tax purposes or to manage short-term cash

[3] Among the 20 authorized ETF Management Companies, only one states that they may do synthetic replication in some of their ETF offerings. The use of synthetic ETFs was most prominent in Europe and traditionally used for less liquid and hard-to-access markets. However, in 2011, global organizations like the International Monetary Fund and Bank of International Settlements expressed concerns about potential risks posed by synthetic ETFs due to their exposure to counterparty risk.

[4] https://www.jpx.co.jp/english/equities/products/etfs/etf-outline/02.html. Accessed July 2019.

inflows or outflows, we do not expect any distortions in the impact of ETF purchases. If the index fund manager seeks to minimize trading costs and decides to use derivatives to minimize the price impact of the underlying stocks, then the observed impact of ETF purchases on underlying share prices could be attenuated, and subsequently the expected positive effects on corporate financing and investment could be attenuated. If the index fund manager seeks to maximize fund returns by using the embedded leverage in derivatives to amplify returns, then the notional purchase amount would be larger than the yen-purchase initiated by the BOJ, possibly overestimating the price impact. However, since the mandate of index fund managers is to track the index rather than generate outperformance relative to the index, we believe the trading-cost scenario is most likely.

This section, summarised in Table 1, describes the events in the evolution of BOJ equity-indexed ETF purchases. The October 2010 policy change 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 those 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.

Since the inception of the ETF purchase policy in the CME program, 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) summarises 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.

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 400 stocks picked to include firms with good performance and good corporate governance ratings. The BOJ initially weighted its ETF purchases across indexes by the market capitalizations of each – 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 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.[5]

3. Data and Variable Construction

3.1 Data for Financial and Stock Return Variables

The sample is 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.

Daily stock returns, market capitalizations, public floats, and shares outstanding are from Thomson-Reuters DataStream. Financial data are from Thomson-Reuters WorldScope. BOJ ETF-purchase daily data are from the Bank of Japan's website. ETFs trading on the TSE are from the Japan Exchange Group (JPX) website. 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

[5] 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 SNB's foreign equities serve as a profit center for the central bank and as an additional channel for influencing the exchange rate. As another example, the Hong Kong Monetary Authority adopts a foreign exchange targeting policy and holds up to 20% of its balance sheet in equities. It had used its Exchange Fund Ordinance to purchase US$15 billion worth of stocks during the Asian Finance Crisis, but reduced its portfolio of Hong Kong equities to 5% of its reserves as of 2003. Various governments purchase shares via sovereign wealth funds, public –sector pension plans, or to effect complete or partial nationalizations; however, central banks do not take part in these policies and these purchases are not formally considered monetary policy interventions.

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 allows extensive margin portfolio-level tests, which contrast the returns of two portfolios: a value-weighted portfolio of stocks in the BOJ-targeted ETFs and another of stocks not in the BOJ-targeted ETFs. 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. We drop observations with 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; long-term book leverage ratios outside 0 to 100%; or changes in balance sheet items below -100%.[6] 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. Also, we winsorize changes in balance-sheet variables at the 1% level when using them as outcome variables to study corporate actions. Table 2 lists the variables used and their summary statistics.

As a robustness check for our empirical results and data quality, Appendix Figure A1 corroborates the main results in Barbon and Gianinazzi (2019) which shows the impact of the BOJ

[6] The mapping of these variables to actual WorldScope data codes is described in Appendix Table A1 and the subsequent tables are each explained in their headings.

ETF purchase policy announcements on returns of stocks that have high weights in the BOJ purchase basket relative to those with less exposure.

[Table 2 here]

3.2 Construction of Bank of Japan–backed ETF demand measure

BOJ's purchases of ETF units mechanically cause these ETFs to purchase 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 $w_{i,t}^{N225}$, $w_{i,t}^{Topix}$, and $w_{i,t}^{N400}$, respectively and each index's day *t* weight in the BOJ's purchase menu as $w_{BOJ,t}^{N225}$, $w_{BOJ,t}^{Topix}$ and $w_{i,t}^{N400}$, respectively, all expressed as percentages. The percentage weight of stock *i* in total BOJ purchases on day *t* is then

$$[1] \qquad w_{i,t} \equiv (w_{i,t}^{N225} \times w_{BOJ,t}^{N225}) + (w_{i,t}^{Topix} \times w_{BOJ,t}^{Topix}) + (w_{i,t}^{N400} \times w_{BOJ,t}^{N400}).$$

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

The three indexes' different weight-calculation systems create substantial time-varying cross-sectional heterogeneity in ETFs' increased demand for each individual stock arising from a given amount of BOJ's ETF purchases. 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 price-weighted Nikkei 225 tracks 225 stocks selected to collectively reflect the health of Japan's economy, analogously to the Dow-Jones Industrial Average in the United States. The JPX-Nikkei Index 400 tracks 400 stocks of 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.[8]

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 day t, BOJ_t, times that stock's weight in BOJ purchases, $w_{i,t}$ 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] $$BOJ_{i,t} \equiv w_{i,t} BOJ_t / V_{i,t-22}.$$

For example, a value of 1% for $BOJ_{i,t}$ means BOJ-driven ETF purchases on day *t* of shares in firm i equal 1% of the firm *i*'s market capitalization one month prior.

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

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

[8] The four tailored 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* are excluded because they were designed for the BOJ, so the stocks in them are not exogenously predetermined, and because the firms in these indexes are very small.

[3] $$BOJ_{i,q} \equiv \frac{1}{A_{i,q-1}} \sum_{t \in q} w_{i,t} BOJ_{i,t}.$$

Tests using annual financial data analogously sum BOJ-backed 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 Identifying an Exogenous Component of BOJ-driven ETF Demand

As a preliminary first pass through the data, Panel A of Table 3 contrasts the daily 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. The explanatory variable is the log of one plus the total daily amount of BOJ ETF purchases, denoted BOJ_t, in hundreds of millions of yen. Regressions 3A.1 and 3A.2 explain the return premium of the portfolio of stocks in ETFs the BOJ purchases over that of the portfolio of other stocks, $r_t^{BOJ} - r_t^{non-BOJ}$. All regressions assess significance using Newey-West standard errors with five lags.

[Table 3 Here]

The two regressions associate a small but statistically significant positive return premium with BOJ ETF purchases: a 0.02-basis-point increase in the return of the BOJ purchase-basket portfolio relative to that of the portfolio of other stocks accompanies a 10% increase in BOJ purchases.

Regressions 3A.3 and 3A.4 highlight a timing problem: Both portfolios, stocks in and not in the BOJ's ETF portfolio, drop on days when the BOJ buys more shares. This reflects the BOJ's stated purpose in intervening in the stock market: to exert upward pressure on stock prices (Kuroda 2016). However, it also means our tests must consider both the timing and overall magnitude of the BOJ's interventions must be considered endogenous.

This endogeneity in the timing and aggregate magnitude of BOJ purchase means we must identify a source of exogenous heterogeneity in BOJ-backed ETF purchases to test for effects of BOJ ETF purchases on individual stock returns and, through these, on corporate strategies. We do so by using the exogenous heterogeneity that arises from firms' different weights in the indexes tracked by ETFs the BOJ purchases. Panel B of Table 3 presents the results of daily firm-level panel regressions of the form

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

where r_{it} is the return of firm *i*'s stock on day *t*, $j(i,t)$ is firm i's primary industry at time *t*, and $BOJ_{i,t}$ is demand for shares in i associated with BOJ ETF purchases on day t, 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 $1_{j(i,t)}$, which subsume time-varying sector-specific risk loadings and time-varying macroeconomic risk loadings. Standard errors cluster bidirectionally, by both stock and day, adjusting significance levels for persistence in BOJ-backed share purchases by ETFs through time and for common shocks to all firms on given days.[9]

Panel B of Table 3 shows the impact of successively finer fixed-effects on the relation between individual daily stock returns and BOJ-driven ETF demand for each stock. Day fixed-effects control for the BOJ timing purchases to counter market dips and reveal a positive cross-sectional coefficient that captures differences in stocks' returns associated with their different weights in the combination of indexes the ETFs track (Regression 3B.3). The regression fit improves significantly as day fixed effects are included, and again as industry-day fixed effects

[9] The partial autocorrelation peaks at a lag of 5 trading days and insignificant at longer lags.

are included, so we adopt industry-day fixed effects as our baseline specification (3B.4). Our specification compares daily stock returns with their peers in the same industry on the same day.[10]

We take the coefficient on BOJ-driven ETF demand in regressions of the form of 3B.4 as capturing the effects on individual stock returns of a defensibly exogenous source of heterogeneity in BOJ non-standard monetary policy interventions in the stock market. This regressions shows stocks with greater weights in the BOJ's purchase menu gaining significantly more on days when the BOJ buys more ETFs.

4.2 Windows and Weights in Daily Returns Panel Regressions

Table 4 explores further the baseline specification in regression (3B.4). Panel A begins with the sample in Panel B of Table 3, all stocks in the indexes the BOJ ETFs track, and thus investigates an intensive margin. Panel B includes all stocks, and so investigates an extensive margin. The first columns in both panels show stocks with greater weights in the BOJ's purchase menu gaining significantly more on the days when the BOJ buys more ETFs.

[Table 4 about here]

Jain (1987) argues that studies measuring price gains on a stock's inclusion in an index should consider temporary price pressure. Temporary gains due to market makers' tardiness meeting index funds' abruptly increased demand are soon reversed.[11] The remaining columns in Panels A and B examine cumulative log returns over longer windows from the day the BOJ buys

[10] Stock fixed effects account for firm-specific average returns, including static loadings to stock return factors, but do not significantly improve the fit. Our results are quantitatively and qualitatively similar including stock fixed effects.

[11] Price pressure that raises share prices on abrupt spikes in demand by index ETFs could affect our results in two ways. First, the immediate positive abnormal return might be overstated and followed by reversal, a negative abnormal return. Second, if index ETF managers act to mitigate immediate price pressure by delaying buying the underlying shares, the immediate reaction is muted and the abnormal return is spread across a longer time window. In either case, cumulative abnormal returns over longer time windows measure the overall price impact.

ETFs, t, to the next trading day $[t, t+1]$, the trading day a day after $[t, t+2]$, 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 suggests a complete reversal. Rather, both show slightly decreasing but persistent gains as the length of the window increases. The persistence 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, the price increase remains evident. Although the approach in Panel C is free from the impact of future purchases, the persistence of the accelerating returns may be due to the BOJ's ETF purchases initiating positive feedback loops, with higher prices boosting market sentiment or the expectation of more future purchases, which further boosts prices. 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 stock-level 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 monthly stock return volatility, $\sigma_{i,m}(r_{i,t})$,

calculated from daily returns in a month. We focus on the intensive margin by only including stocks in the BOJ ETF basket and the sample accounts for stocks that enter the BOJ basket partway through the month due to revisions in index-component lists. Aggregating to the monthly level yields a sample with 173,404 stock-month observations. All measures of volatility are annualized and defined based on daily returns within a month, with returns in percentages.

[Table 5 Here]

Regression 5.1 in Table 5 associates higher BOJ ETF purchases during a month with higher stock return volatilities. Regressions 5.2 and 5.3, decomposing volatility into upside and downside volatilities, associate BOJ ETF purchases with more upside volatility and less downside volatility. Stock i's upside volatility in month m, $\sigma_{i,m}(r_{i,t}|r_{i,t} > 0)$, is the volatility using all days t in month m on which the return $r_{i,t}$ is positive and its downside volatility, $\sigma_{i,m}(r_{i,t}|r_{i,t} < 0)$, 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.

Overall, the table is consistent with the BOJ's state policy of putting upward pressure on stocks, in that more BOJ-driven ETF purchases are associated with a more positive skewness in 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 justifies our primary tests in Table 4 using returns, rather than volatilities.[12]

[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'

4.4 Policy Transmission Tests

Traditional monetary policy expansion is thought to function by reducing costs of debt, thereby inducing firms to borrow more to undertake expansions. This section explores whether firms whose share prices are affected by BOJ ETF purchases raise new financing.

Attributing firm actions to BOJ-driven ETF purchases requires variation in their intensity that is not only defensibly exogenous but also separable from other developments. For example, the BOJ's interest rate policies, open-market operations, and quantitative easing via T-bill and JGB purchases all unfold as the BOJ accumulates ETFs. These interventions aim to change economy-wide interest rates and term structures. Controlling for economy-wide latent factors requires time fixed effects. The effectiveness of these interventions may differ across industries, so industry-quarter fixed effects are used.[13] We posit that, to a first approximation, firms' weights in the basket of index-ETFs the BOJ purchases constitute exogenous variation in the intensity of BOJ share purchases across firms within a given time period and that industry-fiscal period (quarter or annual) fixed effects subsume differences in the impact of other developments.

Each firm's decision to raise external financing is assessed by two indicator variables: $1_{i,q}^{SOE}$ is set to one if firm i issued equity or debt in quarter q and to zero otherwise and $1_{i,q}^{DI}$ is set to one if the firm increased its long-term debt during the quarter. Because the explained variables are binary, we supplement OLS linear probability estimation with logit and probit estimation.

All of these regressions take the form

costs of capital, increasing share valuations and reducing firms' costs of financing corporate investment. We leave these issues to future research.

[13] The BOJ's quantitative easing has included purchases of commercial paper and investment grade corporate bonds, but it does not disclose which firms' debt securities it buys.

[5] $$I^{\bullet}_{i,q} = 1_{j(i,q),q} + \xi BOJ_{i,q} + \mathbf{\Gamma}'\Delta\mathbf{X}_{i,q-1} + \varepsilon_{i,q},$$

where $I^{\bullet}_{i,q}$ is either $1^{SOE}_{i,q}$ or $1^{DI}_{i,q}$. The explanatory variable of primary interest, $BOJ_{i,q}$ is BOJ-driven ETF purchases of the firm's stock each quarter scaled by the firm's prior-quarter total assets, from [3]. The coefficient of interest, ξ, gauges the association of a firm's financing decisions with increased demand for its shares that quarter attributable to BOJ ETF purchases. The vector $\Delta\mathbf{X}_{i,q-1}$ contains control variables, which are represented as flow variables, including: one-quarter lagged changes in each of market-to-book ratios, return-on-assets, book leverage, and log total assets. Industry-quarter fixed effects, denoted $1_{j(i,q),q}$ with i indexing firms, q indexing quarters, and $j(i,q)$ denoting firm i's primary industry in quarter q, are included in OLS estimations. Since all variables are represented as flows and not levels, we do not include firm fixed effects. First-differencing removes any firm-specific fixed heterogeneities in the levels specification.[14] The limited dependent variable specification employ corresponding pseudo-fixed-effects; that is, demeaning all explanatory variables by industry-quarter instead. All regressions cluster by firm.

[Table 6 Here]

Panel A of Table 6 summarizes these regressions.[15] All three estimation techniques link BOJ ETF purchases of a firm's stock to that firm issuing seasoned equity. Regression 6A.1 associates a one percentage point increase in BOJ-driven ETF purchases of the firm's stock with a 1.5-percentage-point increase in the probability of the firm issuing seasoned equity, relative to an unconditional probability in the sample of around 7 percentage points. The probit and logit estimations associate a 0.7% increase in the marginal probability of a seasoned equity issue with

[14] A similar specification is to use variables in levels and include firm fixed effects. Our results are quantitatively and qualitatively similar when using a levels specification.

[15] Appendix Tables A2 and A3 present complete summaries of the regressions in both panels of Table 6, including control variable coefficients.

the same BOJ interventions. This suggests that the first link in the transmission channel is operational: BOJ-driven ETF purchases may indeed stimulate firms to increase their outstanding shares. Panel A shows no analogous increases in long-term debt issues.

Panel B supplements these tests with an instrumental-variables approach to isolate the transmission channel in question: differences across firms in corporate financing actions associated with BOJ index ETF purchases boosting different firms' valuations by different amounts. The first stage associates a change in each firm's market valuation, scaled by its lagged book value, $\Delta M_{i,q}/B_{i,q-1}$, with BOJ-driven ETF purchases of its shares by estimating

$$[6] \qquad \Delta M_{i,q}/B_{i,q-1} = 1_{j(i,q),q} + \beta\, BOJ_{i,q} + \mathbf{\Gamma'X}_{i,q-1} + \eta_{i,q}$$

with all explanatory variables as in [5]. The second stage repeats the exercises in Panel A, but using the predicted changes in firms' market valuation [6] associates with BOJ-driven ETF purchases of their shares, denoted $\Delta M_{i,q}/B_{i,q-1}\big|BOJ_{i,q}$. The second stage estimation is thus

$$[7] \qquad I^{\bullet}_{i,q} = 1_{j(i,q),q} + \xi\,(\Delta M_{i,q}/B_{i,q-1}\big|BOJ_{i,q}) + \mathbf{\Gamma'}\Delta\mathbf{X}_{i,q-1} + \varepsilon_{i,q}$$

Again, with all else as in [5].

Panel B of Table 6 summarizes these regressions. The first stage regression 6B.1.1 links a one-percentage-point increase – approximately 0.7 of a standard deviation – in BOJ ETF-induced purchasing of a firm's shares during a given quarter to a 0.38 increase in a firm's market-to-book – approximately one third of a standard deviation. The first-stage clustered F-statistic is 7.028, slightly below the rule of thumb of 10, meaning that the bias in our second-stage estimates may be up to 14.3%. However, since our focus is not in using the BOJ ETF purchase as an instrument but merely to study the BOJ impact occurring through changes in valuation ratios, we proceed with the standard two-stage set up rather than a weak instrument approach. The instrumental variables

estimates in Panel B affirm that the BOJ's ETF purchases of a firm's shares indeed increased its odds of issuing seasoned equity by increasing its market valuation.

4.5 Policy Effectiveness Tests

The BOJ undertook large-scale ETF purchases as a new form of unconventional monetary policy aiming to stimulate corporate investment. The policy can be deemed effective if it can be tied to such actions. We test for these using firm-quarter regressions explaining various measures of changes in corporate assets, generically denoted $\Delta Y_{i,q}$, of the form

$$[8] \qquad \Delta Y_{i,q} = 1_{j(i,q),q} + \xi BOJ_{i,q} + \mathbf{\Gamma}'\Delta\mathbf{X}_{i,q-1} + \varepsilon_{i,q},$$

with i indexing firms, q indexing quarters. The coefficient of interest, ξ, gauges the relationship between the corporate-action variable and $BOJ_{i,q}$, increased demand for the firm's shares that quarter attributable to BOJ ETF purchases, from [3]. As in [5], $\Delta\mathbf{X}_{i,q-1}$ contains control variables: one-quarter lagged changes in each of market-to-book ratios, return-on-assets, book leverage, and log total assets. All regressions cluster by firm and include industry-quarter, denoted, $1_{j(i,q),q}$, with $j(i,q)$ as i's primary industry as of quarter q.

The $\Delta Y_{i,q}$ are quarterly changes in total assets, tangible capital assets, current assets, cash and short-term securities, inventories, and accounts receivable, each as a fraction of prior quarter total assets. Some variables capturing important corporate investment decisions are disclosed only annually, so we also consider annual regressions analogous to [8], but including industry-year fixed effects. The additional annual $\Delta Y_{i,\mathrm{y}}$ are changes in cash holdings, short-term investments, and research and development (R&D), each scaled by prior year total assets. We also run regressions explaining changes in market value, expressed as a quarterly or annual return.

[Table 7 Here]

Panels A and B of Table 7 summarise the quarterly and annual regressions, respectively.[16] Panel A associates higher BOJ ETF purchases of a firm's shares with higher quarterly returns and increased assets. The increases are spread across all the components of total assets, except goodwill (not shown), though the largest increases are to current assets, especially cash and short-term securities. Panel B, using annual data, which provide cash and short-term investments as separate items, shows that firms accumulate more cash as the BOJ buys more of their shares and no change in tangible assets.

The quarterly increase in tangible assets in Panel A is statistically significant, but economically insignificant. The 0.023-percentage-point increase in tangible assets associated with the BOJ purchases worth 1% of a firm's lagged assets is only 8.5% of the corresponding increase in total assets and only 1.8% of the 1.30%-standard-deviation of tangible asset growth relative to total assets in Table 2. BOJ share purchases are associated with large increases in current assets, with cash and short-term investments accounting for almost half of this.

To focus more narrowly on the transmission channel from BOJ-driven ETF purchases of a firm's shares to increases in firm valuations to corporate investment decisions, Table 8 adopts an instrumental-variables approach as in Panel B of Table 7. The first stage is [6] and the second stage

$$[9] \qquad \Delta Y_{i,q} = 1_{j(i,q),q} + \xi(\Delta M_{i,q}/B_{i,q-1}\big|BOJ_{i,q}) + \mathbf{\Gamma}'\Delta\mathbf{X}_{i,q-1} + \varepsilon_{i,q},$$

[16] Appendix Tables A4 and A5 present complete summaries of these regressions for quarterly and annual analyses respectively, including control variable coefficients.

relates changes in the components of a firm's assets to changes in its market-to-book ratio attributable to prior quarter BOJ-backed ETF purchases of its shares, $\Delta M_{i,q}/B_{i,q-1}\big|BOJ_{i,q}$ from [6]. Annual tests do likewise with annual data.

[Table 8 Here]

Panel A of Table 8 summarizes these regressions. Regressions 8A.1.1 shows the first-stage relation from the quarterly panel, where an increase in BOJ demand of 1% relative to assets corresponds to an increased in the market-to-book ratio of 0.384, or around one-third of a standard deviation. Regressions 8A.1 through 8A.6 associate BOJ ETF purchases-driven increases firms' market-to-book ratio with expansions in their balance sheets, but again mostly through current assets. Here too, the increase in tangible assets associated with the BOJ buying shares worth one percent of lagged assets is only 8.5% of the increase in total assets and less than 5% of the standard deviation of tangible assets growth relative to total assets. The annual results in Panel B continue to depict net increases in total assets, with almost 40% of the increase coming from cash and no change in tangible assets.

We explore further which types of firms might drive the results. Figure A4 associates increased BOJ equity purchases with asset expansions in all major sectors except real estate. BOJ-driven expansions in tangible assets appear confined to firms in the manufacturing and construction sectors. Table 9 therefore presents regressions allowing BOJ-driven share purchase to have different coefficients for firms in those two sectors. Panel A, using quarterly data, links greater BOJ purchases of manufacturing firms shares with expansions in tangible assets, current assets, cash holding, inventory, and good will. However, the results all disappear in the annual data regression analysis in Panel B.

If higher market-to-book firms were more financially constrained, the BOJ purchasing their

shares might have an especially strong effect. Table 10 therefore allows BOJ equity purchases to have a different coefficient for high growth firms, indicated by a dummy set to one for firms with prior fiscal quarter or year-end market-to-book ratio above one. More BOJ purchases of a high growth firm's shares are associated with no higher increase in tangible assets in the quarterly data and are actually associated with lower investment in tangible assets in the annual data.

Repeating the Table 8 Panel A tests-by-year shows declining effectiveness across the board. Figure 3 shows diminished impacts of BOJ purchases on all corporate action variables after the initial rollout of the policy. This decreased impact occurs despite the escalating scale of BOJ equity ownership in Figure 2 and increased share price impact of those purchases in the first three months 2018 in Figure 1.

5. Additional Robustness Checks

A standard battery of robustness tests generate qualitatively similar results to those in the tables. By this, we mean they produce the same pattern of signs and statistical and economic significance. The Appendix tables summarize robustness checks the most important of these.

Winsorization. In unreported results, we run various regressions and apply various winsorization methods namely winsorizing the BOJ ETF purchases and corporate policy variables at 1% as well as winsorizing stock returns at 1%, 2% and 5%. All these tests generate qualitatively and quantitatively similar results.

Issuance amounts. If BOJ ETF purchases increase firms share prices, share buybacks should not be attractive corporate decision to disbursing cash to shareholders. Indeed, regressions 4, 5, and 6 in Appendix Table A6 summarizes regressions analogous to those in Table 6 show that firms are less prone to repurchases shares as the BOJ's ETF purchases of their shares rise.

Regression 6A.1 in Table A6 also shows that BOJ ETF purchases, despite being related to more secondary equity offerings, are unrelated to net equity issuance amount scaled by total lagged assets. This is because, although firms increase SEOs along the extensive margin, conditional on raising more equity, firms may issue more or less. If firms were financially constrained prior to the BOJ ETF purchase policy, then they should increase SEOs and issuance amounts. However, if they were not financially constrained but seek to raise additional equity as a means to "cash out" from the program rather than investing, they may not issue as much.

Sales and employment growth. Tables 7 through 10 associate BOJ-driven ETF purchases of a firm's shares with increases in firms' cash and short-term securities, rather than increases in its capital investment. However, the BOJ's equity purchases might be deemed effective if they were associated with increases in firm sales or employment, despite their having no association with capital investment. We therefore revisit the regressions in Tables 7 through 10, but use them to explain either firm sales growth, defined as change in net sales or revenues over lagged assets, or firm employment growth, defined as change in employees over lagged employees. Sales growth is available quarterly and annually; employee growth is only available annually.

Regressions (not shown) explaining both variables assign BOJ-driven ETF purchases positive and statistically significant coefficients. In regressions analogous to those in Table 7, but explaining quarterly and annual sales growth, these coefficients are 0.005 ($p = 0.01$) and 0.078 ($p = 0.07$), respectively, and that in a regressions explaining annual employment growth is 0.329 ($p=0.01$). In regressions of the form of Table 8, explaining quarterly and annual sales growth, the coefficients are 0.014 ($p = 0.03$) and 0.462 ($p = 0.05$), respectively, and in annual employment growth regressions, the coefficient is 1.30 ($p=0.04$).

These results suggest that the BOJ's equity purchases might indeed have traction in

outcomes other than corporate investment. However, we are reluctant to emphasize these results for two reasons. First, the coefficients are economically insignificant. The estimated increases in sales from the reduced-form linear specification are less than 0.02 and 0.01 standard deviations in the quarterly and annual regression, respectively. Similarly, the employment increase is about 0.02 standard deviations. Second, these results are not robust in tests of the form of those in Tables 9 and 10. The Table 9 regressions also include interactions of BOJ-driven ETF demand with construction and manufacturing sector dummies. In these, BOJ purchases of a construction firms shares are actually associated with statistically significant decreases in its employment. A BOJ purchases relative to last fiscal year's total assets of one-percentage-point decreases employment in construction firms by 16% of a standard deviation compared to companies in other industries. The regressions in Table 10 also include a dummy for high market-to-book ratio firms and its interaction with BOJ-driven ETF purchases of a firm's shares. Analogues to these regressions explaining sales growth and employment growth assign BOJ-driven ETF purchases and its interaction with the high market-to-book dummy uniformly statistically insignificant coefficients.

The policy date effects. We find that corporate policy changes associated with BOJ ETF purchases are larger prior to July 29, 2016, when the BOJ doubled its purchasing target to 6 trillion yen. In untabulated results, using the full BOJ purchase basket sample, we find a larger price impact as well as a larger positive impact on up-side volatility and a larger negative impact on down-side volatility. We also find a larger changes in the firm's total assets upon BOJ purchases. However, the composition of the balance sheet expansion is similar to our main results: 81% of the increase comes from current assets and about 40% of the increase in current assets come from cash and short-term investments. These results are consistent with the time series effects of the BOJ purchases shown in Figure A2.

Nikkei 225 firms. Our index weights, though determined mechanically, depend on firm characteristics. TOPIX weights depend on public float market capitalization, and thus firm size. The JPX-Nikkei 400 also uses market capitalizations, but caps firm's weights at 1.5% and thus value-weights small firms and equal-weights large firms; and also uses performance and corporate governance selection criteria. Meanwhile, the Nikkei 225 uses price weights, rather than market value weights, and so the cross sectional weights across stocks in a given point in time may be more plausibly exogenous to firm fundamentals that may affect stock returns or corporate policy. However, Nikkei 225 firms are large and in the other indexes, and price weights may change with market-to-book ratios through time. Also, using only Nikkei 225 firms reduces the sample by almost 90%. However, for completeness we repeat our tests using only stocks in the Nikkei 225 index.

Appendix Tables A7 associates positive one-day price impact point estimates with BOJ purchases, however these are statistically insignificant, perhaps because of the smaller sample size. In longer windows, the price impact is positive and significant, and exhibits a monotonic decreasing effect after the first day of returns as in the full sample. Regression A8.1.1 in Table A8 associates BOJ-driven ETF purchases of a firm's shares over a quarter with around a one and a half percent higher quarterly stock return, roughly the same point estimate as in the full sample, but statistically insignificant in this smaller sample. Regressions A8.1 through A8.3 associate BOJ purchases of Nikkei 225 stocks with secondary equity issuances, though only the linear probability model does so significantly. As in the main results, debt issues appear unaffected in regressions A8.4 through A8.6.

As with the return effects, the corporate policy changes are larger than in the full sample: a 1% BOJ purchase relative to total assets increases total assets by 1.8 percentage points, of which

over 60% is increased current assets, and over 55% of the increase in current assets comes from cash and short-term investments. Less than 18% of the increase in total assets is increased tangible capital. The point estimate on increase in tangible assets in A8.8 is 0.32, which – though higher than the full sample 0.023 point estimate in regression 7A.2 – remains an economically insignificant 5% of its standard deviation in the Nikkei 225 subsample. Overall, the Nikkei 225 results affirm the full sample results, though with reduced statistical significance in some cases. Consistent with the main results, the majority of the balance sheet expansion among Nikkei 225 is coming from an increase in current assets like cash and short-term investments.

6. 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. However, those voting rights effectively constitute large government block holdings in private-sector businesses. Were the BOJ's example followed in other countries with less 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.

Bibliography

Baba, Naohiko, Frank Packer, and Teppei Nagano. 2008. “The Spillover of Money Market Turbulence to FX Swap and Cross-Currency Swap Markets - BIS Quarterly Review, March 2008.” *BIS Quarterly Review*, no. March: 1–14.

Bakshi, Gurdip S., Nikunj Kapadia, and Dilip Madan. 2003. “Stock Return Characteristics, Skew Laws, and the Differential Pricing of Individual Equity Options.” *Review of Financial Studies* 16 (1): 101–43. doi:10.1093/rfs/16.1.101.

Barbon, Andrea, and Virginia Gianinazzi. 2019. “Quantitative Easing and Equity Prices : Evidence from the ETF Program of the Bank of Japan.” *Review of Asset Pricing Studies* Forthcomin (May).

Bernanke, Ben S. 2015. *The Courage to Act: A Memoir of a Crisis and Its Aftermath.*

Bernanke, Ben S, and Vincent R Reinhart. 2004. “Conducting Monetary Policy at Very Low Short-Term Interest Rates.” *American Economic Review* 94 (2): 85–90.

Bouis, Romain, Lukasz Rawdanowicz, Jean-Paul Renne, Shingo Watanabe, and Ane Kathrine Christensen. 2013. “The Effectiveness of Monetary Policy since the Onset of the Financial Crisis.” *OECD Economics Department Working Papers*, no. 1081: 1–83. doi:10.1787/5k41zq9brrbr-en.

Brunnermeier, Markus K, Christian Gollier, and Jonathan A Parker. 2007. “Asset Prices , and the Preference Beliefs , Optimal for Skewed Returns.” *American Economic Review* 97 (2): 159–65. doi:10.1257/aer.97.2.159.

Cecioni, Martina, Giuseppe Ferrero, and Alessandro Secchi. 2011. “Unconventional Monetary Policy in Theory and in Practice.” *Banca D’Italia: QUestioni Di Economia e Finanza*, no. 102. doi:10.2139/ssrn.1998755.

Christensen, Jens H E, Glenn D Rudebusch, and U K Quantitative Easing. 2012. “The Response of Interest Rates to US and UK.” *The Economic Journal* 122 (May): 385–415. doi:10.1111/j.1468-0297.2012.02554.x.

D’Amico, Stefania, and Thomas B. King. 2013. “Flow and Stock Effects of Large-Scale Treasury Purchases: Evidence on the Importance of Local Supply.” *Journal of Financial Economics* 108 (2): 425–48. doi:10.1016/j.jfineco.2012.11.007.

Eusepi, Stefano, and Bruce Preston. 2018. “The Science of Monetary Policy: An Imperfect Knowledge Perspective.” *Journal of Economic Literature* 56 (1): 3–59.

Gagnon, Joseph, Matthew Raskin, Julie Remache, and Brian P. Sack. 2011. “Large-Scale Asset Purchases by the Federal Reserve: Did They Work?” *Economic Policy Review - Federal Reserve Bank of New York*, no. May: 41–60. doi:10.2139/ssrn.1952095.

Gambacorta, Leonardo, Jin Yang, and Kostas Tsatsaronis. 2014. “Financial Structure and Growth.” *BIS Quarterly Review* 17 (4): 1–37. doi:10.1093/oxrep/17.4.467.

Greenwood, Robin. 2005. “Short- and Long-Term Demand Curves for Stocks: Theory and Evidence on the Dynamics of Arbitrage.” *Journal of Financial Economics* 75 (3): 607–49. doi:10.1016/j.jfineco.2004.03.007.

———. 2008. “Excess Comovement of Stock Returns: Evidence from Cross-Sectional Variation in Nikkei 225 Weights.” *Review of Financial Studies* 21 (3): 1153–86.

Hamilton, James D., and Jing Cynthia Wu. 2012. “The Effectiveness of Alternative Monetary Policy Tools in a Zero Lower Bound Environment.” *Journal of Money, Credit and Banking* 44 (SUPPL. 1): 3–46. doi:10.1111/j.1538-4616.2011.00477.x.

Hancock, Diana, and Wayne Passmore. 2015. “How Does the Federal Reserve’s Large-Scale Asset Purchases (LSAPs) Influence Mortgage-Backed Securities (MBS) Yields and U.S. Mortgage Rates?” *Real Estate Economics* 43 (4): 855–90. doi:10.1111/1540-6229.12109.

Hayashi, Fumio, and Junko Koeda. 2014. “Exiting From QE.” *NBER Working Paper*.

Honda, Yuzo, Yoshihiro Kuroki, and Minoru Tachibana. 2013. “An Injection of Base Money At Zero Interest Rates: Empirical Evidence From the Japanese Experience 2001 - 2006.” *Graduate School of Economics and Osaka School of International Public Policy* 1 (Discussion Paper 07-08): 1–24.

Hördahl, Peter, and Michael R. King. 2008. “Developments in Repo Markets during the Financial Turmoil.” *BIS Quarterly Review*, no. December: 37–53.

Inoue, Tomoo, and Tatsuyoshi Okimoto. 2008. “Were There Structural Breaks in the Effects of Japanese Monetary Policy? Re-Evaluating Policy Effects of the Lost Decade.” *Journal of the Japanese and International Economies* 22 (3): 320–42. doi:10.1016/j.jjie.2007.11.002.

Iwata, Kazumasa, and Shinji Takenaka. 2012. “Central Bank Balance Sheet Expansion: Japan’s Experience.” *BIS Working Papers* No. 66: 1–28.

Joyce, Michael A.S., and Matthew Tong. 2012. “Qe and the Gilt Market: A Disaggregated Analysis.” *Economic Journal* 122 (564): 348–84. doi:10.1111/j.1468-0297.2012.02552.x.

Kashyap, Anil, and Jeremy C Stein. 2000. “What Do a Million Banks Have to Say About the Transmission of Monetary Policy?” *American Economic Review* 90 (3): 407–28. doi:10.3386/w6056.

Krishnamurthy, Arvind, and Annette Vissing-Jørgensen. 2011. “The Effects of Quantitative Easing on Interest Rates: Channels and Implications for Policy.” *Brookings Papers on Economic Activity* 2011 (2): 215–87. doi:10.1353/eca.2011.0019.

Kuroda, Haruhiko. 2013. “Quantitative and Qualitative Monetary Easing.” *Speech at a Meeting Held by the Yomiuri International Economic Society in Tokyo Haruhiko Kuroda Governor of the Bank of Japan*.

———. 2016. “Answers to Frequently Asked Questions on ‘ Quantitative and Qualitative Monetary Easing (QQE) with a Negative Interest Rate.’” *Speech at a Meeting Held by Haruhiko Kuroda Governor of the Bank of Japan*.

Lagos, Ricardo, Guillaeme Rocheteau, and Randall Wright. 2017. “Liquidity: A New Monetarist Perspective.” *Journal of Economic Literature* 55 (2): 371–440.

Leland, Hayne E. 1999. “Beyond Mean-Variance: Risk and Performance Measurement in A Nonsymmetrical World.” *Financial Analysts Journal* 55 (1): 27–36.

Lucas, Deborah. 2016. “Credit Policy as Fiscal Policy.” *Brookings Institution Press* Brookings (Spring 2016): 1–41. doi:10.1353/eca.2016.0012.

Morck, Randall, M Deniz Yavuz, and Bernard Yeung. 2019. “State-Run Banks, Money Growth, and the Real Economy.” *Management Science.* Forthcoming: 1–26.

Nakashima, Kiyotaka, Masahiko Shibamoto, and Koji Takahashi. 2017a. “Identifying Unconventional Monetary Policy Shocks.” *Working Paper*.

———. 2017b. “Risk-Taking Channel of Unconventional Monetary Policies in Bank Lending.” *Working Paper*, 65 pages.

Neely, Christopher J. 2015. “Unconventional Monetary Policy Had Large International Effects.” *Journal of Banking & Finance* 52 (3): 101–11. doi:10.1021/ja01597a015.

Neely, CJ, and PA Weller. 2001. “Technical Analysis and Central Bank Intervention.” *Journal of International Money and Finance* 20: 949–70.

Ng, Serena, and Jonathan H Wright. 2013. “Facts and Challenges from the Great Recession for Forecasting and Macroeconomic Modeling.” *Journal of Economic Literature* 51 (4): 1120–54.

Petrov, Alexander. 2017. “ETFs in Monetary Policy: Case Study of Japan.”

Singleton, J Clay, and John Wingender. 1986. “Skewness Persistence in Common Stock Returns.” *Journal of Financial and Quantitative Analysis* 21 (3): 335–41.

Swanson, Eric T, Lucrezia Reichlin, and Jonathan H Wright. 2011. “Let’s Twist Again: A High-Frequency Event-Study Analysis of Operation Twist and Its Implications for QE2 [with Comments and Discussion].” *Brookings Papers on Economic Activity*, no. Spring: 151–207.

Taylor, John B., and John C. Williams. 2010. *Simple and Robust Rules for Monetary Policy*. *Handbook of Monetary Economics*. 1st ed. Vol. 3. Elsevier B.V. doi:10.1016/B978-0-444-53454-5.00003-7.

Williamson, Stephen. 2012. “Liquidity , Monetary Policy , and the Financial Crisis : A New Monetarist Approach.” *American Economic Review* 102 (6): 2570–2605. doi:10.1257/aer.102.6.2570.

Wright, Jonathan H. 2012. “What Does Monetary Policy Do at the Zero Lower Bound ?” *Economic Journal* 122: 447–66. doi:10.1111/j.1468-0297.2012.02556.x.

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 three 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 42,919 firm-quarter observations and of yearly variables over 6,114 firm-year observations. The variables are as defined in Table A1.

Panel A. Daily Variables

	Min	Median	Max	Mean	Std. Dev.
BOJ Purchases (¥ Thousands)	0.01	7.36	32,158.45	113.83	618.88
BOJ Purchases/market cap	0.00	0.24	362.81	1.54	3.23
Stock return (%)	-100.00	-0.15	211.76	-0.27	2.62

Panel B. Firm Fundamentals	**Quarterly Variables**					**Annual Variables**				
	Min	**Median**	**Max**	**Mean**	**Std. Dev.**	**Min**	**Median**	**Max**	**Mean**	**Std. Dev.**
BOJ Purchases (¥ M)	0.1	39.7	57,742.3	351.7	1,573.7	0.9	143.4	17,0374.7	803.0	4,777.2
BOJ Purchases/assets (%)	0.0	0.1	100.4	0.3	1.5	0.0	0.4	281.5	1.6	6.1
BOJ No. of Purchase Days	0	18	62	25.34	21.34	1	77	245	104.39	78.62
Sales (¥ B)	0.001	15.1	7,442.5	82.3	280.7	0.000	10.2	3,408.4	44.7	147.4
Total Assets (¥ B)	0.048	56.7	49,456.0	384.5	1,636.7	0.048	38.3	24,229.2	201.6	918.9
Current Assets (¥ B)	0.014	29.4	18,825.1	165.5	644.3	0.026	19.9	7,248.4	82.9	312.6
Cash & Short-term Investment	0.000	7.6	12,311.9	46.2	264.3	0.008	6.2	3,487.9	26.2	110.6
Accounts Receivable (¥ B)	-0.056	10.2	8,827.4	70.4	336.1	0.000	6.5	3,751.9	31.4	134.7
Inventory (¥ B)	0.000	5.9	4,190.6	38.7	132.6	0.000	3.5	1,930.2	19.0	75.4
Tangible Capital (¥ B)	0.000	15.4	10,237.7	129.4	549.9	0.000	9.4	6,330.0	67.9	332.2
ΔTotal Assets (%)	-14.32	0.79	25.24	1.26	5.85	-25.10	4.37	93.39	7.01	15.52
ΔCurrent Assets (%)	-14.10	0.49	22.16	0.88	5.31	-19.57	2.43	64.02	4.18	11.00
ΔCash & ST Investment (%)	-10.66	0.11	15.40	0.34	3.66	-19.48	0.92	41.92	2.07	7.87
Δ Accounts Receivable (%)	-12.66	0.00	13.94	0.24	3.41	-28.93	0.50	27.63	1.13	6.26
ΔInventory (%)	-7.70	0.05	9.27	0.17	2.14	-7.93	0.16	18.69	0.79	3.35
ΔTangible Capital (%)	-3.99	-0.03	6.48	0.19	1.30	-9.93	0.19	23.00	1.17	4.29
ΔSales (%)	-0.56	0.02	1.14	0.04	0.23	-19.48	0.92	41.91	2.07	7.86
Book Leverage (%)	0.01	18.85	98.22	21.81	16.68	0.00	13.37	765.23	18.18	19.33
Market-to-Book	0.12	0.89	49.65	1.40	2.02	0.46	1.03	193.57	1.72	9.29
Return on Assets (%)	-48.62	3.03	112.09	3.17	5.37	-340.37	3.50	51.95	3.49	8.71
Returns (%)	-95.78	2.32	1,010.47	5.00	21.77	-53.45	11.42	240.50	19.85	44.92

Table 3. Returns and BOJ ETF Purchases in the Time-series and Cross-section

This table shows stocks subject to greater BOJ-driven ETF purchases rising relative to other stocks. The sample includes all stocks and all trading days from 15 Dec. 2010, to 31 Mar. 2018 except in (3A.1), which uses the subsample of days with $BOJ_t > 0$, where $BOJ_t$is BOJ-driven equity index ETF purchases in hundreds of million yen. Panel A presents time-series regressions and reveal a positive daily premium for the portfolio of stocks in the BOJ's ETF purchase basket, r_t^{BOJ}, over that of other stocks, $r_t^{non-BOJ}$ on days when BOJ-driven ETF purchases are larger. Numbers in parentheses are Newey-West p-values allowing for autocorrelation up to 5 lags, boldface indicating significance at 5% or better. Panel B presents panel regressions on the impact of fixed effects on the relation between individual stock returns and BOJ-driven ETF demand for each stock as a fraction of the firm's prior month market capitalization, $BOJ_{i,t}$. Standard errors cluster by firm and day, with p-values in parentheses and boldface indicating significance at 5% or better.

Panel A: Time-series portfolio return regressions

Explained variable:	$r_t^{BOJ} - r_t^{non-BOJ}$ (as %)		$r_t^{non-BOJ}$ (as %)	r_t^{BOJ} (as %)
	(3A.1)	(3A.2)	(3A.3)	(3A.4)
$\ln(1 + BOJ_t)$	**0.002 (0.000)**	**0.001 (0.000)**	**-0.222 (0.016)**	**-0.221 (0.016)**
Intercept	**-0.006 (0.001)**	**-0.003 (0.000)**	**0.474 (0.036)**	**0.471 (0.036)**
Sample	Purchase Days	All Days	All Days	All Days
Observations	553	1,350	1,350	1,350
R^2	0.104	0.138	0.199	0.199

Panel B: Panel regressions of daily individual stock returns with alternative fixed-effects

Explained variable:	$r_{i,t}$ (as %)			
	(3B.1)	(3B.2)	(3B.3)	(3B.4)
$BOJ_{i,t}$	**-2.559 (0.000)**	**-2.627 (0.000)**	**1.620 (0.000)**	**1.684 (0.000)**
Intercept or fixed effects	**0.734 (0.000)**	Stock	Day	Industry-Day
Observations	1,675,132	1,675,132	1,675,132	1,675,132
R^2	0.001	0.020	0.210	0.388

Table 4. Individual Stock Returns and BOJ-driven ETF Demand

The table shows BOJ purchases are associated with a positive return effect across multiple holding periods, using cumulated log returns. Firm-day panel regressions explain stock returns in intervals, indicated in square brackets, around BOJ purchase date, t. Explanatory variable $BOJ_{i,t}$ 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 market capitalization. In all regressions, $BOJ_{i,t}$ is winsorized at 0.5%. Regressions include industry-day fixed effects where industries are 4-digit SIC codes. Panel A uses all trading days and stocks in the BOJ purchase basket. Panel B uses all trading days and stocks. Panel C uses only days with BOJ purchases on day t alone in the interval $[t-k, t+k]$ for k = 0, 1, 2, 4, 9, 21 trading 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 only stocks in BOJ ETF-tracked indexes						
$BOJ_{i,t}$	**1.684 (0.000)**	**1.331 (0.000)**	**1.217 (0.000)**	**1.081 (0.000)**	**0.924 (0.000)**	**0.626 (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 B. All trading days and all stocks						
$BOJ_{i,t}$	**1.478 (0.000)**	**1.250 (0.000)**	**1.250 (0.000)**	**1.127 (0.000)**	**1.003 (0.000)**	**0.645 (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 C. Trading days with isolated (no others within k trading days) BOJ ETF purchases and only stocks in BOJ ETF-tracked indexes						
$BOJ_{i,t}$	**1.684 (0.000)**	**2.162 (0.000)**	**2.823 (0.000)**	**3.699 (0.000)**	**4.119 (0.000)**	**2.828 (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	0.356

Table 5. Changes in Monthly Stock Volatility

The table below shows monthly BOJ purchases are slightly positively related to monthly volatility, with an increase in upside volatility and decrease in downside volatility. Regressions explain 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 $\sigma_{i,m}(r_{i,t})$. The explanatory variables are total BOJ-driven ETF purchases of that stock in the same calendar month, denoted $BOJ_{i,m}$, and the explained variable lagged one month. $BOJ_{i,m}$ is scaled by total market capitalization in yen of stock i in the previous 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 $r_{i,t} > 0$ and downside volatility, $\sigma_{i,m}(r_{i,t}|r_{i,t} < 0)$, using returns of stock i only for days t in month m on which the return $r_{i,t} < 0$. A log-log specification facilitates interpretation. Sample sizes differ because some stocks have only positive or negative returns in some months. Numbers in parentheses are p-levels clustering by firm, boldface indicating significance at 1% or better.

Explained variable:	Log Monthly Volatility $\ln[1+\sigma_{i,m}(r_{i,t})]$	Log Monthly Upside Volatility $\ln[1+\sigma_{i.m}(r_i\|r_{it}>0)]$	Log Monthly Downside Volatility $\ln[1+\sigma_{i,m}(r_i\|r_{it}<0)]$
	(5.1)	(5.2)	(5.3)
$\ln BOJ_{i,m}$	**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)**
Observations	173,404	172,709	172,632
R^2	0.590	0.388	0.451

Table 6. External Financing

This table summarizes external financing, indicated by a seasoned equity issuance (SEO) dummy, $1_{i,q}^{SEO}$, set to 1 if firm i made seasoned equity offering (SEO) during quarter q and zero otherwise or a debt issuance dummy, $1_{i,q}^{D}$ set to 1 if firm i increased its long-term debt outstanding in quarter q, and 0 otherwise, with BOJ-driven ETF purchases of their shares, $BOJ_{i,q}$. Panel A reports OLS (linear probability model), probit, and logit regressions. Panel B reports instrumental variables versions of the same regressions with (6B.1.1) as a first stage (F-stat = 7.028) estimating the change in market-to-book ratio explained by BOJ ETF demand. All regressions use 42,919 firm-quarters and include control variables – lagged changes in market-to-book ratio, ROA, log total assets and book leverage – and firm and industry-quarter fixed-effects in OLS regressions or pseudo-fixed-effects (de-meaning explanatory variables by firm and industry-quarter) in probit and logit regressions. Standard errors cluster by firm, with p-values in parentheses, boldface indicating significance at 10% or better. Appendix Table A provides detailed variable definitions; Tables A2 and A3 provide coefficients of control variables.

Panel A. Regressions of external financing indicators on BOJ share purchases

Explained variable:	SEO indicator $1_{i,q}^{SEO}$			Debt issuance indicator $1_{i,q}^{D}$		
Model	Linear	Probit	Logit	Linear	Probit	Logit
	(6A.1)	(6A.2)	(6A.3)	(6A.4)	(6A.5)	(6A.6)
$BOJ_{i,q}$	**0.015** **(0.002)**	**0.007** **(0.001)**	**0.007** **(0.002)**	-0.002 (0.493)	-0.002 (0.472)	-0.002 (0.446)
Observations	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.309	0.024	0.025	0.322	0.004	0.005

Panel B. Instrumental Variables Regressions

Explained variable:	$\Delta M_{i,q}/B_{i,q-1}$	SEO indicator $1_{i,q}^{SEO}$			Debt issuance indicator $1_{i,q}^{D}$		
Model	1st stage OLS	Linear	Probit	Logit	Linear	Probit	Logit
	(6B.1.1)	(6B.1)	(6B.3)	(6B.4)	(6B.4)	(6B.5)	(6B.6)
$\left.\frac{\Delta M_{i,q}}{B_{i,q-1}}\right\vert BOJ_{i,q}$		**0.038** **(0.010)**	**0.025** **(0.000)**	**0.024** **(0.000)**	-0.006 (0.475)	-0.004 (0.109)	-0.004 (0.108)
$BOJ_{i,q}$	**0.384** **(0.000)**						
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.175	-0.355	0.011	0.012	0.306	0.004	0.005

Table 7. Changes in Components of Corporate Assets

This table explains changes in the components of firms' assets using quarterly (Panel A) or annual (Panel B) OLS regressions on $BOJ_{i,\bullet}$, total BOJ-driven ETF purchases of their shares in the quarter or year, accounting for firms entering or leaving indexes partway through. All explained variables are scaled by prior fiscal-period-end total assets except 7A.1.1, 7B.1.1, which explain raw percentage returns. All regressions include as control variables lagged changes in each of market-to-book, return on assets, log total assets and book leverage and SIC4-by-fiscal period fixed effects. Regressions 7A.1.1 and 7B.1.1 cluster bidirectionally by firm and fiscal period; all other regressions cluster by firm. Numbers in parentheses are p-values with boldface indicating significance at 10% or better. Appendix Table A provides detailed variable definitions; Tables A4 and A5 provide coefficients of control variables.

Panel A: Firm-quarter panel regressions

Explained variable:	Returns	ΔTotal Assets	ΔTangible Capital	ΔCurrent Assets	ΔCash & Short-Term Investments	ΔInventory	ΔAccounts Receivable
	(7A.1.1)	(7A.1)	(7A.2)	(7A.3)	(7A.4)	(7A.5)	(7A.6)
$BOJ_{i,q}$	**1.022** **(0.059)**	**0.272** **(0.001)**	**0.023** **(0.026)**	**0.300** **(0.001)**	**0.144** **(0.007)**	**0.050** **(0.009)**	**0.065** **(0.001)**
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.430	0.401	0.340	0.405	0.312	0.438	0.471

Panel B: Firm-year panel regressions

Explained variable:	Returns	ΔTotal Assets	ΔTangible Capital	ΔCash	ΔShort-Term Investments	ΔR&D	ΔAccounts Receivable
	(7B.1.1)	(7B.1)	(7B.2)	(7B.3)	(7B.4)	(7B.5)	(7B.6)
$BOJ_{i,y}$	0.340 (0.342)	**0.226** **(0.090)**	-0.002 (0.867)	**0.084** **(0.096)**	-0.006 (0.699)	0.004 (0.430)	0.020 (0.469)
Observations	6,114	6,114	5,979	6,114	6,114	3,543	6,114
R^2	0.387	0.357	0.361	0.322	0.379	0.238	0.343

Table 8. Changes in Components of Corporate Assets via Changes in Market-to-Book Ratio

This table explains changes in the components of firms' assets with changes in their market-to-book ratios attributable to BOJ-driven ETF purchases of their shares. Panel A and Panel B present quarterly and annual regressions, respectively. $BOJ_{i,\bullet}$ is total BOJ purchases in the quarter or year, accounting for firms entering or exiting indexes partway through. All variables are scaled by prior fiscal-period-end total assets except change in market-to-book ratio in 8A.1 and 8B.1, where $\Delta M/B$ is fiscal-period market-capitalization growth in yen scaled by prior-fiscal-period-end book value in yen. All regressions include as control variables lagged changes in each of market-to-book, return on assets, log total assets and book leverage and SIC4-by-fiscal period fixed effects. Regressions 8A.1.1 and 8B.1.1 have 1st stage F-statistics 6.888 and 1.709, respectively. Other regressions are second-stage regressions with $BOJ_{i,\bullet}$ instrumented by $\Delta M_{i,\bullet}/B_{i,\bullet-1}$. Regressions 8A.1.1 and 8B.1.1 cluster bidirectionally by firm and fiscal period; all others cluster by firm. Numbers in parentheses are p-values, with boldface indicating significance at 10% or better. Appendix Table A provides detailed variable definitions.

Panel A: Firm-quarter panel instrumental-variable regressions

Explained variable	$\Delta M/B$	ΔTotal Assets	ΔTangible Capital	ΔCurrent Assets	ΔCash & Short-Term Investments	ΔInventory	ΔAccounts Receivable
	(8A.1.1)	(8A.1)	(8A.2)	(8A.3)	(8A.4)	(8A.5)	(8A.6)
$\Delta M_{i,q}/B_{i,q-1}\|BOJ_{i,q}$		**0.710**	**0.060**	**0.781**	**0.376**	**0.132**	**0.170**
		(0.011)	**(0.047)**	**(0.010)**	**(0.020)**	**(0.024)**	**(0.009)**
$BOJ_{i,q}$	**0.384**						
	(0.00001)						
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.163	0.271	0.322	0.202	0.210	0.403	0.450

Panel B: Firm-year panel instrumental-variable regressions

Explained variable	$\Delta M/B$	ΔTotal Assets	ΔTangible Capital	ΔCash	ΔShort-Term Investments	ΔR&D	ΔAccounts Receivable
	(8B.1.1)	(8B.1)	(8B.2)	(8B.3)	(8B.4)	(8B.5)	(8B.6)
$\Delta M_{i,y}/B_{i,y-1}\|BOJ_{i,y}$		**1.335**	-0.011	**0.496**	-0.034	0.027	0.117
		(0.040)	(0.869)	**(0.065)**	(0.695)	(0.449)	(0.475)
$BOJ_{i,y}$	**0.169**						
	(0.003)						
Observations	6,114	6,114	5,979	6,114	6,114	3,543	6,114
R^2	0.501	-1.084	0.358	-0.051	0.377	-0.275	0.247

Table 9. Comparing Construction and Manufacturing to Other Sectors

This table compares changes in the components of firms assets in the construction and manufacturing sectors to those for of firms using quarterly (Panel A) and annual (Panel B) OLS regressions on $BOJ_{i,\bullet}$ total BOJ purchases of firm i's shares in in the fiscal quarter or year (accounting for firms entering or leaving indexes partway through) and its interactions with on J-SIC code manufacturing and construction sector dummies, $1_{i,q}^{manufactuing}$ and $1_{i,q}^{construction}$. Explained variables are scaled by prior fiscal-period-end total assets except in 9A.1.1 and 9B.1.1, which explain raw percentage returns. All regressions include as control variables lagged changes in market-to-book, return on assets, log total assets and book leverage and SIC4-by-fiscal period fixed-effects. Regression 9A.1.1 and 9B.1.1 clusters bidirectionally by firm and fiscal period; all other regressions cluster by firm. Numbers in parentheses are p-values, boldface indicating significance at 10% or better. Appendix Table A provides detailed variable definitions

Panel A: Quarterly Actions

Explained Variable:	Returns	ΔTotal Assets	ΔTangible Capital	ΔCurrent Assets	ΔCash & Short-Term Investments	ΔInventory	ΔAccounts Receivable
	(9A.1.1)	(9A.1)	(9A.2)	(9A.3)	(9A.4)	(9A.5)	(9A.6)
$BOJ_{i,q}$	**1.110**	**0.273**	0.005	**0.251**	**0.107**	**0.021**	**0.062**
	(0.084)	**(0.006)**	(0.428)	**(0.006)**	**(0.035)**	**(0.066)**	**(0.023)**
$BOJ_{i,q} \times 1_{i,q}^{construction}$	-1.756	0.125	0.216	-0.532	0.344	-0.209	0.111
	(0.445)	(0.894)	(0.109)	(0.559)	(0.267)	(0.647)	(0.235)
$BOJ_{i,q} \times 1_{i,q}^{manufactuing}$	-0.515	-0.008	**0.114**	**0.343**	**0.232**	0.199	**0.020**
	(0.551)	(0.955)	**(0.000)**	**(0.005)**	**(0.004)**	(0.000)	**(0.038)**
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.431	0.401	0.341	0.405	0.313	0.439	0.259

Panel B: Annual Actions

Explained Variable:	Returns	ΔTotal Assets	ΔTangible Capital	ΔCash	ΔShort-Term Investments	ΔR&D	ΔAccounts Receivable
	(9B.1.1)	(9B.1)	(9B.2)	(9B.3)	(9B.4)	(9B.5)	(9B.6)
$BOJ_{i,y}$	0.173	0.237	-0.002	**0.098**	-0.009	0.004	0.030
	(0.589)	(0.124)	(0.816)	**(0.090)**	(0.541)	(0.488)	(0.311)
$BOJ_{i,y} \times 1_{i,q}^{construction}$	2.310	1.416	0.150	-0.810	0.441	-0.012	0.114
	(0.456)	(0.098)	(0.503)	(0.115)	(0.180)	(0.216)	(0.593)
$BOJ_{i,y} \times 1_{i,q}^{manufactuing}$	**1.277**	-0.128	0.002	-0.095	0.017	-0.0001	-0.087
	(0.023)	(0.572)	(0.979)	(0.308)	(0.758)	(0.989)	(0.251)
Observations	6,114	6,114	5,979	6,114	6,114	3,543	6,114
R^2	0.389	0.358	0.359	0.322	0.379	0.238	0.344

Table 10. Comparing High Market-to-Book Firm Corporate Actions to Others

This table explains changes in the components of firms' assets using quarterly (Panel A) and annual (Panel B) OLS regression on $BOJ_{i,\bullet}$, total BOJ purchases in the fiscal period, adjusting for firms entering or leaving indexes within the period, $1_{i,\bullet}^{M/B_{i,\bullet-1}>1}$ a dummy variable indicating high-growth firms from the previous fiscal quarter or year, and their interaction. All explained variables are scaled by prior fiscal-period-end total assets except returns in 10A.1.1 and 10B.1.1, which explain raw percentage returns. All regressions also include as control variables lagged changes market-to-book, return on assets, log total assets and book leverage and SIC4-by-fiscal period fixed effects. Regression 10A.1.1 and 10B.1.1cluster bidirectionally by firm and fiscal period; all other regressions cluster by firm. Numbers in parentheses are p-values with boldface indicating significance at 10% or better. Appendix Table A provides detailed variable definitions

Panel A: Quarterly changes in components of firm assets

Explained Variable:	Returns	ΔTotal Assets	ΔTangible Capital	ΔCurrent Assets	ΔCash & Short-Term Investments	ΔInventory	ΔAccounts Receivable
	(10A.1.1)	(10A. 1)	(10A.2)	(10A.3)	(10A.4)	(10A.5)	(10A.6)
$1_{i,q}^{M/B_{i,q-1}>1}$	**-0.900** **(0.088)**	**0.736** **(0.000)**	**0.126** **(0.000)**	**0.544** **(0.000)**	**0.208** **(0.000)**	**0.091** **(0.005)**	**0.224** **(0.000)**
$BOJ_{i,q}$	**1.724** **(0.008)**	**0.315** **(0.00001)**	0.019 (0.611)	**0.481** **(0.0004)**	**0.373** **(0.000)**	**0.137** **(0.052)**	**0.118** **(0.078)**
$BOJ_{i,q} \times 1_{i,q}^{M/B_{i,q-1}>1}$	**-0.736** **(0.058)**	-0.056 (0.596)	0.003 (0.948)	-0.200 (0.197)	**-0.247** **(0.005)**	-0.093 (0.186)	-0.059 (0.418)
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.431	0.403	0.341	0.406	0.313	0.438	0.471

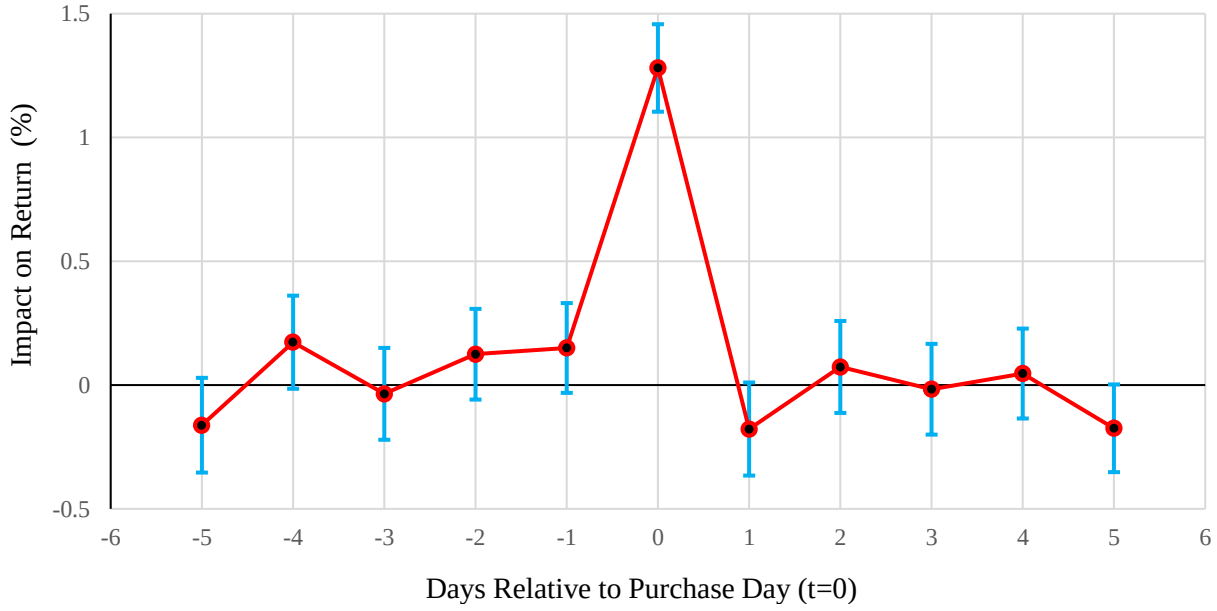
Panel B: Annual changes in components of firm assets

Explained Variable:	Returns	ΔTotal Assets	ΔTangible Capital	ΔCash	ΔShort-Term Investments	ΔR&D	ΔAccounts Receivable
	(10B. 1.1)	(10B.1)	(10B.2)	(10B.3)	(10B.4)	(10B.5)	(10B.6)
$1_{i,y}^{M/B_{i,,y-1}>1}$	**6.755** **(0.000)**	**3.812** **(0.000)**	**0.898** **(0.000)**	**1.186** **(0.009)**	-0.242 (0.521)	**0.097** **(0.028)**	**0.723** **(0.000)**
$BOJ_{i,y}$	0.534 (0.430)	**0.849** **(0.001)**	**0.278** **(0.061)**	-0.061 (0.664)	0.030 (0.760)	-0.003 (0.886)	**0.149** **(0.006)**
$BOJ_{i,y} \times 1_{i,y}^{M/B_{i,y-1}>1}$	-0.232 (0.764)	**-0.676** **(0.016)**	**-0.289** **(0.051)**	0.150 (0.316)	-0.037 (0.717)	0.007 (0.743)	**-0.140** **(0.010)**
Observations	6,114	6,114	5,979	6,114	6,114	3,543	6,114
R^2	0.390	0.366	0.366	0.324	0.379	0.241	0.346

Figure 1. Stock Return Reactions to BOJ ETF Purchases

This figure shows the estimated coefficients of daily BOJ purchases in firm-day panel regressions explaining daily stock returns. Time $t = 0$ is the date of a BOJ ETF purchase. Vertical lines represent 95% confidence intervals from standard errors clustered by day and by stock. All regressions include firm and industry-day fixed effects. Panel A graphs coefficients averaged across all stocks over all time in a regression including BOJ-driven ETF purchases of a stock on trading day $t + k$, with $k \in [-5, +5]$, as a percentage of its market capitalization 22 trading days prior as explanatory variables. Panel B graphs the coefficient from a similar regression including only the t = 0 term by year. The 2018 plotted coefficient only includes data through March 31, 2018 while all other years use a full year of data.

Panel A. Event-Time Impact of BOJ Purchases



Panel B. Mean Impact on Daily Return (%) of BOJ Purchases by Calendar Year

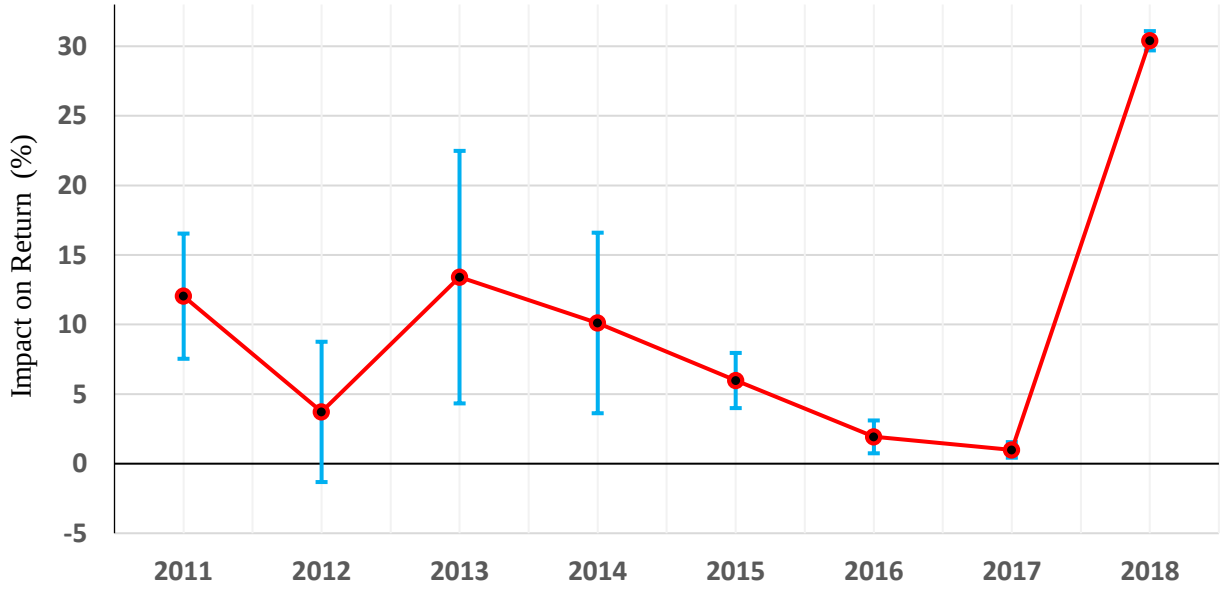
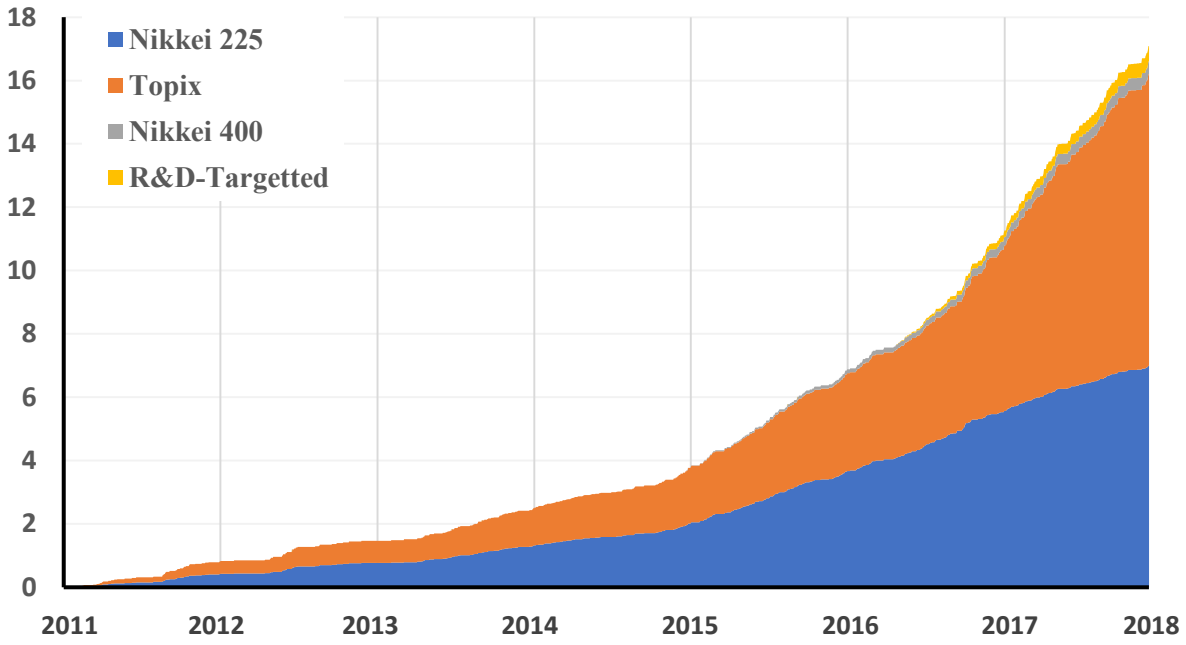


Figure 2. Amount of BOJ ETF Purchases and Returns

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



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

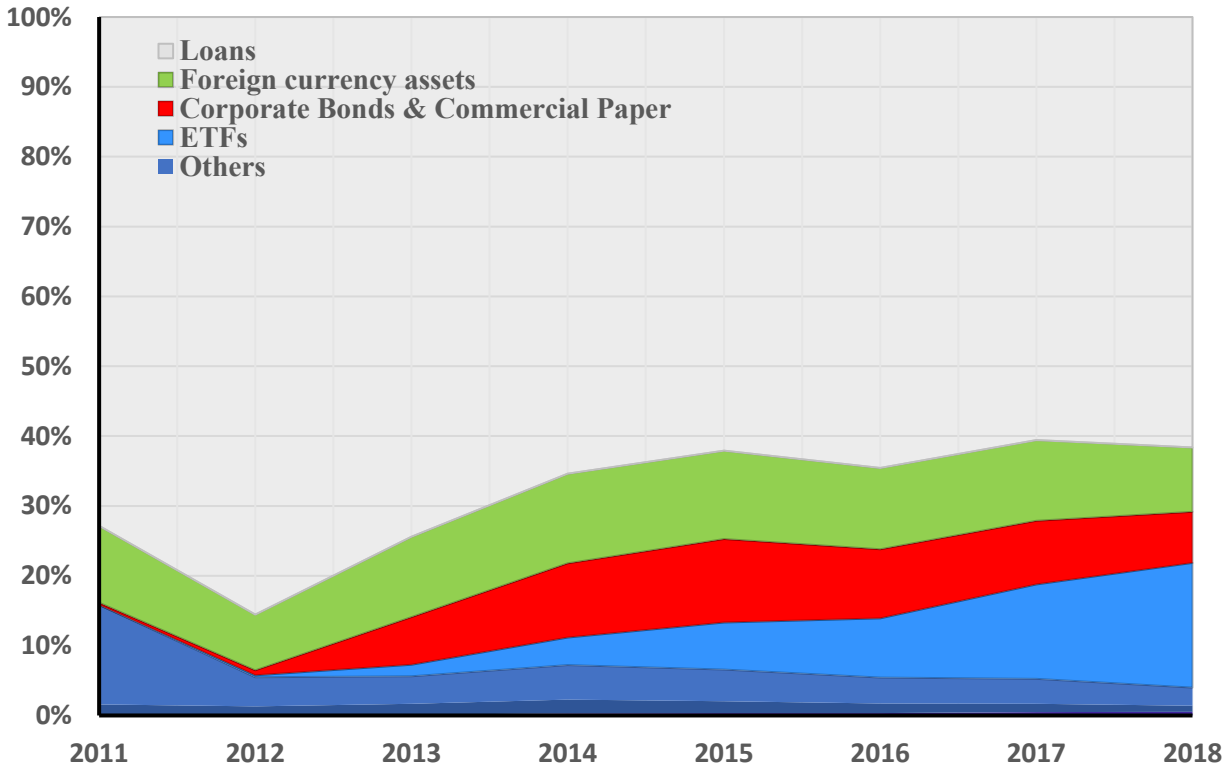
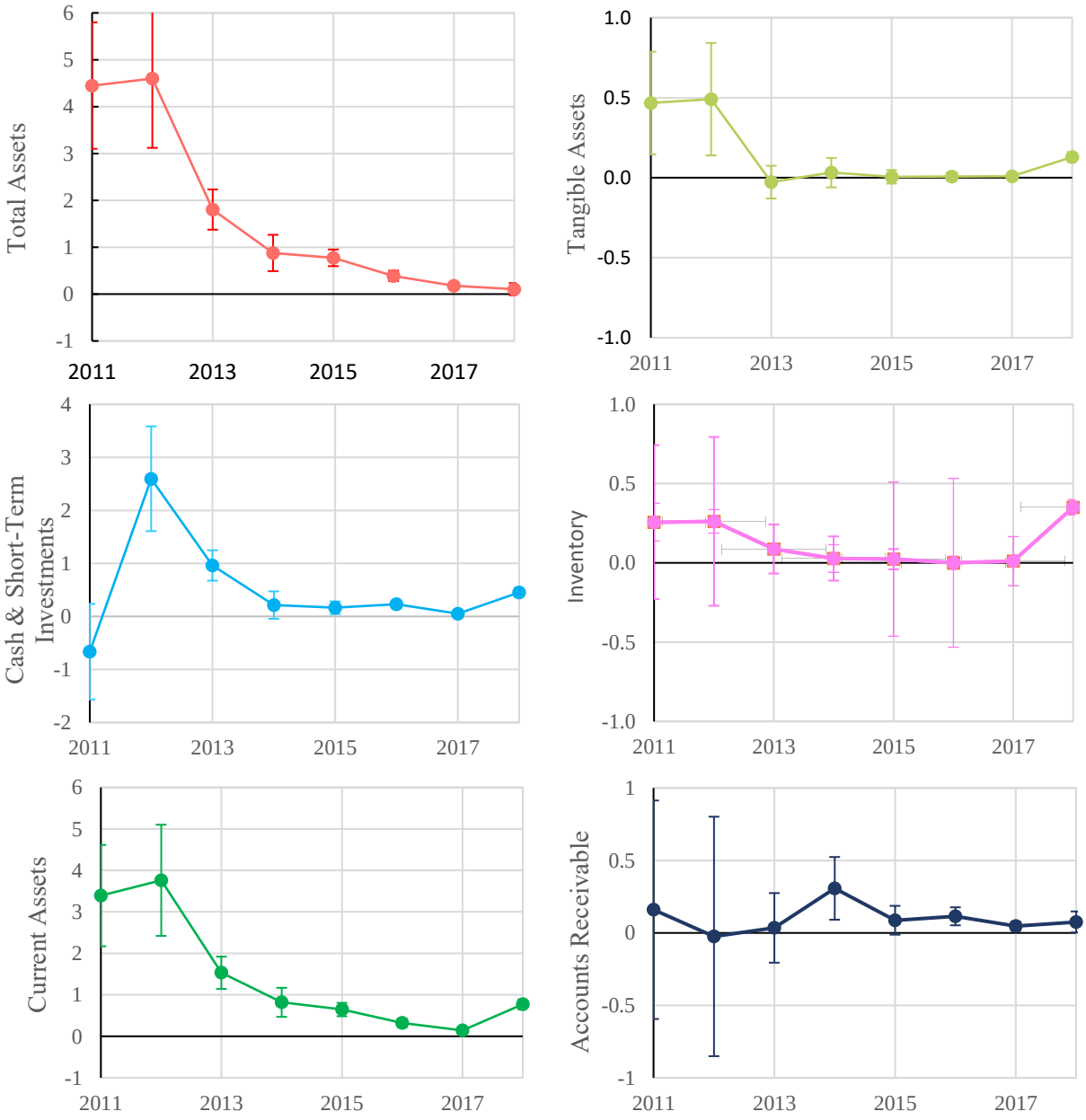


Figure 3. Declining Effectiveness of BOJ Equity Purchases

The figures below shows the estimates of quarterly corporate actions from a regression similar to those shown in Table 7 where the BOJ effect is split by year. The coefficient shown is for the $BOJ_{i,q}$ variable, defined as total BOJ purchases in the fiscal period, adjusting for firms entering or leaving indexes within the fiscal period. All variables are as defined for Table 7 and scaled by prior fiscal-period-end total assets. All regressions also include control variables: lagged changes in each of market-to-book, return on assets, log total assets and book leverage and SIC4-by-quarter or year fixed effects. Standard errors are clustered by firm and two-standard error bars are shown.



Appendix: Robustness and Additional Empirical Analyses

Appendix Table A1. Definitions of Corporate Action and Securities Issuance Variables

Variable	Definition (including WorldScope data codes)
Δ*Cash*	Change in cash holdings (WC02003) over lagged assets, as % (annual only)
Δ*Cash & Short-term Investments*	Change in cash plus short-term investments (assets not strategically held and are non-recurring) (WC02001A, WC02001) over lagged assets, as %
Δ*Current Assets*	All standard liquid assets, inventories, and other assets with mean maturity under 1 year (WC02201A, WC02201) over lagged assets, as %
Δ*Market-to-Book* ($\Delta M/B$)	Change in market value of equity plus debt (WC09304A, WC09304) all over lagged assets, as %
Δ*Long-term Debt*	Change in total long-term debt, average maturity ≥ 1 yr. (WC03251A) over lagged assets, as %
Δ*Tangible Capital*	Change in property, plant and equipment (WC02501A, WC02501) over lagged assets, as %
Δ*R&D*	Change in research and development spending (WC01201) over lagged assets, as % (annual only)
Return	Quarterly stock returns accounting for dividends.
Δ*Return on Assets* (*ROA*)	Change in earnings before interest, taxes, depreciation and amortization (EBITDA) over lagged assets (WC08326A), as %
Δ*Book Leverage*	Change in book long-term debt (WC08236A) over lagged assets, as %
Δ*Short-Term Investments*	Change in holdings of marketable securities (WC02008) over lagged assets, as % (annual only)
Δ*Total Assets*	Change in assets (WC02999A) over lagged assets, as %
Seasoned Equity Issue indicator ($1_{i,q}^{SEO}$)	Derived from shares outstanding (OTNOSH) and stock split data from the Development Bank of Japan. An indicator taking the value 1 if seasoned equity offering (SEO) was issued during the quarter, 0 otherwise.
Debt Issuance indicator ($1_{i,q\ 1}^{D}$)	Derived from total long-term debt outstanding (WC03251A): 1 if the firm's long-term debt strictly increased in the quarter, 0 otherwise.

Appendix Table A2. Share Issuances – Full Table

The table reproduces Table 6 Panel A, which links firms' external financing to BOJ-driven ETF purchases, and includes coefficients for all control variables. Explained variables are a seasoned equity issuance (SEO) indicator, $1_{i,q}^{SEO}$, set to 1 if firm i made seasoned equity offering (SEO) during quarter q and zero otherwise; and a debt issuance indicator, $1_{i,q}^{D}$ set to 1 if firm i increased its long-term debt outstanding in quarter q, and 0 otherwise. Panel A reports OLS (linear probability model), probit, and logit regressions. All regressions use 42,919 firm-quarters and include control variables – lagged changes in market-to-book ratio, ROA, log total assets and book leverage – as well as firm and industry-quarter fixed-effects or pseudo-fixed-effects. Pseudo-fixed-effects, de-meaning explanatory variables by firm and industry-quarter, are used instead of fixed-effects in probit and logit regressions. Standard errors are clustered by firm, with p-values in parentheses, boldface indicating significance at 10% or better. More details, including coefficients of control variables, are in Appendix Table A2.

Explained Variable:	Seasoned equity offering indicator $1_{i,q}^{DSEO}$			Debt Issuance indicator $1_{i,q}^{D}$		
Model:	Linear	Probit	Logit	Linear	Probit	Logit
	(6A.1)	(6A.2)	(6A.3)	(6A.4)	(6A.5)	(6A.6)
$BOJ_{i,q}$	**0.015**	**0.007**	**0.007**	-0.002	-0.002	-0.002
	(0.002)	**(0.001)**	**(0.002)**	(0.493)	(0.472)	(0.446)
$\Delta M/B_{i,q-1}$	-0.0004	**-0.0004**	-0.0006	-0.001	-0.002	-0.002
	(0.254)	**(0.748)**	(0.680)	(0.083)	(0.169)	(0.173)
$\Delta ROA_{i,q-1}$	0.0003	0.001	0.001	**-0.007**	**-0.009**	**-0.009**
	(0.781)	(0.132)	(0.141)	**(0.000)**	**(0.000)**	**(0.000)**
$\Delta Total\ Assets_{i,q-1}$	**0.189**	**0.155**	**0.154**	-0.032	0.032	0.051
	(0.000)	**(0.000)**	**(0.000)**	(0.609)	(0.605)	(0.332)
$\Delta Book\ Leverage_{i,q-1}$	0.000	**0.001**	**0.001**	**-0.011**	**-0.010**	**-0.011**
	(0.409)	**(0.008)**	**(0.001)**	**(0.000)**	**(0.000)**	**(0.000)**
Observations	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.309	0.110	0.110	0.322	0.059	0.059

Appendix Table A3. Share Issuances through M/B – Full Table

The table reproduces Table 6 Panel B, which links firms' external financing to BOJ-driven ETF purchases, but includes all control variable coefficients. Explained variables are a seasoned equity issuance (SEO) indicator, $1_{i,q}^{SEO}$, set to 1 if firm i made seasoned equity offering (SEO) during quarter q and zero otherwise; and a debt issuance indicator, $1_{i,q}^{D}$ set to 1 if firm i increased its long-term debt outstanding in quarter q, and 0 otherwise. Estimation is by OLS (linear probability model), probit, or logit instrumental variables regressions, with 1st stage regression 6B.1.1 (F-stat = 7.028) estimating change in market-to-book ratio attributable to BOJ ETF demand. All regressions use 42,919 firm-quarters and include control variables – lagged changes in market-to-book ratio, ROA, log total assets and book leverage – as well as firm and industry-quarter fixed-effects or pseudo-fixed-effects. Pseudo-fixed-effects, de-meaning explanatory variables by firm and industry-quarter, are used in probit and logit regressions instead of fixed-effects. Standard errors are clustered by firm, with p-values in parentheses, boldface indicating significance at 10% or better. More details, including coefficients of control variables, are in Appendix Table A2.

Explained Variable:	$\Delta M_q/B_{q-1}$	SEO			Debt Issuance		
Model:	First Stage (6B.1.1)	Linear (6B.1)	Probit (6B.3)	Logit (6B.4)	Linear (6B.4)	Probit (6B.5)	Logit (6B.6)
$\Delta M_q/B_{q-1}\|BOJ_{i,q}$		**0.038 (0.010)**	**0.025 (0.000)**	**0.024 (0.000)**	-0.006 (0.475)	**-0.004 (0.109)**	**-0.004 (0.108)**
$BOJ_{i,q}$	**0.384 (0.000)**						
$\Delta M/B_{i,q-1}$	-0.082 (0.227)	0.003 (0.221)	-0.001 (0.560)	-0.001 (0.343)	-0.001 (0.180)	-0.002 (0.110)	-0.002 (0.130)
$\Delta ROA_{i,q-1}$	0.016 (0.101)	-0.0003 (0.744)	**0.001 (0.091)**	**0.001 (0.175)**	**-0.007 (0.000)**	**-0.009 (0.000)**	**-0.009 (0.000)**
$\Delta Total\ Assets_{i,q-1}$	0.910 (0.316)	**0.154 (0.001)**	**0.094 (0.000)**	**0.095 (0.000)**	-0.026 (0.675)	0.039 (0.531)	0.058 (0.273)
$\Delta Book\ Leverage_{i,q-}$	0.022 (0.470)	-0.0003 (0.809)	**0.001 (0.081)**	**0.001 (0.031)**	**-0.011 (0.000)**	**-0.010 (0.000)**	**-0.011 (0.000)**
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.163	0.152	0.058	0.058	0.320	0.004	0.005

Appendix Table A4. Quarterly Firm Fundamentals – Full Table

This table reproduces Panel A of Table 7. Regressions use BOJ purchases to explain annual changes in the components of firms' assets. $BOJ_{i,q}$ is total BOJ purchases of the firm i's shares in quarter q. All explained variables are scaled by prior quarter-end total assets except raw percentage returns in regression (7A.1.1), which are. All regressions also control variables: lagged changes in each of market-to-book, return on assets, log total assets and book leverage and SIC4-by-quarter fixed-effects. Regression (7A1.1) clusters bidirectionally by firm and year; all others cluster by firm. Numbers in parentheses are p-values, with boldface indicating significance at 10% or better.

Explained Variable:	Returns (7A.1.1)	ΔTotal Assets (7A.1)	ΔTangible Capital (7A.2)	ΔCurrent Assets (7A.3)	ΔCash & Short-Term Investments (7A.4)	ΔInventory (7A.5)	ΔAccounts Receivable (7A.6)
$BOJ_{i,q}$	**1.022**	**0.272**	**0.023**	**0.300**	**0.144**	**0.050**	**0.065**
	(0.059)	**(0.001)**	**(0.026)**	**(0.001)**	**(0.007)**	**(0.009)**	**(0.001)**
$\Delta M/B_{i,q-1}$	0.0004	-0.007	**-0.003**	-0.004	-0.001	-0.002	-0.002
	(0.987)	(0.338)	**(0.012)**	(0.537)	(0.687)	(0.120)	(0.671)
$\Delta ROA_{i,q-1}$	-0.057	**0.106**	**-0.007**	**0.100**	**0.066**	**0.013**	**0.019**
	(0.634)	**(0.0004)**	**(0.068)**	**(0.0002)**	**(0.0002)**	**(0.020)**	**(0.052)**
$\Delta Total\ Assets_{i,q-1}$	1.611	**-5.477**	**1.230**	**-7.151**	**-1.284**	**-1.167**	**-3.778**
	(0.689)	**(0.000)**	**(0.000)**	**(0.000)**	**(0.040)**	**(0.003)**	**(0.000)**
$\Delta Book\ Leverage_{i,q-1}$	0.051	**0.082**	**0.009**	**0.049**	-0.002	-0.010	**0.036**
	(0.326)	**(0.001)**	**(0.001)**	**(0.030)**	(0.883)	(0.102)	**(0.004)**
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.430	0.401	0.340	0.405	0.312	0.438	0.471

Appendix Table A5. Annual Changes in Assets Components – Full Table

This table reproduces Panel B of Table 7. Regressions use BOJ purchases to explain annual changes in the components of firms' assets. $BOJ_{i,y}$ is total BOJ purchases of the firm i's shares in year y. All explained variables are scaled by prior fiscal-period-end total assets except raw percentage returns in regression (7B.1.1), which are. All regressions also control variables: lagged changes in each of market-to-book, return on assets, log total assets and book leverage and SIC4-by- year fixed-effects. Regression (7B1.1) clusters bidirectionally by firm and year; all others cluster by firm. Numbers in parentheses are p-values, with boldface indicating significance at 10% or better.

Explained Variable:	Returns	ΔTotal Assets	ΔTangible Capital	ΔCash	ΔShort-Term Investments	ΔR&D	ΔAccounts Receivable
	(7B.1.1)	(7B.1.1)	(7B.1)	(7B.2)	(7B.3)	(7B.6)	(7B.7)
$BOJ_{i,y}$	0.340 (0.342)	**0.226** **(0.090)**	-0.002 (0.867)	**0.084** **(0.096)**	-0.006 (0.699)	0.004 (0.430)	0.020 (0.469)
$\Delta M/B_{i,y-1}$	-0.027 (0.670)	**-0.019** **(0.003)**	**-0.008** **(0.009)**	-0.008 (0.252)	0.002 (0.282)	-0.0001 (0.807)	-0.001 (0.829)
$\Delta ROA_{i,y-1}$	**0.438** **(0.093)**	0.057 (0.561)	0.004 (0.806)	-0.046 (0.451)	0.013 (0.548)	0.009 (0.227)	0.001 (0.989)
$\Delta Total\ Assets_{i,y-1}$	9.767 (0.153)	**17.857** **(0.000)**	**5.996** **(0.000)**	2.335 (0.245)	0.246 (0.737)	0.397 (0.103)	2.093 (0.056)
$\Delta Book\ Leverage_{i,y-1}$	-0.004 (0.967)	0.043 (0.246)	**-0.042** **(0.024)**	**0.048** **(0.021)**	0.003 (0.756)	-0.002 (0.424)	-0.023 (0.079)
Observations	6,114	6,114	5,979	6,114	6,114	3,543	6,114
R^2	0.387	0.357	0.361	0.322	0.379	0.238	0.343

Appendix Table A6. Net Equity Issuances

The table studies net equity issuance amounts, taking into account the intensive margin by considering the amount raised in secondary offerings minus the amount paid in stock buybacks. Regression (1) shows the net issuances in a quarter scaled by the previous quarter's total assets multiplied by 100, regressions (2) and (3) show linear and Tobit regressions for the inverse hyperbolic sine of equity issue amounts, regressions (4) and (5) studies the same specifications for share buybacks, and regressions (6) and (7) studies total amount of debt issuances. Regression (1), (2), (4), and (6) estimate a linear model with industry-quarter fixed effects. Regression (3) and (5) estimate tobit models, regression (7) estimates a probit model, and regression (8) estimates a logit model. We difference all explanatory variables within industry-quarter groups for the tobit, probit, and logit models. Reported numbers correspond to the estimated coefficients. Standard errors are clustered by firm. Numbers in parentheses are p-values, with boldface indicating significance at 10% or better. McFadden pseudo-R^2s are shown for Tobit models.

Explained Variable:	Net Equity Issued over Lagged Total Assets × 100	Inverse Hyperbolic Sine of Equity Issue Amount		Inverse Hyperbolic Sine of Share Buyback Fraction		Indicator for Stock Buyback		
Model Type:	Linear	Linear	Tobit	Linear	Tobit	Linear	Probit	Logit
	(A6.1)	(A6.2)	(A6.3)	(A6.4)	(A6.5)	(A6.6)	(A6.7)	(A6.8)
$BOJ_{i,q}$	0.073 (0.315)	0.008 (0.391)	0.497 (0.393)	-0.006 (0.531)	**-0.080** **(0.038)**	**-0.008** **(0.030)**	**-0.010** **(0.055)**	**-0.011** **(0.008)**
$\Delta M/B_{i,q-1}$	-0.000 (0.765)	-0.000 (0.495)	**-0.520** **(0.055)**	0.003 (0.465)	0.006 (0.393)	0.0004 (0.599)	0.0003 (0.568)	0.0003 (0.573)
$\Delta ROA_{i,q-1}$	-0.016 (0.365)	**-0.004** **(0.053)**	-0.768 (0.001)	0.001 (0.543)	-0.007 (0.370)	0.002 (0.002)	-0.0001 (0.814)	-0.0001 (0.836)
$\Delta Total\ Assets_{i,q-1}$	0.354 (0.403)	**0.197** **(0.082)**	**30.785** **(0.000)**	-0.124 (0.189)	**0.333** **(0.249)**	-0.044 (0.198)	0.037 (0.152)	0.035 (0.179)
$\Delta Book\ Leverage_{i,q-1}$	-0.006 (0.397)	-0.003 (0.211)	-0.155 (0.394)	0.001 (0.581)	**-0.003** **(0.646)**	-0.0002 (0.742)	**-0.001** **(0.094)**	-0.001 (0.115)
Log(Sigma)			**3.507** **(0.000)**		**1.142** **(0.000)**			
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.215	0.280	0.005	0.300	0.0003	0.384	0.044	0.045

Appendix Table A7. Impact on Stock Returns Using Only Nikkei 225 Stocks

The table below revisits Panels A and B of Table 4 restricting the sample to Nikkei 225 stocks. Firm-day panel regressions explain stock returns in intervals, indicated by square brackets, around BOJ purchase date t holding periods, using cumulated log returns. 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 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 5% 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 only stocks in Nikkei 225						
BOJ_{it}	2.550 (0.471)	**6.194** **(0.009)**	**6.153** **(0.001)**	**5.628** **(0.00002)**	**4.722** **(0.0002)**	**4.221** **(0.0001)**
Observations	152,711	152,513	152,315	151,919	151,067	148,677
R^2	0.826	0.823	0.820	0.815	0.807	0.791
Panel B. Trading days with isolated (no others within k trading days) BOJ ETF purchases and only stocks in Nikkei 225						
BOJ_{it}	2.526 (0.471)	**8.505** **(0.005)**	**6.457** **(0.006)**	**4.992** **(0.037)**	**4.766** **(0.031)**	**2.894** **(0.030)**
k	0	1	2	4	9	21
Observations	152,711	65,123	28,881	13,438	3,801	798
Number of Events	2,675	334	144	67	19	4
R^2	0.826	0.816	0.830	0.798	0.785	0.063

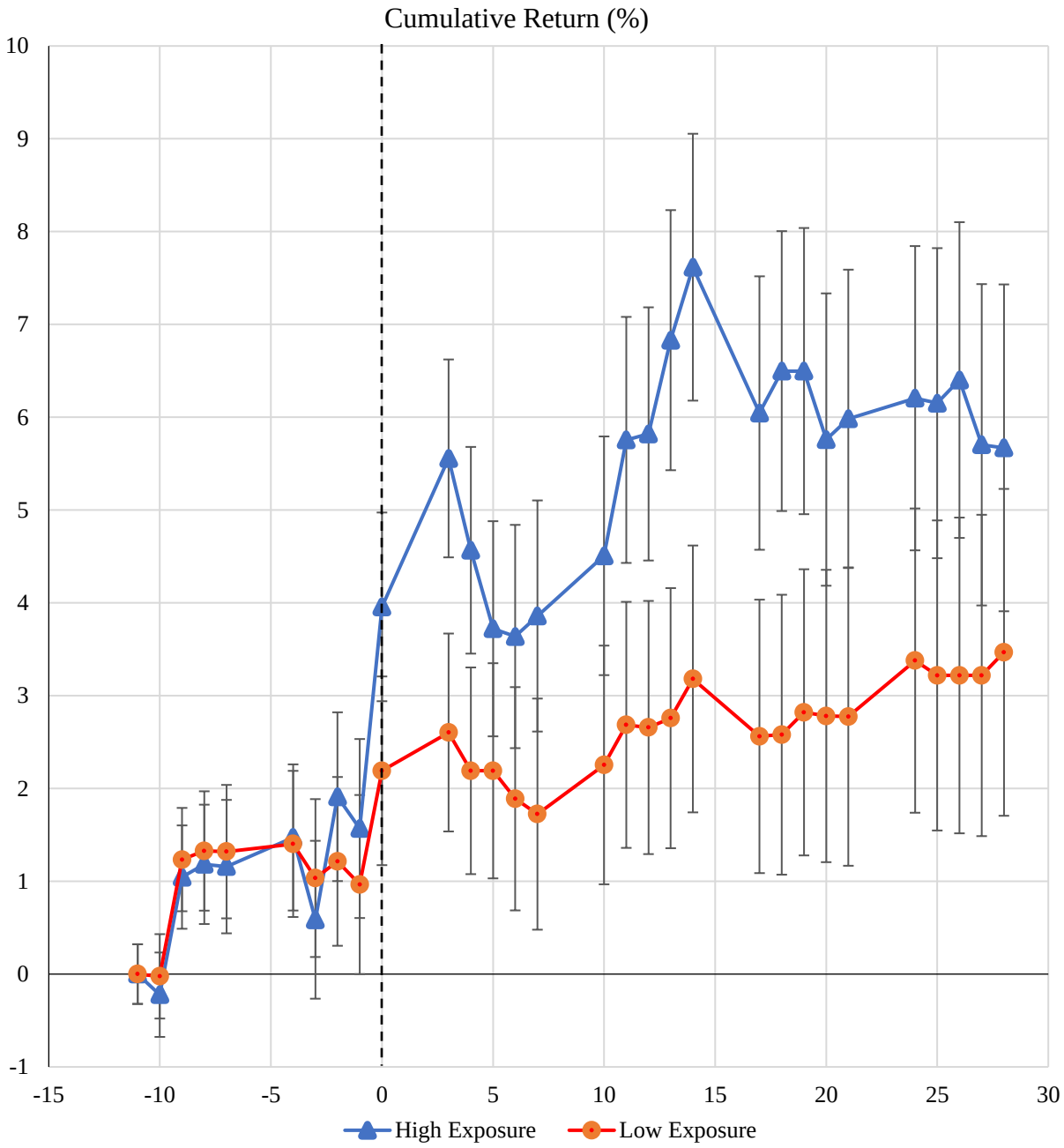
Appendix Table A8. Replication of Main Results Using Nikkei 225 Stocks Only

This table shows the effect of BOJ purchases on various corporate action variables at the quarterly level for stocks that are in the Nikkei 225, accounting for stocks that enter the index within the quarter. $BOJ_{i,q}$ is defined as total BOJ purchases in the fiscal period, adjusting for firms entering or leaving indexes within the period. All explained variables are scaled by prior fiscal-period-end total assets except returns in regressions (1.1), which are raw percentage returns. All regressions also include a set of control variables: lagged changes in each of market-to-book, return on assets, log total assets and book leverage and SIC4-by-quarter or year fixed effects. Regression (1.1) clusters 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.

Explained Variable:	Returns	SEO issuance indicator $1_{i,q}^{SEO}$			Debt issuance indicator $1_{i,q}^{D}$			ΔTotal Assets	ΔTangible Capital	ΔCurrent Assets	ΔCash & S.T. Inv.	ΔInven-tory	ΔAccounts Receivable
Specification	OLS	OLS	Probit	Logit	OLS	Probit	Logit	OLS	OLS	OLS	OLS	OLS	OLS
	(A8.1.1)	(A8.1)	(A8.2)	(A8.3)	(A8.4)	(A8.5)	(A8.6)	(A8.7)	(A8.8)	(A8.9)	(A8.10)	(A8.11)	(A8.12)
$BOJ_{i,q}$	1.606 (0.564)	**0.279** **(0.019)**	0.305 (0.117)	0.331 (0.106)	-0.046 (0.600)	-0.041 (0.628)	-0.041 (0.628)	**1.826** **(0.080)**	**0.321** **(0.034)**	**1.119** **(0.069)**	**0.623** **(0.096)**	**0.310** **(0.016)**	0.302 (0.166)
$\Delta M/B_{i,q-1}$	-1.020 (0.222)	0.027 (0.438)	-0.017 (0.324)	-0.017 (0.329)	0.007 (0.780)	0.001 (0.953)	0.0002 (0.992)	0.280 (0.224)	-0.009 (0.899)	**0.365** **(0.083)**	**0.298** **(0.035)**	-0.044 (0.392)	**0.200** **(0.086)**
$\Delta ROA_{i,q-1}$	**0.499** **(0.094)**	-0.001 (0.903)	0.007 (0.109)	-0.007 (0.109)	-0.016 (0.106)	**-0.028** **(0.000)**	**-0.029** **(0.000)**	-0.027 (0.707)	**-0.030** **(0.070)**	0.103 (0.171)	0.054 (0.250)	0.037 (0.141)	**-0.035** **(0.092)**
$\Delta Total\ Assets_{i,q-1}$	-3.929 (0.674)	-0.234 (0.476)	**-0.560** **(0.001)**	**-0.558** **(0.001)**	0.166 (0.708)	0.221 (0.228)	0.210 (0.255)	0.523 (0.898)	**2.754** **(0.003)**	**-4.392** **(0.063)**	**-3.455** **(0.087)**	-0.413 (0.547)	0.291 (0.820)
$\Delta Book\ Leverage_{i,q-1}$	-0.107 (0.456)	-0.001 (0.822)	0.004 (0.064)	0.004 (0.068)	-0.019 (0.004)	**-0.017** **(0.000)**	**-0.017** **(0.000)**	-0.006 (0.854)	0.002 (0.831)	-0.035 (0.236)	**-0.053** **(0.032)**	-0.003 (0.802)	0.001 (0.962)
Observations	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970	4,970
R^2	0.821	0.705	0.026	0.026	0.613	0.031	0.031	0.732	0.589	0.728	0.672	0.760	0.811

Appendix Figure A1. 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 (2019).



Appendix Figure A2. Firm Actions by Industry

This figure shows estimated coefficients of quarterly corporate policy around BOJ equity purchases, by J-SIC 1-digit industry. The bars represent the coefficient of the BOJ demand variable, defined as total BOJ purchases in the fiscal period, adjusting for firms entering or leaving indexes within the period. All explained variables 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 explained variables are scaled by prior fiscal-period-end total assets. All regressions also include a set of control variables: lagged changes in each of market-to-book, return on assets, log total assets and book leverage and SIC4-by-quarter fixed effects. Two standard error bars are shown.