Monetary Policy and Firm Investment: Evidence from Japan

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1. Introduction

A defining feature of Japan's lost decades has been the prolonged stagnation of fixed investment. Fukao et al. (2021) compared the natural growth rate and the actual growth rate of capital stock across five major economies-Japan, the United States, Germany, France, and the United Kingdom- over the 2000–2015 period. They found that although Japan's natural growth rate was the lowest at a mere 0.11%, the lowest among the five countries, the actual growth rate of Japan's capital stock during this period feel even further below this already low natural rate. This result indicates that Japan has been unable to achieve even the minimum level of capital accumulation required for sustainable economic growth.

The Purpose of this paper is to examine whether the monetary easing policies implemented by the Bank of Japan to overcome deflation, particularly the so-called unconventional monetary easing, have not only contributed to ending deflation but also stimulated corporate fixed investment through lower interest rates and higher asset prices. To this end, the paper estimates a Tobin's Q-type investment function following the framework proposed by Fazzari et al. (1988).

The structure of this paper is as follows. Section 2 provides a brief overview of the Bank of Japan's monetary policy. Section 3 examines whether the monetary easing policies implemented since 2008 have been effective. Section4 presents the empirical specification and variables used to estimate the investment function based on firm-level data. Section 5 summarizes the estimation results. Finally, Section 6 concludes the paper.

2. Overview of BOJ Monetary Policy

Since the collapse of the asset price bubble in the early 1990s, Japan has experienced what is often described as the "lost decades," a prolonged period of economic stagnation, mild deflation, and sluggish productivity growth. The Bank of Japan (BOJ), as the nation's central monetary authority, has been at the center of efforts to revive economic momentum and restore price stability. During the early phase of this period, the BOJ relied primarily on conventional monetary policy instruments, particularly the manipulation of short-term nominal interest rates to influence aggregate demand. However, as the policy rate approached the zero lower bound (ZLB) in the late 1990s, the conventional transmission mechanism of monetary policy lost traction, limiting the BOJ's ability to stimulate the economy through further rate reductions.

In response to persistent deflationary pressures and the zero lower bound constraint, the BOJ initiated a major

policy transformation in 2001 by introducing Quantitative Easing (QE). This marked a historic shift from interest rate targeting to the control of the monetary base, specifically controlling the volume of reserves held at the BOJ. The Japanese experiment with QE represented one of the earliest large-scale implementations of unconventional monetary policy among advanced economies, preceding similar measures later adopted by the Federal Reserve and the European Central Bank. This marked one of the first instances of unconventional monetary policy implementation by a major central bank. The policy aimed to inject liquidity into the financial system, stabilize expectations, and encourage lending through a commitment to maintain accommodative conditions until deflationary pressures subsided.

In 2006, as economic conditions showed signs of improvement, the BOJ exited QE and reverted to its conventional interest rate. However, this was short-lived. The global financial crisis of 2008, coupled with renewed deflationary pressures and yen appreciation, compelled the BOJ to reverse course and adopt ultra-low interest rates. Moreover, political pressures intensified. Critics contended that the BOJ ‘s tightening was premature, exacerbating deflationary dynamics, and argued for closer coordination between monetary and fiscal policy. Consequently, the balance between central bank independence and accountability became an increasingly contentious issue in Japan’s macroeconomic discourse.

A new phase began in 2013, the BOJ introduced an ambitious monetary base targeting regime, often referred to as “Quantitative and Qualitative Monetary Easing” (QQE), which has been expanded several times thereafter. This regime represented a more aggressive and comprehensive version of earlier QE. By setting the monetary base as the main operational target, the BOJ sought to achieve its explicit 2% inflation target at the earliest possible time. Under QQE, the BOJ committed to massive asset purchases, including long-term Japanese government bonds (JGBs), exchange-traded funds (ETFs), and real estate investment trusts (REITs), aimed at exerting downward pressure on long-term yields and altering portfolio composition within the private sector. The policy combined large-scale balance sheet expansion (“quantitative”) with structural changes in the composition of assets (“qualitative”) aiming to lower long-term yields and shift expectations upward. Despite these unprecedented measures, Japan’s inflation expectations remained subdued, prompting the BOJ to further innovate with policies such as Yield Curve Control (YCC) in 2016, which aims to maintain the long-term interest rate (the 10-year Japanese government bond yield) at around 0%.

3. Effects of BOJ Monetary Policy

Japan’s prolonged period of low economic growth has often been attributed to a nexus of structural and cyclical factors, including declining productivity, insufficient aggregate demand stemming from sluggish capital investment, and entrenched deflationary pressures. These deflationary pressures, in particular, eroded corporate profitability, leading to reductions in employment and household consumption, which in turn further weakened aggregate demand, and reinforced a deflationary spiral. To break this vicious cycle, BOJ has implemented a series of monetary easing policies, as discussed in Section 2.

Figure 1 illustrates the trend in the Consumer Price Index (CPI). Following the introduction of the so-called *Abenomics*-an unprecedented quantitative and qualitative monetary easing policy launched in 2013-the CPI turned upward and has shown a moderate and sustained increase. However, the inflation rate still falls short of the BOJ’s 2% target.

Figure1. The Trend in the Consumer Price Index (CPI) (2020=100)

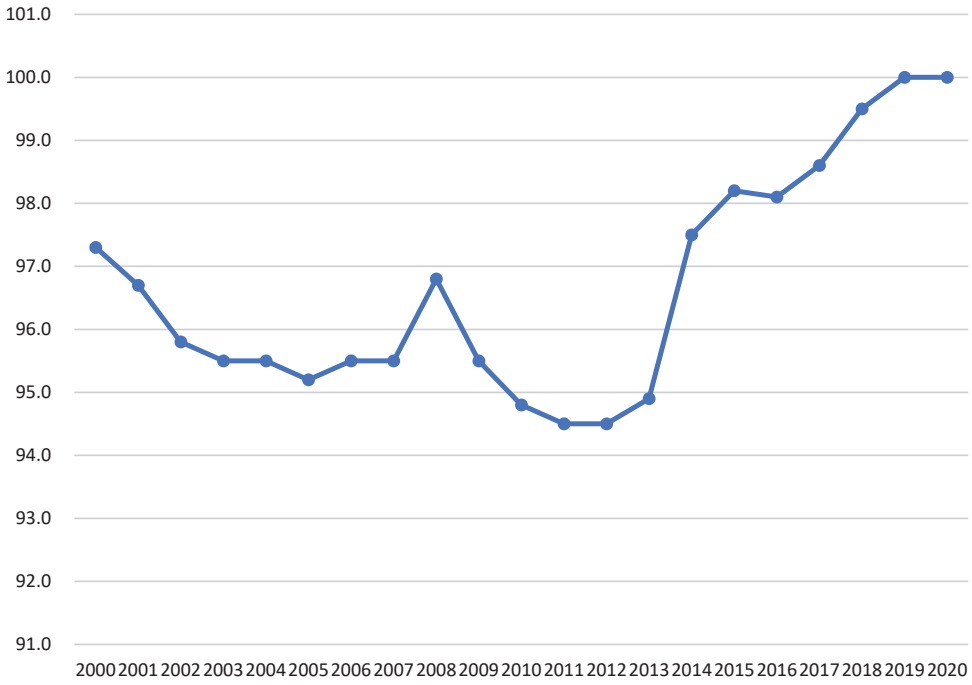
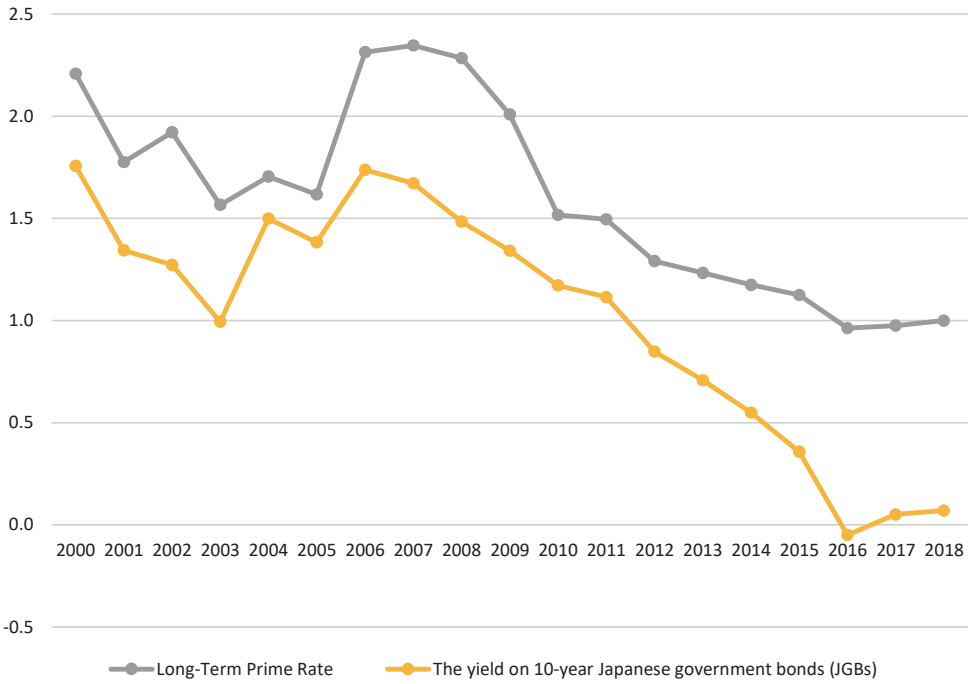
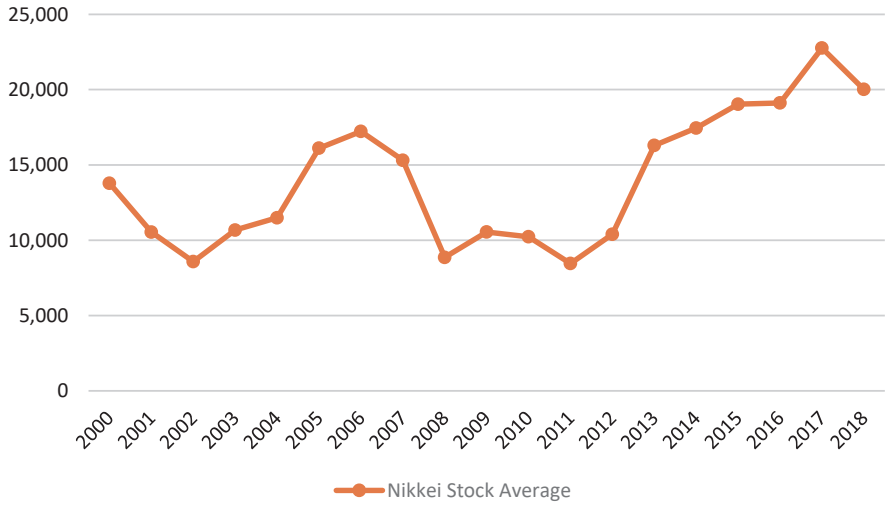


Figure 2. The Trend in Long Term Interest Rates



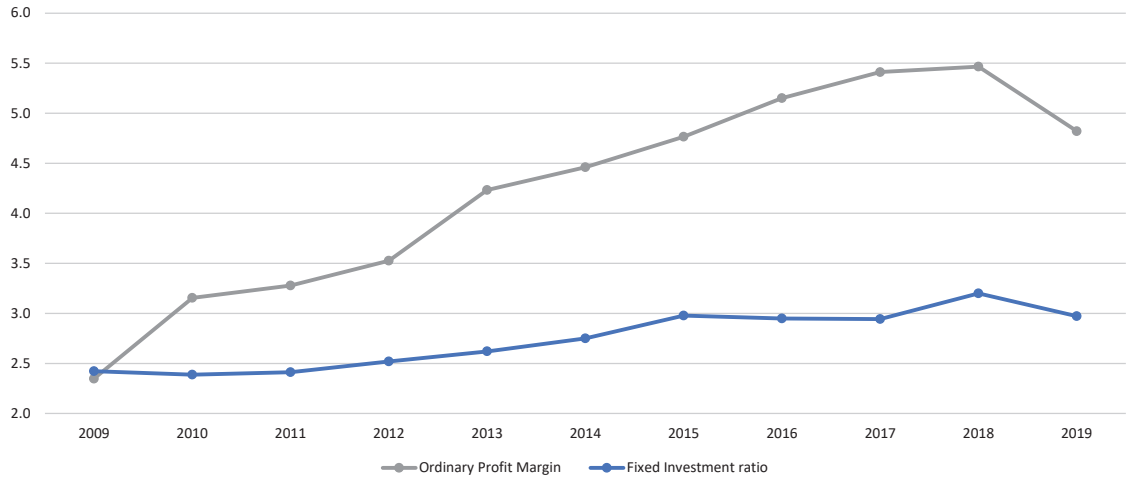
Source) Annual Report on the Japanese Economy and Public Finance (White Paper) 2024

Figure 3. The Trend in Nikkei Stock Average



Source) Nikkei Average Archive (https://indexes.nikkei.co.jp/nkave/archives/data?list=annually)

Figure 4. The Trend in Ordinary Profit and Fixed Investment ratio



Source) Author's calculations based on *the Financial Statements Statistics of Corporations by Industry*

As depicted in Figure 2, the monetary expansion policy -which more than doubled the money stock- resulted in a pronounced decline in both the long-term prime rate and the yield on 10-year Japanese government bonds (JGBs).

As illustrated in Figure 3, The Nikkei Stock Average has generally increased in response to successive rounds of monetary easing policies implemented by the BOJ, indicating that monetary policy has exerted a discernible and persistent influence on Japan's stock market.

Furthermore, Figure 4 illustrates that corporate ordinary profit margin has exhibited a steady upward trend since 2009, while fixed investment ratio has also increased, albeit at a more moderate pace, in line with the gradual recovery of corporate performance.

Taken together, these findings indicate that the BOJ's unconventional monetary policies have played a significant role in halting Japan's deflationary spiral. In following section empirically investigates, using firm-level data, whether these policies have broadened firms' investment opportunities, enhanced their cash flow, and ultimately fostered greater fixed investment.

4. Empirical Specification and Data

To estimating the investment function during the period of monetary easing policies, we use *The Corporate Financial Databank*, compiled by Development Bank of Japan, which covers all listed firms from 2009 to 2018.

We consider the following standard investment function.

$$\frac{I_{f,t}}{K_{f,t}} = \alpha + \beta_1 Q_{f,t-1} + \beta_2 CF_{f,t-1} + \beta_3 D_{f,t-1} + \theta U_t + \mu_f + \varepsilon_{f,t} \quad (1)$$

where $I_{f,t}$ and $K_{f,t}$ denote the real gross investment and real capital stock of firm *f* in the fiscal year t, respectively. We obtain real capital stock by multiplying the nominal value of tangible fixed assets excluding land at the end of the period by the industry-level market-to-book ratio for tangible fixed assets excluding land taken from the *Financial Statement Statistics of Corporations* by industry. $Q_{f,t-1}$, $CF_{f,t-1}$, and $D_{f,t-1}$ is Tobin's Q, cash flow ratio, and debt ratio in the fiscal year t-1, respectively. Tobin's Q is a ratio calculated by dividing the sum of the market value of outstanding stocks and the book value of interest-bearing debts by total assets. Here, interesting-bearing debts include short-term loans payable, straight bonds, long-term loans payable, and commercial papers. Tobin's Q with extreme values in the top and bottom 1% were excluded from sample [1)]. *CF* is defined as cash flow divided by total assets. The nominal value of cash flow is calculated as the sum of after-tax net profits and depreciation expenses. Finally, *D* is defined as interest-bearing debts divided by total assets.

According to the Q theory as expressed in equation (1), the coefficient of Tobin's Q is expected to be positive, while the coefficients of the cash flow ratio and debt ratio are assumed to be zero. If the liquidity constraint theory holds, the coefficient of the cash flow ratio will be positive, while the coefficient of debt ratio will be negative.

The descriptive statistics for each variable considered in estimation of the investment function are presented in Table1.

Table1. Descriptive statistics

Variable	Obs	Mean	Std. Dev.	Min	Max
invest_r	20,527	0.18	0.21	-1.05	0.98
Q(t-1)	16,887	0.93	0.50	0.36	2.94
Cash flow/assets(t-1)	16,887	0.05	0.07	-1.94	0.83
Interest-bearing debt/assets(t-1)	16,887	0.20	0.20	0.00	1.12

1） Although the same dataset is used for different analysis periods, Hori et al. (2006) report that Tobin's Q values of 2.28 for manufacturing sector and 5.70 for non-manufacturing sector. Tanaka (2019) and Ishikawa (2021) report Tobin's Q values of 1.909 and 2.46545, respectively. These values are substantially higher than those obtained in this paper.

Table 2. Estimation Results of Investment Function

	Dependent Variable: Investment/capital stock			
	Pooled OLS	Fixed Effects	Two-Way	Hausman-Taylor
Q(t-1)	0.044 *** (0.004)	0.019 *** (0.006)	0.027 *** (0.007)	0.032 *** (0.007)
Cash flow/assets(t-1)	0.328 *** (0.048)	0.231 *** (0.045)	0.228 *** (0.045)	0.222 *** (0.045)
Interest-bearing debt/assets(t-1)	-0.109 *** (0.009)	-0.233 *** (0.030)	-0.240 *** (0.030)	-0.246 *** (0.030)
Constant	0.141 *** (0.004)	0.195 *** (0.009)	0.183 *** (0.010)	0.276 (0.177)
Observations	16887			
Number of Firms		2639		
Individual FE	×	○	○	○
Year FE	×	×	○	○

Note) 1. Robust standard errors in parenthesis.
2. ***p<0.01

5. Estimation Results

Table 2 presents the estimation results for the full sample period based on an unbalanced panel dataset. We employed four estimation methods to estimate Q-type investment function: Pooled OLS, Fixed effects model without year dummies, Fixed effects model with year dummies, and finally, the Hausman-Taylor method, which accounts for the endogeneity of Tobin's Q, the cash flow ratio, and debt ratio.

We find that the estimated coefficient on Tobin's Q is positive and statistically significant at the 1% level, regardless of the estimation method. In contrast, the estimated coefficient on cash flow ratio is positive, while that on debt ratio is negative, both significant at the 1% level. These results are consistent with liquidity constraint theory.

The fact that Tobin's Q shows a significantly positive value, tighter with its upward trend since 2012, suggests that investment has increased in step with the rise in Tobin's Q. According to the Hausman-Taylor estimation, a one standard deviation increase in Tobin's Q is associated with a 0.016 increase in the investment ratio. If the increase in corporate savings is driven by precautionary motives, it will appear as a higher cash flow ratio, in which case the cash flow ratio and investment are negatively related. Since all the estimated coefficients of the cash flow ratio are significantly positive, the results indicate that an increase in cash flow promotes investment. This finding suggests that cash holdings may have functioned as a reserve for future investment. The finding is consistent with Hori et al. (2006), who estimated an investment function using data on Japanese listed firms from the 1990s, as well as with Nakamura (2017), who employed the same database for the period 2004-2013, and Tanaka (2021), who analyzed data from 1993 to 2015, all of which report significantly positive coefficient on the cash flow ratio. Finally, all estimated coefficients on the debt ratio are significantly negative. An increase of one standard deviation in the debt ratio leads to 0.049 decrease in the investment ratio. These results suggest that maintaining financial soundness has played an important role in shaping firms' investment decisions.

Table3. Estimation Results of Investment Function: Manufacturing sector

	Dependent Variable: Investment/capital stock			
	Pooled OLS	Fixed Effects	Two-Way	Hausman-Taylor
Q(t-1)	0.023 *** (0.006)	0.044 *** (0.011)	0.041 *** (0.012)	0.038 *** (0.012)
Cash flow/assets(t-1)	0.382 *** (0.057)	0.219 *** (0.063)	0.201 *** (0.064)	0.202 *** (0.063)
Interest-bearing debt/assets(t-1)	-0.067 *** (0.013)	-0.305 *** (0.039)	-0.295 *** (0.040)	-0.294 *** (0.040)
Constant	0.149 *** (0.005)	0.181 *** (0.012)	0.182 *** (0.015)	0.379 (0.353)
Observations	6309			
Number of Firms		902		
Individual FE	×	○	○	○
Year FE	×	×	○	○

Note) 1. Robust standard errors in parenthesis.
2. ***p<0.01

Table4. Estimation Results of Investment Function: Non-manufacturing sector

	Dependent Variable: Investment/capital stock			
	Pooled OLS	Fixed Effects	Two-Way	Hausman-Taylor
Q(t-1)	0.053 *** (0.005)	0.007 (0.008)	0.025 *** (0.009)	0.032 *** (0.009)
Cash flow/assets(t-1)	0.308 *** (0.061)	0.230 *** (0.059)	0.234 *** (0.058)	0.222 *** (0.057)
Interest-bearing debt/assets(t-1)	-0.126 *** (0.011)	-0.194 *** (0.040)	-0.210 *** (0.041)	-0.220 *** (0.040)
Constant	0.137 *** (0.005)	0.201 *** (0.012)	0.176 *** (0.014)	0.202 (0.157)
Observations	10578			
Number of Firms		1737		
Individual FE	×	○	○	○
Year FE	×	×	○	○

Note) 1. Robust standard errors in parenthesis.
2. ***p<0.01

Table 3 and 4 present the estimation results by subgroup for manufacturing and non-manufacturing firms. The estimation results obtained separately for manufacturing and non-manufacturing firms are almost identical to those obtained for all firms. Regardless of industry, the results indicate a clear relationship: investment increases when investment opportunities and cash flow rise, and the debt ratio declines. These findings strongly suggests that improving firms' investment environment could play a crucial role in restoring Japan's economy to a sustainable economic growth trajectory through increased capital formation.

6. Conclusion

This paper estimates a Q-type investment function using firm-level data from *The Corporate Financial Databank* covering the period 2009-2018, to investigate how Japanese firms' fixed investment responded to the implementation of unconventional monetary policies introduced after the global financial crisis. The empirical results can be summarized as follows: (1) firms with higher Tobin's Q tended to invest more; (2) increases in cash flow stimulated fixed investment; and (3) a higher debt ratio was associated with a decline in fixed investment.

Two main directions for future research can be identified. First, while this paper has shown that monetary easing policies affect asset prices and thereby exert a significant influence on firms' investment decisions, it does not fully account for firm-level heterogeneity. The effects of monetary easing are likely to differ depending on firm characteristics such as age, size, degree of globalization, and dividend policy. Therefore, future research should conduct subgroup analyses to capture these heterogeneous effects. Second, this paper focused on fixed investment in tangible assets. However, as emphasized by Haskel and Westlake (2017), intangible assets- including software, databases, brands, research and development, and human capital-have become increasingly important in determining firms' competitiveness and long-term growth. Identifying firm-level investment in intangible assets remains a substantial empirical challenge, yet it is essential to extend the analysis to include investment in intangible as well as tangible assets.

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