NBER WORKING PAPER SERIES

BANK OF JAPAN EQUITY PURCHASES: THE (NON-)EFFECTS OF EXTREME QUANTITATIVE EASING

Ben Charoenwong
Randall Morck
Yupana Wiwattanakantang

Working Paper 25525
http://www.nber.org/papers/w25525

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
February 2019

Previously circulated as "Asset Prices, Corporate Actions, and Bank of Japan Equity Purchases." We are grateful to Sumit Agarwal, Francesco Franzoni, Virginia Gianinazzi, Marcin Kacperczyk, Gregor Matvos, Andrew Rose, Pietro Veronesi, Bernard Yeung, our discussants Andrea Barbon and Joe Zhang, seminar participants at the 2020 American Economic Association Meeting, 2019 European Finance Association Meeting, JSPS Core-to-Core Program: Governance Reforms from Comparative Perspectives Conference, Development Bank of Japan, Tokyo Institute of Technology, National University of Singapore, University of New South Wales, the Singapore Scholar Symposium, Bank of Thailand, the Puey Ungphakorn Institute for Economic Research, Chulalongkorn University, and NIDA University for helpful suggestions. This work was supported the NUS Start-up Grant [grant number R-315-000-119-133 to B.C.] and the Singapore Ministry of Education Tier 1 Research Grant [grant number R-315-000-127-115 to B.C.]. This paper has circulated as NBER Working Paper No. W25525. All remaining errors are ours. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

Bank of Japan Equity Purchases: The (Non-)Effects of Extreme Quantitative Easing
Ben Charoenwong, Randall Morck, and Yupana Wiwattanakantang
NBER Working Paper No. 25525
February 2019
JEL No. E52,E58,G31,G32

ABSTRACT

From January 2011 through March 2018, the Bank of Japan purchased equity index ETFs worth about 3.5% of GDP. Identification of the effect of central bank ETF purchases on stock valuations and corporate responses is via differently-weighted and changing stock indices. BOJ purchases lift valuations, increase share issuances, and increase total assets. On average, the latter increase is due to cash and short-term securities rather than capital investment. However, firms with worse corporate governance do increase capital investment. These findings suggest central bank equity purchases are a problematic tool for stimulating economic growth through high broad-based private-sector corporate investment.

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

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

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

1. Introduction

The Bank of Japan (BOJ) is pioneering a unique form of quantitative easing: the central bank buying and holding large equity blocks in domestic corporations. From the policy's advent in December 2010 through March 2018, the BOJ accumulated equity index-backed exchange-traded fund (ETF) holdings worth almost ¥19.3 trillion, some 2.9% of the market capitalization of the Tokyo Stock Exchange, 3.5% of GDP, and over 75% of the total ETF market. In response to the COVID-19 coronavirus crisis, in March of 2020, the BOJ announced a doubling of its equity purchases with an annual budget of ¥12 trillion.[1]

Are massive equity purchases by central banks an effective alternative monetary policy stimulus other central banks might use amid near zero or, as in Japan, negative interest rates when debt market interventions grow ineffective? The possibility of share purchase as an additional policy tool has been discussed in several economies, including the United States, Europe, Israel, and China.[2] However, so far, the BOJ is the only major central bank to have purchased domestic equities on such a scale.[3] Based on our empirical analyses, we conclude that these BOJ equity purchases have scant expansionary impact on corporate actions but temper bankruptcy risk. We argue that Japan's institutions and recent economic history leave its experience relevant to policy-makers elsewhere.

The BOJ's 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

---

[1] Bank of Japan ploughs deeper into stocks to ease coronavirus fears, *Financial Times*, by Leo Lewis and Kana Inagaki, March 16, 2020.

[2] Federal Reserve Chair Janet Yellen has advocated expanding the Fed's mandate to buying corporate stocks – see "Janet Yellen Sees Benefits to Central Bank Stock Purchases" by David Harrison, *Wall Street Journal*, Sept. 29 2016. Boston Fed President Eric Rosengren's March 2020 comments on the central bank intervening in "a broader range of securities or assets" were widely interpreted as referring to stock purchases – see e.g. "Could the Fed resort to buying stocks?" by Stephen Alpher, *SeekingAlpha.com*, Mar. 6. Blackrock Chief Investment Officer Rick Rieder urged the European Central Bank to buy equities – see "ECB can boost growth across Europe by buying stocks" Financial Times, July 22 2019. See also "Businesses urge Bank of Israel to buy corporate bonds, stocks," *Jerusalem Post*, Mar. 18th 2020; "China's next stimulus step could be direct share purchases by its central bank," *Business Insider Australia*, by David Scutt, Jan. 8th 2019.

[3] Equity constitutes about 20% of the Swiss National Bank's (SNB) balance sheet. However, these are foreign stocks such as Apple, Alphabet, Microsoft, and Amazon. The SNB's foreign equities serve as a profit center and as an additional channel for influencing the exchange rate. As another example, the Hong Kong Monetary Authority 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 Financial Crisis, but reduced its portfolio of Hong Kong equities to 5% of its reserves as of 2003. In 2015, the People's Bank of China countered a stock market drop by lending to China Securities Finance Corporation, which then purchased stocks. Various governments purchase shares via sovereign wealth funds, public sector pension plans, or to affect complete or partial nationalizations. However, central banks do not take part in these policies and these purchases are not formally considered monetary policy interventions.

appears to time 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.

Since the policy shock is likely correlated with other factors that simultaneously affect firms' investment opportunity sets, our empirical analysis faces an important endogeneity concern. Our identification strategy exploits a unique institutional feature of the program: the BOJ buys stocks in proportions set by firms' weights in a combination of three indexes: one price-weighted, another free-float value-weighed TOPIX, and the third containing firms selected for "investor appeal". This introduces an exogenous firm-specific heterogeneity in BOJ demand for different stocks that permits identification of the causal effects of central bank equity purchases on stock returns and corporate responses.

Validating the first part of the mechanism, greater BOJ demand increases a stock's price significantly the same day. After a small partial reversal, the increase persists through the subsequent week and month. The data associate total quarterly BOJ purchases worth 1% of a firm's total prior quarter assets with a 1% higher stock return that quarter.

Validating the second link, more BOJ purchases of a firm's shares also correspond to statistically and economically significant increases in that firm's seasoned equity issuances. However, despite a decrease in market leverage ratio due to increased market value of these firms, there is no evidence of any increase in their debt issuance frequency/activity.

The third link— firms investing more after BOJ-backed ETF purchases increase their share values and thereby reduce their costs of capital — is not economically significant. Instead, we observe large increases in current assets, especially in cash and short-term investments. The BOJ purchasing equity amounting to 1% of a firm's lagged assets predicts a 2.28% increase in that firm's assets over the same quarter. However, our quarterly regressions associate only 8.5% of this with increased capital investment. Instead, the increase in assets is overwhelmingly in short term assets, with cash and short-term investments accounting for 53%. In annual regressions, the link

to cash accumulation remains statistically and economically significant, but that to tangible investment becomes statistically insignificant with near zero point estimates. This accords with this monetary-stimulus mechanism amounting to "pushing on a rope" to boost investment.

However, BOJ equity purchases are associated with increased investment in the subsample of firms without valuable growth opportunities ($Q < 1$) and with weak corporate governance (the chair is the CEO or ex-CEO). These findings suggest that, while being generally ineffective in spurring investment, the BOJ's equity purchases have loosened expansion constraints on firms whose investment is least apt to be economically efficient. This suggests BOJ equity purchases may exacerbate Japan's "zombie firms" problems (Caballero et al. 2008).

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.

To what extent can Japanese findings inform policy elsewhere? Japan's unique economic and financial institutions developed uniquely in the post-war era (Morck and Nakamura 2007; Mehrotra et al. 2011). However, these rest atop fundamental similarities to those of other high-income economies (Beason and Patterson 2004). Moreover, Japan's institutions have converged substantially to high-income norms in recent decades (Hoshi et al. 2018). Post-financial crisis concerns about secular stagnation argue that other high-income economies are increasingly "Japanified" (Blanchard and Summers 2020). Acharya et al. (2019) document parallels between Japan's "lost decades" and Europe's slow growth, including "ultra accommodative central bank policies and zombie lending (i.e., cheap credit to impaired firms) by undercapitalized banks". Banerjee and Hofmann (2018) document a growing Japanese-style "zombification" in OECD economies. Peterson Institute President Adam Posen concludes "I don't think you can set aside how ineffective Japanese monetary policy has been in terms of nominal aggregates. I think we need to take [it] very seriously and be troubled by this."[4] Therefore, Japan's experimental monetary policies potentially have important external validity going forward.

Our findings suggest that central bank purchases of equities are a problematic tool for stimulating economic growth through high broad-based private-sector corporate investment.

[4] "Japanification", Secular Stagnation, and Fiscal and Monetary Policy Challenges, American Economic Association Annual Meeting session, 2020.

However, higher stock prices might stimulate economic growth by, for example, increasing consumers' wealth (Poterba 2000), as shown in Di Maggio et al. (2020) and Agarwal et al. (2020) who link stock returns to consumption in Sweden and India respectively. Comparable Japanese data are unavailable, precluding such tests focussed specifically on central bank-driven share value increases. Central banks may thus wish to consider other nonstandard monetary policy interventions for boosting corporate investment.

2. Related Literature and Institutional Background

2.1 The Bank of Japan's Increasingly Unconventional Monetary Policy

Laying out a major monetary stimulus transmission channel and key link between finance and macroeconomics, the Q theory of investment, Tobin (1969) argues "an increase in the quantity of money is expansionary, causing a rise in the valuation of existing capital and stimulating investment" (p. 21). Tobin envisioned the central bank creating money to buy T-bills (government debt maturing in less than one year) to lift T-bills' prices and lower their yields. This was to pull down the yields of securities in general and lower firms' costs of capital, boosting their investment and thus boosting economic growth.[5]

The BOJ successfully kept short-term rates low with "conventional" monetary stimuli along these lines.[6] However, investment and growth remained sluggish. When nominal short-term risk-free rates are already very low, pushing them down further becomes ineffective. Japan's short-term borrowing costs were very low, but long-term borrowing costs were higher. Bernanke and Reinhart (2004) posit that central banks could further stimulate the economy with an "unconventional" monetary stimulus. Termed "quantitative easing" (QE), this had the central bank creating money to buy a broader range of debt securities, including medium- and long-term government bonds and private sector debt securities, to push down rates more generally. In March 2006, the BOJ became the first major central bank to implement QE.

Following the 2008 global financial crisis, most other major central banks followed the BOJ's lead and implemented QE and other non-conventional monetary policies (Kuttner 2018). The BOJ's intensifying QE interventions lowered interest rates across maturities, but investment

[5] Other monetary policy transmission channels are also modelled, but as Bernanke and Reinhard (2003, p. 85) write, "Monetary policy works for the most part by influencing the prices and yields of financial assets, which in turn affect economic decisions and thus the evolution of the economy."

[6] Central bank T-bill purchases are associated with reduced short rates (Christensen et al. 2012; Hördahl and King 2008; Taylor and Williams 2010).

and economic growth remained elusive (Honda et al. 2013).

2.2 The Bank of Japan Expands Quantitative Easing to Stock Purchases

With short-term risk-free interest rates below zero and the yield curve flat, the BOJ again broke new ground. In October 2010, Governor Masaaki Shirakawa directed the BOJ to create money to buy corporate shares as well as debt securities. The BOJ opted to buy shares of index ETFs, which then used the money to buy shares in corporations. This let the BOJ delegate decisions about which stocks to buy and how to vote those stocks in annual shareholder meetings to ETF management companies. Table 1 summarizes the subsequent expansion of the BOJ's stock market interventions.

[Table 1 about here]

The 2010 Comprehensive Monetary Easing (CME) program initially put a cap of ¥450 billion and a December 2011 termination date on the BOJ's equity index ETF purchases. As Table 1 shows, both the cap and termination date were repeatedly extended. The next BOJ governor, Haruhiko Kuroda, replaced the CME with the Quantitative and Qualitative Monetary Easing (QQE) policy, which empowered the BOJ to buy equity index ETFs with no cap or termination date (Kuroda 2013). Rather, the QQE set an annual equity ETF purchase target of ¥1 trillion for the BOJ, which repeatedly increased over subsequent years.

Although the largest entry in the BOJ's balance sheet remains Japanese government bonds (JGBs), its equity holdings show the greatest increase – from ¥1 trillion (shares taken off the balance sheets of troubled banks) before 2011 to over ¥19 trillion by March 2018. On March 16, 2020, the BOJ doubled its annual ETF purchases to a target of ¥12 trillion to counter the COVID-19 crisis.

2.3 Identification via the Mechanics of BOJ Equity Index ETF Purchases

To our knowledge, the BOJ has never framed its equity purchase policy within a formal model. However, empirical evidence supports individual stocks having downward sloping demand curves (Dierker et al. 2016), so the BOJ's policy could plausibly affect stock prices by increasing demand. Our first empirical objective is therefore to estimate how much the BOJ's equity purchases of a stock increase its price. Because demand elasticity identification suffers from an endogeneity bias, prior studies have used changes in index inclusion (Shleifer 1986) or index weighting schemes (Kaul et al. 2000; Greenwood 2008) as sources of exogenous variation in the demand for each stock. Because the BOJ buys stocks by buying equity index ETFs, a similar identification strategy

is possible here.

However, because the BOJ times its ETF purchases to counter market dips, two complications arise. First, this timing could decrease systematic risk of stocks in indexes these ETFs track, lowering their risk premiums and further increasing their prices. This means price changes due to BOJ ETF purchases may overstate pure demand elasticities. However, our interest is in total price impacts of BOJ equity purchases and not in demand elasticities *per se*, so this complication is innocuous. Second, and less innocuous, a stock's price change on any day on which the BOJ buys ETFs is the sum of a change due to BOJ purchases and a change due to whatever caused the market dip. Because time-series variation in BOJ ETF demand is endogenous, our focus is cross-sectional heterogeneity in BOJ demand on each intervention day.

The BOJ cannot alter the cross-sectional distribution of its demand for stocks in response to changes in its price or in any firm, industry or other latent variable because each index has predetermined inclusion criteria and weighting schemes and because the BOJ buys ETFs tracking the different indexes in predetermined proportions. From 2010 to November 2014, the BOJ bought ETFs tracking the Tokyo Stock Price Index (TOPIX) and the Nikkei 225 index. After that, it also bought ETFs tracking the JPX-Nikkei 400. The BOJ initially weighted its ETF purchases across indexes by the market capitalizations of each index. 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 before. The TOPIX is a broad market index that weights firms by free floats (market capitalizations less large stable equity blocks). The Nikkei 225 is a price-weighted index of 225 selected large firms. The JPX-Nikkei 400 contains 400 stocks selected for governance and performance. Section 3.3 derives BOJ demand for each stock on each date as an interaction of index inclusion dummies, index weights, and the BOJ's formula for allotting purchases to ETFs tracking different indexes. The resulting distribution of BOJ demand across stocks on any date is thus both predetermined and highly irregular.

Our identification assumption is that this irregular pattern is – to a first approximation – a randomization that renders the cross-sectional variation in BOJ demand of a stock exogenous to latent firm or macroeconomic factors at a given point in time. This assumption would fail if a shock caused price changes with a correlated cross-sectional variation. For example, a shock hitting firms equally would be collinear with price changes from the BOJ buying an equal-weighted total market index ETF and one hitting larger firms harder would be collinear with price

changes from the BOJ buying a value-weighted total market index ETF. The irregular cross-sectional distribution of BOJ demand in our setting, determined by interactions of index inclusion dummies, index weights, and the BOJ's allocation formula, is unlikely to correlate consistently with that of any plausible series of shocks causing market dips.

3. Empirical Framework

3.1 Economic Motivation

Tobin (1969) argues that a monetary expansion "enables the monetary authority to force the market return on physical capital to diverge from its technological marginal efficiency or, what is the same thing, to force the market valuation of existing capital to diverge from its reproduction cost. By creating these divergences, the monetary authority can affect the current rate of production and accumulation of capital assets. This is the manner in which the monetary authority can affect aggregate demand in the short run" (p. 26). Our theoretical framework elaborates on this to formulate the three criteria the introduction offers for deeming the BOJ's equity purchase policy effective: that it raises share prices, lowers costs of capital, and increases capital investment.

First, could BOJ share purchases raise share prices? If all investors have homogenous information, stocks are merely risk-return pairs and each stock has multiple perfect substitutes (combinations of other stocks and the risk-free asset) and therefore has infinitely elastic demand. Under this hypothesis, the BOJ cannot permanently boost stocks' prices with targeted stock purchases. As BOJ purchases push up targeted stocks' prices, investors would sell those stocks and buy other securities with similar risk-return profiles until the prices of the BOJ targeted stocks revert to their original values. The BOJ buying ETFs would then fail to increase the prices of stocks in those ETFs relative to the prices of other stocks. However, we observe share price increases and no evidence of short-term reversals. In addition, Barbon and Gianinazzi (2019) present empirical evidence that individual Japanese stocks have downward sloping demand curves using two major BOJ share purchase policy announcements. This motivates a more nuanced theoretical framework.

If information is costly and distributed heterogeneously across investors (Grossman and Stiglitz 1980; Hong and Stein 2007; Dierker et al. 2016) or if investors are heterogeneously impatient (Handa and Schwartz 1996)) and liquidity providers compete imperfectly (Sandas 2001), stocks have finite demand elasticities. In such a setting, the BOJ increases the prices of these stocks.

By raising a firm's share prices, the BOJ mechanically lowers the return that its dividends

and future capital gains constitute for investors, which lowers the firm's cost of equity capital and overall cost of capital. Tobin's Q theory says an efficiently run firm should undertake all capital investment projects whose q ratio exceeds one and no others. A potential project's $q\ ratio$ exceeds one if and only if the marginal return it gains by putting an additional unit of capital into a new project exceeds the marginal cost of that unit of capital. By lowering a firm's cost of capital, the BOJ's equity purchase program seeks to increase the number of projects whose q ratios exceed one and therefore boost the firm's investment by the setup costs of all of these projects.

The link from higher stock prices via lower costs of capital to higher capital investment might be more effective for some firms than for others. For example, a cost of capital decline might lead to very little more investment by a "value firm" – that is, one with substantial cash flow from existing projects but limited scope for undertaking new projects. Also, an inefficiently governed firm might undertake "empire-building" investment projects that make the CEO feel important and more entrenched rather than investment projects whose q ratios exceed one (Jensen 1986; Pinkowitz et al. 2006). Lowering the cost of capital of such a firm might stimulate inefficient investment that ultimately fails to justify its costs.

Finally, Gross Domestic Product (GDP) is $Y_t = \mathrm{C_t} + I_t + G_t + X_t$; that is, the sum of aggregate consumption, aggregate investment, government spending, and net exports. Fluctuations in aggregate investment are largely due to fluctuations in its most important component, capital investment. This is, to a first approximation, the sum of the set-up costs of all investment projects that firms undertake in each period. Aggregate investment is the most volatile and pro-cyclical component of GDP, and economic downturns typically correspond to low aggregate investment. Central bank monetary stimulus policies therefore seek to boost aggregate investment. We take this to be the objective of the BOJ's equity purchase program.

3.2 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 BOJ's website. ETFs trading on the TSE are from the Japan Exchange Group (JPX) website. Index components and weights of TOPIX, Nikkei 225 and JPX-Nikkei 400 indexes are from the website of Tokyo Stock Exchange

and Nikkei Inc. Assets-under-management data for each ETF are from Bloomberg.

The BOJ announces its day t ETF purchases on day $t+1$. Market participants reportedly become aware of BOJ ETF purchases as, or shortly after, they occur. Therefore, we look at day t returns as well as returns in the two-day window $[t, t+1]$ and longer windows. Longer non-overlapping windows allow tests for reversals, but the cost is fewer usable data points as BOJ purchases tend to cluster, especially in more recent data.

Tests of the impact of BOJ purchases on stock returns use stocks with positive volume and non-missing prior-day market capitalization. The daily returns sample of over 4.2 million stock-day observations allows for portfolio-level tests, which contrast the return of a portfolio of stocks in the BOJ-targeted ETFs, which we call the "BOJ purchase basket", with a portfolio of all other stocks. The BOJ purchase basket is virtually identical to the TSE's First Section (large liquid stocks) and the portfolio of all other stocks is virtually identical to the TSE's Second Section (small illiquid stocks). Consequently, tests contrasting the two are confounded by systematic size and liquidity differences. Our main daily return tests therefore exploit the substantial heterogeneity in BOJ demand within the BOJ purchase basket at each point in time. These tests use over 1.7 million stock-day observations.

Tests for corporate policy effects of BOJ ETF purchases use firm-quarter and firm-year observations for BOJ purchase basket firms. 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%. 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, and Appendix Table 1 lists exact Thomson Reuters variable codes.

[Table 2 about here]

3.3 Measuring Cross-Sectional Heterogeneity in BOJ Demand for Stocks

Our tests exploit firm-level heterogeneity in BOJ demand for identification. To assess how the

BOJ's purchases of ETF units cause these ETFs to purchase shares of their component stocks, we require precise measures of each stock's weight in each index and each index's weight in the BOJ's purchase menu each day. 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 $w_{BOJ,t}^{N400}$, respectively, all expressed as percentages. The percentage weight of stock *i* in total BOJ purchases on day *t* is then

$$[6] \qquad w_{i,t} \equiv (w_{i,t}^{N225} \times w_{BOJ,t}^{N225}) + (w_{i,t}^{Topix} \times w_{BOJ,t}^{Topix}) + (w_{i,t}^{N400} \times w_{BOJ,t}^{N400}).$$

The 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 roughly 2,000 stocks in the First Section of the Tokyo Stock Exchange (TSE). 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 minus publicly disclosed long-term block-holdings. The price-weighted Nikkei 225 tracks 225 stocks, selected to collectively reflect the health of Japan's economy, analogous 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 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.[7] BOJ-driven ETF demand for firm i's shares is the yen cost of total BOJ ETF purchases on day t, BOJ_t, times that stock's weight in BOJ purchases, $w_{i,t}$ from [1]. We scale BOJ yen demand for a firm's stock by 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

$$[7] \qquad BOJ_{i,t} \equiv w_{i,t} BOJ_t / V_{i,t-22}.$$

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

[7] We exclude the four indexes specifically tailored for the BOJ: 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* because their component stocks may be endogenously selected and rebalanced.

quarter q and scale this amount by total assets as of the end of the prior quarter:

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

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 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 about 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, with 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. However, it also means our tests must consider both the timing and overall magnitude of the BOJ's interventions endogenous.

This endogeneity in the timing and aggregate magnitude of BOJ purchases means we must identify a source of exogenous heterogeneity in BOJ-linked purchases to test for effects of these 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

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

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 [6].

The explained variable is the stock's raw total return because the regressions include stock fixed-effects, denoted 1_i, which subsume different static risk loadings for different stocks, and industry-day fixed-effects, denoted $1_{j(i,t),t}$, which subsume time-varying sector-specific risk loadings and time-varying macroeconomic risk loadings. 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.[8]

Panel B of Table 3 shows the impact of successively finer fixed-effects on the relation between daily firm-level stock returns and BOJ-driven ETF demand for that stock. Day fixed-effects control for the BOJ timing purchases to counter market dips and reveal a positive cross-sectional coefficient, indicating higher stock returns for stocks with greater weights in the combination of indexes that the BOJ's target ETFs track (Regression 3B.3). The regression fit improves significantly as day fixed-effects are included, and again as industry-day fixed-effects are included, so we adopt industry-day fixed-effects as our baseline specification (Regression 3B.4). This compares BOJ ETF stocks' daily returns to those of their industry peers each day.[9]

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 regression shows stocks with greater weights in the BOJ's purchase menu gaining significantly more on days when the BOJ buys more ETFs. As a robustness check, Appendix Figure A1 corroborates the main results in Barbon and Gianinazzi (2019), showing the BOJ ETF purchase policy announcements increase returns of stocks with high weights in the BOJ purchase basket relative to those with less exposure.

4.2 Windows and Weights in Daily Returns Panel Regressions

Table 4 further explores the baseline specification in regression (3B.4). Panel A uses the sample in (3B.4), all stocks in the BOJ purchase basket. Panel B includes all stocks, assigning zero weights to stocks not in the BOJ purchase basket. The first columns in both panels show stocks with greater

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

weights in the BOJ's purchase menu gaining significantly more on days when the BOJ buys more ETFs.

[Table 4 about here]

Jain (1987) argues that event studies of stocks' inclusions in an index should consider longer event windows to exclude temporary price pressure effects, which arise as passive investors, who pay an immediacy premium to avoid the risk of not tracking the index accurately, bid up index constituent prices temporarily. Gains from temporary price pressures reverse once abnormal passive investor buying subsides, leaving a smaller permanent gain attributable to increased demand for the stocks. Prior works (e.g., Kaul et al. 2000) find partial reversals within a few trading days. The BOJ relies on its ETF purchases boosting index constituent firms' share prices long enough to affect investment decisions, so only the permanent component of the price gain is relevant in assessing the effectiveness of this unconventional monetary policy.[10]

To explore the permanence of price gains, the remaining columns in Panels A and B examine cumulative log returns over longer windows from the day the BOJ buys ETFs 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 $[t, t+21]$. Both panels admit partial short-term reversals but show most of the immediate gains persisting as the length of the window increases.

As the window increases, the odds of it including a second BOJ ETF purchase date rise. This means that the long event window returns in Panels A and B could reflect subsequent BOJ ETF purchases on days later in these windows, rather than a permanent price increase following the initial BOJ intervention date. To exclude this possibility, Panel C repeats the exercise, dropping all event windows containing one or more subsequent BOJ ETF purchase dates. This substantially reduces the sample size, but the price increase remains permanent. Indeed, rather than reversing, it rises slightly with window length. This is an artefact of the BOJ's market timing: interventions not followed by other interventions are interventions not followed by price declines. Regardless, share price gains associated with the BOJ's interventions do not appear to fully reverse, so its

[10] 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 if followed by a reversal, a negative abnormal return. Second, if index ETF managers act to mitigate immediate price pressure by delaying the buying of underlying shares, the immediate reaction might be muted and the abnormal return might spread across a longer window. In either case, cumulative abnormal returns over longer time windows measure the overall price impact.

unconventional monetary policy could affect corporate decisions and the real economy.

4.3 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 a firm's actions to BOJ-driven ETF purchases requires variation in their intensity that is not only defensibly exogenous but also separable from other developments. 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.[11]

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 additional equity in quarter q and set to zero otherwise; and $1_{i,q}^{DI}$ is set to one if the firm increased its long-term debt during the quarter and set to zero otherwise. Because the explained variables are binary, we supplement OLS linear probability estimation with logit and probit estimation. All of these regressions take the form

$$[10] \quad I_{i,q}^{\bullet} = 1_{j(i,q),q} + \xi BOJ_{i,q} + \mathbf{\Gamma}'\Delta\mathbf{X}_{i,q-1} + \varepsilon_{i,q},$$

where $I_{i,q}^{\bullet}$ is either $1_{i,q}^{SOE}$ or $1_{i,q}^{DI}$.[12] The explanatory variable of primary interest, $BOJ_{i,q}$, is BOJ-driven ETF purchases of the firm's stock in each quarter scaled by the firm's prior-quarter total assets, from [8]. The coefficient of interest, ξ, gauges the association of a firm's financing decisions with increased demand for its shares in that quarter which are due to BOJ ETF purchases. The vector $\Delta\mathbf{X}_{i,q-1}$ contains control variables represented as flow variables, including: one-quarter lagged changes in each of the market-to-book ratios, return-on-assets, book leverage, and log total

[11] The BOJ's quantitative easing also includes purchases of commercial paper and investment-grade corporate bonds. It does not disclose which firms' debt securities it buys, so we cannot control for these purchases explicitly. However, as of calendar year 2018, the BOJ had only bought ¥5.2 trillion in commercial paper and corporate bonds in total, versus ¥25 trillion yen equity ETFs. If greater BOJ equity purchases increased firms' debt capacities, affected firms may issue debt that the BOJ also buys. This might bias the coefficient of BOJ ETF purchases upward in explaining debt issuances. However, Table 6 shows no relation to debt issuances.

[12] We consider responses in the same quarter as the BOJ purchase because, since 1988, the Japanese Securities Exchange Law permits issuances to occur well within one month, with the fastest time from announcement to payment date of only 21 days. The minimum time between filing an equity offering document to the actual raise is 7 or 15 days, contingent on firms meeting certain disclosure guidelines imposed by the Ministry of Finance. The date a company receives cash proceeds from the issuance must be at least 14 days from the original equity offer filing day. Issuing corporate bonds takes less than 3 months and loans from existing banking relationships are faster.

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 flows, we do not include firm fixed-effects. All regressions cluster by firm.

[Table 5 Here]

Panel A of Table 5 summarizes these regressions.[13] All three estimation techniques link BOJ ETF purchases of a firm's stock to that firm issuing seasoned equity. Regression 5A.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 the same BOJ intervention. 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 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

$$[11] \quad \Delta M_{i,q}/B_{i,q-1} = 1_{j(i,q),q} + \beta\, BOJ_{i,q} + \mathbf{\Gamma'X}_{i,q-1} + \eta_{i,q}$$

with all explanatory variables as in [10]. The second stage repeats the exercises in Panel A, but uses the predicted changes in firms' market valuation that [11] 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

$$[12] \quad I^{\bullet}_{i,q} = 1_{j(i,q),q} + \xi\,(\Delta M_{i,q}/B_{i,q-1}\big|BOJ_{i,q}) + \mathbf{\Gamma'}\Delta\mathbf{X}_{i,q-1} + \varepsilon_{i,q}$$

with all else as in [10]. This does not directly relate new financing to capital investment as in Kim and Purnanandam (2014). Instead, we later test investment and other corporate responses directly.

Panel B of Table 5 summarizes these regressions. The first stage regression 5B.1.1 links a one-percentage-point increase – approximately 0.7 of a standard deviation – in BOJ-induced purchasing of a firm's shares during a given quarter to a 0.38 increase in a firm's market-to-book

[13] Appendix Tables A2 and A3 reproduce Table 6, including all control variable coefficients.

ratio – 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.

4.4 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 this using firm-quarter regressions explaining various measures of changes in corporate assets, generically denoted $\Delta Y_{i,q}$, of the form

$$[13] \quad \Delta Y_{i,q} = 1_{j(i,q),q} + \xi BOJ_{i,q} + \mathbf{\Gamma}'\Delta\mathbf{X}_{i,q-1} + \varepsilon_{i,q},$$

with i and q indexing firms and quarters. The coefficient of interest, ξ, gauges the relationship between the corporate-action variable and $BOJ_{i,q}$, which is the increased demand for the firm's shares in that quarter due to BOJ ETF purchases, from [8]. As in [10], $\Delta\mathbf{X}_{i,q-1}$ contains control variables: one-quarter lagged changes in market-to-book ratio, return-on-assets, book leverage, and log total assets. All regressions cluster by firm and include industry-quarter fixed-effects, denoted, $1_{j(i,q),q}$, with $j(i,q)$ as i's primary industry in quarter q. The coefficient ξ measures the differences across firms associated with the BOJ buying more of a firm's shares.

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 [13], but include 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 6 Here]

Panels A and B of Table 6 summarise quarterly and annual regressions, respectively.[14] Panel A associates higher BOJ ETF purchases of a firm's shares with higher quarterly returns and asset growth. The growth is spread across all components of total assets except goodwill (not shown), though the largest growth is of current assets, especially cash and short-term securities. Panel B, using annual data which separates cash and short-term investments, shows that firms accumulate more cash as the BOJ buys more of their shares and no growth 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 lagged assets is only 8.5% of the corresponding increase in total assets and only 1.8% of the 1.30% standard deviation of the growth rate of tangible assets over total assets in Table 2. In annual data, the point estimate goes to zero with a large standard error. One possibility is BOJ purchases cause firms to do things in the current quarter that they would subsequently have done anyway. 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 and corporate investment decisions, Table 7 adopts an instrumental-variables approach as in Panel B of Table 5. The first stage is [6] and the second stage

$$[14] \quad \Delta Y_{i,q} = 1_{j(i,q),q} + \xi(\Delta M_{i,q}/B_{i,q-1}\big|BOJ_{i,q}) + \mathbf{\Gamma}'\Delta\mathbf{X}_{i,q-1} + \varepsilon_{i,q},$$

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 [11]. Annual tests do likewise with annual data.

[Table 7 Here]

Panel A of Table 7 summarizes these regressions. Regressions 7A.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 increase in the market-to-book ratio of 0.384, or around one-third of a standard deviation. Regressions 7A.1 through 7A.6 associate BOJ-driven ETF purchases, acting via increases in 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

[14] Appendix Tables A4 and A5 present these regressions again, including control variable coefficients.

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. Additional tests, summarized in Appendix Figure A3, show the impact of BOJ share purchases on all corporate action variables diminishing over time. This diminishing transmission occurs despite the escalating scale of BOJ equity purchases in Figure 2 and their increased share price impact in the first three months 2018 in Figure 1.

Overall, we find (1) ETF purchases over a quarter lifted share prices by around one percentage point, (2) higher share prices led firms to issue more equity and less debt, but (3) firms did not appear to use additional capital to undertake more capital investment. Instead, increases in the firm's total assets correspond largely to increases in cash and short-term investments.

4.5 BOJ Purchases and Bankruptcy Risk

A secondary effect of BOJ ETF purchases could be a decline in firms' bankruptcy risk. This is plausible for several reasons. First, Table 3 shows the BOJ timing its ETF purchases to counter market dips, which reduces downside return volatility.[15] Second, Tables 4 through 8 show that BOJ ETF purchases increase equity valuations, which mechanically decreases market-value leverage and thus bankruptcy risk. Third, Table 5 links BOJ ETF purchases to firms issuing equity and Tables 7 and 8 suggest the proceeds largely finance increased cash and short-term securities holdings, which tend to reduce bankruptcy risk. BOJ ETF purchases could thus reduce firm-level bankruptcy risk.

We use five alternative measures of $\Psi_{i,q}$: interest coverage ratios, manufacturing and non-manufacturing versions of Altman Z-scores, Bharath and Shumway (2008) default probabilities, and Campbell et al. (2008) distress measures.[16] Denoting the change in firm j's quarter q bankruptcy risk as $\Delta\Psi_{i,q}$, with all other variables defined as in [10], we regress

$$[15] \quad \Delta\Psi_{i,q} = 1_{j(i,q),q} + \xi BOJ_{i,q} + \mathbf{\Gamma}'\Delta\mathbf{X}_{i,q-1} + \varepsilon_{i,q}$$

[15] Monthly regressions of stock-level downside return volatility, defined as $ln\left[1 + \sigma(r_{i,t}|r_{i,t} < 0)\right]$ for all days t in a month on its own lag and monthly BOJ ETF purchases assign the latter a coefficient of -0.015 (p = 0.0001). See Appendix Table A13 for details.

[16] Altman's manufacturing Z-score predicts bankruptcy over a two-year horizon using 5 financial ratios with weights derived from discriminant analysis. The non-manufacturing Z-score is derived analogously and uses 4 financial ratios. Bharath-Shumway default probabilities derived from a Merton (1974) model assume log-normal asset values and use historical stock price volatility, book-value liabilities, market capitalization, and a risk-free rate assumption to forecast one year ahead. Campbell et al. (2008) distress probabilities are from a panel logit model using accounting and stock market variables.

to obtain ξ, an estimate of the impact of BOJ ETF purchases on bankruptcy risk. Missing values for some bankruptcy risk measures leave samples smaller than in Tables 6, 7 and 8.

Table 8 summarizes these results. More BOJ ETF purchases of a firm's stock correspond to statistically significantly lower bankruptcy risk (higher Altman Z-scores and lower Bharath and Shumway default probabilities). BOJ ETF purchases are marginally significant ($p < 0.10$ in one-tailed tests) in increasing interest coverage and decreasing Campbell et al. distress probabilities, and both signs align with the other results. Additional unreported tests link BOJ equity purchases to statistically significantly reduced default risk measured as in Campbell et al. (2008) and Hilscher and Wilson (2017). These results suggest BOJ equity purchases decrease bankruptcy risk.

Cascading bankruptcies and large negative wealth shocks along credit and supply chains are a systemic risk (Battiston et al. 2007). Borrowing from large customers and suppliers is an important financing channel for smaller Japanese firms, and its blockage worsened Japan's financial crisis (Taketa & Udell, 2006). Table 8 suggests BOJ ETF purchases, however ineffective as a stimulus, reduce bankruptcy risk. If the expanded short-term assets and accounts receivable associated with BOJ ETF purchases in Tables 7 and 8 expand credit to smaller firms, or could do so in a crisis, BOJ ETF purchases may reduce systemic risk redefined to reflect Japanese practices.

4.6 Robustness

Appendix Section A.3 provides details about robustness checks of Tables 6 through 11. These either yield qualitatively similar results (identical signs and statistical significance and comparable economic significance) to the tables or reinforce the conclusions in the tables. Specifically, qualitatively similar results ensue using alternative winsorizations; firm fixed-effects; external financing gauged by amounts rather than issuance indicators; lagged responses in firms' accessing of external capital; using only firms in the price-weighted Nikkei 225; slope shifters for firms in construction and manufacturing; and excluding 2011 and 2012, when an earthquake, tidal wave, and nuclear incident necessitate large fiscal stimulus spending in Fukushima and other regions.

Results that differ are economically consistent with the tables. Including current and lagged BOJ ETF purchases in regressions of external financing associates higher BOJ purchases with more current quarter equity issuance and less next quarter debt issuance, consistent with "lumpy" external financing leaving making debt unnecessary just after an equity issuance. Sub-period tests show larger coefficients on BOJ ETF purchases in regressions explaining firm decisions in earlier

years, despite the BOJ's doubling of its ETF purchase targets on July 29, 2016. Indeed, interest coverage attains statistical significance in Table 8 analogs using data before July 29, 2016.

5. Differential Transmission and Investment Efficiency

Ideally, a monetary stimulus would encourage increased investment by firms with value-increasing investment opportunities and management incentivized to undertake such opportunities. Accordingly, this section explores whether BOJ purchases encourage increased investment by "growth stock" firms with valuable growth opportunities obstructed by financing constraints (Hennessy et al. 2007), and by firms with good corporate governance, whose managers are likely to undertake efficient investments and forgo inefficient investments (Billett et al. 2011).

5.1 Do Growth Firms Respond More?

Tobin (1969) argues that firms have valuable investment opportunities if their valuations in financial markets exceed the replacement costs of their assets, roughly approximated by their market-to-book ratios being above one. We identify *growth firms* as those with a prior fiscal quarter or year-end market-to-book ratio above one and designate all other firms as *value firms*. Table 9 allows BOJ equity purchases to have a different coefficient for growth firms. The table shows BOJ share purchases boost share prices significantly less for growth firms than for value firms at quarterly frequencies, though the two are statistically indistinguishable at annual frequencies. BOJ share purchases are significantly less associated with cash and short-term securities accumulation for growth than for value firms at quarterly frequencies; and significantly less associated with assets, tangible investment, and goodwill growth at annual frequencies.

Firms with higher valuation ratios are viewed as having valuable marginal investment opportunities left unexploited because of financing constraints (Hayashi 1982 and Bernanke et al. 1999). From this perspective, BOJ equity purchase policies appear to disproportionately encourage cash accumulation and expansion by firms without valuable growth opportunities. However, this conclusion must be qualified by more nuanced interpretations of the link between high market-to-book ratios and growth opportunities (Farre-Mensa and Ljungqvist 2016). Growth opportunities might be left unexploited, not because of financing constraints, but because the firm has market power (Cooper and Ejarque 2003), lumpy capital (Thomas 2002), or as stock prices become elevated by investor sentiment (Morck et al. 1990). Therefore, we revisit the Table 9 regressions using alternative proxies for financial constraints: the Whited and Wu (2006) index (Table A12,

Panel A in the online appendix) and the Kaplan and Zingales (1997) index as modified by Lamont et al. (2001) (Table A12, Panel B in the online appendix). None of the interactions of BOJ purchases with these financial constraint indexes attract statistically significant coefficients explaining capital investment. Further untabulated tests using firm size and age as proxies for financial constraints generate insignificant results for capital investments as well. These results support Table 10's conclusion that BOJ purchases of relatively financially constrained firms' shares do not disproportionately increase investment by those firms.

5.2 Do Well-Governed Firms Respond More?

Managers do not follow the script in Tobin's Q theory of investment. Table 10 lets BOJ ETF purchases play out differently in firms with different corporate governance. This is gauged by dummies for the CEO or an ex-CEO chairing the board. These data are subcomponents of Environment, Social, and Governance scores assigned by Thomson Reuters.

Panels A and B of Table 10 link more BOJ share purchases to significantly less growth in assets, capital investment and goodwill (potentially reflecting expansions via mergers and acquisitions) in firms whose CEOs do not chair their boards (more shareholder-oriented governance) and in firms whose ex-CEO chair their boards (less shareholder-oriented governance).[17] These findings suggest BOJ equity purchases spur less well-governed firms to expand via capital investment and acquiring other firms. Furthermore, the BOJ's equity purchase policies may aggravate the propensity of ill-governed firms to invest inefficiently (Jensen 1986; Billett et al. 2011).

5.3 Robustness and Discussion

Tables 10 and 11 survive the robustness tests of Section 4.6, including alternative winsorization, firm fixed-effects, only studying data before the doubling of BOJ ETF purchase targets on July 29, 2016, and dropping 2011 and 2012 due to the Fukushima nuclear meltdown and following policy interventions. We also find BOJ purchases do not appear to statistically differentially affect bankruptcy risk significantly for growth firms or firms with better corporate governance.

[17] The CEO or ex-CEO chairing the board is deemed a governance deficiency in these data, as in e.g. Mace (1979). Entrenchment can be mitigated by performance-based CEO pay (Fahlenbrach 2009), but stock and option grants are marginal in Japan (Pan and Zhou 2018). In addition, in analogous regressions, an independent board dummy is insignificant, consistent with conclusion that "in Japan… emphasis is more on externality than independence" (Ferrarini and Marilena 2015, p. 269).

Overall, Tables 10 and 11 and these related results suggest BOJ purchases encourage more investment by firms without highly valuable investment opportunities (market-to-book ratios below one) and by firms less likely to undertake economically efficient investment (less shareholder-oriented corporate governance). These findings are consistent with BOJ equity purchases aggravating overinvestment associated with poor corporate governance – that is, inefficient corporate empire-building (Hayashi 2006).

6. Conclusions

The BOJ's groundbreaking and innovative experiment in large scale and prolonged equity ETF purchases have (1) boosted share valuations of the affected firms and encouraged those firms to issue equity, (2) increased their balance sheets with cash and short-term investments, but (3) not economically significantly increase their capital investment. From January 2011 to March 2018, BOJ equity purchases totalled ¥19.3 trillion (around US$179 billion). Our quarterly point estimates and summary statistics link these to an increase in aggregate investment of ¥1.16 trillion (around US$4 billion), a mere 0.19% cumulative increase in total assets over all 29 quarters, and a thirteen-fold greater ¥15.1 trillion (around US$26 billion) increase in aggregate corporate cash and short-term investment holdings.[18] Our annual results point to a negligible increase in aggregate capital investment, but link the BOJ's purchases of ¥19.3 trillion in shares to aggregate corporate cash accumulations summing to almost ¥10 trillion over the same period. These calculations show BOJ share purchases are ineffective in boosting capital investment, but boost corporate savings and thereby reduce corporate bankruptcy risk.

BOJ share purchases do boost capital investment for firms with few valuable investment opportunities or with weak corporate governance. These findings raise the possibility that, to the extent that BOJ equity purchases boost aggregate capital investment, they encourage capital investment that is more likely to be economically inefficient. By lowering costs of capital and bankruptcy risks, the BOJ's policy may aggravate Japan's ongoing "zombie firm" problem, and

[18] Total cumulative BOJ ETF purchases, ¥19.3 trillion, equal 3.1 % of the aggregate assets of our sample firms (mean assets of ¥373.4 billion/firm ×1,612 firms = ¥602 trillion). Multiplying this by the 0.060 coefficient on quarterly tangible investment in Table 8 puts BOJ ETF-driven aggregate capital investment at 0.19% of aggregate assets, or ¥1.158 trillion. Analogous calculations put BOJ ETF-driven current asset accumulation and cash and short-term securities accumulation at ¥15 trillion and ¥7.257 trillion, respectively. In annual regressions, tangible investment is insignificant and the 0.496 coefficient on cash increases associate BOJ share purchases with ¥9.573 trillion in aggregate corporate cash accumulation.

other central banks emulating this policy might further spread zombification (Banerjee and Hofmann 2018). Zombie firms, whose survival depends on ongoing cost of capital suppression, are associated with low productivity growth, deflationary pressure, and the continued ineffectiveness of monetary stimulus policies (Acharya et al. 2019).

This lesson is important because central banks holding corporate equities on a large scale raises serious issues. First, central banks heavily buying the shares of firms without genuine growth opportunities can misallocate capital. Second, central banks that are major shareholders can cast votes in shareholder meetings. While the BOJ does not vote its shares, a central bank with large equity blocks that opts to cast its voting power could influence CEO selection, CEO pay, and corporate strategies. Equity purchases by a central bank subject to political pressure could project political agendas into corporate boardrooms. If equity purchases gave central banks an additional stimulus tool, offsetting social welfare gains might counter these issues. However, the BOJ's experience suggests this tool has limited power for stimulating aggregate investment.

Bibliography

Acharya, Viral, Tim Eisert, Christian Eufinger & Christian Hirsch. 2019. Whatever It Takes: The Real Effects of Unconventional Monetary Policy. *Review of Financial Studies* 124(2)3366–411

Agarwal, Sumit, Ben Charoenwong & Pulak Ghosh. 2020. Foregone Consumption & Return-Chasing Investments. National University of Singapore Business School *Working Paper*

Banerjee, Ryan & Boris Hofmann. 2018. The Rise of Zombie Firms: Causes & Consequences. *BIS Quarterly Review* September: 67–78.

Barbon, Andrea & Virginia Gianinazzi. 2019. Quantitative Easing & Equity Prices : Evidence from the ETF Program of the Bank of Japan. *Review of Asset Pricing Studies* 9(2)210–55.

Battiston, Stefano, Domenico Delli Gatti, Mauro Gallegati, Bruce Greenwald & Joseph E Stiglitz. 2007. Credit Chains & Bankruptcy Propagation in Production Networks. *Journal of Economic Dynamics & Control* 31(6)2061–84.

Beason, Richard & Dennis Patterson. 2004. *The Japan That Never Was: Explaining the Rise & Decline of a Misunderstood Country*. New York: SUNY Press.

Bernanke, Ben, Mark Gertler & Simon Gilchrist. 1999. The Financial Accelerator in a Quantitative Business Cycle Framework. In *Handbook of Macroeconomics* 1:1341–93. Elsevier.

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

Bharath, Sreedhar T. & Tyler Shumway. 2008. Forecasting Default with the Merton Distance to Default. *Review of Financial Studies* 21(3)1339–69.

Billett, Matthew, Jon Garfinkel & Yi Jiang. 2011. The Influence of Governance on Investment: Evidence from a Hazard Model. *Journal of Financial Economics* 102(3). Elsevier: 643–70.

Blanchard, Olivier J & Lawrence H Summers. 2020. Automatic Stabilizers in a Low-Rate Environment. *PIIE Policy Brief* February.

Caballero, Ricardo J, Takeo Hoshi & Anil K Kashyap. 2008. Zombie Lending & Depressed Restructuring in Japan. *American Economic Review* 98(5)1943–77.

Campbell, John Y., Jens Hilscher & Jan Szilagyi. 2008. In Search of Distress Risk. *Journal of Finance* 63(6)2899–2939.

Cooper, Russell & João Ejarque. 2003. Financial Frictions & Investment: Requiem in Q. *Review of Economic Dynamics* 6(4)710–28.

Di Maggio, Marco, Amir Kermani & Kaveh Majlesi. 2020. Stock Market Returns & Consumption. Journal of Finance, Forthcoming: 1–52.

Dierker, Martin, Jung Wook Kim, Jason Lee & Randall Morck. 2016. Investors' Interacting Demand & Supply Curves for Common Stocks. *Review of Finance* 20(4)1517–47.

Farre-Mensa, Joan & Alexander Ljungqvist. 2016. Do Measures of Financial Constraints Measure Financial Constraints? *Review of Financial Studies* 29(2)271–308.

Ferrarini, G. F., Marilena. (2015). Independent directors and controlling shareholders around the world. In J. Hill & R. Thomas (Eds.), *Research Handbook on Shareholder Power.* (pp. 269): Elgar.

Fresard, Laurent. 2012. Cash Savings & Stock Price Informativeness. *Review of Finance* 16(4)985–1012.

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

Grossman, Sanford J & Joseph E Stiglitz. 1980. On the Impossibility of Informationally Efficient Markets. *American Economic Review* 70(3)393–408.

Handa, Puneet & Robert A Schwartz. 1996. Limit Order Trading. *Journal of Finance* 51(5)1835–61.

Hayashi, Fumio. 1982. Tobin's Marginal q & Average q: A Neoclassical Interpretation. *Econometrica* 50(1)213–24.

Hayashi, Fumio. 2006. The Over-Investment Hypothesis. *Long-Run Growth & Short-Run Stabilization: Essays in Memory of Albert Ando*, no. 12124202: 275–87.

Hennessy, Christopher A, Amnon Levy & Toni M Whited. 2007. Testing Q Theory with Financing Frictions. *Journal of Financial Economics* 83(3)691–717.

Hilscher, Jens & Mungo Wilson. 2017. Credit Ratings & Credit Risk: Is One Measure Enough? *Management Science* 63(10)3414–37.

Honda, Yuzo, Yoshihiro Kuroki & Minoru Tachibana. 2013. An Injection of Base Money At Zero Interest Rates: Empirical Evidence from the Japanese Experience 2001 - 06. *Graduate School of Economics & Osaka School of International Public Policy*, Disc. Paper 07-08: 24.

Hong, Harrison & Jeremy C Stein. 2007. Disagreement & the Stock Market of of Both Theory & Empirical Evidence. *Journal of Economic Perspectives* 21(2)109–28.

Hoshi, Takeo, Satoshi Koibuchi & Ulrike Schaede. 2018. The Decline in Bank-Led Corporate Restructuring in Japan: 1981-2010. *Journal of the Japanese & International Economies* 47, 81–90.

International Monetary Fund. 2017. Japan Financial System Stability Assessment. IMF.

Jain, Prem C. 1987. The Effect on Stock Price of Inclusion in or Exclusion from the S&P 500. *Financial Analysts Journal* 43(1)58–65.

Jensen, Michael C. 1986. Agency Costs of Free Cash Flow, Corporate Finance & Takeovers. *American Economic Review* 76(2)323–29.

Kaplan, Steve & Luigi Zingales. 1997. Do Investment-Cash Flow Sensitivities Provide Useful Measures of Financing Constraints? *Quarterly Journal of Economics* 112(1)169–215.

Kaul, Aditya, Vikas Mehrotra & Randall Morck. 2000. Demand Curves for Stocks Do Slope down: New Evidence from an Index Weights Adjustment. *Journal of Finance* 55(2)893–912.

Kim, E Han & Amiyatosh Purnanandam. 2014. Seasoned Equity Offerings, Corporate Governance & Investments. *Review of Finance* 18(3)1023–57.

Kuroda, Haruhiko. 2013. Quantitative & Qualitative Monetary Easing. *Speech at Yomiuri International Economic Society in Tokyo*

Kuttner, Kenneth N. 2018. Outside the Box: Unconventional Monetary Policy in the Great Recession & Beyond. *Journal of Economic Perspectives* 32(4)121–46.

Lamont, Owen, Christopher Polk & Jesus Saa-Requejo. 2001. Financial Constraints & Stock Returns. *Review of Financial Studies* 14(2)529–54.

Mehrotra, Vikas, Dimitri Van Schaik, Jaap Spronk & Onno Steenbeek. 2011. Creditor-Focused

Corporate Governance: Evidence from Mergers & Acquisitions in Japan. *Journal of Financial & Quantitative Analysis* 46(4)1051–72.

Morck, Randall & Masao Nakamura. 2007. Business Groups & the Big Push: Meiji Japan's Mass Privatization & Subsequent Growth. *Enterprise & Society* 8(3)543–601.

Morck, Randall, Andrei Shleifer & Robert Vishny. 1990. The Stock Market & Investment: Is the Market a Sideshow? *Brookings Papers on Economic Activity* 2: 157–215.

Pinkowitz, Lee, René Stulz & Rohan Williamson. 2006. Does the Contribution of Corporate Cash Holdings & Dividends to Firm Value Depend on Governance? A Cross-Country Analysis. *Journal of Finance* 61(6)2725–51.

Poterba, James M. 2000. Stock Market Wealth & Consumption. *Journal of Economic Perspectives* 14(2)99–118.

Sandas, Patrik. 2001. Adverse Selection & Competitive Market Making: Empirical Evidence from a Limit Order Market. *Review of Financial Studies* 14(3)705–34.

Shleifer, Andrei. 1986. Do Demand Curves for Stocks Slope Down? *Journal of Finance* 41(3)579–90.

Taketa, K., & Udell, G. (2006). Lending Channels & Financial Shocks: The Case of SME Trade Credit & the Japanese Banking Crisis. *Tokyo: Bank of Japan.*

Thomas, Julia K. 2002. Is Lumpy Investment Relevant for the Business Cycle? *Journal of Political Economy* 110(3)508–34.

Tobin, James. 1969. A General Equilibrium Approach To Monetary Theory. *Journal of Money, Credit & Banking* 1(1)15–29.

Whited, Toni M. & Guojun Wu. 2006. Financial Constraints Risk. *Review of Financial Studies* 19(2)531–59.

Tables and Figures

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.
Mar 16, 2020	¥12 trillion/year	Doubled annual ETF purchases to ¥12 trillion to cope with the COVID-19 crisis.

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 annual variables over 6,114 firm-year observations, respectively, except for the corporate governance indicators for the CEO not chairing the board, the chair not being an ex-CEO, and the board being independent, which are available only for Nikkei 225 firms. All figures are rounded to three significant digits, except number of BOJ purchase days, an integer whose mean and standard deviation are rounded to one decimal place. Appendix Tables A1.1 and A1.2 show variable definitions and summary statistics for additional variables used in robustness checks.

Panel A. Daily Variables	**Percentiles**				**Standard**
	25th	**50th**	**75th**	**Mean**	**Deviation**
BOJ Purchases (¥ M)	0.11	0.74	4.22	11.4	61.9
BOJ Purchases (bps of Market Capitalization)	0.03	0.24	1.49	1.53	3.23
Stock return (%)	-1.26	-0.15	0.71	-0.27	2.62

Panel B. Quarterly and Annual Variables	**Quarterly data**				**Std.**	**Annual data**				**Std.**
Quarterly and Annual Tests	**25th**	**50th**	**75th**	**Mean**	**Dev.**	**25th**	**50th**	**75th**	**Mean**	**Dev.**
BOJ Purchases (¥ M)	10.9	40.3	154	324	1,510	32.9	129	491	1,050	5,190
BOJ Purchases (%Assets)	0.02	0.07	0.23	0.33	1.47	0.07	0.24	0.77	1.15	5.23
BOJ No. of Purchase Days	12	19	32	26.5	21.6	26	71	150	86.4	73.4
Accounts Receivable (¥ B)	2.7	9.8	32.7	66.1	329	2.49	9.07	30.2	60.3	307
Book Leverage (%Assets)	8.33	19.2	32.6	22.1	16.6	6.73	17.7	31.5	20.9	16.8
Market-to-Book	0.59	0.88	1.43	1.36	1.94	0.63	0.94	1.53	1.47	2.13
Return on Assets (%)	1.46	3.02	5.12	3.20	5.34	4.15	9.66	17.7	11.8	19.5
Stock Return (%)	-5.54	2.59	12.7	5.25	22.0	-4.17	9.44	28.3	17.2	42.6
Tangible Capital (¥ B)	4.8	15.1	51.1	128	557	4.48	13.9	46.8	120	546
Total Assets (¥ B)	19.6	55.1	166	373	1,640	18.8	51.3	152	344	1,530
ΔAccounts Receivable (%Assets)	-0.60	0.00	1.00	0.23	5.20	-0.60	0.00	1.50	0.57	6.72
ΔTangible Capital (%Assets)	-0.31	-0.03	0.45	0.29	13.4	-0.66	0.05	1.42	0.96	24.5
ΔTotal Assets (%)	-1.81	0.81	3.79	1.39	8.40	-1.44	2.78	8.05	4.52	15.5
Quarterly Tests Only										
Altman Manufacturing Z-Score	1.80	2.49	3.36	2.90	2.13					
Altman Non-Manufacturing Z-Score	1.87	3.41	5.38	4.18	4.17					
Bharath-Shumway Default Prob.	0.00	0.00	0.00	0.07	2.33					
Campbell et al. Default Prob.	0.00	0.00	0.00	0.11	0.31					
Cash & Short-term Investment (¥ B)	2.5	7.3	22.0	43.8	267					
CEO Does Not Chair Board Indicator	0.00	0.00	1.00	0.38	0.48					
Chair is Ex CEO Indicator	0.00	0.00	1.00	0.29	0.45					
Current Assets (¥ B)	9.8	28.2	86.9	159	642					
Interest Coverage Ratio	4.89	18.8	64.7	110	447					
Inventory (¥ B)	1.5	5.8	20.9	37.7	133					
ΔCash & ST Investment (%Assets)	-1.30	0.11	1.70	0.60	31.2					
ΔCurrent Assets (%Assets)	-1.70	0.49	3.03	1.01	8.15					
ΔInventory (%Assets)	-0.52	0.05	0.80	0.21	4.30					
Annual Tests Only										
Cash (¥ B)						2.39	6.93	20.5	33.9	135
Research & Development (¥ B)						0.14	0.62	2.76	9.52	53.1
Short-term Investment (¥ B)						0.00	0.00	0.10	7.26	74.8
ΔCash (%Assets)						-1.39	1.04	5.37	5.92	31.2
ΔResearch & Development (%Assets)						-0.07	0.03	0.28	0.42	3.62
ΔShort-term Investment (%Assets)						0.00	0.00	0.00	0.17	10.2

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, which 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 autocorrelation up to 5 lags, boldface indicating significance at 5% or better. Panel B presents panel regressions explaining how fixed-effects clarify the relation between $r_{i,t}$, stock i's return on day t, and $BOJ_{i,t}$, BOJ-driven ETF demand for stock i on day t, scaled by firm i's prior month market capitalization. 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: (as %)	$r_t^{BOJ} - r_t^{non-BOJ}$		$r_t^{non-BOJ}$	r_t^{BOJ}
	(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: (as %)	$r_{i,t}$			
	(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 summarizes firm-day panel regressions associating BOJ purchases with positive cumulative log returns over successively longer trading day windows, their start and end points indicated in square brackets, around BOJ purchase date, t. The explanatory variable $BOJ_{i,t}$ is BOJ-driven ETF demand for stock i, as a fraction of firm i's prior month market capitalization, on trading day t. 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. External Financing

This table summarizes regressions explaining 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 (5B.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 A1 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
	(5A.1)	(5A.2)	(5A.3)	(5A.4)	(5A.5)	(5A.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)
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
	(5B.1.1)	(5B.1)	(5B.3)	(5B.4)	(5B.4)	(5B.5)	(5B.6)
$\left.\frac{\Delta M_{i,q}}{B_{i,q-1}}\right\vert BOJ_{i,q}$		**0.038**	**0.025**	**0.024**	-0.006	-0.004	-0.004
		(0.010)	**(0.000)**	**(0.000)**	(0.475)	(0.109)	(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 6. 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. All explained variables are scaled by prior fiscal-period-end total assets except (6A.1.1), (6B.1.1), which explain raw percentage returns. 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-fiscal period fixed-effects. Regressions 6A.1.1 and 6B.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 A1 provides detailed variable definitions; Appendix 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
	(6A.1.1)	(6A.1)	(6A.2)	(6A.3)	(6A.4)	(6A.5)	(6A.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
	(6B.1.1)	(6B.1)	(6B.2)	(6B.3)	(6B.4)	(6B.5)	(6B.6)
$BOJ_{i,y}$	0.340 (0.342)	**0.226 (0.090)**	0.005 (0.662)	**0.084 (0.096)**	-0.006 (0.699)	0.004 (0.430)	0.020 (0.469)
Observations	6,114	6,114	6,114	6,114	6,114	3,543	6,114
R^2	0.387	0.357	0.353	0.322	0.379	0.238	0.343

Table 7. 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 (7A.1) and (7B.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 also include 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 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 7A.1.1 and 7B.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.

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
	(7A.1.1)	(7A.1)	(7A.2)	(7A.3)	(7A.4)	(7A.5)	(7A.6)
$\left.\frac{\Delta M_{i,q}}{B_{i,q-1}}\right\vert BOJ_{i,q}$		**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
	(7B.1.1)	(7B.1)	(7B.2)	(7B.3)	(7B.4)	(7B.5)	(7B.6)
$\left.\frac{\Delta M_{i,y}}{B_{i,y-1}}\right\vert BOJ_{i,y}$		**1.335**	0.027	**0.496**	-0.034	0.027	0.117
		(0.040)	(0.651)	**(0.065)**	(0.695)	(0.449)	(0.475)
$BOJ_{i,y}$	**0.169**						
	(0.003)						
Observations	6,114	6,114	6,114	6,114	6,114	3,543	6,114
R^2	0.501	-1.084	0.350	-0.051	0.377	-0.275	0.247

Table 8. Changes in Company Bankruptcy Risk

This table associates BOJ share purchases with reduced bankruptcy risk. Alternative bankruptcy risk measures include *interest coverage ratios* (EBIT over interest, Altman's (1968) Z-Score for manufacturing, Altman's (2001) Z-score for non-manufacturing sector firms, Bharath and Shumway's (2008) default probabilities, and Campbell et al. (2008) distress measures. Quarterly OLS regressions explain quarterly first differences in bankruptcy risk with $BOJ_{i,q}$, total BOJ-driven ETF purchases of firm i's shares in quarter q, accounting for firms entering or leaving indexes. Regressions explaining manufacturing and non-manufacturing Altman z-scores use subsamples of manufacturing (1-digit SIC 2 or 3) and non-manufacturing (all other SICs) firms, respectively. All regressions also include control variables: lagged changes in each of market-to-book, return on assets, log total assets and book leverage as well as SIC4-by-fiscal period fixed-effects. All regressions cluster by firm. Numbers in parentheses are p-values with boldface indicating significance at 10% or better.

Explained variable:	ΔInterest Coverage Ratio	ΔAltman Z-Score Manufacturing	ΔAltman Z-Score Non-Manufacturing	ΔBharath-Shumway Default Probability	ΔCampbell et al. Distress Measure
	(8.1)	(8.2)	(8.3)	(8.4)	(8.5)
$BOJ_{i,q}$	2.227 (0.176)	**0.028** **(0.033)**	**0.050** **(0.057)**	**-0.104** **(0.022)**	-0.009 (0.185)
Observations	38,755	21,230	17,525	38,755	38,755
R^2	0.287	0.427	0.229	0.098	0.326

Table 9. Corporate Actions by Low- versus High Market-to-Book Firms

This table presents quarterly (Panel A) and annual (Panel B) OLS regression explaining changes in the components of firms' assets with $BOJ_{i,\bullet}$, total BOJ share purchases in the fiscal period, adjusting for firms entering or leaving indexes within the period, an indicator variable $1_{i,\bullet}^{M/B_{i,\bullet-1}>1}$ flagging growth firms as those with market-to-book ratios above one the previous fiscal quarter or year, and their interaction. All explained variables are scaled by prior fiscal-period-end total assets except returns in (9A.1.1) and (9B.1.1), which explain raw percentage returns. All regressions also include control variables: lagged changes 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 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.

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
	(9A.1.1)	(9A.1)	(9A.2)	(9A.3)	(9A.4)	(9A.5)	(9A.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
	(9B. 1.1)	(9B.1)	(9B.2)	(9B.3)	(9B.4)	(9B.5)	(9B.6)
$1_{i,y}^{M/B_{i,,y-1}>1}$	**6.755** **(0.000)**	**3.812** **(0.000)**	**0.815** **(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)**	**0.200** **(0.054)**	-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)**	**-0.210** **(0.045)**	0.150 (0.316)	-0.037 (0.717)	0.007 (0.743)	**-0.140** **(0.010)**
Observations	6,114	6,114	6,114	6,114	6,114	3,543	6,114
R^2	0.390	0.366	0.359	0.324	0.379	0.241	0.346

Table 10. Corporate Actions by Corporate Governance Indicators

This table explains changes in the components of firms' assets using quarterly data. The sample includes Nikkei 225 firms. OLS regression on $BOJ_{i,q}$, total BOJ purchases in the fiscal period, CG is a corporate governance indicator set to one if the CEO does not chair the board, an ex-CEO chairs the board, and a majority of directors is nominally independent in Panels A, B and C, respectively, and to zero otherwise. These variables are available for Nikkei 225 firms only. All explained variables are scaled by prior fiscal-period-end total assets. All regressions also include control variables: lagged changes market-to-book, return on assets, log total assets and book leverage and SIC4-by-fiscal period fixed-effects. All regressions cluster by firm. Numbers in parentheses are p-values with boldface indicating significance at 10% or better.

Panel A: $CG_{i,q}$ = 1 if the CEO Does Not Chair the Board and Zero Otherwise

Explained Variable:	ΔTotal Assets (10A.1)	ΔTangible Capital (10A.2)	ΔCurrent Assets (10A.3)	ΔCash & Short-Term Investments (10A.4)	ΔGoodwill (10A.5)
$CG_{i,q}$	0.237 (0.400)	**0.249** **(0.023)**	-0.017 (0.925)	-0.057 (0.652)	0.037 (0.418)
$BOJ_{i,q}$	**3.093** **(0.002)**	**0.864** **(0.004)**	**1.444** **(0.038)**	0.815 (0.133)	**0.306** **(0.080)**
$BOJ_{i,q} \times CG_{i,q}$	**-1.787** **(0.074)**	**-0.722** **(0.024)**	-0.557 (0.452)	-0.352 (0.575)	**-0.339** **(0.081)**
Observations	4,517	4,517	4,517	4,517	4,517
R^2	0.726	0.470	0.717	0.672	0.704

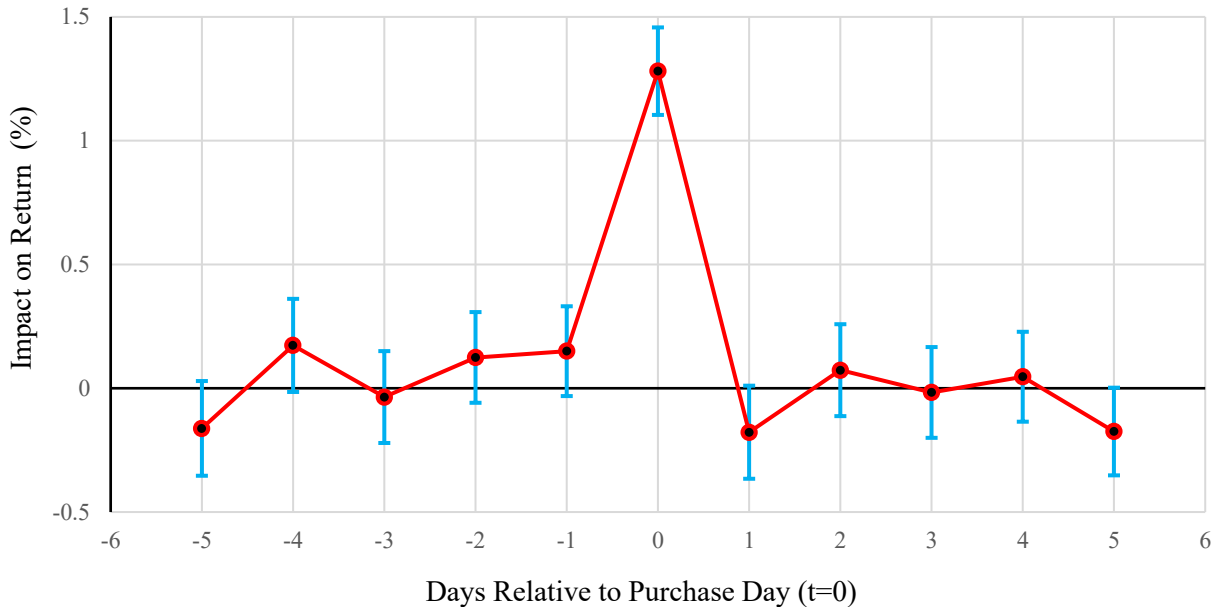
Panel B: $CG_{i,q}$ = 1 if an ex-CEO Chairs the Board and Zero Otherwise

Explained Variable:	ΔTotal Assets (10B.1)	ΔTangible Capital (10B.2)	ΔCurrent Assets (10B.3)	ΔCash & Short-Term Investments (10B.4)	ΔGoodwill (10B.5)
$CG_{i,q}$	**-0.533** **(0.065)**	**-0.340** **(0.002)**	-0.115 (0.496)	-0.015 (0.914)	-0.057 (0.241)
$BOJ_{i,q}$	1.285 (0.148)	0.119 (0.382)	0.902 (0.118)	0.485 (0.167)	-0.033 (0.781)
$BOJ_{i,q} \times CG_{i,q}$	**1.645** **(0.097)**	**0.817** **(0.011)**	0.316 (0.644)	0.127 (0.827)	**0.329** **(0.098)**
Observations	4,517	4,517	4,517	4,517	4,517
R^2	0.726	0.472	0.716	0.672	0.704

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

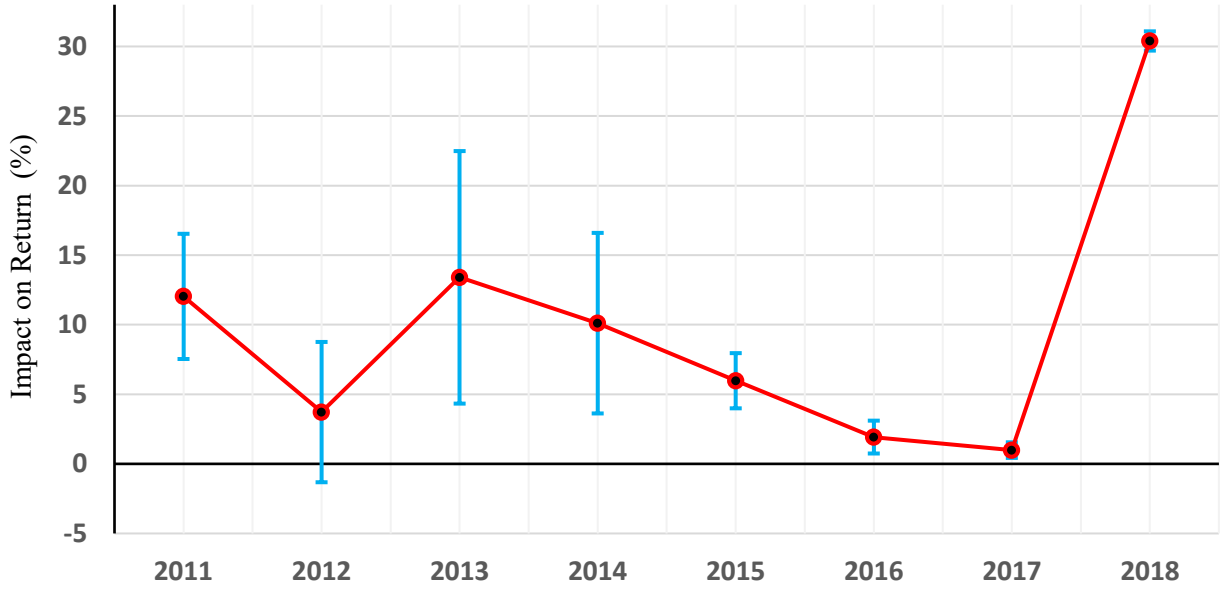
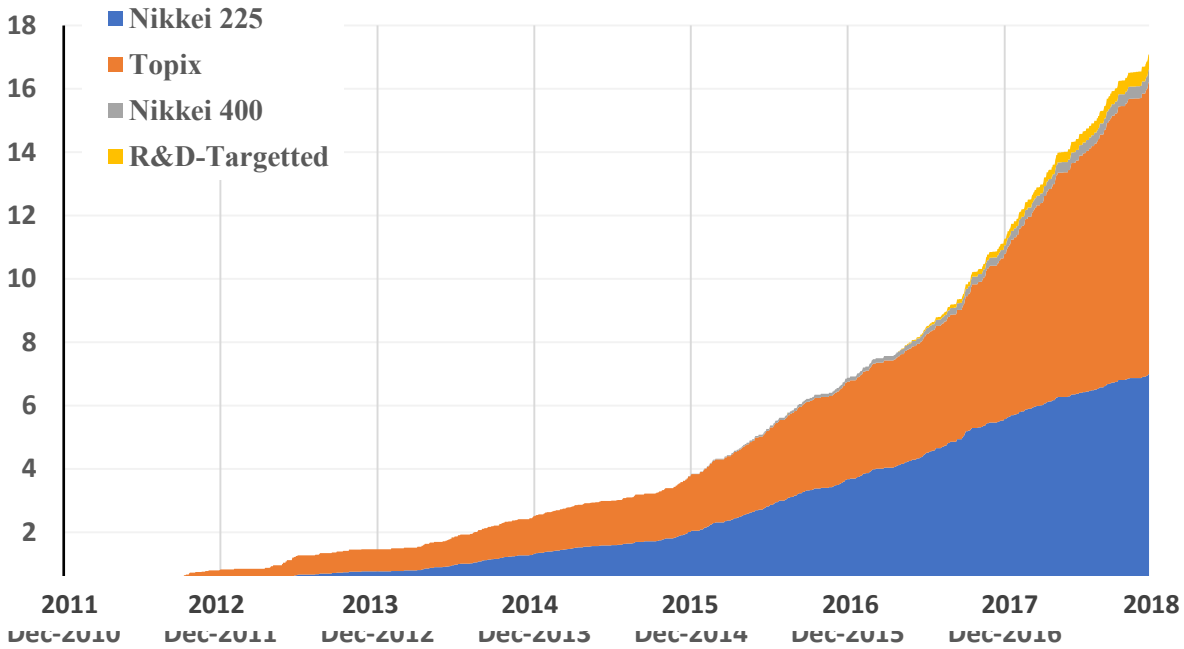
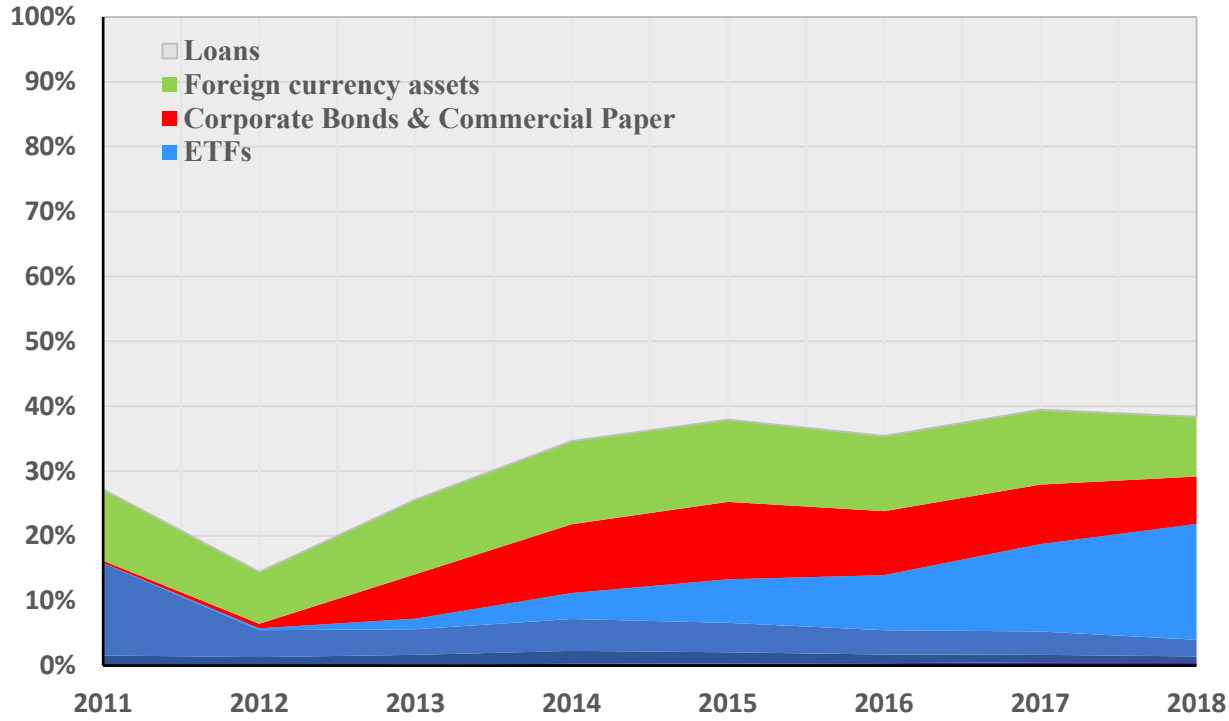


Figure 2. Amount of BOJ ETF Purchases and Returns

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



Bank of Japan Equity Purchases: The (Non-)Effects of Extreme Quantitative Easing, Online Appendix

Ben Charoenwong, Randall Morck & Yupana Wiwattanakantang

A. Appendix: Robustness and Additional Empirical Details

This section (1) provides detailed definitions of variables, including those used in robustness checks, (2) shows summary statistics for all variables used in our main results and in the robustness tests below, (3) reproduces the tables in the paper including the coefficients and significance levels of all control variables, and (4) presents and discusses the robustness test results. All untabulated robustness checks are available upon request.

A.1 Variable Definitions and Summary Statistics

The two tables below provide detailed variable definitions and summary statistics. Appendix Table A.1.1 shows variable definitions with the corresponding Thomson Reuters WorldScope data codes. Appendix Table A.1.2 provides summary statistics for all variables used in our empirical analyses, including the following robustness tests for the calculations of the economic significance and aggregate implications of the BOJ equity ETF purchasing policy.

Appendix Table A1.1 Definitions of Corporate Action and Securities Issuance Variables

Variable	Definition (including Thompson-Reuters WorldScope data codes)
Altman Manufacturing Z-Score	Constructed as in Altman (1968) with lower values indicating highest likelihood of bankruptcy
Altman Non-Manufacturing Z-Score	Constructed as in Altman (2001) adapted to non-manufacturing firms with lower values indicating highest likelihood of bankruptcy
Bharath-Shumway Default Probability	Constructed as in Bharath-Shumway (2008) with higher values indicating highest likelihood of bankruptcy
Campbell et al. Default Risk	Constructed as in Campbell et al. (2008) using coefficients reported in Column (1) of Table IV from the logistic model in equation (1) of the paper, with higher values indicating greater default risk
Corporate governance indicator variable (I^{CG})	In alternative specifications, indicator variable set to one if CEO does not chair the board, the chair is an ex CEO, or the board is nominally independent and set to zero otherwise in each case. Available only for Nikkei 225 firms
Debt Issuance Indicator ($1^{D}_{i,q}$)	Derived from total long-term debt outstanding (WC03251A): 1 if the firm's long-term debt strictly increased in the quarter, 0 otherwise.
Interest Coverage Ratio	EBIT divided by interest expenses
Kaplan-Zingales Measure	Calculated from coefficients in equation 13 in Section 1.4 of Whited and Wu (2006). Cash dividends is from WC04551 and total capital is total liability (WC03351) minus shareholder's book equity (WC06798)
Net Issuance	Amount of Seasoned Equity Issue multiplied by ,over lagged assets, as (%)
Seasoned Equity Issue Indicator ($1^{SEO}_{i,q}$)	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.
Stock Return	Quarterly stock returns accounting for dividends.
Whited-Wu Index	Calculated from coefficients in equation 14, Section 1.4 of Whited & Wu (2006).
ΔAccounts Receivable	Change in accounts receivable (WC08131A) over lagged assets, as %
Δ*Book Leverage*	Change in book long-term debt (WC08236A) over lagged assets, as %
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*Goodwill*	Change in goodwill (WC06693A) over lagged assets, as (%)
Δ*Inventory*	Change in inventory (WC02101A) over lagged assets, as (%)
Δ*Long-term Debt*	Change in total long-term debt, average maturity ≥ 1 yr. (WC03251A) 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*Research & Development*	Change in research and development spending (WC01201) over lagged assets, as % (annual only)
Δ*Return on Assets* (*ROA*)	Change in earnings before interest, taxes, depreciation and amortization (EBITDA) over lagged assets (WC08326A), as %
Δ*Short-Term Investments*	Change in holdings of marketable securities (WC02008) over lagged assets, as % (annual only)
Δ*Tangible Capital*	Change in property, plant and equipment (WC02501A, WC02501) over lagged assets, as %
Δ*Total Assets*	Change in assets (WC02999A) over lagged assets, as %

Appendix Table A1.2 Detailed Summary Statistics

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 monthly variables for 173,391 firm-month observations. Panel C presents summary statistics of quarterly fundamental variables for 42,919 firm-quarter observations, with the exception of the Whited-Wu Index which has data for 41,232 firm-quarter observations due to some missing dividend data, riskiness variables for 38,755 firm-quarter variables due to some missing non-headline financial statement data, and corporate governance for 4,517 firm-quarter observations for firms within the Nikkei 225 due to data availability; and, Panel D presents summary statistics of yearly variables for 6,119 firm-year observations, except for R&D spending which covers 3,543 firm-year observations because its disclosure is not mandatory (and we do not impute values). The variables are as defined in Table A1. All figures are rounded to three significant digits, except for the number of BOJ purchase days, which is an integer whose mean and standard deviation are rounded to one decimal place.

Panel A. Daily Variables

	25th	Median	75th	Mean	Std. Dev.
BOJ Purchases (¥ M)	0.11	0.74	4.22	11.38	61.9
BOJ Purchases/market cap (bps) (b.p.)	0.03	0.24	1.49	1.53	3.23
Stock return (%)	-1.26	-0.15	0.71	-0.27	2.62

Panel B. Monthly Variable

	25th	Median	75th	Mean	Std. Dev.
BOJ Purchases (¥ M)	3.14	12.0	47.4	110	540
BOJ Purchases/market cap (bps) (b.p.)	1.57	4.75	14.2	14.7	27.8
Stock return (%)	-3.74	0.65	5.56	1.63	12.4
Monthly Volatility (%)	5.65	8.11	11.7	9.74	7.09
Monthly Upside Volatility (%)	3.24	5.03	7.96	6.85	7.01
Monthly Downside Volatility (%)	2.95	4.53	6.92	5.64	4.49

Panel C. Quarterly Variables

	25th	Median	75th	Mean	Std. Dev.
BOJ Purchases (¥ M)	10.9	40.3	154	324	1,510
BOJ Purchases (% of Assets)	0.02	0.07	0.23	0.33	1.47
BOJ No. of Purchase Days	12	19	32	26.5	21.6
Accounts Receivable (¥ B)	2.7	9.8	32.7	66.1	329
Altman Manu. Z-Score	1.80	2.49	3.36	2.90	2.13
Altman Non-Manu. Z-Score	1.87	3.41	5.38	4.18	4.17
Bharath-Shumway Probability	0.00	0.00	0.00	0.07	2.33
Book Leverage (% of Assets)	8.33	19.2	32.6	22.1	16.6
Buyback Amount (¥ B)	0.0	0.0	0.0	0.0	0.1
Campbell et al. Default Risk.	0.00	0.00	0.00	0.11	0.31
Cash & Short-term Investment (¥ B)	2.5	7.3	22.0	43.8	267
Current Assets (¥ B)	9.8	28.2	86.9	159	642
Debt Issuance Indicator	0.00	0.00	1.00	0.43	0.50
Ex-CEO is Chair	0.00	0.00	1.00	0.29	0.45
Interest Coverage Ratio	4.89	18.8	64.7	110	447
Inventory (¥ B)	1.5	5.8	20.9	37.7	133
Kaplan-Zingales Index	5.75	48.2	97.0	40.1	118
Market-to-Book	0.59	0.88	1.43	1.36	1.94
CEO is Not Chair	0.00	0.00	1.00	0.38	0.48
Net Issuance (%of Assets)	0.00	0.00	0.00	0.00	0.16
Net Issuance (¥ B)	-0.0	0.0	0.0	0.0	2.8
Return on Assets (%)	1.46	3.02	5.12	3.20	5.34

Sales (¥ B)	5.0	14.5	47.0	82.1	296
Secondary Equity Issuance Indicator	0.00	0.00	0.00	0.07	0.25
Stock Return (%)	-5.54	2.59	12.7	5.25	22.0
Tangible Capital (¥ B)	4.8	15.1	51.1	128	557
Total Assets (¥ B)	19.6	55.1	166	373	1,640
Whited-Wu Index	-0.57	-0.51	-0.45	-0.51	0.11
Δ Accounts Receivable (% of Assets)	-0.60	0.00	1.00	0.23	5.20
ΔAltman Manu. Z-Score	-0.08	0.01	0.12	0.02	0.58
ΔAltman Non-Manu. Z-Score	-0.13	0.04	0.22	0.05	1.02
ΔBharath-Shumway Probability (%)	0.00	0.00	0.00	0.08	2.38
ΔCash & ST Investment (% of Assets)	-1.30	0.11	1.70	0.60	31.2
ΔCurrent Assets (% of Assets)	-1.70	0.49	3.03	1.01	8.15
ΔInterest Coverage Ratio(%)	-10.5	0.89	15.2	5.48	353
ΔInventory (% of Assets)	-0.52	0.05	0.80	0.21	4.30
ΔSales (%)	-6.66	1.63	10.6	6.52	109
ΔTangible Capital (% of Assets)	-0.31	-0.03	0.45	0.29	13.4
ΔTotal Assets (% of Assets)	-1.81	0.81	3.79	1.39	8.40

Panel D. Annual Variables

	25th	Median	75th	Mean	Std. Dev.
BOJ No. of Purchase Days	26	71	150	86.4	73.4
BOJ Purchases (¥ M)	32.9	129.3	490.6	1,050	5,190
BOJ Purchases/assets (%)	0.07	0.24	0.77	1.15	5.23
Accounts Receivable (¥ B)	2.49	9.07	30.2	60.3	307
Book Leverage (%of Assets)	6.73	17.7	31.5	20.9	16.8
Cash & Short-term Investment (¥ B)	2.53	7.24	21.5	41.7	248
Cash (¥ B)	2.39	6.93	20.5	33.9	135
Current Assets (¥ B)	9.51	26.9	82.7	150	613
Employees	516	1,390	4,410	6,840	23,100
Inventory (¥ B)	1.4	5.4	19.8	35.6	131
Market-to-Book	0.63	0.94	1.53	1.47	2.13
R&D Expenses (¥ B)	0.14	0.62	2.76	9.52	53.1
Return on Assets (%)	4.15	9.66	17.7	11.8	19.5
Sales (¥ B)	13.7	42.3	143	268	1,040
Short-term Investments (¥ B)	0.00	0.00	0.10	7.26	74.8
Stock Return (%)	-4.17	9.44	28.3	17.2	42.6
Tangible Capital (¥ B)	4.5	13.9	46.8	120	546
Total Assets (¥ B)	18.8	51.3	152	344	1,520
Δ Accounts Receivable (% of Assets)	-0.60	0.00	1.50	0.57	6.72
Δ Short-term Investments (% of	0.00	0.00	0.00	0.17	10.2
ΔCash & ST Investment (% of Assets)	-1.33	0.50	2.85	1.86	56.9
ΔCash (% of Assets)	-1.39	1.04	5.37	5.92	31.2
ΔCurrent Assets (% of Assets)	-1.24	1.71	5.62	3.13	13.8
ΔEmployees (%)	-0.81	1.78	5.99	5.97	44.5
ΔInventory (% of Assets)	-0.56	0.12	1.21	0.64	7.18
ΔR&D Expenses (% of Assets)	-0.07	0.03	0.28	0.42	3.62
ΔSales (%)	-8.12	3.84	26.9	27.4	805
ΔTangible Capital (% of Assets)	-0.66	0.05	1.42	0.96	24.5
ΔTotal Assets (% of Assets)	-1.44	2.78	8.05	4.52	15.52

A.2 Full Tables of Main Results

This section reproduces the tables in the paper including the coefficients and significance levels of all control variables. These are omitted in the main tables to conserve space.

Appendix Table A2. Share Issuances – Full Table

The table reproduces Table 5 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. Appendix Table A1 provides detailed variable definitions.

Explained Variable:	Seasoned equity offering indicator $1_{i,q}^{SEO}$			Debt Issuance indicator $1_{i,q}^{D}$		
Model:	Linear	Probit	Logit	Linear	Probit	Logit
	(5A.1)	(5A.2)	(5A.3)	(5A.4)	(5A.5)	(5A.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)
$\Delta Book\ Leverage_{i,q-}$	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 5 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 5B.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. Appendix Table A1 provides detailed variable definitions.

Explained Variable:	$\Delta M_q / B_{q-1}$	SEO			Debt Issuance		
Model:	First Stage (5B.1.1)	Linear (5B.1)	Probit (5B.3)	Logit (5B.4)	Linear (5B.4)	Probit (5B.5)	Logit (5B.6)
$\Delta M_q/B_{q-1} \mid BOJ_{i,q}$		**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 6. Regressions use BOJ purchases to explain quarterly 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 6A.1. 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. Appendix Table A1 provides detailed variable definitions.

Explained Variable:	Returns (6A.1.1)	ΔTotal Assets (6A.1)	ΔTangible Capital (6A.2)	ΔCurrent Assets (6A.3)	ΔCash & Short-Term Investments (6A.4)	ΔInventory (6A.5)	ΔAccounts Receivable (6A.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 6. 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 6B.1.1. 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. Appendix Table A1 provides detailed variable definitions.

Explained Variable:	Returns	ΔTotal Assets	ΔTangible Capital	ΔCash	ΔShort-Term Investments	ΔR&D	ΔAccounts Receivable
	(6B.1.1)	(6B.1.1)	(6B.1)	(6B.2)	(6B.3)	(6B.6)	(6B.7)
$BOJ_{i,y}$	0.340 (0.342)	**0.226** **(0.090)**	0.005 (0.662)	**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)**	**-0.007** **(0.021)**	-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)	0.001 (0.921)	-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)**	**5.319** **(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)	**0.001** **(0.932)**	**0.048** **(0.021)**	0.003 (0.756)	-0.002 (0.424)	-0.023 (0.079)
Observations	6,114	6,114	6,114	6,114	6,114	3,543	6,114
R^2	0.387	0.357	0.353	0.322	0.379	0.238	0.343

A.3 Robustness Tests

A series of robustness tests generate qualitatively similar results to those in the main tables. By this, we mean they produce the same pattern of signs and statistical and economic significance. Selected robustness checks are tabulated below. All robustness checks are available in tabulated form upon request.

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

Firm fixed-effects. Including firm fixed-effects yields qualitatively similar results. This eliminates time-invariant firm-level latent factors as possible alternative explanations of our findings. Firm-specific latent variables include head office location, corporate management traditions, stable shareholders, keiretsu membership, constant growth trends, and other variables. For example, a firm's long-run trend growth, and hence the expansion of its balance sheets, could correlate with its weight in the BOJ purchase basket because the indexes select rapidly growing firms or, if growth correlated with size, larger firms. Re-estimating all our quarterly and annual regression results (untabulated) including firm-fixed-effects, preserves the results in the tables. BOJ purchases remain correlated with asset expansion reflecting economically significant short-term assets accumulation and economically insignificant tangible investment.

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, BOJ share purchases in the earlier sub-period elicit larger price gains, upside returns volatility increases, downside returns volatility decreases, and total assets increases. However, the composition of the balance sheet expansion is similar to our main results: 81% is current assets accumulation and about 40% is cash and short-term investments accumulation.

Other major government interventions. Our findings are robust to excluding 2011 and 2012, when an earthquake, tidal wave and nuclear incident necessitated unusually high government spending in Fukushima and other areas of Japan. Untabulated regressions excluding

these years show results quantitatively and qualitatively similar to those in the tables.[19]

Issuance amounts. If BOJ ETF purchases increase firms' share prices, share buybacks should be less attractive means of disbursing cash to shareholders. Regressions A6.4, A6.5, and A6.6 in Appendix Table A6, analogous to those in Table 5, show that firms are less prone to repurchasing shares as BOJ-driven ETF purchases of their shares rise. Regression A6.1 in Table A6 also shows that BOJ-driven ETF purchases, despite being related to more secondary equity offerings, are unrelated to net equity issuance amount scaled by lagged total assets. This is because although firms increase SEOs along the extensive margin, conditional on raising more equity, firms may issue more or less.

Allowing a longer response period for external financing. Firms might take more than one quarter to tap increased external financing in response to the BOJ interventions. Tables A7A and A7B revisit Table 5 permitting responses across two and three quarters, respectively. The results are stronger—the estimated coefficients on equity and debt issuance are larger. The R^2 measure of fit on the regressions using one quarter and two quarter lags increases when compared to the contemporaneous results. Appendix Table A8 shows the horserace between contemporaneous and lagged terms and indicates that the effect on equity issuance is due to the contemporaneous BOJ purchases. BOJ-driven ETF purchases, insignificantly associated with debt issuances in the main results, become negatively associated with debt issuances another period on. One interpretation of this finding is that major equity issuances one period obviate the need for debt issuances the next period. Allowing longer delays for corporate actions (untabulated) leaves our results unchanged: larger BOJ equity purchases are related to economically significantly greater growth in assets, current assets, and cash and short-term investment, but not capital investment, over the current and subsequent quarters combined.

Industry focus. Policymakers may also be more concerned about corporate investment and growth in certain sectors such as manufacturing, construction, or real estate. Appendix Table A9 therefore presents regressions allowing BOJ-driven share purchase to have different coefficients for firms in those sectors. Panel A, using quarterly data, links greater BOJ purchases of manufacturing firms shares with expansions in tangible assets, current assets, cash holding,

[19] Repeating the construction, manufacturing, and real estate sector analyses excluding 2011 and 2012 generates quantitatively similar results.

inventory, and good will. However, all the results disappear in the annual data regression analysis in Panel B. Appendix Figure A2 shows estimated coefficients for individual major corporate sectors, suggesting that increased BOJ equity purchases associates 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.

Employment and sales growth. Rather than investing in more capital, firms might employ more workers. We therefore estimate regressions (not shown) of the same form as those in Table 6, explaining firm employment growth and sales growth. Employee growth is defined as change in employees over lagged employees, which is only available annually. BOJ-driven ETF purchases attract a positive and statistically significant coefficient of 0.329 ($p = 0.01$) in explaining employment growth. In regressions of the form of Table 6, explaining quarterly and annual sales growth, the coefficients are 1.30 (p =0.04) and 0.078 (p=0.07) respectively.

This result suggests that the BOJ's equity purchases might 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 employment increase is about 0.02 standard deviations and the sales increase is less than 0.01 standard deviations. Second, both sets of results do not survive the battery of robustness checks as shown in the Appendix tables. The sign actually flips in regressions analogous to those in Tables A9, which include interactions of BOJ-driven ETF demand with construction and manufacturing sector dummies. In these, BOJ purchases of a construction firm's shares are actually associated with statistically significant decreases in its employment. A BOJ's 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.

Nikkei 225 firms. Stocks' weights in indexes and in the BOJ's purchase basket, though determined mechanically, may be correlated with firm characteristics. TOPIX weights depend on firms' public floats, and thus on firm size. The JPX-Nikkei 400 also uses public floats, but caps firm's weights at 1.5% and thus value-weights small firms but equal-weights large firms, and also uses performance and corporate governance criteria to select which firms are included in this index. The Nikkei 225 uses price weights, rather than market value weights, but includes large and prominent firms. Moreover, Nikkei 225 price weights change with stock prices, and thus with

market-to-book ratios and their correlates. Nonetheless, the cross sectional variation in BOJ purchase weights among Nikkei 225 stocks may be less endogenous in some contexts. 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 Table A10, which revisits the tests in Table 4 using Nikkei 225 stocks, associates positive one-day price impact point estimates with BOJ purchases. However these are statistically insignificant, perhaps because of the smaller sample size. In two-day and longer windows, the price impact is positive and significant, larger in magnitude than in Table 4, and exhibits a comparable partial reversal after the second day.

Appendix Table 11 revisits the quarterly tests in Tables 5 through 7 using Nikkei 225 firms only. Regression A11.1.1 associates quarterly BOJ-driven ETF purchases shares worth one percent of assets with a 1.5% higher stock return, roughly the same point estimate as in the full sample, but statistically insignificant in this smaller sample. Regressions A11.1 through A11.3 associate BOJ purchases of Nikkei 225 stocks with secondary equity issuances, though only the linear probability model does so significantly. As in the full sample, debt issues appear unaffected in regressions A11.4 through A11.6. As with the return effects, the corporate policy changes are larger than in the full sample: BOJ stock purchase worth one percent of assets increases total assets by 1.8%, of which over 60% is increased current assets, of which 55% is increased cash and short-term holdings. Less than 18% of the increase in assets is capital investment. The point estimate on increase in tangible assets in A11.8 is 0.32, which – though larger than the 0.023 point estimate in regression 6A.2 – is nonetheless an economically insignificant 5% of its standard deviation in the Nikkei 225 subsample. Also echoing the tables, regressions using annual data for Nikkei 225 firms associate BOJ share purchases with significant increases in assets ($\xi = 0.135$, $p = 0.067$); no statistically significant increase in tangible capital; and significant cash accumulation ($\xi = 0.783$, $p = 0.038$). Overall, the Nikkei 225 results affirm the full sample results, though with reduced statistical significance in some cases. BOJ ETF purchases increased share prices, induced more equity but not debt financing, and showed a balance sheet expansion which overwhelmingly reflects higher current assets, most notably cash and short-term investments.

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) analyse share buybacks and use the same specifications. Regressions (6) and (7) analyse 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. Appendix Table A1 provides detailed variable definitions.

Explained Variable:	Net Equity Issued over Lagged Total Assets (%)	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)
$BOJ_{i,q}$	**0.00002**	**0.057**	0.497	**-0.015**	**-0.080**	**-0.009**	**-0.010**	**-0.011**
	(0.035)	**(0.027)**	(0.393)	**(0.016)**	**(0.038)**	**(0.004)**	**(0.055)**	**(0.008)**
$\Delta M/B_{i,q-1}$	-0.00000	**-0.005**	**-0.520**	**0.004**	0.006	**0.0005**	0.0003	0.0003
	(0.197)	**(0.004)**	**(0.055)**	**(0.004)**	(0.393)	**(0.001)**	(0.568)	(0.573)
$\Delta ROA_{i,q-1}$	-0.00000	**-0.006**	-0.768	**0.005**	-0.007	**0.002**	-0.0001	-0.0001
	(0.407)	**(0.007)**	(0.001)	**(0.006)**	(0.370)	**(0.001)**	(0.814)	(0.836)
$\Delta Total\ Assets_{i,q-1}$	**0.0001**	1.045	**30.785**	-0.354	**0.333**	**-0.042**	0.037	0.035
	(0.001)	(0.319)	**(0.000)**	(0.270)	**(0.249)**	**(0.038)**	(0.152)	(0.179)
$\Delta Book\ Leverage_{i,q-1}$	0.00000	**0.004**	-0.155	**-0.004**	**-0.003**	**-0.001**	**-0.001**	-0.001
	(0.541)	**(0.006)**	(0.394)	**(0.005)**	**(0.646)**	**(0.001)**	**(0.094)**	(0.115)
Log (Sigma)			**3.507**		**1.142**			
			(0.000)		**(0.000)**			
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.391	0.349	0.005	0.478	0.0003	0.414	0.044	0.045

Appendix Table A7A. External Financing – Allowing Up to One Quarter Lag in Financing

This table summarizes external financing, indicated by a seasoned equity issuance (SEO) dummy, $1^{SEO}_{i,[q,q+1]}$, set to 1 if firm i made seasoned equity offering (SEO) during quarter q or quarter q + 1 and zero otherwise or a debt issuance dummy, $1^{D}_{i,[q,q+1]}$ set to 1 if firm i increased its long-term debt outstanding in quarter q or quarter q + 1, 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 (A7B.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 A1 provides detailed variable definitions.

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

Explained variable:	SEO indicator $1^{SEO}_{i,[q,q+1]}$			Debt issuance indicator $1^{D}_{i,[q,q+1]}$		
Model	Linear	Probit	Logit	Linear	Probit	Logit
	(A7AA.1)	(A7 AA.2)	(A7A.3)	(A7AA.4)	(A7AA.5)	(A7AA.6)
$BOJ_{i,q}$	**0.016 (0.001)**	**0.009 (0.015)**	**0.010 (0.005)**	-0.006 (0.151)	-0.005 (0.110)	-0.005 (0.121)
Observations	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.326	0.103	0.104	0.315	0.056	0.056

Panel B. Instrumental Variables Regressions

Explained variable:	$\Delta M_{i,q}/B_{i,q-1}$	SEO indicator $1^{SEO}_{i,[q,q+1]}$			Debt issuance indicator $1^{D}_{i,[q,q+1]}$		
Model	1st stage OLS	Linear	Probit	Logit	Linear	Probit	Logit
	(A7AB.1.1)	(A7AB.1)	(A7AB.2)	(A7AB.3)	(A7AB.4)	(A7AB.5)	(A7AB.6)
$\left\|\frac{\Delta M_{i,q}}{B_{i,q-1}}\right\| BOJ_{i,q}$		**0.043 (0.007)**	**0.038 (0.000)**	**0.038 (0.000)**	-0.014 (0.130)	**-0.007 (0.009)**	**-0.007 (0.008)**
$BOJ_{i,q}$	**0.384 (0.000)**						
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.175	0.199	0.060	0.060	0.304	0.003	0.003

Appendix Table A7B External Financing – Allowing Up to Two Quarter Lags in Financing

This table summarizes external financing, indicated by a seasoned equity issuance (SEO) dummy, $1^{SEO}_{i,[q,q+2]}$, set to 1 if firm i made seasoned equity offering (SEO) during quarter q through quarter q + 2 and zero otherwise or a debt issuance dummy, $1^{D}_{i,[q,q+2]}$ set to 1 if firm i increased its long-term debt outstanding in quarter q through quarter q + 2, 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 (A10B.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.

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

Explained variable:	SEO indicator $1^{SEO}_{i,[q,q+2]}$			Debt issuance indicator $1^{D}_{i,[q,q+2]}$		
Model	Linear	Probit	Logit	Linear	Probit	Logit
	(A7BA1)	(A7BA2)	(A7A3)	(A7BA4)	(A7BA5)	(A7BA6)
$BOJ_{i,q}$	**0.017**	**0.010**	**0.011**	-0.006	**-0.005**	**-0.005**
	(0.003)	**(0.018)**	**(0.007)**	(0.108)	**(0.051)**	**(0.053)**
Observations	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.340	0.095	0.095	0.301	0.059	0.059

Panel B. Instrumental Variables Regressions

Explained variable:	$\Delta M_{i,q}/B_{i,q-1}$	SEO indicator $1^{SEO}_{i,[q,q+2]}$			Debt issuance indicator $1^{D}_{i,[q,q+2]}$		
Model	1st stage OLS	Linear	Probit	Logit	Linear	Probit	Logit
	(A7BB1.1)	(A7BB.1)	(A7BB.3)	(A7BB.4)	(A7BB.4)	(A7BB.5)	(A7BB.6)
$\left\|\frac{\Delta M_{i,q}}{B_{i,q-1}}\right\| BOJ_{i,q}$		**0.044**	**0.047**	**0.048**	**-0.016**	**-0.008**	**-0.008**
		(0.010)	**(0.000)**	**(0.000)**	**(0.090)**	**(0.001)**	**(0.001)**
$BOJ_{i,q}$	**0.384**						
	(0.000)						
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.175	0.233	0.055	0.057	0.286	0.004	0.004

Appendix Table A8. External Financing Including Lagged Bank of Japan Purchases

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) in 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 in the current and two prior quarters, $BOJ_{i,q}$, $BOJ_{i,q-1}$ and $BOJ_{i,q-2}$. The table reports OLS linear probability model, Probit, and Logit regressions. All regressions use 35,669 firm-quarter 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.

Explained variable:	SEO indicator $1_{i,q}^{SEO}$			Debt issuance indicator $1_{i,q}^{D}$		
Model	Linear	Probit	Logit	Linear	Probit	Logit
	(A8.1)	(A8.2)	(A8.3)	(A8.4)	(A8.5)	(A8.6)
$BOJ_{i,q}$	**0.016**	**0.008**	**0.008**	0.003	0.004	0.004
	(0.001)	**(0.007)**	**(0.001)**	(0.474)	(0.304)	(0.298)
$BOJ_{i,q-1}$	0.002	-0.001	-0.001	**-0.013**	**-0.014**	**-0.014**
	(0.777)	(0.841)	(0.813)	**(0.070)**	**(0.080)**	**(0.094)**
$BOJ_{i,q-2}$	-0.003	-0.001	-0.0004	0.006	0.007	0.007
	(0.720)	(0.896)	(0.915)	(0.309)	(0.342)	(0.365)
Observations	35,669	35,669	35,669	35,669	35,669	35,669
R^2	0.292	0.016	0.016	0.331	0.006	0.006

Appendix Table A9. 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 $BOJ_{i,}$**.** 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.

Panel A: Quarterly Actions

Explained Variable:	Returns (A9A.1.1)	ΔTotal Assets (A9A.1)	ΔTangible Capital (A9A.2)	ΔCurrent Assets (A9A.3)	ΔCash & Short-Term (A9A.4)	ΔInventory (A9A.5)	ΔAccounts Receivable (A9A.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 (A9B.1.1)	ΔTotal Assets (A9B.1)	ΔTangible Capital (A9B.2)	ΔCash (A9B.3)	ΔShort-Term Investments (A9B.4)	ΔR&D (A9B.5)	ΔAccounts Receivable (A9B.6)
$BOJ_{i,y}$	0.173	0.237	-0.001	**0.098**	-0.009	0.004	0.030
	(0.589)	(0.124)	(0.907)	**(0.090)**	(0.541)	(0.488)	(0.311)
$BOJ_{i,y} \times 1_{i,q}^{construction}$	2.310	1.416	0.172	-0.810	0.441	-0.012	0.114
	(0.456)	(0.098)	(0.446)	(0.115)	(0.180)	(0.216)	(0.593)
$BOJ_{i,y} \times 1_{i,q}^{manufactuing}$	**1.277**	-0.128	0.041	-0.095	0.017	-0.0001	-0.087
	(0.023)	(0.572)	(0.438)	(0.308)	(0.758)	(0.989)	(0.251)
Observations	6,114	6,114	6,114	6,114	6,114	3,543	6,114
R^2	0.389	0.358	0.351	0.322	0.379	0.238	0.344

Appendix Table A10. 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 A11. 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 A11.1.1 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. Appendix Table A1 provides detailed variable definitions.

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
	(A11.1.1)	(A11.1)	(A11.2)	(A11.3)	(A11.4)	(A11.5)	(A11.6)	(A11.7)	(A11.8)	(A11.9)	(A11.10)	(A11.11)	(A11.12)
$BOJ_{i,q}$	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 Table A12. Financial Constraints

This table updates Panel A of Table 6 by including two indices for financial constraints: the Whited-Wu index (Panel A) and the Kaplan-Zingales index (Panel B). Regressions use BOJ purchases to explain quarterly 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 A12A.1.1. FC is the financial constraint index, specified in the Panel label. 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. Regressions A12A1.1 and A12B.1.1 cluster bidirectionally by firm and year; all others cluster by firm. Numbers in parentheses are p-values, with boldface indicating significance at 10% or better.

Panel A: FC Index = Whited-Wu Index

Explained Variable:	Returns	ΔTotal Assets	ΔTangible Capital	ΔCurrent Assets	ΔCash & Short-Term Investments	ΔInventory	ΔAccounts Receivable
	(A12A.1.1)	(A12A.1)	(A12A.2)	(A12A.3)	(A12A.4)	(A12A.5)	(A12A.6)
$BOJ_{i,q}$	0.349	**0.943**	4.300	0.220	-3.258	-0.370	0.744
	(0.676)	**(0.014)**	(0.326)	(0.849)	(0.276)	(0.739)	(0.147)
FC Index	3.136	0.554	-3.174	1.222	4.458	0.929	-0.498
	(0.301)	(0.520)	(0.247)	(0.272)	(0.169)	(0.380)	(0.450)
$BOJ_{i,q}$ × FC Index	-1.742	0.754	7.708	-2.837	-12.826	-2.692	1.674
	(0.489)	(0.126)	(0.320)	(0.220)	(0.201)	(0.384)	(0.298)
Observations	41,232	41,232	41,232	41,232	41,232	41,232	41,232
R^2	0.430	0.322	0.182	0.281	0.276	0.292	0.338

Panel B: FC Index = Kaplan-Zingales Index

Explained Variable:	Returns	ΔTotal Assets	ΔTangible Capital	ΔCurrent Assets	ΔCash & Short-Term Investments	ΔInventory	ΔAccounts Receivable
	(A12B.1.1)	(A12B.1)	(A12B.2)	(A12B.3)	(A12B.4)	(A12B.5)	(A12B.6)
$BOJ_{i,q}$	**1.082**	**0.786**	1.628	**1.429**	**1.572**	**0.678**	0.176
	(0.009)	**(0.001)**	(0.340)	**(0.004)**	**(0.097)**	**(0.094)**	(0.327)
FC Index	0.00003	**-0.007**	-0.003	**-0.006**	**-0.004**	**-0.002**	**-0.001**
	(0.989)	**(0.000)**	(0.223)	**(0.00000)**	**(0.032)**	**(0.006)**	**(0.040)**
$BOJ_{i,q}$ × FC Index	0.001	**0.001**	0.002	**0.002**	0.002	0.001	0.0005
	(0.501)	**(0.003)**	(0.385)	**(0.024)**	(0.218)	(0.165)	(0.220)
Observations	42,919	42,919	42,919	42,919	42,919	42,919	42,919
R^2	0.431	0.326	0.172	0.285	0.222	0.284	0.335

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.

Appendix Table A13 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. 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.

Regression A13.1 in Table A13 associates higher BOJ ETF purchases during a month with higher stock return volatilities. Regressions A13.2 and A13.3, 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 non-positive. Consistent with the BOJ buying ETFs when the market drops, the table links lower downside volatility to larger BOJ ETF purchases. Also consistent with BOJ ETF purchases

increasing share prices, the table links higher upside volatility to higher BOJ ETF purchases.

Overall, the results are consistent with the BOJ's stated 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. It also motivates our exploration of the impact of BOJ equity purchases on firms' financial distress risk in Section 4.7.

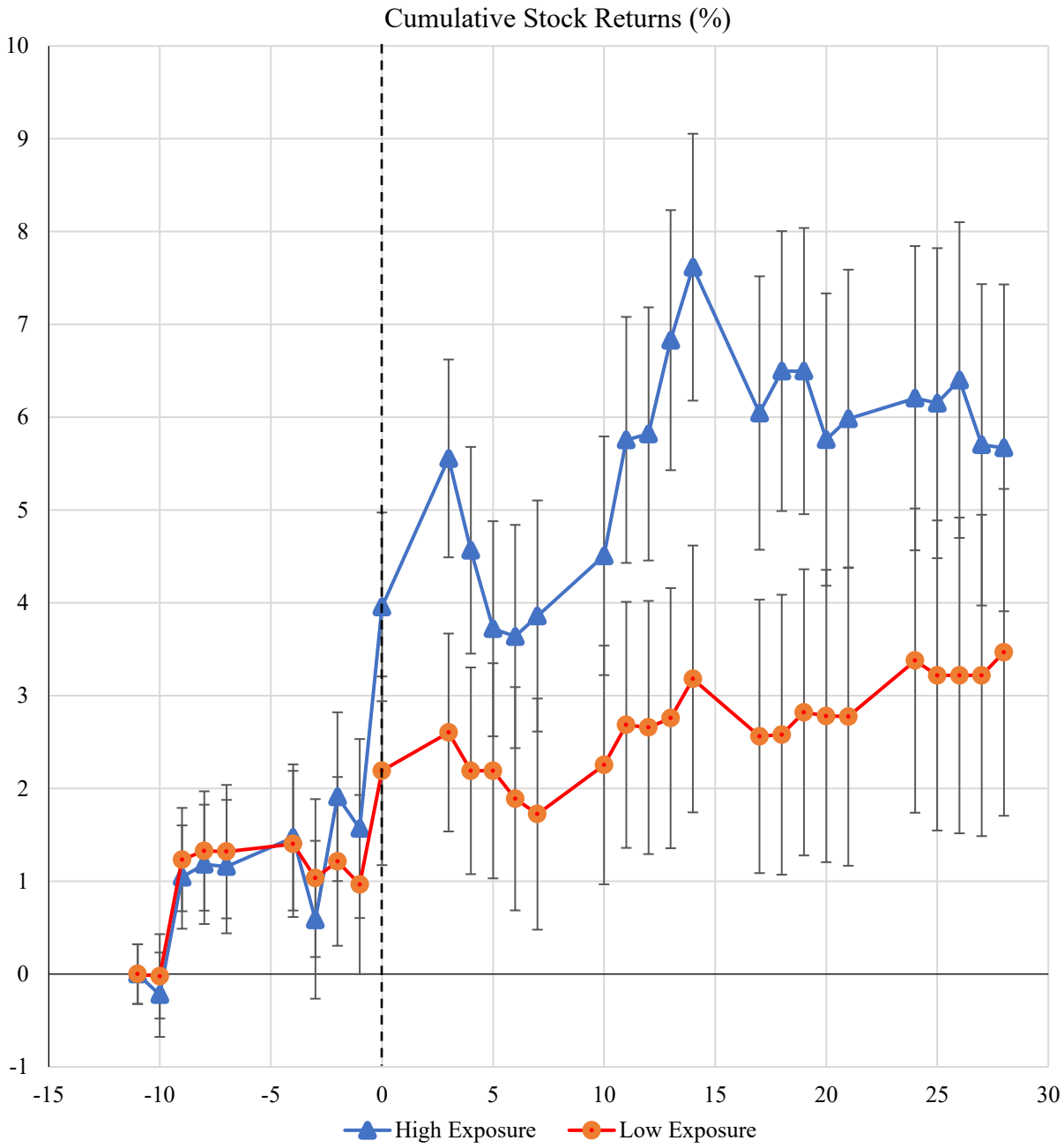
Appendix Table A13. Monthly Volatility Tests

The table below shows more monthly BOJ ETF 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 $\ln[1+\sigma_{i,m}(r_{i,t})]$ (A13.1)	Log Monthly Upside Volatility $\ln[1+\sigma_{i.m}(r_i\|r_{it}>0)]$ (A13.2)	Log Monthly Downside Volatility $\ln[1+\sigma_{i,m}(r_i\|r_{it}<0)]$ (A13.3)
$\ln BOJ_{i,m}$	**0.011** **(0.001)**	**0.037** **(0.000)**	**-0.015** **(0.0001)**
Explained variable lagged 1 month	**0.362** **(0.000)**	**0.209** **(0.000)**	**0.155** **(0.000)**
Observations	173,391	173,391	173,391
R^2	0.590	0.382	0.444

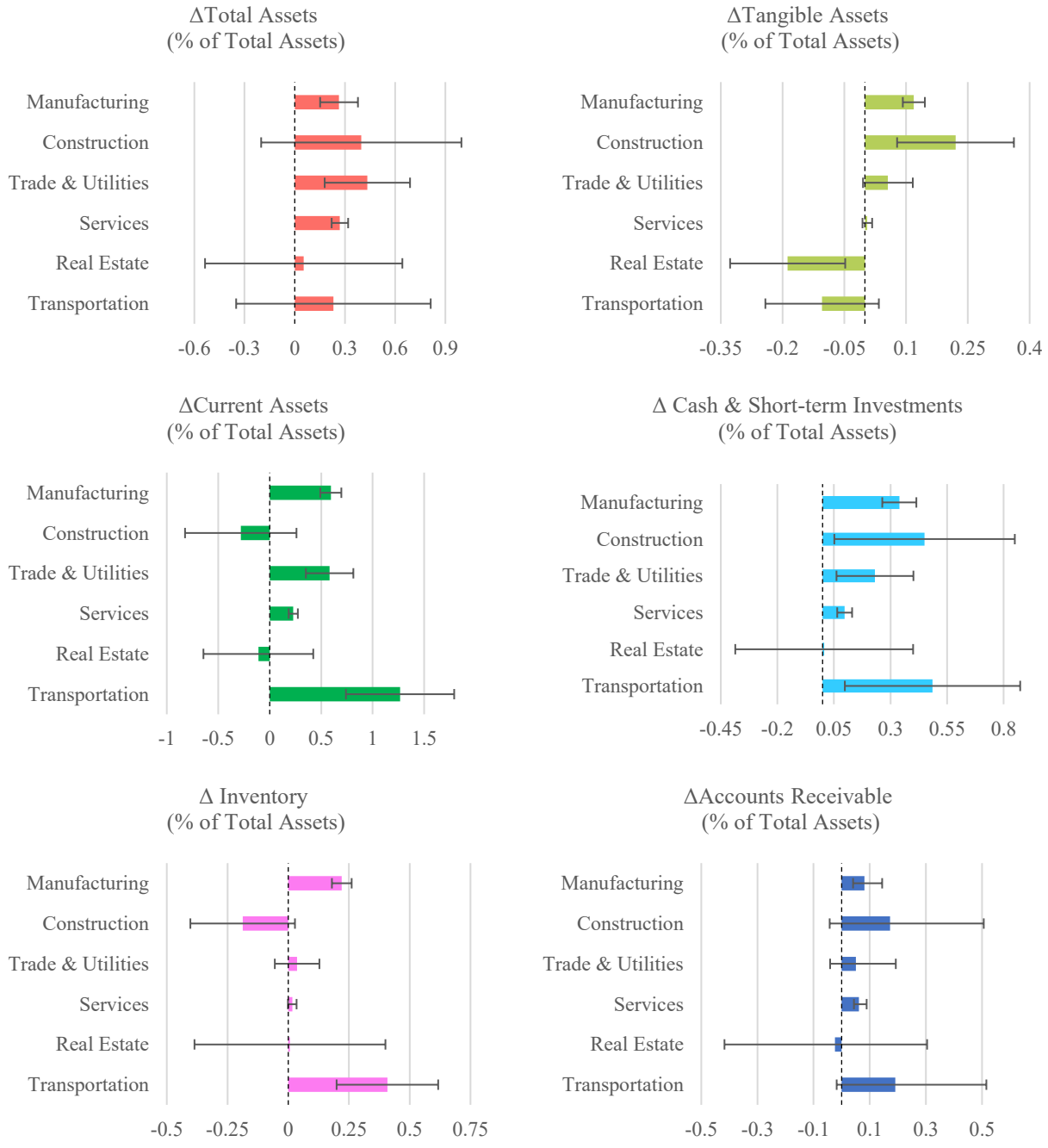
Appendix Figure A1. Announcement Effect of BOJ Purchases

This figure plots event-study cumulative stock 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 6**. 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.



Appendix Figure A3. 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 6 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 6 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.