



Fixed investment, liquidity constraint, and monetary policy: Evidence from Japanese manufacturing firm panel data



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ARTICLE INFO

Article history:

Received 15 January 2013

Received in revised form 28 October 2014

Accepted 1 January 2015

Available online 16 January 2015

JEL classification:

E51

E52

G31

Keywords:

Monetary policy shock

Real fixed investment

Net worth

ABSTRACT

We empirically analyze the effects of monetary policy shocks on real fixed investment using panel data on Japanese manufacturing firms to examine the existence of a balance sheet channel. We find that contractionary monetary policy statistically significantly increases the firms' liquidity constraint. Especially, the smaller the firm size, the greater the effects of contractionary monetary policy. Therefore, our estimation results support the presence of a balance sheet channel. In addition, the firms' liquidity constraint decreases significantly during quantitative monetary easing policy (QMEP) period. Specifically, QMEP relaxes the liquidity constraint of large firms. Our evidence suggests that QMEP transmission works through the balance sheet channel and affects the real economy.

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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 investment 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 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

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 et al. \(1988\)](#).

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.

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

Table 1
Summary statistics.

	All firms			Relatively small firms			Large firms		
	I/K	q	LIQ	I/K	q	LIQ	I/K	q	LIQ
Mean	0.1262	1.2584	0.4251	0.1177	1.2535	0.4374	0.1348	1.2624	0.4128
Median	0.0948	0.9935	0.4251	0.0806	0.9807	0.4374	0.1080	1.0060	0.4126
Maximum	4.4048	19.557	0.8117	4.4048	19.557	0.8190	3.1129	19.351	0.7999
Minimum	-0.6887	-19.662	0.0470	-0.6422	-19.662	0.0584	-0.6887	-18.238	0.0354
Std. deviation	0.1524	1.7455	0.1248	0.1699	1.9340	0.1236	0.1319	1.5204	0.1247
Observations	24,202	24,202	24,202	12,148	12,148	12,148	12,050	12,050	12,050

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 investment 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.

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 investment 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 investment 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' investment is 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 the QMEP relaxes liquidity constraints of large firms. Our evidence suggests that the QMEP transmission works through the balance sheet channel and has an effect on the real economy.

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. Section 6 checks the robustness of the main results. Conclusions are stated in Section 7.

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. However, estimation periods begin in

⁵ See Ugai (2006) for a recent survey of the empirical research of the QMEP.

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