

The Pump-Priming Effect of Regulatory Reform  
on Stock Repurchases:  
Evidence from Lifting the Ban on Treasury Stocks  
in Japan

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# The Pump-Priming Effect of Regulatory Reform on Stock Repurchases: Evidence from Lifting the Ban on Treasury Stocks in Japan

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## Abstract

This study investigates corporate reactions to the deregulation of stock repurchases set forth on 1 October 2001, in Japan, by looking at the motivations for stock repurchases. We found that stock repurchases increased significantly after the ban on treasury stocks was lifted. Our results show that firms with free-cash flow problems initiated a repurchase plan to distribute excess cash to shareholders and reduce agency costs over the sample period. In addition, firms who wanted to signal undervaluation also undertook stock repurchases over the sample period. These firms were affected by the deregulation, unlike firms that repurchase to reduce agency costs. We determined that firms with weak incentives to signal undervaluation increased stock repurchases significantly in order to respond to the deregulation, since these firms had the ability to take advantage of treasury stock purchases.

*Keywords:* Treasury stocks; Undervaluation; Takeover deterrence; Capital structure;  
Cash distribution

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## 1 Introduction

Stock repurchases have received significant attention in financial literature because they have become an increasingly important financial behaviour that has been implemented in a large number of countries. Much of the research focuses on open-market repurchase programs adopted by U.S. firms. Those previous research has successfully discussed this financial behavior and documented the potential motivations for stock repurchases, including the signalling of undervaluation, takeover defence, dividend substitution, stock options and capital structure adjustment (Kaplan and Reishus, 1990; Fenn and Liang, 1997; Bagwell and Shoven, 1988; Dittmar, 2000). However, research on stock repurchases in Japan is much more scarce.

Unlike in the United States, stock repurchases were nearly non-existent in Japan until the Japanese Commercial Code was revised in October 1994. The revision allowed Japanese corporations to acquire their own shares, but only for the purpose of retiring stocks or for employees' stock plans. The 1997 revision of the Code lifted the prohibition on repurchasing, but only for the purpose of granting stock options. Finally, on 1 October 2001, the Japanese government amended the Commercial Code; this amendment completely abolished the restrictions on stock repurchases and lifted the ban on treasury stocks. Since then, Japanese companies have been able to repurchase their stocks, regardless of the amount and the purpose of the acquisition. Long-term holding of treasury stocks also became possible; this was not possible under the formerly strict requirement for their immediate redemption or disposition.

Corporate managers could now initiate a repurchase plan and hold treasury stocks for specific purposes.

As a result, stock repurchase announcements in Japan have grown dramatically since the end of 2001 (see Figure 1). Table 1 illustrates the change in open-market stock repurchases in Japan. Panel A details announced repurchases by frequency, value and number. The mean and the median of repurchases per announcement in the two periods—before and after 1 October 2001—are shown in Panels B and C, respectively. Panel A shows that stock repurchase announcements in the second period occurred at the rate of 52 per month, or almost two times the rate of repurchases in the first period (before 1 October 1 2001). The value of open-market repurchase announcements by Japanese firms listed on the Tokyo Stock Exchange increased by 448%, from JPY 75 billion to JPY 411 billion, and the number of repurchase announcements increased 198%, from 86 million to 256 million monthly.

By looking closely at the value of stock repurchases, we found that, after the deregulation of stock repurchases on 1 October 2001, the mean of repurchases per announcement increased, while the median of repurchases per announcement decreased. This suggests that firms with high stock prices tended to initiate a repurchase plan. The number of stock repurchases per announcement decreased after 1 October 2001, regardless of the mean and the median of repurchases. We found that firms used stock repurchases more flexibly after the Japanese government lifted the ban on treasury stocks. Corporate managers have more discretion and tend to undertake smaller stock repurchases, and to buy more frequently.

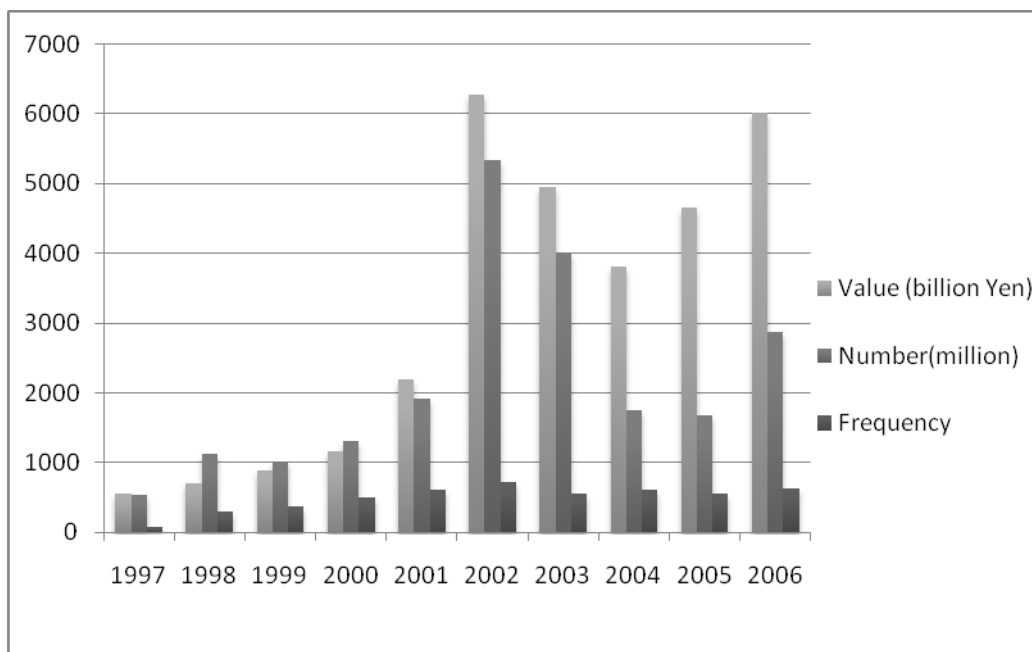


Figure 1: Fluctuation of stock repurchases, fiscal years 1997–2006

Table 1: Stock repurchases in the two periods

Panel A			
	frequency/month	value/month	number/month
Before 1 October 2001	28	75,000,000	86
After 1 October 2001	52	411,000,000	256
Panel B average			
	value/frequency	number/frequency	
Before 1 October 2001	3,490,000,000	3,967	
After 1 October 2001	4,660,000,000	2,903	
Panel C median			
	value/frequency	number/frequency	
Before 1 October 2001	392,000,000	654	
After 1 October 2001	293,000,000	293	

In this study, we investigate corporate reactions to the deregulation of stock repurchases. Using a sample of 2161 Japanese firms listed on the Tokyo Stock Exchange, we can assess the increasing importance of stock repurchases to Japanese companies, study the usage of treasury stocks and discover what kind of firms tend to increase stock repurchases in response to the lifting of the ban on treasury stocks.

To summarize our main findings, we found that Japanese firms initiated a repurchase program to signal undervaluation or to distribute excess cash over the sample period. The deregulation of stock repurchases motivated Japanese firms to acquire their own shares and to take advantage of treasury stocks. By controlling the motivations for repurchasing, our results show that the deregulation did not prompt firms with free cash flow problems to increase repurchase programs, since these firms can hold treasury stocks until later reissue and agency problems still exist unless firms cancel them. We also found that firms that are motivated to signal undervaluation increased stock repurchases to respond to the deregulation, since these firms have managerial discretion and can take advantage of treasury stocks. We also observed that after 1 October 2001, stock repurchases increased for firms with weak incentives to signal undervaluation but did not increase for those who had strong incentives. We call the effect of deregulation on those firms the ‘pump-priming effect’.

The remainder of this paper proceeds as follows. Section 2 surveys the motivations for stock repurchases. Section 3 develops the hypotheses. Section 4 describes sample, data and variables. Section 5 reports our results. Our conclusions are presented in section 6.

## 2 The Motivation behind Stock Repurchases

Previous studies documented five motivations for stock repurchases. First, Dann (1981), Vermaelen (1981), Comment and Jarrell (1991) and Dittmar (2000) suggest that managers who believe that their firms are undervalued by the market tend to repurchase outstanding shares as a way of signalling information. The announcement of stock repurchases is then followed by a stock price increase, which may correct the misvaluation.

Second, Vermaelen (1984), Harris and Raviv (1988), Stulz (1988) and Bagwell

(1992) look at how managers undertake stock repurchases to increase the acquisition price and to lower the threat of being acquired. Stock repurchases can decrease floating stocks and increase stable shareholders' holding. In this way, firms can increase the lowest price at which their shares may be available, and thus lower the risk of becoming takeover targets.

Third, according to the trade-off theory of capital structure, firms are likely to mitigate deviation between actual and target leverage ratio in order to achieve their optimal leverage ratio. Bagwell and Shoven (1988), Opler and Titman (1996) and Dittmar (2000) show that firms with a leverage ratio below their target ratio retire a large number of shares by stock repurchases in order to increase their debt-to-equity ratio.

Fourth, stock repurchases and dividends are two ways in which firms distribute excess cash to shareholders and decrease the agency costs resulting from excess cash flow. Kaplan and Reishus (1990) and Denis, Denis and Sarin (1994) suggest that, since the income tax rate is higher than the capital gains tax rate, management may prefer repurchase, which is taxed at the capital gains tax rate, over dividends, which are taxable at the income tax rate.

Finally, Dunsby (1994), Jolls (1998) and Fenn and Liang (1997) examine how stock options encourage managers to substitute stock repurchases for dividends, because repurchases decrease the shares outstanding, and, unlike dividends, do not dilute the per-share value of firms.

### **3 Developing the Hypotheses**

Under the old regulation, Japanese firms were able to repurchase their own shares solely for the purposes of stock cancellation or employee stock option plans. Under the new regulation, as of 1 October 2001, repurchased stocks can be either retired or held as treasury stocks for later reissue. If they are cancelled, stock repurchases decrease outstanding shares permanently unless there is a new share issue. If they are not cancelled, treasury stocks can be reissued to specific shareholders, business partners or employees; a move that strengthens a firm's relationships with its stakeholders. They can also be reissued in order to raise funds when firms find they are overvalued by the market.

We considered the influence of holding and reissuing treasury stocks on stock repurchases by firms that had several different motivations. Companies may acquire their own shares; this move will signal undervaluation if a company finds that its stocks are undervalued by the market and subject to a takeover threat. Firms can exchange treasury stocks with stable shareholders—its main bank, business partners and employee stock ownership plans—because the deregulation of stock repurchases give firms managerial discretion to do so. Stable holdings mitigate the threat of takeover. We assumed that stock repurchases on the notion of signalling and takeover deterrence increased after the ban on treasury stocks was lifted.

The deregulation of stock repurchases also gives firms the ability to hold treasury stocks for subscription rights. Firms granting warrant bonds will decrease their future debt-to-equity ratio and may adjust their capital structure through a repurchase

program; this will maintain their optimal leverage. On the other hand, those firms with a leverage ratio that is below their target ratio can repurchase stock and then resell it when they find that their debt ratio is higher than expected. We assumed that stock repurchases for capital structure adjustment increase, since firms have managerial discretion.

Since the deregulation of stock repurchases, firms can now hold treasury stocks until a later reissue. Agency problems will still exist, however, unless firms cancel their treasury stocks. Repurchasing is not an efficient way for firms to distribute excess cash to shareholders and reduce agency costs, as it once was. Keeping this in mind, we believe that stock repurchase for cash distribution would not increase after the ban on treasury stocks was lifted. This belief led to the following testable hypothesis:

*[H1] Once the ban on treasury stocks has been lifted, there is a corresponding increase in stock repurchases based on motivations that have some degree of managerial discretion. The greater that discretion is, the greater the number of stock repurchases.*

Since firms were strictly limited in their stock repurchase plans before 1 October 2001, corporate managers would have initiated a repurchase plan only when they had a strong incentive to do so. This move would have signalled the firm's strong future prospects and thus mitigated any takeover threat, deviation from optimal leverage or the distribution of excess cash to lower agency cost. Therefore, the deregulation of stock repurchases might have less attraction for those firms that already have a strong incentive to repurchase stock. However, those firms with a weak incentive to repurchase stock might respond more positively to the regulatory reform, because they are free to repurchase and can use treasury stocks flexibly. Thus, we can assume that there is no significant difference between the two periods for companies that have a stronger incentive to repurchase—that is, the period before 1 October 2001, and afterward—while those firms that have a weaker incentive to repurchase stocks would increase their stock repurchases significantly during the period after deregulation. This brings us to our second hypothesis:

*[H2] Lifting the ban on treasury stocks promotes stock repurchases by firms that have a relatively weak motivation to repurchase their stock*

## **4 Construction of Sample, Data and Variables**

### **4.1 Sample and Data**

The sample begins with all open-market stock repurchase announcements by Japanese firms listed on the Tokyo Stock Exchange. The stock repurchase sample spans a 10-year period from fiscal year 1997 to fiscal year 2006. We excluded firms that had insufficient financial data or stock prices. Only Japanese firms that are general businesses with a 12-month fiscal year-end are included in the sample. The screening process yields 2161 observations after a sampling distribution by  $3\sigma$  rule.

The data on stock repurchase announcements were obtained from the *Nikkei* Corporate Finance Database. We gather corporate annual financial data from *Nikkei* Corporate Financial Database. The data on stock prices were drawn from the Toyo Keizai Stock Price Data Bank.

## **4.2 Construction of Variables**

### **4.2.1 Dependent Variable**

Two measures of stock repurchase are used in this paper. The first is the natural logarithm of the number of stock repurchases announced during a given year (*ln number*). The second is the number of announced repurchases to outstanding shares ratio (*number of repurchases/shares*)<sup>[1]</sup>.

### **4.2.2 Explanatory Variables**

There are four main explanatory variables that correspond to the potential motivations behind stock repurchases. The first variable is market-to-book ratio (*M/B*), which is defined as the market value of equity to the book value of equity at the end of the year prior to the repurchases. We used market-to-book ratio to measure market performance and takeover risk, since firms with a low market-to-book ratio are likely to repurchase shares as a signalling undervaluation to markets, and as a tool to avoid becoming takeover targets.

The second variable is *deviation*, which represents the difference between firms' actual and target leverage ratio. In light of the firms' actual performance, we use the industry median leverage to predict the firms' target leverage ratio, and deviation is then defined as actual leverage minus target leverage ratio estimated by industry median leverage<sup>[2]</sup>.

The third variable is free-cash flow (*FCF*), which is defined as operating income before depreciation minus interest expense, income taxes and dividends, scaled by book value of total assets.

The fourth variable is payout ratio (*payout*), which is calculated as the ratio of cash dividends paid to net income in the year prior to the repurchase. Free-cash flow and payout ratio are included as proxies for dividend substitutions.

### **4.2.3 Control Variables**

We follow previous studies' conventions (Dittmar, 2000) and also include *cash level*, which is defined as the ratio of cash and equivalents to total assets. Stock option is designed as a dummy (*stock option*), which is equal to one if a firm grants stock options, and zero otherwise.

According to Billett (2008), unlike larger firms, which can attract more attention from investors, small firms are likely to buy back more outstanding shares, in part to attract attention from the market. *Size* is thus included, and defined as the natural logarithm of sales. Pre-repurchase profitability is also measured by return on equity (*ROE*).

## **4.3 Summary Statistics**

We examined differences in the mean and the median of announced repurchases between the two periods using other measures of stock repurchases—that is, the *value of repurchase/market equity* and the number of repurchases/shares. Table 2 shows our sample’s summary statistics. Both the mean and the median of stock repurchases during the latter period are significantly larger than they were before (a 1% level), regardless of for repurchases. This is an expected outcome, since the deregulation of stock repurchases on 1 October 2001, gave firms the ability to take advantage of treasury stocks.

Table 2: Difference in stock repurchases between the two periods

Panel A Mean		
	value of repurchases /market equity	number of repurchases /outstanding shares
Before October 1, 2001	0.030	0.025
After October 1, 2001	0.050	0.040
difference	0.019	0.014
t-statistics	(5.107)***	(8.037)***
Panel B Median		
	value of repurchases /market equity	number of repurchases /shares outstanding
Before October 1, 2001	0.020	0.018
After October 1, 2001	0.031	0.027
difference	0.011	0.010
wilcoxon-test	(8.690)***	(8.524)***

Note: \*, \*\* and \*\*\* indicate significance at the 10%, 5% and 1% levels, respectively.

Table 3 illustrates our main variables and tests the difference in means between the two periods—before and after 1 October 2001. The M/B and the deviation after 1 October 2001 have means of 1.361 and  $-0.036$ , respectively, which are not significantly higher than those in the former period (1.285 and  $-0.057$ , respectively). There is a significant increase in the FCF (from 1.626 to 2.633), and a significant decrease in the payout (from 0.859 to 0.394) when we compare the means of the two periods. The results suggest that firms have more excess cash and fewer cash dividends during the latter period, and firms with large financial margins tend to undertake stock repurchases instead of cash dividends.

Table 3: Summary statistics

	M/B	Deviation	FCF	Payout	Cash	Size	ROE	N
Before 1 October 1	1.285	-0.057	1.626	0.859	0.170	11.583	0.027	615
After 1 October 2001	1.361	-0.036	2.633	0.394	0.147	11.680	0.049	1546
difference	0.076	0.020	1.008	-0.464	-0.023	0.097	0.021	931
t-statistics	(0.520)	(0.678)	(4.072)***	(-2.189)**	(-4.870)***	(1.433)	(4.207)***	

Notes: \*, \*\* and \*\*\* indicates significance at the 10%, 5% and 1% levels, respectively.

N = the number of the observations.

## 5 Empirical Results

### 5.1 Univariate Analysis



We investigated the impact of the deregulation of stock repurchases in Japan on corporate financial behaviours by looking at the motivations for repurchase. We created five portfolios based on our four explanatory variables, respectively, and computed the mean of  $\ln$  number in each portfolio. We then reported the results of  $t$ -statistics for the differences among small, medium and large portfolios, and between the two periods—before and after 1 October 2001, as Table 4 shows.

Panel A in Table 4 shows how firms increase stock repurchases significantly when they have relatively higher market-to-book ratios, while for those firms undervalued by the market, there is no significant difference between the two periods. We also found that, in both periods, firms repurchased more outstanding shares when they were undervalued, and repurchased fewer shares when they were overvalued. This suggests that signalling undervaluation might be a motivation for firms to acquire treasury stocks, whether before or after the deregulation of stock repurchases, and that regulatory reform motivated those firms with relatively high market-to-book ratio to increase their stock repurchases.

Table 4: Univariate analysis

Panel A											
	M/ B					difference					
	1(small)	2	3(middle)	4	5(large)	5-3	t-statistics	3-1	t-statistics	5-1	t-statistics
Before	14.302	14.215	14.356	13.959	13.426	-0.930	(-4.217)***	0.053	(0.358)	-0.877	(-4.271)***
After	14.506	14.355	14.396	14.771	14.262	-0.134	(-1.023)	-0.110	(-0.967)	-0.244	(-1.915)*
difference	0.204	0.139	0.040	0.812	0.837						
t-statistics	(1.608)	(1.019)	(0.270)	(4.088)***	(4.021)***						
Panel B											
	Deviation					difference					
	1(small)	2	3(middle)	4	5(large)	5-3	t-statistics	3-1	t-statistics	5-1	t-statistics
Before	14.173	13.715	13.848	14.221	14.314	0.466	(2.352)**	-0.324	(-1.675)*	0.141	(0.860)
After	14.565	14.302	14.291	14.510	14.681	0.390	(2.835)***	-0.274	(-2.169)**	0.116	(0.800)
difference	0.393	0.587	0.443	0.288	0.367						
t-statistics	(2.717)***	(3.789)***	(2.459)**	(1.653)*	(2.056)**						
Panel C											
	FCF					difference					
	1(small)	2	3(middle)	4	5(large)	5-3	t-statistics	3-1	t-statistics	5-1	t-statistics
Before	13.821	14.322	14.241	13.619	13.816	-0.426	(-1.736)*	0.420	(1.646)	-0.005	(-0.020)
After	14.299	14.443	14.493	14.595	14.466	-0.027	(-0.239)	0.194	(1.643)	0.167	(1.416)
difference	0.478	0.121	0.252	0.976	0.650						
t-statistics	(2.261)**	(0.832)	(1.321)	(5.055)	(3.378)***						
Panel D											
	Payout					difference					
	1(small)	2	3(middle)	4	5(large)	5-3	t-statistics	3-1	t-statistics	5-1	t-statistics
Before	14.046	13.424	14.009	14.310	14.341	0.331	(1.852)*	-0.037	(-0.178)	0.295	(1.773)*
After	14.523	14.258	14.480	14.553	14.521	0.041	(0.344)	-0.043	(-0.341)	-0.001	(-0.011)
difference	0.477	0.834	0.471	0.243	0.180						
t-statistics	(2.791)***	(3.907)***	(2.855)***	(1.627)	(1.296)						

Panel B illustrates how stock repurchases after 1 October 2001, increased

significantly, regardless of the deviation from firms' target leverage ratio. The differences between the two periods are greater and more significant when firms are underlevered (significant at 1%) than when they are overlevered (significant at 5%). The results also show a U-shaped relationship between stock repurchases and the deviation. It seems that the deregulation of stock repurchases encourages underlevered firms to acquire treasury stocks, by which they approximate optimal debt ratio to maximise firm value. For those firms with higher leverage ratios, deregulation also motivated them to repurchases their own shares through managerial discretion.

The results shown in Panel C indicate that stock repurchases increased significantly after 1 October 2001, for both firms with very low free-cash flow and for those with the highest level of free cash. In both periods, we cannot find a positively linear relationship between stock repurchases and the FCF as Bagwell and Shoven (1989) and Grullon (1997) suggest.

Panel D highlights how firms with relatively lower cash dividends in the year prior to the repurchase program increased stock repurchases significantly in the later period. We assume that these firms increased their repurchases rather than dividends in order to avoid a dividend cut in the future. The results do not support a negative relationship between stock repurchases and the payout in each period.

## **5.2 Bivariate Analysis**

We also examined corporate reaction to the deregulation of stock repurchases and looked at the usage of treasury stocks using bivariate analysis. If we regard firms in the top two portfolios (the 4<sup>th</sup> and the 5<sup>th</sup> portfolios) in Table 4 as firms with large M/B (deviation, FCF, or payout) (see Table 5), and firms in the bottom two portfolios (the 1<sup>st</sup> and the 2<sup>nd</sup> portfolios) in Table 4 as those with small M/B (deviation, FCF or payout) (see Table 5), then one portfolio (the 3<sup>rd</sup> portfolio) is out of bivariate analysis.

Table 5 shows the mean ln number of each new portfolio and the *t*-statistics for the difference between the two periods. Panel A illustrates how firms with a higher market price and higher leverage ratios increased their stock repurchases significantly during the later period, whilst, for those firms with strong incentives to signal undervaluation and adjust capital structure by repurchases, there is no significant difference between the two periods. This finding suggests that firms with weak incentives to signal undervaluation and adjust capital structure are likely to increase stock repurchases in response to the deregulation.

The results in Panel B show that stock repurchases were significantly higher during the later period, when market-to-book ratio is relatively low and firms hold greater free cash. This finding suggests that after the ban on treasury stocks was lifted, firms with large agency costs tended to increase repurchases, in order to distribute excess cash. In Panel C, we see that firms with good market performance and relatively low cash dividend ratios tended to increase stock repurchase after 1 October 2001. Panel D shows that for firms with low leverage ratios and excess cash, stock repurchases increased after the ban on treasury stocks was lifted. In Panel E, we see a significant increase in repurchases, when firms have low debt ratios and low cash dividend ratios

in the year prior to repurchases. Panel F illustrates how stock repurchases increased significantly when a firm had high free-cash flow and low cash dividend ratios. The results suggest that stock repurchase may be an increasingly important way for firms with relatively low debt ratios to distribute cash to shareholders and reduce agency costs, because corporate managers have discretion during the later period.

Overall, the deregulation of stock repurchases motivates repurchase programs announced by those firms with relatively high market-to-book ratios, more excess cash or fewer cash dividends. We did not find evidence that is consistent with the capital structure adjustment theory. It seems that capital structure adjustment might be a secondary motivation for stock repurchases.

Table 5: Bivariate analysis

Panel A		Deviation							
		small		difference	t-statistics	large		difference	t-statistics
		D1	D2			D1	D2		
M/B	small	14.200	14.391	0.191	(1.526)				
	large					13.726	14.586	0.860	(3.422)***
Panel B		M/B							
		small		difference	t-statistics	large		difference	t-statistics
		D1	D2			D1	D2		
FCF	large	14.106	14.397	0.291	(1.709)*				
	small					13.917	14.245	0.327	(1.507)
Panel C		M/B							
		small		difference	t-statistics	large		difference	t-statistics
		D1	D2			D1	D2		
Payout	small	14.278	14.499	0.221	(1.345)				
	large					14.294	14.674	0.380	(1.662)*
Panel D		Deviation							
		small		difference	t-statistics	large		difference	t-statistics
		D1	D2			D1	D2		
FCF	large	13.586	14.525	0.939	(4.877)***				
	small					14.453	14.590	0.137	(0.799)
Panel E		Deviation							
		small		difference	t-statistics	large		difference	t-statistics
		D1	D2			D1	D2		
Payout	small	13.522	14.292	0.771	(4.024)***				
	large					14.500	14.610	0.110	(0.652)
Panel F		Payout							
		small		difference	t-statistics	large		difference	t-statistics
		D1	D2			D1	D2		
FCF	large	13.334	14.298	0.964	(4.014)***				
	small					14.433	14.327	-0.106	(-0.736)

Note: \*, \*\* and \*\*\*: significant at the 10%, 5% and 1% levels, respectively.

### 5.3 Regression analysis

We followed the convention of stock repurchases studies and regressed a model in which stock repurchases announced by firm  $i$  in year  $t$  are dependent on a set of potential motivations:

$$\begin{aligned} \text{Stock Repurchase}_{i,t} &= \alpha + \beta_1 \times (M/B)_{i,t-1} + \beta_2 \times \text{Deviation}_{i,t-1} + \beta_3 \times \text{FCF}_{i,t-1} + \beta_4 \\ &\times \text{Payout}_{i,t-1} + \beta_5 \times \text{Cash}_{i,t-1} + \beta_6 \times \text{Stock Option}_{i,t-1} + \beta_7 \\ &\times \text{Size}_{i,t-1} + \beta_8 \times \text{ROE}_{i,t-1} + \varepsilon_{i,t} \end{aligned}$$

To further understand the change in stock repurchases that resulted from lifting the ban on treasury stocks, we developed the above model, which gave us a new regression, as follows.  $X_n$  represents a set of potential motivations for stock repurchases.  $D$  is a dummy, which is equal to one when a repurchase was announced after the deregulation on 1 October 2001, and zero otherwise<sup>[3]</sup>.

$$\text{Stock Repurchase}_{i,t} = \alpha + \sum_{n=1}^8 \beta_n X_{i,t-1,n} + D \times \left( \sum_{n=1}^8 \beta_n X_{i,t-1,n} \right)$$

We employed two measures of stock repurchases. The first is the natural logarithm of the number of repurchases (ln number). The second measure is the number of repurchases to outstanding shares ratio (number of repurchases/shares).

In Table 6, we can see that Adj.  $R^2$  decreases by 15% when we change our measure of stock repurchases from ln number to number of repurchases/share (0.220 vs. 0.069). Correspondingly,  $F$ -value decreased by 28, from 39 to 11. Panel A in Table 6 shows that the relationship between stock repurchases and market performance is negative with the coefficient of  $-0.272$ , significant at a 1% level, on average, while in the period after the deregulation, there is a significantly positive effect on this relationship. We can see that the coefficient of M/B becomes  $-0.021$  during the later period. This suggests that the deregulation of treasury stocks attracts firms with relatively high market-to-book ratio to increase their stock repurchases, since firms have managerial discretion and are able to take advantages of treasury stocks to reach their expected goals, such as mergers and acquisitions or a stock option plan.

Our results do not support the theory that stock repurchases are used for capital structure adjustment by Japanese firms. We find that the relationship between stock repurchases and the deviation did not change after 1 October 2001<sup>[4]</sup>. Instead, we saw that stock repurchases are positively and significantly related to excess cash and do not change a great deal during the later period, which suggests that Japanese firms undertook stock repurchases in order to distribute excess cash to shareholders and reduce agency costs, and that deregulation did not provide an incentive for firms to increase their stock repurchases. We believe this is the case because, during the later period, firms are not subject to the regulations and can hold treasury stocks for as long

as they want, they can also reissue treasury stocks and still have agency problems. It seems that stock repurchases may not be an efficient way to lower agency costs after the ban on treasury stocks was lifted. The results shown in Panel A do not support the notion that stock repurchases are significantly related to cash dividends in the year prior to repurchasing, whether before or after the deregulation.

There are several similarities between Panel B and Panel A. The relationship between stock repurchases and M/B is negative and significant during the period from 1997 to 2006, and there is a significantly positive effect on this relationship after 1 October 2001, when the slope becomes gentler. Stock repurchases are positively and significantly related to free-cash flow, on average, and do not increase during the later period. There is no significant relationship between stock repurchases and cash dividends. We also found that stock repurchase is positively but not significantly related to deviation from target leverage.

Table 6: Regression of stock repurchases

Panel A Dependent variable: ln number				
			D	
	coefficient	(t-statistics)	coefficient	(t-statistics)
(Constant)	9.759	(17.888)***		
M/B	-0.272	(-6.262)***	0.251	(5.630)***
Deviation	-0.093	(-1.022)	-0.094	(-0.840)
FCF	0.026	(1.948)*	-0.009	(-0.619)
Payout	0.002	(0.231)	0.014	(0.430)
Cash	-0.607	(-1.023)	-0.983	(-1.396)
Stock option	-0.445	(-3.727)***	-0.187	(-0.299)
Size	0.435	(9.776)***	0.042	(0.816)
ROE	-2.041	(-2.143)**	1.398	(1.401)
Adi. R2		0.220		
F-statistics		39.032		
N		2161		
Panel B Dependent variable: number of repurchases/shares				
			D	
	coefficient	(t-statistics)	coefficient	(t-statistics)
(Constant)	0.065	(4.445)***		
M/B	-0.004	(-3.109)***	0.003	(2.540)**
Deviation	0.000	(0.060)	0.003	(0.857)
FCF	0.001	(2.000)*	-0.001	(-1.406)
Payout	0.000	(0.387)	0.000	(-0.197)
Cash	0.013	(0.841)	-0.002	(-0.097)
Stock option	-0.002	(-0.670)	0.032	(1.884)*
Size	-0.003	(-2.698)***	-0.002	(-1.251)
ROE	-0.005	(-0.202)	0.040	(1.499)
Adi. R2		0.069		
F-statistics		10.968		
N		2161		

Notes: Estimated *t*-statistics appear in parentheses after the coefficient estimates. N = the number of observations. \*, \*\* and \*\*\* indicates significance at the 10%, 5% and 1% levels, respectively.

Since we use both free-cash flow and dividend payouts as proxies for dividend substitutions, we then, to find stronger evidence about the effect of the deregulation on agency problems, split our sample into four sub-samples by controlling for FCF and payout simultaneously. A portion of our testing model's estimates for each sub-sample is shown in Table 7; it includes only the coefficients of FCF and payout.

Table 7: Regression of stock repurchases on agency interpretation

Panel A		Dependent variable: ln number			
			D		
	coefficient	(t-statistics)	coefficient	(t-statistics)	
total sample					
FCF	0.026	(1.948)*	-0.009	(-0.619)	
Payout	0.002	(0.231)	0.014	(0.430)	
subsample: small <i>FCF</i> & small <i>Payout</i>					
FCF	0.009	(0.180)	-0.004	(-0.061)	
Payout	-0.094	(-0.776)	-0.166	(-0.649)	
subsample: small <i>FCF</i> & large <i>Payout</i>					
FCF	0.101	(1.159)	-0.086	(-0.932)	
Payout	0.020	(1.454)	0.120	(1.574)	
subsample: large <i>FCF</i> & small <i>Payout</i>					
FCF	0.091	(2.578)**	-0.071	(-1.748)*	
Payout	-0.644	(-1.349)	0.629	(1.279)	
subsample: large <i>FCF</i> & large <i>Payout</i>					
FCF	0.023	(0.411)	-0.043	(-0.707)	
Payout	-0.006	(-0.811)	-0.004	(-0.079)	
Panel B		Dependent variable: number of repurchase/shares outstanding			
			D		
	coefficient	(t-statistics)	coefficient	(t-statistics)	
total sample					
FCF	0.001	(2.000)*	-0.001	(-1.406)	
Payout	0.000	(0.387)	0.000	(-0.197)	
subsample: small <i>FCF</i> & small <i>Payout</i>					
FCF	0.000	(-0.193)	0.000	(-0.177)	
Payout	0.001	(0.260)	0.000	(0.067)	
subsample: small <i>FCF</i> & large <i>Payout</i>					
FCF	0.000	(0.162)	-0.001	(-0.397)	
Payout	0.001	(1.543)	0.002	(1.149)	
subsample: large <i>FCF</i> & small <i>Payout</i>					
FCF	0.003	(3.944)***	-0.001	(-1.542)	
Payout	0.002	(0.20)	-0.001	(-0.055)	
subsample: large <i>FCF</i> & large <i>Payout</i>					
FCF	0.001	(0.746)	0.000	(-0.177)	
Payout	0.000	(-0.441)	0.000	(-0.097)	

Notes: Estimated *t*-statistics appear in parentheses after the coefficient estimates. \*, \*\* and \*\*\* indicates significance at the 10%, 5% and 1% levels, respectively.

With respect to the four sub-samples, the results from Table 7 show that only for firms with large excess cash and fewer cash dividends are stock repurchases

positively and significantly related to free-cash flow. This finding suggests that firms with free-cash flow problems tend to lower agency costs by stock repurchases over the sample period. For those firms, the deregulation of stock repurchases had a significantly negative effect on the relationship between repurchase programs and free-cash flow. Hence, the coefficient of FCF becomes 0.020 after the deregulation, when we measure repurchase announcements by number. The results also show that firms with a great deal of excess cash and fewer cash dividends did not change their behaviour after the deregulation of stock repurchases, when the dependent variable is the number of repurchase/shares. In other words, the deregulation of stock repurchases prompted only a small portion of firms with free-cash flow problems to increase stock repurchases. These results thus verify our hypotheses.

## **6 Conclusion**

The deregulation of stock repurchases in Japan that began on 1 October 2001, gave firms the ability to take advantage of treasury stocks to help them meet specific goals. This study focused on that regulatory reform and examined in detail the effect of the deregulation on corporate financial behaviours. We found that stock repurchases increased significantly after the ban on treasury stocks was lifted. Repurchases became an increasingly important financial strategy in Japan because of their inherent flexibility. We focused on the firms that increased stock repurchases to respond to the new reform by looking at the motivations for repurchasing, and confirming the pump-priming effect of the deregulation of stock repurchases.

Our results show that Japanese firms undertook stock repurchases in order to signal undervaluation or to distribute excess cash to shareholders, whether before or after the ban on treasury stocks was lifted. We did not find that Japanese firms initiated a repurchase program to adjust capital structure. Firms with a large amount of excess cash and fewer cash dividends tended to undertake stock repurchases in order to reduce agency costs over the sample period. The deregulation of stock repurchases did not motivate repurchase programs by firms that had incentives to mitigate agency problems, since firms could hold treasury stocks and agency problems still existed unless cancellation of treasury stocks. Although firms repurchased stock when they had excess cash, stock repurchases were used to complement cash dividends, rather than as a substitute for them. We determined that, after the deregulation of stock repurchases, there was a significant increase in repurchases announced by firms with weak incentives to signal undervaluation or deter hostile takeover, rather than by firms with strong incentives to do so, since firms are free to acquire their own shares and can use treasury stocks flexibly.

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## Notes

<sup>[1]</sup> We also used the natural logarithm of the value of announced repurchases and the value of repurchases divided by market capitalisation as measures of dependent variable. We focused on number volume of stock repurchases only, not the estimates of value of stock repurchases, in order to avoid biasing the results, since the value of stock repurchases is naturally positively related to market prices, all things being equal.

<sup>[2]</sup> We used two methods to predict firms' target leverage ratio. First, as Hovakimian, Opler and Titman (2007) do, we modelled a similar regression in order to predict firms' targets. Second, considering firms' potential preference, we also used industry median leverage as another measure of predicted leverage ratio. The results suggest that firms do not use a complicated regression model to estimate their target leverage ratio, because this model makes it more difficult for firms to benchmark themselves to industry counterparts, and because industry median leverage may be a more reliable estimator than the regression model.

<sup>[3]</sup> In order to robust test, we classified our observations by controlling the repurchase announcement day: this gave us two sub-samples. The first sub-sample includes stock repurchases announced before the ban on treasury stocks was lifted. The other sub-sample includes stock repurchases announced after 1 October 2001. Our robust check is based on the basic model presented in Section 5. Ln number and number of repurchases/shares are used to measure stock repurchases. The results are similar to those shown in Table 6.

<sup>[4]</sup> From univariate analysis, we observed a U-shaped relationship between stock repurchases and deviation from the target leverage. We therefore regressed a model in which we included  $\text{Deviation}^2$  as one of explanatory variables. We observed one difference from the results shown in Table 6: the coefficient of  $\text{Deviation}^2$  is positive (with the coefficient of 0.017) and significant at the 5% level when we measure stock repurchases by number.