Unconventional monetary policy and stock repurchases: Firm-level evidence from a comparison between the United States and Japan

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ABSTRACT

This paper is the first comparative study examining the determinants of stock repurchases during the period of unconventional monetary policy. By constructing a vast firm-level dataset of the U.S. and Japan and conducting multivariate Tobit and probit analyses, this paper presents evidence that during the period of unconventional monetary policy, in both the U.S. and Japan, firms with more free cash flow and lower borrowing costs are more likely to repurchase stock, firms with higher financial leverage are more likely to abstain from stock repurchases, and firms coordinate dividends and stock repurchases to please shareholders. I also find striking contrasts between the results of U.S. and Japanese firms, and show the importance of financial structure in explaining the contrasting results. From a micro perspective, this paper provides new insight and evidence to support the view that financial structure should be thought of as an important factor determining the effects of unconventional monetary policy.

1. Introduction

In response to the recent global financial crisis and its aftermath of the sharp global recession, major central banks around the world lowered their short-term policy rates essentially to their zero lower bound. In order to stimulate economic activity and financial markets by tools other than the short-term policy rates, they have turned to unconventional monetary policies – expanding their balance sheets through purchasing assets. The literature on unconventional monetary policy so far has mainly focused on its macroeconomic effects, and it is still quite unclear in regard to firms’ microeconomic behavior during the period of unconventional monetary policy. This paper tries to shed light on this issue.

Another factor motivating this study is the fact that countries differ widely in financial structure: the mixture of financial instruments, markets, and intermediaries operating in an economy. In the financial structure literature, in regard to whether it is banks or securities markets that play the leading role in financing firms and exerting corporate control, financial systems are divided into bank-based systems and market-based systems (see Allen and Gale, 2000; Demirgüç-Kunt and Levine, 2004). Do the enforcement technique, transmission mechanism or effects of unconventional monetary policy depend on or change with financial structure? Although researchers have made great strides in improving our understanding of unconventional monetary policy, studies on this question have just begun. Cour-Thimann and Winker (2012) point out that the bank-based financial structure of the euro area economy is an important factor framing the ECB’s unconventional monetary policy. Wang (2016) is the first paper to examine empirically how differences in financial structure have been responsible for the differences in approach and effects of unconventional
monetary policy between Japan (the financial system of which is regarded as market-based), while focusing on aggregate bank credit. Also from the macro perspective, Wang (2018) conducts a comparative study on monetary-fiscal policy interactions during the unconventional monetary periods of both the U.S. and Japan, and the results suggest that financial structure may affect the interactions between unconventional monetary policy and fiscal policy. Using micro-level data of Mortgage-Backed Securities (MBS) deals of both the U.S. and Japan, Wang (2019) provides evidence on how financial structure affects the impact of unconventional monetary policy on MBS pricing from a different perspective than that of prior research: the micro perspective. This paper also attempts to explore the way in which financial structure affects the impact of unconventional monetary policy at the micro level.

In this paper, I construct a vast firm-level dataset of both the U.S. and Japan and conduct multivariate Tobit and probit analyses, with a focus on firm stock repurchasing behavior during the period of unconventional monetary policy. I try to answer the following important questions through the comparative study: what firm-specific characteristics determine firms’ stock repurchases during the period of unconventional monetary policy, and are there any differences in the results due to the differences in the two countries’ financial structures?

To the best of my knowledge, no other study has been carried out to investigate the determinants of actual stock repurchases during the period of unconventional monetary policy. Although using different approaches and purposes for analyzing, different theoretical hypotheses and variables and different sample periods – since U.S. unconventional monetary policy was implemented in order to counter the economic downward pressure triggered by the 2008 financial crisis – this paper complements the findings of Iyer and Rao (2017) and Chen et al. (2018). The two studies both focus on the financial crisis period during which firms suffered from financial difficulties and might have been in a conservative mode. To the contrary, during the period of unconventional monetary policy, the central banks of both have conducted unconventional monetary policy, while having contrasting financial structures. I believe that this provides us with a good opportunity to examine the way in which financial structure relates to the effects of unconventional monetary policy. My rationale behind the comparative method is that, after controlling for economic conditions, if the coefficients of the variables I use as proxies for the determinants of stock repurchases during the period of unconventional monetary policy differ significantly between the U.S. sample and the Japanese sample, then this may suggest that financial structure could be a relevant factor. By using this method, I find firm-level cross-country evidence that differences in financial structure may be associated with differences in firms’ stock repurchases in the U.S. and Japan during the period of unconventional monetary policy. Thus, this comparative study may further enhance our understanding of financial structure as well.

The remainder of the paper is organized as follows: Section 2 illustrates hypotheses for the determinants of stock repurchases during the period of unconventional monetary policy, while comprehensively reviewing the closely related literature. Section 3 specifies the methods and describes the data employed for testing the hypotheses. Section 4 presents the empirical evidence. Finally, Section 5 draws conclusions and provides further discussions.

2. Theoretical hypotheses

Unconventional monetary policy boosts the quantity of money in the financial system and pushes interest rates lower across the economy by providing financial institutions and financial markets with massive liquidity while the central bank’s own short-term policy rate is at or near zero. The unprecedented use of unconventional monetary policy raises new research questions. The question that interests me in this paper is: what factors influence firms’ repurchase behavior during the period of unconventional monetary policy? Since this question relates to the transmission mechanism and the effectiveness of unconventional monetary policy, I believe that in order to obtain a deeper and fuller understanding of the new monetary policy framework, it is very important to answer this question.

In this section, I construct five testable hypotheses relating to firms’ motives of stock repurchases in the context of unconventional monetary policy, focusing on a set of firm characteristics. The general idea behind these hypotheses is that the expansive monetary environment characterized by extremely low interest rates and abundant supply of liquidity (as a result of aggressive unconventional monetary policy actions over an extended period of time) will affect firms’ decision to repurchase stock.

2.1. Free cash flow hypothesis

The Free Cash Flow Hypothesis is based on the premise that stock repurchasing serves as a tool for firms that don’t know what else to do with free cash flow.\(^2\) Jensen (1986) argues that firms with free cash flow will encounter high agency costs if the excess cash is

\(^2\)According to Jensen (1986), free cash flow is cash flow in excess of that required to fund all projects that have positive net present values when discounted at the relevant cost of capital.
not distributed to shareholders since self-interested managers have an incentive to put the excess cash into wasteful investments and other negative net present value projects. Stephens and Weisbach (1998) and Nohel and Tarhan (1998) find empirical evidence of a positive relation between repurchases and free cash flow. In Lee and Suh (2011), it is documented that large cash holdings have a significant association with the amount of stock repurchases in all examined major countries.

With reference to my focus on the period of unconventional monetary policy, it can be noted that Foley-Fisher et al. (2016) find evidence that unconventional monetary policy would relax firms' financial constraints. In addition, it is well known that during a financial crisis, due to the considerable pressure on firms' liquidity conditions and the huge increase in uncertainty, firms tend to conserve cash flow (see, for example, DeAngelo and DeAngelo, 1990; Campello et al., 2010; Iyer and Rao, 2017). There is a general consensus that unconventional monetary policy measures taken in response to the recent global financial crisis helped to restore the functioning of the financial system and stabilize financial markets (see, for example, Joyce et al., 2012; Cukierman, 2013). Therefore, during the period of unconventional monetary policy – a period when financial distress receded – firms may be less financial constrained and become more inclined to use their free cash flow.

Hence, I expect that during the period of unconventional monetary policy, firms with higher levels of free cash flow are more likely to repurchase stock to distribute the excess cash to shareholders.

2.2. Debt cost hypothesis

Theoretically, unconventional monetary policy will make it easier for firms to borrow, and encourage them to spend more (Joyce et al., 2012). For example, the persistent low-interest-rate environment resulting from unconventional monetary policy would reduce the financing costs for commercial banks. The banks (lenders) may, in turn, pass on the reduced financing costs, in the form of lower lending rates, to firms (borrowers). In addition, as many studies have shown, unconventional money policy can also push up asset prices (see, for example, D’Amico et al., 2012; Rosa, 2012; Ueda, 2012; Rogers et al., 2014). When asset prices rise, balance sheets of both banks and firms will become stronger (for example, banks’ capital and firms’ collateral value will increase). According to the credit channel of monetary policy, the strengthening of banks and firms’ financial conditions will lead to a decline in firms’ external finance premiums and an increase in firms’ credit availability (Bernanke and Gertler, 1995; Bernanke et al., 1996). Hence, as discussed by Bowdler and Radia (2012), unconventional monetary policy would lead to lower interest rates at which firms access finance, and the reduction in borrowing costs would lessen firms’ interest burdens, increasing their incentive to borrow and boosting their spending.

Is it possible that firms facing lower costs of borrowing might take advantage of historically low interest rates by borrowing funds and using these funds to repurchase their stock? Theoretically, this possibility cannot be excluded, particularly when there is nothing better to invest in and firms have motives for stock repurchases such as those posited by other hypotheses in the section. This research issue has not been empirically investigated in previous literature. I hypothesize that firms having lower borrowing costs during the period of unconventional monetary policy are more likely to repurchase stock.

2.3. Undervaluation hypothesis

Since there is information asymmetry between a firm’s insiders and lesser-informed outside investors concerning the intrinsic value and future prospects of the firm, it is possible that the firm is undervalued by the market. Many previous studies find empirical evidence for the link between undervaluation and stock repurchases (see, for example, Vermaelen, 1981; Lakonishok and Vermaelen, 1990; Ikenberry et al., 1995; Stephens and Weisbach, 1998; Ben-Rephael et al., 2014; Wang and DeGennaro, 2019). As mentioned before in the Debt Cost Hypothesis, there also are studies reporting that unconventional monetary policy would lead to a rise in asset prices. Moreover, as Chen et al. (2018) suggest, low stock prices due to the financial crisis may motivate firms to repurchase stock in order to provide support for their own shares and to send a signal to the market that their shares are undervalued. Furthermore, it is also noteworthy that during the period of unconventional monetary policy, since there is a lack of good real investment opportunities in the sluggish economy, repurchasing undervalued stock would be a good investment for firms’ managers.

For the above reasons, I use the Undervaluation Hypothesis to see whether more undervalued firms are more likely to repurchase stock during the period of unconventional monetary policy.

2.4. Financial leverage hypothesis

If a firm repurchases stock, its equity will be less and therefore its financial leverage will be higher after the repurchase. Prior studies suggest that a firm tends to repurchase stock to adjust its capital structure when its leverage ratio is below its target leverage ratio (see, for example, Dittmar, 2000; Hovakimian et al., 2001). Chen et al. (2018) note that low stock prices due to the financial crisis provides firms with good opportunities to adjust their capital structure through repurchasing stock at lower prices.

On the other hand, in the literature of capital structure, it is also widely acknowledged that there are agency costs of debt financing since shareholders of highly leveraged firms have a strong incentive to invest sub-optimally (for example, shareholders may

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3 Besides the fact that nominal short-term interest rates are persistently close to zero, unconventional monetary policy also compresses long-term interest rates and yields (see, for example, Joyce et al., 2011; Krishnamurthy and Vissing-Jorgensen, 2011; Wright, 2012). In such an ultra-loose monetary environment, banks can reduce the deposit rates or yields that they pay to depositors or investors.
take on highly risky investment projects at the expense of debt holders) due to the conflict between shareholders and debt holders (Jensen and Meckling, 1976; Myers, 1977). As suggested by Grossman and Hart (1982), firms which are aggressively taking on debts as a means of leveraging are also often associated with a high risk of default and bankruptcy in the future. For these reasons, highly leveraged firms will be more likely to be closely monitored by debt holders, which may reduce the possibility of distributing capital to shareholders by stock repurchases.

As mentioned in the Debt Cost Hypothesis, unconventional monetary policy may create a strong incentive for firms to borrow, in other words, encourage firms to increase their leverage. Hence, I use the Financial Leverage Hypothesis to investigate how a firm’s financial leverage affects its decision to repurchase during the period of unconventional monetary policy.

### 2.5. Complementarity hypothesis

For firms, in addition to repurchasing stock, paying dividends is also a main method of distributing cash to shareholders. Since dividends are traditionally viewed as related to firms’ ongoing, sustainable earnings stream by investors (Miller and Rock, 1985), firms use dividends as a signal of long-term growth and stability in earnings to increase shareholders or investors’ confidence in them, and prefer to increase dividends regularly if possible, in order to avoid the adverse investor reaction that accompanies dividend cuts (see, for example, Lintner, 1956; Healy and Palepu, 1988; Michaely et al., 1995; Koch and Sun, 2004; Wesson et al., 2018). On the other hand, with regard to stock repurchases, firms appreciate their flexibility (see, for example, Jagannathan et al., 2000; Brav et al., 2005; Iyer and Rao, 2017; Wesson et al., 2018)\(^4\), tax efficiency relative to dividends (depending on the country’s tax system), and positive impact on financial indicators such as EPS (earnings per share) and ROE (return on equity), etc. (see, for example, Bens et al., 2003; Brav et al., 2005; Hribar et al., 2006). In particular, in the period of unconventional monetary easing, when firms tend to be careful with capital spending amid uncertainty (thinking they may find themselves short of liquidity later), the flexibility inherent in stock repurchases would be beneficial for firms.

Recent literature on corporate payout policy suggests that dividends and repurchases are inherently different and thus not interchangeable. Guay and Harford (2000) find evidence that firms choose dividend increases to distribute relatively permanent cash-flow shocks, while they use repurchases to distribute more transient shocks. Floyd et al. (2015) demonstrate the staying power of dividends along with the growth of repurchases through the recent financial crisis. Following the recent developments in the literature, I hypothesize that firms may use stock repurchases as a complement to dividends.

Finally, it is worth pointing out that since the U.S. sample studied in this paper refers to the time after the 2008 financial crisis (i.e. when the crisis had receded), as already shown during hypothesis development, this paper relates to studies on the impact of the financial crisis on stock repurchases. It is well known that the financial crisis had a great impact on the design and implementation of unconventional monetary policy, hence I believe that the answers to the question of whether or not the financial crisis had changed firms’ motives for stock repurchases can also give us insight into the link between unconventional monetary policy and stock repurchases. So far, two studies about U.S. firms have addressed this question. Iyer and Rao (2017) find that during the financial crisis, stock repurchasers are more flexible than dividend payers and stock repurchasers have the ability to alter their ongoing open market stock repurchase programs. Also focusing on the financial crisis period, Chen et al. (2018) show that firms with higher cash flows, lower leverage, less or no dividends, and potential takeover target firms are more likely to announce stock repurchase programs. They also find evidence that firms’ motivations for announcing stock repurchase programs and actually repurchasing stocks may be different.

In the next section, I conduct multivariate Tobit analyses to test each of the above five hypotheses.

### 3. Empirical specification and data description

In this section, I provide details on my estimation approach, discuss my empirical design for examining the theoretical hypotheses posited in the previous section, and describe the data I use in the empirical analyses.

#### 3.1. The Tobit model

As shown in Section 2, the decision of the observed firms to repurchase stock is hypothesized to be the result of a complex set of factors. Not all firms would choose stock repurchases. In other words, for some firms, choosing not to repurchase stock (i.e., repurchases equal to zero) is optimal. Regression analysis using the OLS (ordinary least squares) method, which assumes that the dependent variable is normally distributed, is known to lead to biased and inconsistent parameter estimates in this case (Maddala, 1999; Greene, 2000). Therefore, a Tobit model is used in this study since it employs both data at zero as well as those above zero.

The Tobit model can be expressed as follows:

\(^4\) Compared with paying dividends, repurchasing stock is regarded as more flexible, since repurchases won’t recur on a regular basis and firms don’t have a commitment to repurchase even though the stock repurchase is announced. Stock repurchases offer flexibility not only in the choice of whether or not to distribute cash but also when to distribute. Firms can wait to repurchase until the stock price is undervalued in order to save repurchasing costs.
where for the ith firm, $RP_i^*$ is the latent variable reflecting the combined effect of the explanatory variables on the quantity of stock repurchases, $RP_i$ is its observable counterpart, $X_i$ is a vector of explanatory variables, $\beta$ is a vector of parameter to be estimated, and $\mu_i$ is the normally and independently distributed error term assumed to be normal with mean zero and standard deviation $\sigma$.

The expected value of $RP$ for all observations is:

$$E(RP|X_i) = P(RP > 0)E(RP|RP > 0) + P(RP = 0)E(RP|RP = 0)$$

$$= \Phi(X_i\beta + \sigma\frac{\varphi(X_i\beta)}{\Phi(\frac{X_i\beta}{\sigma})}) + 0$$

$$= \Phi(X_i\beta + \sigma\frac{\varphi(X_i\beta)}{\Phi(\frac{X_i\beta}{\sigma})}) + 0$$

where $\Phi$ represents the standard normal cumulative distribution function, $\varphi$ represents the standard normal cumulative density function.

It should be noted that unlike linear models, the marginal effects or partial derivative for a given explanatory variable (for example, $X_k$, the kth explanatory variable) is non-linear and thus not equal to the coefficient $\beta_k$. Following McDonald and Moffitt (1980), the marginal effects of $X_k$ on the expected value of $RP$ can be expressed:

$$\frac{\partial E(RP|X_i)}{\partial X_k} = \frac{\partial P(RP > 0)}{\partial X_k}E(RP|RP > 0) + P(RP = 0)\frac{\partial E(RP|RP > 0)}{\partial X_k}$$

$$= \frac{\beta_k}{\sigma}\varphi(X_i\beta + \sigma\frac{\varphi(X_i\beta)}{\Phi(\frac{X_i\beta}{\sigma})}) + \Phi(X_i\beta + \sigma\frac{\varphi(X_i\beta)}{\Phi(\frac{X_i\beta}{\sigma})})[1 - \frac{\varphi(X_i\beta)}{\Phi(\frac{X_i\beta}{\sigma})}]$$

$$= \frac{\beta_k}{\sigma}\varphi(X_i\beta + \sigma\frac{\varphi(X_i\beta)}{\Phi(\frac{X_i\beta}{\sigma})}) + \Phi(X_i\beta + \sigma\frac{\varphi(X_i\beta)}{\Phi(\frac{X_i\beta}{\sigma})})[1 - \frac{\varphi(X_i\beta)}{\Phi(\frac{X_i\beta}{\sigma})}]$$

$$= \frac{\beta_k}{\sigma}\Phi(X_i\beta)$$

Eq. (3) shows that the marginal effects of $X_k$ on the expected value of $RP$ for all firms (total marginal effects, also known as unconditional marginal effects) can be decomposed into two parts: the change in the probability of repurchasing stock, weighted by the expected value of $RP$ for firms repurchasing stock; and the change in the expected value of $RP$ for firms repurchasing stock, weighted by the probability of repurchasing stock.

From Eq. (3), we can also know that the fraction of the total marginal effects due to the change in the expected value of $RP$ for firms repurchasing stock (so-called conditional marginal effects) associated with $X_k$ is:

$$\frac{\partial E(RP|RP > 0)}{\partial X_k} = \frac{\beta_k}{\sigma}\varphi(X_i\beta) + \Phi(X_i\beta)[1 - \frac{\varphi(X_i\beta)}{\Phi(\frac{X_i\beta}{\sigma})}]$$

And, the change in the probability of repurchasing stock associated with $X_k$ is:

$$\frac{\partial P(RP > 0)}{\partial X_k} = \frac{\beta_k}{\sigma}\varphi(X_i\beta)$$

As suggested by Roncek (1992), $\frac{\partial}{\partial X_k}E(RP|RP > 0)$ and $\frac{\partial P(RP > 0)}{\partial X_k}$ identify important effects for the two types of observations, i.e., repurchasing firms and non-repurchasing firms.

For repurchasing firms, $\frac{\partial}{\partial X_k}E(RP|RP > 0)$ identifies how the quantity of repurchases is expected to change due to a unit change in $X_k$; for non-repurchasing firms, $\frac{\partial P(RP > 0)}{\partial X_k}$ identifies the marginal effect of $X_k$ on the probability of repurchasing stock.

Therefore, I estimate the total marginal effect using Eq. (3), the conditional marginal effect using Eq. (4), and the change in probability using Eq. (5) in the empirical analysis.

3.2. Model specification

Based on the five hypotheses discussed in Section 2, the stock repurchase decision is specified as a function of firm characteristics as follows:

$$RP_{it} = \alpha_{it} + \beta_1FCASHFLOW_{it-1} + \beta_2DEBTCOST_{it-1} + \beta_3BMR_{it-1} + \beta_4DER_{it-1} + \beta_5DIV_{it-1} + \mu_{it}$$

The dependent variable $RP_{it}$ represents the repurchase ratio (converted to percentage) of firm $i$ at the end of fiscal year $t$,
measured by the amount of cash the firm paid to repurchase stock over the previous 12 months compared with its market capitalization at the fiscal year-end.

The explanatory variables designed to capture the effects of the motives of stock repurchases include:

1. **FCASHFLOW\(_{i,t-1}\)**: the ratio of levered free cash flow to total assets of firm \(i\) at the end of the fiscal year prior to the repurchase

   Levered free cash flow is the free cash flow that remains after a firm has paid its obligations on its debt, which equals “EBIT – Tax Expense – Interest Expense + Depreciation and Amortization – Change in Working Capital – Capital Expenditure”. **FCASHFLOW** is used to examine the Free Cash Flow Hypothesis. A positive coefficient on **FCASHFLOW** may indicate that firms repurchase stock to distribute excess cash to shareholders.

2. **DEBT\(_{i,t-1}\)**: the ratio of interest expense to the sum of interest expense and operating expenses of firm \(i\) at the end of the fiscal year prior to the repurchase

   As we know, interest expense is a typical example of non-operating expenses. Thus, we can know from this ratio how expensive the firm’s borrowing costs are in terms of the percentage of interest expense in the firm’s main expenses. I use **DEBT\(_{i,t-1}\)** to test the Debt Cost Hypothesis. If the coefficient on **DEBT\(_{i,t-1}\)** is negative, then it is indicated that firms repurchase stock due to the low cost of borrowing during the period of unconventional monetary policy.

3. **BMR\(_{i,t-1}\)**: the book-to-market ratio of firm \(i\) at the end of the fiscal year prior to the repurchase

   **BMR** is measured as book value of equity divided by market value of equity. Book value of equity is calculated by “book value per share multiplied by shares outstanding”. For U.S. firms, following Fama and French (1992), the calculation of market value of equity is based on the price at the end of December, while for Japanese firms, the price information at the end of March is used. In the literature of finance theory, the book to market ratio has been regarded as one of the fundamental variables and an important indicator of firm value. Moreover, there are many studies showing that the book to market ratio has a significant role in explaining stock returns. For example, Rosenberg et al. (1984) find that average returns on U.S. stocks are positively related to the book to market ratio, and Chan et al. (1991) find that the book to market ratio has a reliably positive impact on expected stock returns in the Japanese stock market. Thus, I use **BMR** to examine the Undervaluation Hypothesis which predicts that firms with higher book-to-market ratio (i.e., being more undervalued in the market) are more likely to repurchase stock.

4. **DER\(_{i,t-1}\)**: the debt-to-equity ratio of firm \(i\) at the end of the fiscal year prior to the repurchase

   **DER** is calculated by dividing the firm’s total liabilities by its shareholders’ equity. The debt-to-equity ratio is a measure of the firm’s financial leverage. Thus, **DER** is used to test the Financial Leverage Hypothesis which predicts that highly leveraged firms are more likely to abstain from stock repurchases. Thus, the coefficient on **DER** is expected to be negative.

5. **DIV\(_{i,t-1}\)**: dividends per share of firm \(i\) at the end of the fiscal year prior to the repurchase

   **DIV** is used to examine the Complementarity Hypothesis. A positive coefficient on **DIV** may indicate that repurchases are not substitutes for dividends but rather complement them, in other words, for firms, repurchasing stock has different effects from paying dividends although both of them are primary payout methods to distribute capital to shareholders.

### 3.3. Sample description

The firm-level data used in this study are obtained from S&P Capital IQ. The U.S. sample includes 3407 public companies, and the Japanese sample contains 1964 public companies.

I set the sample periods of both the U.S. sample and the Japanese sample within the period of unconventional monetary policy, since the objective of this study is to analyze why firms repurchase stock during the unconventional monetary policy period. Speaking more specifically, for the Japanese sample, the sample period is FY2005, and for the U.S. sample, FY2009 is selected as the sample period. The reasons for selecting the above sample periods are as follows:

FY2005 and FY2009 are the final phase of extended-period unconventional monetary policy in Japan and the United States respectively: the Bank of Japan’s QE (Quantitative Easing, March 2001 – March 2006) and the Federal Reserve’s CE&LASP1 (Credit Easing and the first Large Scale Asset Purchase, December 2007 – March 2010). It is noteworthy that QE and CE&LASP1 are special in that they both are the first attempt for either the Bank of Japan or the Federal Reserve to implement unconventional monetary policy. In other words, QE and CE&LASP1 are unprecedented events in the history of monetary policy in both Japan and the U.S., and are beyond the control of firms in the economy. Hence, due to their unexpectedness, the Bank of Japan’s QE and the Federal Reserve’s CE&LASP1 can be seen as exogenous positive monetary shocks to all firms in the economy. In this sense, my rationale for choosing the above sample periods is similar to that of Iyer and Rao (2017) and Chen et al. (2018), which use the financial crisis of 2008 – 2009 as “a natural experiment” (an exogenous negative economic shock) to investigate firms’ motives for stock repurchases during that period. Because of this common feature in the Bank of Japan’s QE and the Federal Reserve’s CE&LASP1, the choice of the above sample periods can improve our understanding of the motives for firms’ stock repurchases that correspond to the unprecedented exogenous positive monetary shocks. Moreover, by investigating the difference in U.S. firms and Japanese firms’ repurchasing behavior taken in reaction to monetary shocks caused by the unanticipated and unprecedented adoption of unconventional monetary policy, we can also explore the ways in which firms’ motives for repurchasing stock may be affected by financial structure and thus

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5 Since it takes time for firms to learn about and react to economic changes, all of the explanatory variables are introduced with a one-year lag in order to capture the delayed response of firms to changes in economic conditions and monetary policy. This method is also used for reducing the potential of endogeneity problems.

6 In Japan, the fiscal year starts on April 1 and ends on March 31.
know more about the importance of financial structure to the transmission of unconventional monetary policy.

Second, although both QE and CE&LASP1 are unconventional monetary policy aiming to achieve a further monetary easing effect when short-term interest rates were already close to zero, the Bank of Japan and the Federal Reserve used different policy approaches. Wang (2016) shows empirical evidence that the approaches of the Bank of Japan’s QE and the Federal Reserve’s CE&LASP1 are different, and those differences reflect the differences in financial structure between Japan and the United States.7 On the other hand, as Hancock and Passmore (2011) suggest, there may exist a “stock effect” of central banks’ persistent asset purchases stemming from the substantial stock of assets held by central banks for a long period. Moreover, Farrugia et al. (2011) find evidence that economic conditions affect firms’ motives for stock repurchases. In addition, it is well known that there are transmission lags between money policy actions and the responses of economic agents (Friedman, 1961). Hence, it takes time for monetary policy to have a real effect on firms’ investment opportunity sets and investment activities. In light of all these considerations, I select the final phase of the Bank of Japan’s QE and the Federal Reserve’s CE&LASP1 as sample periods to control for economic conditions. Hence, by examining firm stock repurchasing behavior in the two countries during the above sample periods, I can investigate whether or not different approaches to unconventional monetary policy influence firm stock repurchasing behavior in the two countries differently when the central banks of both believed the unconventional monetary policy they undertook had taken effect in bringing about the recovery of the economy (otherwise they would not have announced its end soon after the sample periods).8

Lastly, according to Dittmar (2000), firms’ motives for repurchasing stock may fluctuate over time, which suggests that analysis results of stock repurchases are likely to be dependent on the choice of sample period if there is no control for the time-varying motives for stock repurchases. In the existing literature, Iyer and Rao (2017) and Chen et al. (2018) use an exogenous negative economic shock to all firms – the financial crisis in 2008, rather than annual periods or long sample periods – as an explicit control to reduce the potential sample-period dependence. I use a similar approach with these two studies: I identify an exogenous positive economic shock to all firms – the unprecedented implementation of unconventional monetary policy – and deliberately select the final phase of that first attempt on unconventional monetary policy as the sample period to take the time-varying motives for stock repurchases and monetary transmission lags mentioned before into account.

Summary statistics of the U.S. sample and the Japanese sample for all variables discussed above and used in the estimation are reported in Tables 1 and 2 respectively. Tables 3 and 4 further show the descriptive statistics for the variables of repurchasing and non-repurchasing firms over the sample period of the U.S. sample and the Japanese sample respectively. Results of t-tests for differences of means between repurchasing and non-repurchasing firms are also presented for each country.

These statistics indicate that, compared with the Japanese sample, in the U.S. sample, although the percentage of repurchasing firms is much lower, for those firms which conduct stock repurchases, the mean and median repurchase ratio is much higher. This evidence is consistent with the finding in DeAngelo et al. (2004) that in the United States, industrial firms now exhibit a two-tier structure in which a small number of firms collectively dominate the distribution of both earnings and payouts.

We also observe that both in the U.S. and Japanese samples, repurchasing firms have larger mean (median) FCASHFLOW, lower mean (median) DEBTCOST, lower mean DER, and larger mean (median) DIV than non-repurchasing firms. Furthermore, in both samples, except for DER in the U.S. sample, the differences in means of these key characteristics between repurchasing and non-repurchasing firms are highly statistically significant. Thus, these statistics support the Free Cash Flow Hypothesis, the Debt Cost Hypothesis, the Financial Leverage Hypothesis, and the Complementarity Hypothesis.

In addition, it is noteworthy that while in the U.S. sample repurchasing firms have lower mean (median) BMR than non-repurchasing firms, in the Japanese sample repurchasing firms’ mean (median) BMR is larger than that of non-repurchasing firms. Table 5 reports results of tests for equality of means of the U.S. and Japanese samples. It can be seen that in the group of repurchasing firms, except for BMR, the null hypotheses of equal means between the U.S. sample and the Japanese sample are rejected at the 1% level. Such evidence suggests that the means of U.S. repurchasing firms’ RP, FCASHFLOW, DEBTCOST, DER and DIV are significantly different than those of Japanese repurchasing firms. Regarding the group of non-repurchasing firms, except for DER, means of explanatory variables are significantly different between the U.S. sample and the Japanese sample.

4. Empirical results

4.1. The Tobit model

Tables 6 and 7 report the maximum likelihood estimation results of the Tobit model of stock repurchases, total marginal effects, the marginal effects among repurchasing firms, and the changes in the probability of repurchasing stock among non-repurchasing firms of the U.S. and Japanese samples, respectively. Reported marginal effects are calculated at the means of the explanatory variables. The results support the inferences drawn from the summary statistics.

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7 The approaches of the two central banks are different in reference to the following three points: (1) from whom assets were purchased; (2) what kinds of assets were purchased; and (3) how assets were purchased. In the case of the Bank of Japan, it supplied a huge amount of funds directly to commercial banks mainly by purchasing long-term government bonds from them through open market operation. In the case of the Federal Reserve, it supplied a huge amount of funds directly to financial markets both by lending to market participants, and by purchasing marketable financial products.

8 As for the announcements, see Bank of Japan (2006) and the Federal Reserve Press Release (2010).
The positive and significant results of FCASHFLOW indicate that both in the U.S. and Japan, firms are more likely to repurchase stock to distribute capital to shareholders when they have more free cash flow during the period of unconventional monetary policy. This evidence supports the Free Cash Flow Hypothesis.

The evidence also indicates that in an economic environment with persistent record-low interest rates and increased liquidity as a result of prolonged monetary easing but with a lack of good real investment opportunities, less financially constrained firms tend to distribute excess cash by stock repurchases.

It is intriguing, moreover, that the positive relationship between free cash flow and stock repurchases is more obvious in the U.S. than in Japan, as shown by the larger marginal effects and change in probability of repurchasing stock. In other words, evidence for

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**Table 1**

Descriptive statistics for the variables (U.S.).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Median</th>
<th>Max</th>
<th>Min</th>
<th>S. D.</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP (%)</td>
<td>1.035</td>
<td>0.000</td>
<td>23.767</td>
<td>0.000</td>
<td>2.862</td>
<td>3407</td>
</tr>
<tr>
<td>FCASHFLOW</td>
<td>−0.032</td>
<td>0.000</td>
<td>1.578</td>
<td>−1.807</td>
<td>0.236</td>
<td>3407</td>
</tr>
<tr>
<td>DEBT/COST</td>
<td>0.018</td>
<td>0.004</td>
<td>0.313</td>
<td>0.000</td>
<td>0.036</td>
<td>3407</td>
</tr>
<tr>
<td>BMR</td>
<td>1.209</td>
<td>0.833</td>
<td>10.636</td>
<td>0.000</td>
<td>1.366</td>
<td>3407</td>
</tr>
<tr>
<td>DER</td>
<td>0.957</td>
<td>0.371</td>
<td>20.726</td>
<td>0.000</td>
<td>1.848</td>
<td>3407</td>
</tr>
<tr>
<td>DIV (Dollar)</td>
<td>0.327</td>
<td>0.000</td>
<td>14.700</td>
<td>0.000</td>
<td>0.873</td>
<td>3407</td>
</tr>
</tbody>
</table>

**Table 2**

Descriptive statistics for the variables (Japan).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Mean</th>
<th>Median</th>
<th>Max</th>
<th>Min</th>
<th>S. D.</th>
<th>Obs.</th>
</tr>
</thead>
<tbody>
<tr>
<td>RP (%)</td>
<td>0.454</td>
<td>0.011</td>
<td>19.352</td>
<td>0.000</td>
<td>1.557</td>
<td>1964</td>
</tr>
<tr>
<td>FCASHFLOW</td>
<td>0.017</td>
<td>0.016</td>
<td>0.357</td>
<td>−0.434</td>
<td>0.064</td>
<td>1964</td>
</tr>
<tr>
<td>DEBT/COST</td>
<td>0.005</td>
<td>0.002</td>
<td>0.081</td>
<td>0.000</td>
<td>0.008</td>
<td>1964</td>
</tr>
<tr>
<td>BMR</td>
<td>0.939</td>
<td>0.384</td>
<td>13.905</td>
<td>0.000</td>
<td>0.558</td>
<td>1964</td>
</tr>
<tr>
<td>DER</td>
<td>0.846</td>
<td>0.384</td>
<td>13.905</td>
<td>0.000</td>
<td>1.419</td>
<td>1964</td>
</tr>
<tr>
<td>DIV (Yen)</td>
<td>7.372</td>
<td>0.000</td>
<td>88.000</td>
<td>0.000</td>
<td>12.030</td>
<td>1964</td>
</tr>
</tbody>
</table>

**Table 3**

Descriptive statistics for the variables of repurchasing and non-repurchasing firms (U.S.).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Repurchasing Firms: n = 1261</th>
<th>Non-repurchasing Firms: n = 2146</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(37.0% of full sample n = 3407)</td>
<td>(63.0% of full sample n = 3407)</td>
</tr>
<tr>
<td>RP (%)</td>
<td>2.797</td>
<td>0.701</td>
</tr>
<tr>
<td>FCASHFLOW</td>
<td>0.034</td>
<td>0.020</td>
</tr>
<tr>
<td>DEBT/COST</td>
<td>0.014</td>
<td>0.004</td>
</tr>
<tr>
<td>BMR</td>
<td>1.028</td>
<td>0.980</td>
</tr>
<tr>
<td>DER</td>
<td>0.918</td>
<td>0.712</td>
</tr>
<tr>
<td>DIV (Dollar)</td>
<td>0.405</td>
<td>8.302</td>
</tr>
</tbody>
</table>

**Table 4**

Descriptive statistics for the variables of repurchasing and non-repurchasing firms (Japan).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Repurchasing Firms: n = 1253</th>
<th>Non-repurchasing Firms: n = 711</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>(63.8% of full sample n = 1964)</td>
<td>(36.2% of full sample n = 1964)</td>
</tr>
<tr>
<td>RP (%)</td>
<td>0.701</td>
<td>0.020</td>
</tr>
<tr>
<td>FCASHFLOW</td>
<td>0.020</td>
<td>0.018</td>
</tr>
<tr>
<td>DEBT/COST</td>
<td>0.004</td>
<td>0.002</td>
</tr>
<tr>
<td>BMR</td>
<td>0.980</td>
<td>0.886</td>
</tr>
<tr>
<td>DER</td>
<td>0.712</td>
<td>0.312</td>
</tr>
<tr>
<td>DIV (Yen)</td>
<td>8.302</td>
<td>3.415</td>
</tr>
</tbody>
</table>

Listed P-values are from t-tests for differences of means.

(1) Free Cash Flow Hypothesis

The positive and significant results of FCASHFLOW indicate that both in the U.S. and Japan, firms are more likely to repurchase stock to distribute capital to shareholders when they have more free cash flow during the period of unconventional monetary policy. This evidence supports the Free Cash Flow Hypothesis.

The evidence also indicates that in an economic environment with persistent record-low interest rates and increased liquidity as a result of prolonged monetary easing but with a lack of good real investment opportunities, less financially constrained firms tend to distribute excess cash by stock repurchases.

It is intriguing, moreover, that the positive relationship between free cash flow and stock repurchases is more obvious in the U.S. than in Japan, as shown by the larger marginal effects and change in probability of repurchasing stock. In other words, evidence for
the Free Cash Flow Hypothesis is stronger in the case of U.S. firms than in that of Japanese firms. As we know, stock repurchases generally increase shareholder value since the relative ownership of each shareholder increases, as there are fewer shares on earnings of the firm after stock repurchases. Therefore, one possible explanation for this finding relating to the United States’ securities market-based financial system is that, compared with their Japanese counterparts, U.S. firms are more shareholder-friendly and more oriented to emphasizing the maximization of shareholder value as the principle of their corporate governance (Lazonick and O’Sullivan, 2000).

(2) Debt Cost Hypothesis

Both in the U.S. and Japan, firms associated with lower borrowing costs are more likely to repurchase stock, as evidenced by the negative and significant coefficients of DEBT/COST. It is also notable that in both the U.S. and Japanese samples, the estimated effect of debt costs on stock repurchases is large enough to be economically meaningful. This finding supports the Debt Cost Hypothesis, implying that the cost of debt is an important factor in determining why firms repurchase stock during the period of unconventional

Table 5
Tests for equality of means of the U.S. and Japanese samples.

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Repurchasing Firms (U.S. vs. Japan)</th>
<th>Non-repurchasing Firms (U.S. vs. Japan)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>P-value</td>
<td>P-value</td>
</tr>
<tr>
<td>RP (%)</td>
<td>0.000</td>
<td>–</td>
</tr>
<tr>
<td>FCASHFLOW</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>DEBT/COST</td>
<td>0.000</td>
<td>0.000</td>
</tr>
<tr>
<td>BMR</td>
<td>0.144</td>
<td>0.000</td>
</tr>
<tr>
<td>DER</td>
<td>0.000</td>
<td>0.136</td>
</tr>
<tr>
<td>DIV</td>
<td>0.000</td>
<td>0.000</td>
</tr>
</tbody>
</table>

Listed P-values are from t-tests for differences of means.

Table 6
Tobit Model Results for Firms’ Stock Repurchases (U.S.).

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Coefficient</th>
<th>z-Statistic</th>
<th>P-value</th>
<th>Total Marginal Effect</th>
<th>Conditional Marginal Effect among Repurchasing Firms</th>
<th>Change in Probability of Repurchasing Stock among Non-repurchasing Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>−1.696***</td>
<td>−8.855</td>
<td>0.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FCASHFLOW</td>
<td>7.841***</td>
<td>11.307</td>
<td>0.000</td>
<td>2.483</td>
<td>2.135</td>
<td>0.507</td>
</tr>
<tr>
<td>DEBT/COST</td>
<td>−15.309***</td>
<td>−4.020</td>
<td>0.000</td>
<td>−4.847</td>
<td>−4.167</td>
<td>−0.990</td>
</tr>
<tr>
<td>BMR</td>
<td>−0.378***</td>
<td>−4.024</td>
<td>0.000</td>
<td>−0.120</td>
<td>−0.103</td>
<td>−0.024</td>
</tr>
<tr>
<td>DER</td>
<td>−0.035</td>
<td>−0.525</td>
<td>0.599</td>
<td>−0.011</td>
<td>−0.010</td>
<td>−0.002</td>
</tr>
<tr>
<td>DIV</td>
<td>0.254**</td>
<td>2.001</td>
<td>0.045</td>
<td>0.080</td>
<td>0.069</td>
<td>0.016</td>
</tr>
</tbody>
</table>

Number of left-censored observations at RP = 0: 2146.
Number of uncensored observations: 1261.
** indicates statistical significance at the 5% level.
*** indicates statistical significance at the 1% level.

Table 7
Tobit Model Results for Firms’ Stock Repurchases (Japan).

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Coefficient</th>
<th>z-Statistic</th>
<th>P-value</th>
<th>Total Marginal Effect</th>
<th>Conditional Marginal Effect among Repurchasing Firms</th>
<th>Change in Probability of Repurchasing Stock among Non-repurchasing Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>−0.452***</td>
<td>−3.594</td>
<td>0.000</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>FCASHFLOW</td>
<td>2.190***</td>
<td>2.672</td>
<td>0.008</td>
<td>1.020</td>
<td>0.756</td>
<td>0.427</td>
</tr>
<tr>
<td>DEBT/COST</td>
<td>−13.587***</td>
<td>−1.790</td>
<td>0.073</td>
<td>−6.329</td>
<td>−4.689</td>
<td>−2.651</td>
</tr>
<tr>
<td>BMR</td>
<td>0.275***</td>
<td>2.947</td>
<td>0.003</td>
<td>0.128</td>
<td>0.095</td>
<td>0.054</td>
</tr>
<tr>
<td>DER</td>
<td>−0.095**</td>
<td>−2.174</td>
<td>0.030</td>
<td>−0.044</td>
<td>−0.033</td>
<td>−0.019</td>
</tr>
<tr>
<td>DIV</td>
<td>0.017***</td>
<td>4.181</td>
<td>0.000</td>
<td>0.008</td>
<td>0.006</td>
<td>0.003</td>
</tr>
</tbody>
</table>

Number of left-censored observations at RP = 0: 711.
Number of uncensored observations: 1253.
* indicates statistical significance at the 10% level.
** indicates statistical significance at the 5% level.
*** indicates statistical significance at the 1% level.

L. Wang
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monetary policy. The evidence suggests that the persistent ultra-low interest rate environment resulting from unconventional monetary policy is likely to encourage firms to use cheap debt to finance stock repurchases, and thus enhance the likelihood of firms’ stock repurchases.

By comparing the marginal effects and change in probability of repurchasing stock of non-repurchasing firms, interestingly, I find that Japanese firms’ stock repurchase activities are more negatively affected by the cost of borrowing, or in other words, are more likely to be spurred by low debt cost. Speaking from the perspective of financial structure, this finding suggests that Japanese firms depend more on debt finance, which is consistent with the bank-based structure of financing – the fundamental feature of the Japanese financial system.

(3) Undervaluation Hypothesis

Regarding the results of the book-to-market ratio (BMR), although both estimated coefficients are statistically significant, the coefficient of the U.S. sample is negative, while that of the Japanese sample is positive. This result suggests that during the period of unconventional monetary policy, firms’ market valuations have different impacts on stock repurchases in the U.S. and Japan.

Since the means of BMR (all firms, repurchasing firms, and non-repurchasing firms) of the U.S. sample are larger than 1, and those of the Japanese sample are less than 1 (see Tables 1–4), I consider it necessary to look in more detail at BMR and conduct a more careful examination. I divide the U.S. and Japanese samples further into two subsamples based on the firms’ BMR values – undervalued firms (if BMR > 1) and non-undervalued firms (if BMR ≤ 1)9 – and perform Tobit regressions to the two subsamples of each country (see Tables 8 and 9 for the U.S. results, and Tables 10 and 11 for the Japanese results).

It can be seen from Table 8 that among undervalued U.S. firms (firms with BMR > 1), less undervalued firms (firms having lower BMR) are more likely to repurchase their stock.10 In other words, we still find evidence that BMR has a significant negative influence on U.S. firms’ stock repurchases after dividing firms into different groups according to their BMR values.

Compared with the U.S. results, the Japanese results are more consistent with the Undervaluation Hypothesis, which posits that firms having higher BMR would be more likely to repurchase stock. More specifically, among undervalued firms (firms with BMR > 1), more undervalued firms (firms having higher BMR) are more likely to repurchase their stock, and among non-undervalued firms (firms with BMR ≤ 1), less overvalued firms (firms having higher BMR) are more likely to repurchase their stock.

Overall, the evidence obtained by performing separate regressions for subsamples provides support to the findings regarding BMR in Tables 6 and 7. The result for the U.S. sample that BMR has a negative influence on U.S. firms’ stock repurchases is consistent with the tendency found by Zenner et al. (2009) that U.S. firms may “buy high” when repurchasing their own stock. This evidence also provides additional support for the finding of previous studies that U.S. firms repurchase stock pro-cyclically (see for example, Jagannathan et al., 2000; Dittmar and Dittmar, 2008; Bonaimé et al., 2016). The result for the Japanese sample that BMR has a positive influence on Japanese firms’ stock repurchases is consistent with Zhang (2002); Hatakeda and Isagawa (2004) and Kang et al. (2011), which find empirical evidence that Japanese firms’ stock prices would rise after stock repurchase announcements.

The different results of BMR (in particular, regarding undervalued firms) between the U.S. and the Japanese samples are intriguing. I can provide some possible explanations from the perspective of financial structure. First, prior studies suggest that well-developed stock markets (such as that of the U.S.) may make it easier to tie managerial compensation to stock market performance (Diamond and Verrecchia, 1982). For example, a desire to increase performance measures such as EPS (earnings per share) would be one strong motivation for U.S. firms to repurchase their own stock (Bens et al., 2003; Brav et al., 2005). Hribar et al. (2006) find that U.S. firms use stock repurchases to meet analysts’ EPS forecasts when they would have otherwise missed those forecasts, since missing analyst forecasts generally causes negative stock price responses, and managers with poor stock price performance usually find themselves out of a job. Furthermore, as Fenn and Liang (2001) suggest, there is a significant positive relationship between management stock options and stock repurchases of U.S. firms. In other words, managers who are compensated with stock options may have strong incentives for repurchasing stock, since they themselves will benefit greatly from the repurchases. Hence, such a securities market-based financial system as that of the U.S. may foster great managerial incentives to repurchase stock even when firms become less undervalued. In contrast, in Japan where firms are less reliant on market-based finance than their U.S. counterparts, managers’ compensation is less sensitive to stock market performance (Kaplan, 1994; Kato and Kubo, 2006) and less linked to management stock options as well (Salazar and Raggiunti, 2016; Shinozaki et al., 2016).

Second, taking the significant role played by shareholders in the U.S. corporate governance (Shleifer and Vishny, 1997) into account, U.S. firms may also repurchase stock in order to bolster shareholders’ returns when facing pressure from shareholders – activist shareholders in particular – even though those firms may be undervalued to a lesser degree. Especially, during the period of unconventional monetary policy when expected interest income is extremely low due to the persistent ultra-low interest rate environment, investors may demand more stock returns. In contrast to U.S. firms, due to features of Japanese-style corporate governance such as its main bank system, friendly cross-shareholding based on long-term relationships, stable shareholding by investors who implicitly commit to hold their equity stakes indefinitely, and the passive role played by shareholders who do not actively intervene in firms’ management, Japanese firms have faced less pressure from shareholders to maximize shareholder returns, and activist shareholders are less common in Japan than in the U.S. (Sheard, 1994; Weinstein and Yafeh, 1998; Gibson, 2000; Yafeh, 2000).

---

9 In the U.S. non-undervalued subsample, 99.85% is overvalued (i.e. BMR < 1), and in the Japanese non-undervalued subsample, 99.92% is overvalued.
10 Table 9 shows that among non-undervalued U.S. firms (firms with BMR ≤ 1), less overvalued (firms having higher BMR) are more likely to repurchase their stock.
The above explanations concerning which circumstances may lead to the U.S. and Japanese firms’ different stock repurchasing behavior in response to market valuation suggest that the different results of the Undervaluation Hypothesis between U.S. and Japanese firms may be associated with the differences in financial structure.

(4) Financial Leverage Hypothesis

The debt-to-equity ratio results (DER) show that financial leverage is negatively related to stock repurchases in both the U.S. and Japanese samples, although the estimated coefficient of DER is not statistically significant in the U.S. sample. The finding suggests that for both U.S. and Japanese firms, those having higher financial leverage are less likely to repurchase stock, which provides further support for the view demonstrated in Section 2 that capital structure considerations and agency costs of debt financing play an important role in a firm’s decision to repurchase its own stock.

### Table 8
Tobit Model Results for Undervalued Firms’ Stock Repurchases (U.S.).

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Coefficient</th>
<th>z-Statistic</th>
<th>P-value</th>
<th>Total Marginal Effect</th>
<th>Conditional Marginal Effect among Repurchasing Firms</th>
<th>Change in Probability of Repurchasing Stock among Non-repurchasing Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>−1.889***</td>
<td>−4.562</td>
<td>0.000</td>
<td>3.070</td>
<td>1.856</td>
<td>0.387</td>
</tr>
<tr>
<td>FCASHFLOW</td>
<td>7.141***</td>
<td>4.712</td>
<td>0.000</td>
<td>2.070</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEBTCOST</td>
<td>−9.079</td>
<td>−1.417</td>
<td>0.157</td>
<td>−2.631</td>
<td>−2.359</td>
<td>−0.492</td>
</tr>
<tr>
<td>BMR</td>
<td>−0.567***</td>
<td>−3.859</td>
<td>0.000</td>
<td>−0.164</td>
<td>−0.147</td>
<td>−0.031</td>
</tr>
<tr>
<td>DER</td>
<td>−0.114</td>
<td>−0.782</td>
<td>0.434</td>
<td>−0.033</td>
<td>−0.030</td>
<td>−0.006</td>
</tr>
<tr>
<td>DIV</td>
<td>0.145</td>
<td>0.710</td>
<td>0.478</td>
<td>0.042</td>
<td>0.038</td>
<td>0.008</td>
</tr>
</tbody>
</table>

Number of left-censored observations at \( RP = 0 \): 934.
Number of uncensored observations: 458.
*** indicates statistical significance at the 1% level.

### Table 9
Tobit Model Results for Non-undervalued Firms’ Stock Repurchases (U.S.).

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Coefficient</th>
<th>z-Statistic</th>
<th>P-value</th>
<th>Total Marginal Effect</th>
<th>Conditional Marginal Effect among Repurchasing Firms</th>
<th>Change in Probability of Repurchasing Stock among Non-repurchasing Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>−2.359***</td>
<td>−7.168</td>
<td>0.000</td>
<td>2.578</td>
<td>2.170</td>
<td>0.565</td>
</tr>
<tr>
<td>FCASHFLOW</td>
<td>7.768***</td>
<td>10.085</td>
<td>0.000</td>
<td>0.581</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DEBTCOST</td>
<td>−19.897***</td>
<td>−4.161</td>
<td>0.000</td>
<td>−6.604</td>
<td>−5.558</td>
<td>−1.448</td>
</tr>
<tr>
<td>BMR</td>
<td>1.446***</td>
<td>2.887</td>
<td>0.004</td>
<td>0.480</td>
<td>0.404</td>
<td>0.105</td>
</tr>
<tr>
<td>DER</td>
<td>0.039</td>
<td>0.531</td>
<td>0.595</td>
<td>0.013</td>
<td>0.011</td>
<td>0.003</td>
</tr>
<tr>
<td>DIV</td>
<td>0.308+</td>
<td>1.805</td>
<td>0.071</td>
<td>0.102</td>
<td>0.086</td>
<td>0.022</td>
</tr>
</tbody>
</table>

Number of left-censored observations at \( RP = 0 \): 1212.
Number of uncensored observations: 803.
* indicates statistical significance at the 10% level.
*** indicates statistical significance at the 1% level.

### Table 10
Tobit Model Results for Undervalued Firms’ Stock Repurchases (Japan).

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Coefficient</th>
<th>z-Statistic</th>
<th>P-value</th>
<th>Total Marginal Effect</th>
<th>Conditional Marginal Effect among Repurchasing Firms</th>
<th>Change in Probability of Repurchasing Stock among Non-repurchasing Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>−0.219</td>
<td>−0.855</td>
<td>0.392</td>
<td>0.581</td>
<td>0.424</td>
<td>0.261</td>
</tr>
<tr>
<td>FCASHFLOW</td>
<td>1.178</td>
<td>0.762</td>
<td>0.446</td>
<td>0.541</td>
<td>0.395</td>
<td>0.243</td>
</tr>
<tr>
<td>DEBTCOST</td>
<td>1.098</td>
<td>0.071</td>
<td>0.943</td>
<td>0.091</td>
<td>0.667</td>
<td>0.041</td>
</tr>
<tr>
<td>BMR</td>
<td>0.185</td>
<td>1.195</td>
<td>0.232</td>
<td>−0.117</td>
<td>−0.085</td>
<td>−0.053</td>
</tr>
<tr>
<td>DER</td>
<td>−0.238**</td>
<td>−2.257</td>
<td>0.024</td>
<td>−0.003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DIV</td>
<td>0.005</td>
<td>0.660</td>
<td>0.510</td>
<td>0.002</td>
<td>0.002</td>
<td>0.001</td>
</tr>
</tbody>
</table>

Number of left-censored observations at \( RP = 0 \): 245.
Number of uncensored observations: 524.
** indicates statistical significance at the 5% level.

The above explanations concerning which circumstances may lead to the U.S. and Japanese firms’ different stock repurchasing behavior in response to market valuation suggest that the different results of the Undervaluation Hypothesis between U.S. and Japanese firms may be associated with the differences in financial structure.
By comparing the marginal effects and change in probability of repurchasing stock, I find that the negative relationship between debt-to-equity ratio and stock repurchases is stronger in Japan. I can provide two possible explanations for this interesting finding from the perspective of financial structure. The first explanation is that since Japanese firms are more reliant on debt financing, such considerations as obtaining a higher credit rating and lowering borrowing costs would correlate more significantly with their incentives to prefer lower leverage (tend not to repurchase stock when their financial leverage is high). The second explanation is that, as mentioned in Section 2, there are conflicts between shareholders and debt holders concerning stock repurchases. Debt holders, who are regarded as more risk averse than equity holders, may become the “victims” of stock repurchases. In other words, if a firm repurchases its stock, the firm’s debt holders may end up with subsidizing shareholders and paying the price of stock repurchase, since stock repurchase reduces the firm’s liquidity, increase its financial leverage, and thus raise the default risks for debt holders. Hence, according to this explanation, the finding implies that debt holders (more specifically, banks) in Japanese firms have more powerful negotiating power and can monitor those firms more easily than is the case with U.S. firms.

Moreover, the evidence in the U.S. sample concerning DEBT_COST (stock repurchases relate to borrowing costs negatively) and DER (negative relationship between financial leverage and stock repurchases is both weaker and less significant than with Japanese firms), collectively suggest that during the period of unconventional monetary policy, when compared to their Japanese counterparts, U.S. firms are more likely to borrow money to help finance stock repurchases with less control and intervention from debt holders. It is noteworthy that the strong monitoring and control role played by banks in the case of Japanese firms, and the comparatively weak role played by debt holders in U.S. firms, are the results of Japanese bank-friendly practices fostered in a bank-based financial system, and the shareholder-friendly practices of the U.S. fostered in a securities market-based financial system respectively.

(5) Complementarity Hypothesis

Both U.S. and Japanese firms use stock repurchases as a complement to dividends, as evidenced by the positive and significant estimated coefficients of DIV. This finding is consistent with recent literature discussed in Section 2 and supports the Complementarity Hypothesis. It suggests that during the period of unconventional monetary policy when economic uncertainty is high and the prediction of future cash flows is difficult, firms may prefer to use stock repurchases in combination with dividends as a flexible distribution strategy.

The positive relationship between dividends and repurchases is more obvious in the U.S. than that in Japan, as shown by the larger marginal effects and change in probability of repurchasing stock in the U.S. sample. A possible explanation from the perspective of financial structure is that, on the one hand, due to the higher equity proportion in their financial portfolios, investors in the U.S. are more sensitive to investment income than those in Japan, on the other hand, in the U.S., equity finance is more important for firms and market-based valuation has a more significant impact on them (in terms of firm value, investment decisions, corporate control, etc.) than in Japan. U.S. firms may therefore face more shareholder-oriented pressure to distribute capital and be forced more strongly to maximize shareholder returns than their Japanese counterparts.

This result is consistent with the earlier findings that during the period of unconventional monetary policy, U.S. firms are more likely to repurchase stock to distribute capital to shareholders when they have more free cash flow, and are more likely to repurchase stock following good market valuation than Japanese firms.

### 4.2. Robustness checks

So far I have explained what factors affect firms’ stock repurchases during the period of unconventional monetary policy within a Tobit model framework. In this section, I employ a multivariate probit model to conduct robustness checks.

The dependent variable takes the value of one if the firm repurchases stock, and zero otherwise. Results for the U.S. and Japanese samples are shown in Tables 12 and 13 respectively. Reported marginal effects are calculated at the means of the explanatory variables.

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**Table 11**

Tobit Model Results for Non-undervalued Firms’ Stock Repurchases (Japan).

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Coefficient</th>
<th>z-Statistic</th>
<th>P-value</th>
<th>Total Marginal Effect</th>
<th>Conditional Marginal Effect among Repurchasing Firms</th>
<th>Change in Probability of Repurchasing Stock among Non-repurchasing Firms</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-0.958***</td>
<td>-4.640</td>
<td>0.000</td>
<td>0.466</td>
<td></td>
<td></td>
</tr>
<tr>
<td>FCASHFLOW</td>
<td>2.520**</td>
<td>2.502</td>
<td>0.012</td>
<td>1.127</td>
<td>0.845</td>
<td>0.455</td>
</tr>
<tr>
<td>DEBT_COST</td>
<td>-18.444*</td>
<td>-1.790</td>
<td>0.043</td>
<td>-8.247</td>
<td>-6.186</td>
<td>-3.331</td>
</tr>
<tr>
<td>BMR</td>
<td>1.009***</td>
<td>3.546</td>
<td>0.000</td>
<td>0.451</td>
<td>0.338</td>
<td>0.182</td>
</tr>
<tr>
<td>DER</td>
<td>-0.060</td>
<td>-1.183</td>
<td>0.237</td>
<td>-0.027</td>
<td>-0.020</td>
<td>-0.011</td>
</tr>
<tr>
<td>DIV</td>
<td>0.020***</td>
<td>3.932</td>
<td>0.000</td>
<td>0.009</td>
<td>0.007</td>
<td>0.004</td>
</tr>
</tbody>
</table>

Number of left-censored observations at RP = 0: 466.
Number of uncensored observations: 729.
* indicates statistical significance at the 10% level.
** indicates statistical significance at the 5% level.
*** indicates statistical significance at the 1% level.
Consistent with the evidence presented in the Tobit analyses (see Tables 6 and 7), the probit analyses show that free cash flow and dividends have a positive effect on the probability of repurchasing stock, whereas borrowing costs and financial leverage have a negative impact both in the United States and Japan. Also, as reported in the Tobit analyses, there are some differences between the results of U.S. and Japanese firms. The positive effects that free cash flow and dividends have on the probability of repurchasing stock are more noticeable in U.S. firms, whereas stock repurchases are more negatively affected by borrowing costs and financial leverage in Japanese firms. In contrast to the positive effect on the probability of repurchasing stock in the Japanese sample, book-to-market ratio has a negative effect in the U.S. sample.

In addition, I use book-to-market ratio to classify firms as either undervalued or non-undervalued, and run separate probit regressions for the two subsamples. The results are also consistent with those of the Tobit regressions (see Tables 8–11), so they are not reported here to save space.

5. Conclusions and discussions

Despite the increasing volume of literature focused on the macroeconomic effects of unconventional monetary policy, insufficient attention has so far been paid to its microeconomic effects, and thus very little is known about how firms behave during unconventional monetary policy periods. With the purpose of shedding light on this issue, this paper conducts the first study examining firms’ stock repurchasing behavior during the period of unconventional monetary policy. This paper also contributes to the financial structure literature by showing the effects of financial structure on firm stock repurchasing.

In this paper, I conduct a quantitative comparative study between the U.S. and Japan, two advanced countries which have implemented unconventional monetary policy while having contrasting financial structures: the former with a securities market-based financial system, and the latter with a bank-based financial system.

By constructing a vast firm-level dataset of the two countries and conducting multivariate Tobit and probit analyses, I show empirically what firm-specific characteristics determine firm stock repurchasing behavior during unconventional monetary policy periods. I find that in both the U.S. and Japan, firms with more free cash flow and lower borrowing costs are more likely to repurchase stock, firms with higher financial leverage are less likely to repurchase stock, and firms coordinate dividends and stock repurchases to please shareholders.

I also find some striking contrasts between U.S. and Japanese firms. The likelihood of repurchasing stock is more positively affected by free cash flow and dividends in U.S. firms but more negatively affected by borrowing costs and financial leverage in Japanese firms. Additionally, more undervalued Japanese firms are more likely to repurchase their stock, while less undervalued U.S. firms are more likely to repurchase their stock. Differences in financial structure of the two countries were explored to explain these contrasting results, by which it is indicated that financial structure may also be a relevant factor affecting firms’ stock repurchases during the period of unconventional monetary policy.

### Table 12
Probit Model Results for Firms’ Stock Repurchases (U.S.).

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Coefficient</th>
<th>z-Statistic</th>
<th>P-value</th>
<th>Marginal Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>−0.159***</td>
<td>−4.539</td>
<td>0.000</td>
<td></td>
</tr>
<tr>
<td>FCASHFLOW</td>
<td>1.570***</td>
<td>12.144</td>
<td>0.000</td>
<td>0.585</td>
</tr>
<tr>
<td>DEBTCOST</td>
<td>−2.364***</td>
<td>−3.318</td>
<td>0.001</td>
<td>−0.881</td>
</tr>
<tr>
<td>BMR</td>
<td>−0.112***</td>
<td>−6.096</td>
<td>0.000</td>
<td>−0.402</td>
</tr>
<tr>
<td>DER</td>
<td>−0.010</td>
<td>−0.730</td>
<td>0.465</td>
<td>−0.004</td>
</tr>
<tr>
<td>DIV</td>
<td>0.076***</td>
<td>3.026</td>
<td>0.003</td>
<td>0.028</td>
</tr>
</tbody>
</table>

*** indicates statistical significance at the 1% level.

### Table 13
Probit Model Results for Firms’ Stock Repurchases (Japan).

<table>
<thead>
<tr>
<th>Explanatory Variables</th>
<th>Coefficient</th>
<th>z-Statistic</th>
<th>P-value</th>
<th>Marginal Effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>0.141**</td>
<td>2.001</td>
<td>0.045</td>
<td></td>
</tr>
<tr>
<td>FCASHFLOW</td>
<td>1.017**</td>
<td>2.191</td>
<td>0.028</td>
<td>0.376</td>
</tr>
<tr>
<td>DEBTCOST</td>
<td>−7.567*</td>
<td>−1.780</td>
<td>0.075</td>
<td>−2.798</td>
</tr>
<tr>
<td>BMR</td>
<td>0.241***</td>
<td>4.428</td>
<td>0.000</td>
<td>0.089</td>
</tr>
<tr>
<td>DER</td>
<td>−0.060**</td>
<td>−2.530</td>
<td>0.011</td>
<td>−0.022</td>
</tr>
<tr>
<td>DIV</td>
<td>0.013***</td>
<td>4.691</td>
<td>0.000</td>
<td>0.005</td>
</tr>
</tbody>
</table>

* indicates statistical significance at the 10% level.

** indicates statistical significance at the 5% level.

*** indicates statistical significance at the 1% level.
There are some potential caveats concerning this study. First, firm stock repurchasing behavior is related to a broad range of issues in corporate management, thus firms may repurchase stock for other reasons (such as to deter takeover). In this paper, in order to see why firms repurchase stock during the period of unconventional monetary policy, I try to focus on determinants associated with unconventional monetary policy. Second, although this paper focuses exclusively on the period of unconventional monetary policy, how the determinants of stock repurchases and their effects are different before and after the period of unconventional monetary policy is an intriguing and important issue for future research. In addition, how do differences in law and regulations between the U.S. and Japan in terms of stock repurchases affect firms’ repurchase activity in the two countries? This is also an interesting question, although it is beyond the scope of this paper.

I believe that the findings of this paper have important implications for the effectiveness of unconventional monetary policy. One of the main channels in the transmission of unconventional monetary policy is to boost real business investment by reducing firms’ financing costs through injecting massive amounts of liquidity in the financial system when the policy rate is constrained by the zero lower bound, thereby increasing aggregate demand and output in the economy. But what if firms do not increase investing in real businesses but instead take advantage of the unusually accommodative monetary conditions to repurchase their own stock, as this paper reveals? This paper suggests that serious concerns should be raised as to how to align firms’ investment incentives effectively with the objectives of unconventional monetary policy.

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References


