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Fixed Investment, Liquidity Constraint, and Monetary Policy: Evidence from Japanese Manufacturing Firm Panel Data

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Fixed Investment, Liquidity Constraint, and Monetary Policy: Evidence from Japanese Manufacturing Firm Panel Data

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Abstract

We empirically analyze the effect of monetary policy shocks on real fixed investments using panel data of Japanese manufacturing firms to examine the existence of a balance sheet channel. We observe that the firms' investment sensitivity to their net worth significantly increases during the tight monetary policy period. The smaller the firm size, the greater is the effects of the contractionary monetary policy. Therefore, our estimation result supports the balance sheet channel. In addition, the firms' investment sensitivity to their net worth decreases statistically significantly during the quantitative monetary easing policy (QMEP) period. The QMEP relaxes the liquidity constraints more on small firms than on large firms. Our evidence suggests that the effect of QMEP is transmitted to the real economy through the balance sheet channel.

JEL classification: E51; E52; G31

Keywords: Monetary policy shock; Real fixed investment; Net worth

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1. Introduction

Does a monetary policy shock affect a firm's real investment? If so, how does a monetary shock influence its activity? Many researchers and economists have described how monetary policy shocks can significantly influence the real economy.

The effects of monetary policy shocks spread to the real economy through several channels.[1] Among them, we focus on the effects of monetary policy shocks on a firm's real fixed investment, which is a crucial component of aggregate output. According to Bernanke and Gertler (1995), this route is the *balance sheet channel.*

The underlying concept of the balance sheet channel is the theoretical prediction that a wedge between the cost of funds raised externally (e.g., through the issuance of imperfectly collateralized debt) and the opportunity cost of internal funds results from asymmetric information. This wedge is called the external finance premium. When effects such as imperfect information or costly enforcement of contracts interfere with the smooth functioning of financial markets, the size of the external finance premium should depend on the borrower's net worth (financial position).[2] In other words, there is a negative relationship between the external finance premium and net worth.

We consider it important to investigate the existence of the balance sheet channel, because, according to credit view, the firm's real investment activities play a significant role in the transmission of monetary and financial shocks to the real economy.

This study's purpose is two-fold. First, to investigate the existence of the balance sheet channel, we empirically analyze the effect of monetary policy shocks on fixed investments on the basis of a large panel dataset of Japanese manufacturing firms from 1970 to 2006.[3] Specifically, following Angelopoulou and Gibson (2009), we estimate Tobin's q-type function

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[1] See, for example, Bernanke and Gertler (1995), Mishkin (1995), and Hoshi (1997).

[2] The theoretical studies of financial propagation mechanisms that emphasize the role of borrowers' balance sheets include Bernanke and Gertler (1989), Calomiris and Hubbard (1990), Gertler (1992), and Kiyotaki and Moore (1997).

[3] The panel studies for examining firms' liquidity constraints begin with Fazzari, Hubbard, and Peterson (1988).

by introducing the firm's liquid assets as a proxy for net worth.[4] We then present evidence on the differential response to contractionary monetary policy shocks categorized by firm size.

Second, we statistically reveal the quantitative monetary easing policy (hereafter, QMEP) transmission mechanism, which was enforced in Japan from 2001 to 2006. If the QMEP influenced the real economy, we assume that it would spread via the balance sheet channel. Although many researchers and policy makers have described the effects of the QMEP, all previous reported results have significant deficiencies, and this line of research provides no evidence for or against the existence of the QMEP transmission mechanism.[5] One major approach uses the vector autoregressive (hereafter, VAR) system, but the VAR system cannot adequately distinguish the effects of the QMEP from other factors. In contrast, using the aforementioned method, we estimate Tobin's q-type function by appending the firm's liquid assets as proxy for net worth to examine the significance of the QMEP.

The present study differs from previous research in several respects. Gertler and Gilchrist (1994) attempted to obtain empirical evidence on the same type of financial transmission mechanism for the US economy. They deal with the impact of net worth conditions on inventory demand, whereas this study demonstrates that the balance sheet channel can explain swings in a more important aggregated demand component, which is the real fixed investment.

Ogawa (2000) investigated the existence of the balance sheet channel in the Japanese economy using the quarterly time series data disaggregated by firm size for manufacturing and non-manufacturing industries. He focused on the role of land as collateral in the monetary transmission mechanism. However, his estimation results demonstrated that the monetary policy shock decreased the investments of large firms but kept those of small manufacturing industry firms at a high level for several quarters. This outcome is inconsistent with the balance sheet channel theory.

[4] Angelopoulou and Gibson (2009) used cash flow as a proxy for net worth. In Section 4, we state the reason for using the liquid assets.
[5] See Ugai (2006) for a recent survey of the empirical research of the QMEP.

Ogawa (2002) applied Gertler and Gilchrist (1994), *ibid.* to inventory investment of Japanese firms, but obtained contradictory results. This outcome may have resulted from a non-financial factor, such as the Japanese subcontracting system between large and small firms being different from that in the US, or it may have been contaminated by the observational equivalence problem in the reduced-form VAR system.

To improve these deficiencies, we choose the real fixed investment as a dependent variable, which seems to be relatively independent of the differences in the subcontracting systems. Moreover, rather than the VAR system, we use structural equations to avoid both small sample and observational equivalence problems.

Hosono and Watanabe (2002) also analyzed the importance of the balance sheet channel in Japan. Unfortunately, however, their estimation based on cross-section data may have suffered from omitted variable problems. Therefore, they reached the very misleading conclusion that the decrease in net worth in the 1990s had nothing to do with Japanese firms' inactive investment behavior. It is preferable to estimate the equation allowing for unobserved firm effects.

Nagahata and Sekine (2005) investigated how the monetary easing policy influenced firms' investment after the collapse of asset prices in the early 1990s in Japan. Their analysis focused on the effect of the bank balance sheet on a firm's investment. They found that the monetary easing policy worked through the interest rate channel but the effect of the balance sheet channel was interrupted because of the deterioration in balance sheet conditions. Because they use accelerator investment functions, and not Tobin's q investment functions, their evidence cannot readily support the interest rate channel without considering asset prices.

Angelopoulou and Gibson (2009) investigated the sensitivity of investments to cash flow in contractionary monetary policy period using UK manufacturing firm panel data to examine the existence of the balance sheet channel. Using a dummy of tight monetary policy for the UK based on the narrative indicator of Romer and Romer (1989), they found that the investments of financially constrained firms relative to unconstrained firms became more sensitive to cash flow during the contractionary monetary policy periods.

Next, few results exist in the field of QMEP effects. Kimura et al. (2002) and Fujiwara (2006) did not cover the entire QMEP period, and Kimura and Small (2004) and Oda and Ueda (2007) analyzed the QMEP impact only on financial variables. Although Honda et al. (2007, 2010) demonstrated that the QMEP might affect industrial production by stimulating stock prices, their results were highly vulnerable to dispute because their VAR models not only suffered from small sample size but also lacked theoretical background. Furthermore, their model omitted differences in firm-size classes, and therefore, could not distinguish financial from non-financial factors. Our analysis, in contrast, is based on the balance sheet channel theory (the external finance premium) and is compatible with large panel data of different firm-size classes.

Here we briefly summarize the main results of this study. First, we succeed in extracting the effects of the monetary policy even after controlling for the omitted variable problem. Specifically, firms' investments are sensitive to their net worth during the tight monetary policy period. Additionally, the smaller the firm size, the greater is the effects of the contractionary monetary policy. The second contribution demonstrates that QMEP impact relaxes the liquidity constraints on small firms more than on large firms. Our evidence suggests that the QMEP effect spreads to the real economy through the balance sheet channel.

This paper proceeds as follows. In Section 2, we construct a panel data set and define the firm-size classes. Section 3 presents the construction of dummy variables for monetary policy. Section 4 tests the existence of the balance sheet channel and reports the estimation results. In Section 5, we investigate the QMEP transmission mechanism. Conclusions are stated in Section 6.

2. Data Description

2.1. Construction of Panel Data

We constructed the panel data set from the firm financial database of Nikkei NEEDS Financial Quest, with sample periods ranging from 1970 to 2006. We used a sample of 1245 manufacturing firms listed in the first and second section of the Tokyo Stock Exchange. Our dataset is unbalanced for two reasons. First, a number of firms delisted from the market during the sample period. Second, two firms combined to form a new company via a merger and/or acquisition during the estimation period.[6]

2.2. Classification of Firm Sizes

Bernanke and Gertler (1995) found that firms with less net worth face more severe liquidity constraints. That is, a stronger financial position facilitates raising external funds, favoring large firms with more net worth over small firms with less. Several reasons explain the small firm disadvantage.

First, small firms must pay higher external finance premiums in raising funds from lenders or investors, but they lack sufficient collateralizable net worth to reduce the default risk. Second, from the creditor and investor perspectives, large firms generally have a better reputation for creditworthiness than do small firms. Therefore, firms' net worth should affect not only the magnitude of the external finance premium but also, indirectly, the investment decision itself.

Therefore, to examine the differential response to contractionary monetary policy shocks categorized by firm size, each firm falls into one of two categories on the basis of their total assets. As the distribution of the total assets of all firms is skewed to the right, we use the median, not the mean, to classify firms into two groups. Firms with total assets greater than the median are defined as large firms, and firms with total assets less than the median are defined as

[6] We consider a single case of such a merger.

relatively small firms.[7]

3. Construction of Dummy Variables for Monetary Policy Shocks

First, we concentrate on only one type of shock, monetary policy shock, to exclude endogenous factor influences as much as possible. Kuroki (1999) analyzes the historical record in detail to isolate the monetary policy shock. During our sample period, we identify three episodes in which the Bank of Japan established a tight monetary policy to cool down the economic overheating and stabilize inflation; therefore, we adopt 1973–1974, 1979–1980, and 1989–1990 as contractionary monetary policy periods.

Our strategy is straightforward. To precisely identify the significance of the balance sheet channel and the QMEP transmission mechanism, following Angelopoulou and Gibson (2009), we introduce in our models interaction variables composed of the proxy variable for net worth and a monetary policy shock dummy. That is, we enter in our regression models the cross term for the net worth variable and contractionary monetary policy (CMP) dummy ("one" for the periods of contractionary policy and "zero" for other periods) and the interaction term for the net worth variable and the QMEP dummy ("one" for the periods of 2001 through 2006 and "zero" for others). This device is quite useful in proving the existence of the balance sheet channel.

4. Test for the Balance Sheet Channel

4.1. Regression Model

To investigate whether the effect of the balance sheet channel is significant and whether it varies dependent upon firm size, we add the cross term to Tobin's q investment function. We use the one-year lagged Tobin's q, net worth, and cross term to avoid the simultaneous equation bias problem. Based on the Hausman specification test results, we adopt the fixed effects model. Our

[7] Because our all samples are listed firms, they are generally considered "large" firms. Therefore, we refer to firms with total assets less than the median as "relatively" small firms.

regression model is as follows.

$$\frac{I_{it}}{K_{it-1}} = \alpha_0 + \alpha_1 q_{it-1} + \alpha_2 LIQ_{it-1} + \alpha_3 (LIQ_{it-1} \times CMP) + \tau_i + \varepsilon_{it} \quad (1)$$

where

Subscript i and t indicate firm i at time t ($i = 1, 2,\ldots, N$, $t = 1, 2,\ldots, T$),

I: real fixed investment,

K: real capital stock of firm,

q: Tobin's marginal q,

LIQ: the liquid assets ratio (proxy variable for net worth or measurement of liquidity constraints),

CMP: contractionary monetary policy dummy,

τ_i: individual firm effect,

α_0: constant term, and

ε: disturbance term.

Although Angelopoulou and Gibson (2009) used cash flow as a proxy for net worth, we use liquid assets (LIQ). The liquid assets ratio is defined as liquid assets divided by total assets.[8] We adopt liquid assets rather than cash flow for two reasons. First, Fazzari et al. (1988) investigated the sensitivity of firm investments to cash flow. Their empirical results found that the increase in investment sensitivity to cash flow suggested that firms face difficulty in raising external funds because of liquidity constraints. However, Kaplan and Zingales (1997) disputed the relationship between liquidity constraints and investment cash flow sensitivities, finding that the increase in the investments-cash flow sensitivities does not reflect the firms' liquidity constraints.

[8] Liquid assets include cash deposit, bills receivable, accounts receivable, and security.

Second, Hosono and Watanabe (2002) suggested that the liquid assets ratio is a good proxy for net worth because it has a low measurement error and is the most important indicator for creditors and investors. Therefore, we use the liquid assets ratio as proxy for net worth to avoid the Kaplan and Zingales (1997) critique and utilize the advantage noted by Hosono and Watanabe (2002).

Therefore, if the contractionary monetary policy affects the sensitivity of investments to net worth—that is, the balance sheet channel exists—we expect the coefficients of LIQ and $LIQ \times CMP$ to be significantly positive (i.e., $\alpha_2,\ \alpha_3 > 0$). In addition, the net worth sensitivity of relatively small firms may be higher than that of large firms during the contractionary monetary policy period (i.e., relatively small firms $(\alpha_2 + \alpha_3)$ > large firms $(\alpha_2 + \alpha_3)$). We discuss both these coefficients in detail in Subsections 4.2 and 4.3.

4.2. Estimation Results: Firms' Investments and the Balance Sheet Channel

Table 2 reports the results from regression model (1). All the coefficients are statistically significantly positive at the 1% level. Columns 1 and 2 of Table 2 report the estimation results of all firms with or without the identification dummy variable. The LIQ coefficient for all firms is 0.3558. However, as expected, column 2 shows that the sensitivity of investments to the liquid assets ratio is higher during the tight monetary policy period ($\alpha_2 + \alpha_3 = 0.3228 + 0.0737$).

Columns 3 and 5 of Table 2 present the estimation results without the cross term and columns 4 and 6 report the results with the interaction term for relatively small firms and large firms, respectively. Comparing the degree of liquidity constraints for these firms, the LIQ coefficient for the relatively small firms in column 3 is 0.3738, whereas that for large firms in column 5 is 0.3313. This result suggests that relatively small firms consistently face more serious liquidity constraints than do large firms.

Let us focus on the different responses of relatively small firms and large firms to a contractionary monetary policy. Columns 4 and 6 report the estimation results of the effect of tight monetary policy on firms' liquidity constraints. The sensitivity of investments to the liquid assets ratio of relatively small firms is greater than that of large firms during the contractionary monetary policy period (relatively small firms ($\alpha_2 + \alpha_3 = 0.4299$) $>$ large firms ($\alpha_2 + \alpha_3 = 0.3615$)). Further, the cross-term coefficient of relatively small firms is larger than that of large firms (relatively small firms ($\alpha_3 = 0.0909$) $>$ large firms ($\alpha_3 = 0.0593$)).

In summary, we have confirmed that the contractionary monetary policy affects the firms' investments through their net worth. The verified evidence demonstrates the importance of net worth in the monetary transmission, and as the theoretical consensus suggests, it proves that the smaller the firm size, the larger is the effects of monetary policy shocks via net worth. Consequently, we conclude that the balance sheet channel of monetary policy operates more effectively for relatively small firms than for large firms.

4.3. Contaminated Estimation Periods

Our conclusion from the aforementioned empirical results holds that the balance sheet channel transmits the effect of tight monetary policy to the real economy. However, our empirical evidence may have been contaminated by other monetary and financial factors. Therefore, in this subsection, to remove these factors, we construct and estimate subsample periods. Specifically, we create two types of panel data sets: Type 1 ranges from 1971 to 1996 (before the Asian financial crisis began in 1997) and Type 2 from 1971 to 1998 (before the introduction of the zero-interest-rate policy in 1999) to remove the unique impact of the Asian financial crisis and the zero-interest-rate policy.

Table 3 reports the estimated results of the regression model (1) during the period from 1971 to 1996. Although the significance levels of the coefficients on Tobin's q and cross term shown in column 5 and 6 for large firms decrease, the estimation results are largely similar to those in Table 2. As presented in columns 3 and 5, the LIQ coefficient for relatively small firms is larger than that for large firms (relatively small firms ($\alpha_2 = 0.3891$) $>$ large firms ($\alpha_2 = 0.2797$)). Columns 4 and 6 report that the investment sensitivity to net worth of relatively small firms is greater than that of large firms (relatively small firms ($\alpha_2 + \alpha_3 = 0.4167$) $>$ large firms ($\alpha_2 + \alpha_3 = 0.2935$)).

Including the financial crises period does not alter our conclusion. Table 4 reports the estimation results of regression model (1) during the period from 1971 to 1998. Table 4 presents the empirical results of equation (1) excluding and introducing the cross term: the magnitudes and significance levels of the estimated coefficients of Tobin's q, LIQ, and cross term are nearly identical with those reported in Tables 2 and 3. Columns 4 and 6 report that the investments of relatively small firms are more sensitive to the liquid assets ratio during the tight monetary policy period (relatively small firms ($\alpha_2 + \alpha_3 = 0.4077$) $>$ large firms ($\alpha_2 + \alpha_3 = 0.2874$)).

These findings suggest that firm investments are decidedly sensitive to net worth, particularly during the contractionary monetary policy period. That is, our results establish statistically significantly the existence of the balance sheet channel.

5. Testing the Transmission Mechanism of the QMEP

5.1. The Model

This section serves to ascertain the QMEP transmission mechanism. To distinguish the QMEP channel from other factors, we estimate the Tobin's q-type regression model appending the LIQ cross terms with the QMEP dummy instead of the LIQ interaction term with the CMP dummy in equation (1).[9] The investment function is as follows.

$$\frac{I_{it}}{K_{it-1}} = \beta_0 + \beta_1 q_{it-1} + \beta_2 LIQ_{it-1} + \beta_3 (LIQ_{it-1} \times QMEP) + v_i + \eta_{it} \qquad (2)$$

[9] The estimation results of regression model (2) without the cross term are the same as those of equation (1) without the interaction term discussed in Subsection 4.2.

QMEP, β_0, v_i, and η_{it} denote the quantitative monetary easing policy dummy, constant term, individual firm effect, and disturbance term, respectively. The remaining notations are the same as shown in equation (1).

Now, if the QMEP effect mitigates the firm's liquidity constraint, the LIQ coefficient should be statistically significantly positive ($\beta_2 > 0$) and the cross term coefficient must be significantly negative ($\beta_3 < 0$). That is, the net worth sensitivity of relatively small firms and large firms should decline during the QMEP period rather than other periods (i.e., $\beta_2 - \beta_3$). This finding specifically means that the QMEP can affect the real economy through the balance sheet channel. Thus, we focus on the coefficients of LIQ and the cross term for relatively small and large firms in Subsection 5.2.

5.2. Evidence for a Channel of the QMEP

Table 5 reports the estimation results of regression model (2). All the explanatory variable coefficients are statistically significant at the 1% level. As we predict in Subsection 5.1, columns 2, 4, and 6 report that the interaction term coefficients for all categories are statistically significantly negative ($\beta_3 < 0$). Columns 1 and 2 report the results of model (2) for all firms without and with the cross term, respectively. Although, as column 1 reports, investment sensitivity to the liquid assets ratio is 0.3558 during other periods, the sensitivity of investments to the liquid assets ratio presented in column 2 substantially decreases during the QMEP period ($\beta_2 - \beta_3 = 0.1671$).

As we observed in Subsection 4.2, columns 3 and 5 of Table 5 show that relatively small firms suffer more severely from liquidity constraints than do large firms (relatively small firms ($\beta_2 = 0.3738$) > large firms ($\beta_2 = 0.3313$)). Columns 4 and 6 of Table 5 report the estimation results of the QMEP effect on the liquidity constraints of relatively small firms and large firms, respectively. The QMEP statistically significantly reduces both size firms' investment sensitivity to their liquid assets ratio. The sensitivity of relatively small firm investments to their liquid assets ratio in the QMEP period declines significantly ($\beta_2 - \beta_3 = 0.1969$). Large firm sensitivity also decreases ($\beta_2 - \beta_3 = 0.1328$)).

In addition, the magnitude of relatively small firms' cross term coefficient is slightly lower than that of large firms (relatively small firms ($\beta_3 = -0.1333$) < large firms ($\beta_3 = -0.1254$)). These results suggest that QMEP leads to both size firms' decreased investment sensitivity to their liquid asset ratio.

In summary, we have found a high probability that the QMEP affects the real fixed investments of both relatively small firms and large firms by improving their net worth and easing their liquidity constraints. Therefore, we conclude that the QMEP transmission does operate through the balance sheet channel.

6. Conclusions

This study's purpose was to investigate the balance sheet channel of monetary policy and the QMEP transmission mechanism. We obtained two findings. First, the firms' investments are sensitive to their net worth during the contractionary monetary policy period. As expected, the smaller the firm size, the greater is the effects of contractionary monetary policy shocks. Therefore, our analysis demonstrates the existence of the balance sheet channel. Second, we examined the QMEP transmission mechanism and found that for relatively small firms and large firms, the investments are less sensitive to their net worth during the QMEP period than during other periods. Thus, we demonstrate that the QMEP effects are propagated to the real economy through the balance sheet channel.

Appendix. Data Construction

This appendix describes the construction of the variables used in the estimation.

Data Source. There are three primary data sources. We obtained the company financial statements data from the Nihon Keizai Shinbun's NEEDS Financial QUEST. The price index for investment goods is taken from components of the Corporate Goods Price Index (CGPI). For the corporate tax rate calculation, we use SNA statistics.

PK_t: *Price of Capital Goods.* The three categories of capital goods are (1) buildings and structures, (2) machinery and equipment, and (3) transportation equipments. The price index for (1) is a construction material component of the CGPI in index by stage of demand and use.[10] The general machinery and equipment component of the CGPI is adopted as the index price for (2). The transportation equipment component of the CGPI is used as the index price for (3).

$NOMI_t$: *Nominal Investment.* These assets are depreciable. The calculation of a nominal investment is carried out for each category:

KTE_t = book value of tangible fixed assets at the ending of year t,

$ADEP_t$ = amount of executed depreciation during year t.[11]

The nominal investment ($NOMI_t$) is

$$NOMI_t = KTE_t - KTE_{t-1} + ADEP_t.$$

I_t: *Real investment.* We divide the nominal investment ($NOMI_t$) by the price of capital goods (PK_t) to calculate the real investment for each category as follows:

$$I_t = NOMI_t / PK_t.$$

The total real investment is defined as sum of the real investment calculated for these categories.

[10] The construction material is calculated from raw materials and intermediate materials.

[11] Nikkei NEEDS Financial Quest does not include the book value of the capital wastage cost for the each of the three asset types. Then, by proportionally dividing the book value of the total of capital wastage cost according to the each asset amount, we calculate the book value of the capital wastage cost for each asset.

δ: *Physical Depreciation Rates*. The depreciation rate for buildings and structures is 0.047, that for machinery and equipment is 0.09489, and that for transportation equipment is 0.147.[12]

K_t: *Real Capital Stock*. Based on Inoue and Hayashi (1991) and Fukuda (2003), we conduct the perpetual inventory method for each asset. K_t stands for the real capital stock during year *t*, PK_t for the price index at the ending of year *t*, and δ for the physical depreciation rate. The perpetual inventory calculation is given by

$$K_t = (1 - \delta)K_{t-1} + I_t.$$

We began to execute the perpetual inventory method from the end of 1971 since the data is covered from the bench mark year of 1970. For the companies that started up after 1971, we apply this method from the point at which the companies appeared on the basis of the assumption that the book value is equal to the market value. If we encounter negative K_t during the process of perpetual inventory accounting, K_t is excluded.

Proxy for Tobin's Marginal q. Based on Suzuki (2001), we adopt the method by Suzuki (2001) for the contraction of Tobin's marginal *q*.

(a) Marginal returns rate to capital = (current income + amount of executed depreciation + interest expense & discount expense) / (investment-goods price * real capital stock at the end of the previous year),

(b) Debt cost = (interest expense & discount expense + amortization of bond discount) / interest-bearing debt at the end of the previous year,[13]

(c) Capital cost = (1 − corporate tax rate) * debt cost + depreciation ratio.[14][15]

[12] Hayashi and Inoue (1991) adopt the depreciation rate of 0.0564 for structures, but we use the depreciation rate of 0.047.

[13] Interest-bearing debt is the sum value of short-term borrowings, long-term borrowings, corporate and convertible bonds, current portion of long-term debt, current portion of corporate and convertible bonds, long-term note payable, long-term accounts payable, and deposit payable.

[14] The calculation of corporate tax rate is based on SNA statistics.

[15] We compute the value of depreciation ratio by dividing the amount of executed depreciation by the sum of the book value in the each of the three assets.

Then, the definition of proxy for Tobin's marginal q is as follows:

q = (a) marginal return rate to capital / (c) capital cost.

LIQ: *Ratio of Liquidity Assets to Total Asset*. Liquidity assets consist of a sum of cash deposit, bills receivable, accounts receivable, and security are divided by the total asset to get the ratio of liquidity assets to the total asset.

Tables

Table 1. Summary Statistics

	All Firms			Large Firms			Relatively Small Firms		
	I/K	*q*	LIQ	I/K	*q*	LIQ	I/K	*q*	LIQ
Mean	0.1357	1.3799	0.4330	0.1354	1.3206	0.4258	0.1360	1.4566	0.4420
Median	0.0979	1.0421	0.4328	0.1063	1.0278	0.4241	0.0844	1.0648	0.4431
Maximum	1.2338	19.557	0.8209	0.9010	19.3505	0.8111	1.5520	19.5571	0.8264
Minimum	-0.6887	-19.662	0.0470	-0.5797	-18.2382	0.0405	-0.6422	-19.6623	0.0576
Std. deviation	0.1467	1.8869	0.1271	0.1190	1.6024	0.1266	0.1797	2.1950	0.1268
Observations	34991	34030	36388	19624	19124	20347	15361	14925	16054

Table 2. The coefficients estimated by model (1) fot the effects of contractionary monetary policy

Independent Variables	All Firms		Relatively Small Firms		Large Firms	
q	0.0134*** (4.2627)	0.0123*** (3.7474)	0.0137*** (5.8314)	0.0125*** (4.9588)	0.0123*** (2.9207)	0.0113*** (2.5955)
LIQ	0.3558*** (16.668)	0.3228*** (14.1180)	0.3738*** (16.128)	0.3390*** (15.521)	0.3313*** (14.219)	0.3022*** (10.697)
LIQ × CMP		0.0737*** (4.0792)		0.0909*** (4.6433)		0.0593*** (3.3722)
Adjusted R-squared	0.1474	0.1554	0.1335	0.1413	0.1539	0.1619
No. of Obervations	32583	32583	14229	14229	18347	18347
No. of Firms	1244	1244	620	620	625	625

Note. 1. ***, **, and * denote 1%, 5%, and 10% significance levels, respectively. 2. Values in parentheses are t-statistics. 3. White's heteroskedasticity-consistent standard errors are used to compute t-statistics. 4. Estimation results by OLS. 5. We adopt the fixed effect model. 6. Columns 1, 3, and 5 show the estimation results excluding the cross tems.

Table 3. The coeffcients estimated by model (1) from 1971 to 1996

Independent Variables	All Firms		Relatively Small Firms		Large Firms	
q	0.0100*** (2.6503)	0.0093** (2.4500)	0.0105*** (3.3385)	0.0010*** (2.9983)	0.0084** (1.9995)	0.0079* (1.8616)
LIQ	0.3435*** (12.357)	0.3185*** (12.439)	0.3891*** (10.883)	0.3585*** (11.210)	0.2797*** (11.870)	0.2600*** (9.6963)
LIQ × CMP		0.0444*** (2.6202)		0.0582*** (3.2830)		0.0335** (1.9734)
Adjusted R-squared	0.1360	0.1398	0.1264	0.1308	0.1340	0.1373
No. of Obervations	20772	20772	8461	8461	12286	12286
No. of Firms	1134	1134	524	524	611	611

Note. 1. ***, **, and * denote 1%, 5%, and 10% significance levels, respectively. 2. Values in parentheses are t-statistics. 3. White's heteroskedasticity-consistent standard errors are used to compute t-statistics. 4. Estimation results by OLS. 5. We adopt the fixed effect model. 6. Columns 1, 3, and 5 show the estimation results excluding the cross tems.

Table 4. The coeffcients estimated by model (1) from 1971 to 1998

Independent Variables	All Firms		Relatively Small Firms		Large Firms	
q	0.0110*** (2.9363)	0.0101*** (2.6681)	0.0114*** (3.7930)	0.0104*** (3.3416)	0.0095** (2.1814)	0.0087** (1.9916)
LIQ	0.3279*** (12.586)	0.2994*** (12.043)	0.3723*** (11.920)	0.3395*** (11.900)	0.2689*** (12.281)	0.2448*** (9.2232)
LIQ × CMP		0.0538*** (3.0871)		0.0682*** (3.7304)		0.0426** (2.4332)
Adjusted R-squared	0.1360	0.1413	0.1383	0.1439	0.1284	0.1335
No. of Obervations	23009	23009	9531	9531	13458	13458
No. of Firms	1171	1171	558	558	614	614

Note. 1. ***, **, and * denote 1%, 5%, and 10% significance levels, respectively. 2. Values in parentheses are t-statistics. 3. White's heteroskedasticity-consistent standard errors are used to compute t-statistics. 4. Estimation results by OLS. 5. We adopt the fixed effect model. 6. Columns 1, 3, and 5 show the estimation results excluding the cross tems.

Table 5. The coeffcients estimated by model (2) for the effects of quantitative monetary easing policy

Independent Variables	All Firms		Relatively Small Firms		Large Firms	
q	0.0134*** (4.2627)	0.0118*** (3.8953)	0.0137*** (5.8314)	0.0119*** (5.0919)	0.0123*** (2.9207)	0.0109*** (2.7130)
LIQ	0.3558*** (16.668)	0.2952*** (13.638)	0.3738*** (16.128)	0.3302*** (14.082)	0.3313*** (14.219)	0.2582*** (11.949)
LIQ × QMEP		-0.1281*** (-6.3312)		-0.1333*** (-6.4376)		-0.1254*** (-5.7853)
Adjusted R-squared	0.1474	0.1632	0.1335	0.1484	0.1539	0.1715
No. of Obervations	32583	32583	14229	14229	18347	18347
No. of Firms	1244	1244	620	620	625	625

Note. 1. ***, **, and * denote 1%, 5%, and 10% significance levels, respectively. 2. Values in parentheses are t-statistics. 3. White's heteroskedasticity-consistent standard errors are used to compute t-statistics. 4. Estimation results by OLS. 5. We adopt the fixed effect model. 6. The values given to columns 1, 3, and 5 are the same as those of Table 2.

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