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Yuta Adachi
PSI, Faculty of Engineering The University of Tokyo

Prof. Fumiko Takeda
Department of Technology Management for Innovation
University of Tokyo

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Innovation Policy Research Center,
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The Impact of Online Flaming on Firm Value: The Evidence from Japan

Y. Adachi,[1] F. Takeda[2]
[1]Department of Systems Innovation, University of Tokyo, Tokyo, Japan
[2]Department of Technology Management for Innovation, University of Tokyo, Tokyo, Japan
(takeda@tmi.t.u-tokyo.ac.jp)

Abstract - **This study investigates Internet flaming using Japanese data on flamed firms listed on the first section of the Tokyo Stock Exchange from 2006 through 2013. Based on a probit model, we find that younger and/or larger firms with higher price book-value ratio (PBR) are more likely to be the target of online flaming. In addition, the event study shows that the stock prices of targeted firms tend to decline during the initial days of online flaming. However, we also show that only big corporate scandals reported by the mass media have significantly negative effects on the stock prices of flamed firms, while the short-term impact of other contents is not significant.**

Keywords – **Flaming, Internet, event study, stock prices**

I. INTRODUCTION

In this study, we examine flaming on the Internet using data provided by Eltes Co., Ltd., a Japanese venture company specializing in online reputation management.[1] Flaming is defined as 'displaying hostility by insulting, swearing or using otherwise offensive language.'[2] Whereas online flaming has been observed for decades, its incidence has increased dramatically since 2011 when the use of SNS (Social Network Services), such as Twitter, gained popularity (Fig. 1).

Firms can be flamed for several reasons, including job-related misconduct, such as information leaks and problematic work conditions, off-the-job misconduct, corporate scandals reported by mass media, and claims on products or services, etc.

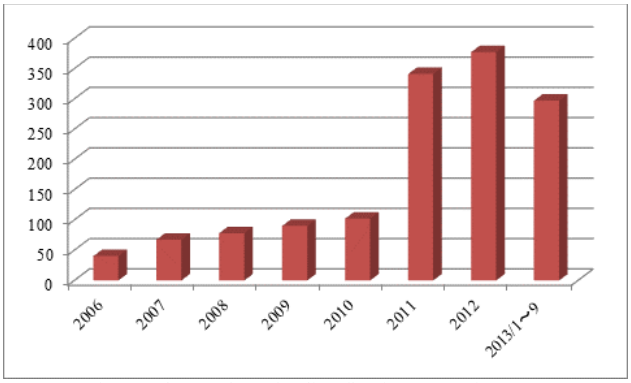

Fig. 1. The number of online flaming events in Japan
Note: Complied by the authors from the data provided by Eltes Co., Ltd.

Prior studies on flaming have focused mainly on its causes and characteristics. Early studies attribute flaming to the lack of social or non-verbal context cues in computer-mediated communication (CMC) [5]. Since then, a greater variety of explanations have been discussed, including deindividuation [3], miscommunication [6, 7], reduced awareness of others [5], etc. Other studies have examined how flaming occurs in specific online media, including Affirmative Action discussion forums, [7], Usenet [8], closed group support systems [9], and YouTube [1].

Although there are many social psychological studies on flaming, no paper, to our knowledge, has examined whether and how flaming may affect firm value. To fill this gap, we examine the economic impact of flaming. Specifically, the purpose of this study is threefold. First, we attempt to determine the characteristics of the firms targeted for online flaming using a probit model. Second, we examine whether online flaming reduces firm value by estimating stock price responses to online flaming using the event study methodology. Third, we study how stock prices are affected by the contents of flaming.

To assess the economic impact of flaming, we utilize literature regarding internal control deficiencies, which flamed firms may lack of. Several prior studies provide evidence of the characteristics of firms disclosing internal control weaknesses (ICW) under Sections 302 and 404 of the U.S. Sarbanes-Oxley Act of 2002 [10, 11, 12].

In particular, [10] finds that firms disclosing ICW are smaller, younger, less profitable, growing rapidly, having more complex operations, and/or undergoing restructuring, compared to firms not disclosing ICW. Similarly, [11] documents that firms reporting ICW tend to have more complex operations, recent changes in organizational

[1] Eltes Co., Ltd. collects the data on online flaming by monitoring the following websites: http://blog.livedoor.jp/dqnplus/; http://hamusoku.com/; http://enzyouch.blog.fc2.com/; http://matome.naver.jp/; http://blog.livedoor.jp/zetusoku/; http://enjou.in/; http://bakatter-now.ldblog.jp/; http://news020.blog13.fc2.com/; http://news4vip.livedoor.biz/; http://yutori2ch.blog67.fc2.com/; and http://bakatter-now.ldblog.jp/.
[2] This definition is based on [1, p. 1537]. Many studies link flaming to CMC [2, 3] and define flaming as an online phenomenon, such as "the expression of strong and inflammatory opinions to others electronically" [2, p. 161]. However, other researchers argue that defining flaming in the context of online behavior assumes technological determinism and confuses the behavior with its causes [4].

structure, more accounting risk exposure, and smaller size. Their results are generally consistent with those in [12] that shows that ICW is related to complexity of operation such as foreign operations, restructuring, accounting risk proxied by higher sales growth and inventory levels, and resource constraints due to smaller size, greater loss, and bankruptcy risk.

Examining the data on the flamed firms listed on the first section on the Tokyo Stock Exchange (TSE) between 2006 and September 2013, we find that younger and/or larger firms with higher price book-value ratio (PBR) are more likely to become the target of online flaming. In addition, stock prices of the target firms tend to decline at the start and for a few days after the online flaming. However, we show that only big corporate scandals reported by the mass media have significantly negative effects on the stock prices of flamed firms, while the other contents may not affect those prices.

The rest of this article is organized as follows. Section 2 describes the methodology and data. Section 3 presents empirical results, which are discussed in Section 4. Concluding remarks are provided in Section 5.

II. METHODOLOGY

To investigate the characteristics of the firms targeted for online flaming, we first estimate the following probit model for the firms listed on the first section of the TSE:

$$\Pr ob(Enjo = 1) = F(\alpha + \beta_1 Age + \beta_2 Big4 + \beta_3 Loss + \beta_4 Size + \beta_5 PBR). \quad (1)$$

A summary of variable definitions is presented in Table I.[3]

Enjo is a dummy variable, which takes 1 if the firm is a target of online flaming during the period between 2006 and September 2013 and 0 otherwise. Independent variables are chosen from the variables that are proved to be associated with internal control weaknesses based on the prior studies such as [10, 11, 12, and 13], because we believe that online flaming results partly from internal control deficiencies.

Age is the natural logarithm of the number of years the firm has been established. Firms with more experience are expected to be better at maintaining a good reputation. Thus, we predict a negative coefficient on *Age*.

Big4 is a dummy variable, which takes 1 if the firm is audited by a Big 4 audit firm[4] and 0 otherwise. Big 4 audit firms face higher reputation risk and thus audit quality is expected to be more rigorous than that of smaller audit firms [14]. Thus, we expect firms audited by a Big 4 auditor to be well monitored and to have less probability of becoming a target of online flaming.

Loss is a dummy variable, which takes 1 if the firm has a net loss and 0 otherwise. We expect that firms with weaker financial condition have fewer resources for reputation management, and thus are more likely to become a target of online flaming.

Size is the natural logarithm of market capitalization. In the literature of internal control, large firms are considered to have sufficient resources to construct better internal control than small firms. However, in the case of online flaming, large size may not necessarily exempt firms from online flaming. Instead, large firms are well known to the public, and thus often become the target of online flaming more frequently than small firms.

PBR is a price book-value ratio, which shows how investors evaluate the future profitability of a firm. We expect that firms with high PBR are more likely to grow fast. However, rapid growth may make management control difficult. Thus we predict that firms with high PBR are likely to be a target of online flaming.

Table II presents descriptive statistics of the independent variables. Table III is a Pearson correlation matrix, which shows that signs of the coefficients of *Enjo* are consistent with our predictions except for *Big4* and that correlation coefficients are less than 0.3, indicating a low possibility of multicollinearity.

TABLE I
VARIABLE DEFINITIONS

Variable	Expected sign	Description
Enjo	NA	A dummy variable, which takes 1 if the firm became a target of online flaming between 2006 and September 2013, and 0 otherwise.
Age	−	The natural logarithm of the number of years the firm has been established.
Big4	−	A dummy variable, which takes 1 if the firm is audited by a Big 4 audit firm, and 0 otherwise.
Loss	+	A dummy variable, which takes 1 if the firm had a net loss, and 0 otherwise.
Size	+	The natural logarithm of market capitalization.
PBR	+	A price book-value ratio.

TABLE II
DESCRIPTIVE STATISTICS

	Enjo	*Age*	*Big4*	*Loss*	*Size*	*PBR*
Mean	0.049	3.938	0.827	0.091	10.804	1.174
Median	0.000	4.159	1.000	0.000	10.587	0.865
Maximum	1.000	4.949	1.000	1.000	16.634	19.360
Minimum	0.000	0.693	0.000	0.000	6.982	0.240
Std. Dev.	0.217	0.672	0.378	0.288	1.529	1.295
Skewness	4.164	-1.881	-1.728	2.845	0.623	7.313
Kurtosis	18.338	6.875	3.986	9.094	3.079	79.488
Sum	84.0	6,710.6	1,409.0	155.0	18,410.2	1,999.9
Sum Sq. Dev.	79.9	769.9	243.9	140.9	3,982.4	2,855.5
Observations	1,704	1,704	1,704	1,704	1,704	1,704

TABLE III
PEARSON CORRELATION MATRIX

	Enjo	*Age*	*Big4*	*Loss*	*Size*
Age	-0.063				
Big4	0.090	-0.031			
Loss	0.003	0.047	-0.017		
Size	0.297	0.025	0.182	-0.092	
PBR	0.109	-0.211	0.042	0.020	0.143

[3] Independent variables are based on the fiscal year end of 2013.
[4] Japanese Big 4 audit firms consist of Ernst & Young ShinNihon LLC, KPMG AZSA LLC, Deloitte Touche Tohmatsu LLC, and Pricewaterhouse Coopers Aarata.

Next, we conduct the event study analysis based on the Fama-French 3 factor model as in [15]:

$$R_{it} - R_{ft} = a_i + b_i(R_{mt} - R_{ft}) + c_i SMB_t + d_i HML_t + e_i \sum_{k=1}^{k=n} Dummy_{kt} + \varepsilon_{it}. \quad (2)$$

R_{it} is the return on stock prices of firm i during the period t. R_{ft} is the return on 10-year Japanese government bonds (JGBs). R_{mt} is a market return. *Dummy* is a dummy variable, which takes 1 on the event window and 0 otherwise. The event window is set at three days (-1, +1) around the event day; the beginning of the online flaming reported by Eltes Co., Ltd. *SMB* and *HML* factors are based on [16]. ε is a disturbance term. The estimation period is from January 5, 2005 to September 30, 2013.

By using the estimated coefficients, $\hat{a}_i, \hat{b}_i, \hat{c}_i, \hat{d}_i$, we calculate the abnormal return (*AR*) as follows:

$$AR_{it} = R_{it} - \left\{R_{ft} + \hat{a}_i + \hat{b}_i\left(R_{mt} - R_{ft}\right) + \hat{c}_i SMB_t + \hat{d}_i HML_t\right\} \quad (3)$$

The cumulative abnormal return (*CAR*) and standardized *CAR* (*SCAR*) are then obtained by summing the abnormal returns over the event window as follows:

$$CAR_i(t_1,t_2) = \sum_{t=t_1}^{t_2} AR_{it}, \text{ and } SCAR_i(t_1,t_2) = \frac{CAR_i(t_1,t_2)}{\sigma_i(t_1,t_2)}. \quad (4)$$

where $\sigma_i(t_1,t_2)$ is the standard deviation of *CAR*. Next, we calculate the mean *CAR* and *SCAR* (*CAAR* and *SCAAR*, respectively) as follows:

$$CAAR(t_1,t_2) = \frac{1}{N}\sum_{i=1}^{N} CAR_i(t_1,t_2), \text{ and}$$
$$SCAAR(t_1,t_2) = \frac{1}{N}\sum_{i=1}^{N} SCAR_i(t_1,t_2). \quad (5)$$

where N represents the number of firms included in each sub-sample.

To test the null hypothesis H_0: *CAAR* (*SCAAR*)=*0*–that is, that online flaming does not affect the stock prices of target firms–we employ the following two test statistics:

$$J_1 = \frac{CAAR(t_1,t_2)}{\bar{\sigma}(t_1,t_2)} \sim N(0,1), \text{ and}$$
$$J_2 = \sqrt{\frac{N(L-4)}{L-2}} SCAAR(t_1,t_2) \sim N(0,1). \quad (6)$$

where L is the length of the estimation window and:

$$\bar{\sigma}^2(t_1,t_2) = VAR[CAAR(t_1,t_2)] = \frac{1}{N^2}\sum_{i=1}^{N}\sigma_i^2(t_1,t_2). \quad (7)$$

Table IV presents the sample selection process. The total number of cases collected by Eltes Co., Ltd., from 2002 and September 30, 2013, is 1,401. Of these, 610 cases targeted firms; 239 cases targeted listed firms; and 194 cases targeted firms listed on the first section of the TSE (Fig. 2). Eliminating firms without sufficient stock price data during the estimation period leaves us with our sample of 188 cases. Fig. 3 presents the distribution of our sample in terms of industry. Information and technology, retail, and service industries account for more than 60%.

TABLE IV
SAMPLE SELECTION

Online flaming reported between 2002 and September, 2013	1,401
(-) Online flaming whose initial date is unclear	7
(-) Online flaming whose target is not a corporation	784
Online flaming whose target is a corporation	610
(-) Online flaming whose target is a unlisted firm	371
Online flaming whose target is a listed firm	239
(-) Online flaming whose target is not a firm listed on the first section of the TSE	45
Online flaming whose target is a firm listed on the first section of the TSE	194
(-) Online flaming without stock price data of the target firm listed on the first section of the TSE	6
Sample	188

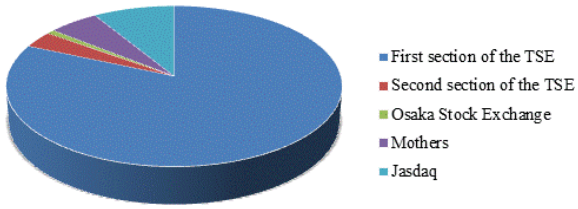

Fig. 2. Stock exchange in which sample firms are listed
Note: Complied by the authors from the data provided by Eltes Co., Ltd.

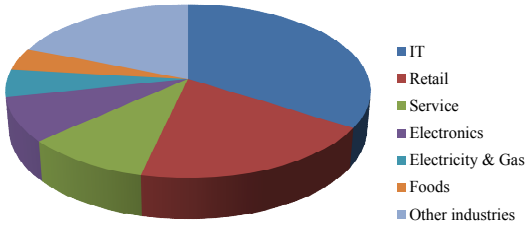

Fig. 3. Industry classification of sample firms
Note: Complied by the authors from the data provided by Eltes Co., Ltd.

We then select control firms with characteristics similar to sample firms that are not a target of online flaming. We employ propensity score matching (PSM) to select control firms. The propensity score of online flaming is calculated based on the probit model (1). We choose control firms whose propensity score is nearest to sample firms, and compare market reactions between sample and control firms by univariate and multivariate analyses.

To conduct these empirical analyses, we obtain daily stock price data from Yahoo! Finance. Fama-French 3 factors are purchased from Financial Data Solutions, Inc. Financial statement data are obtained from Toyo Keizai's Kaisha Shikiho CD-ROM.

III. RESULTS

A. Probit analysis

Table V presents the result based on (1). As expected, the coefficient of *Age* is significantly negative at the 5% level; the coefficient of *Size* is significantly positive at the

1% level; and the coefficient of *PBR* is significantly positive at the 5% level. These results are consistent with the notion that younger and/or larger firms with higher PBR are more likely to become the target of online flaming. In addition, the coefficient of *Loss* is positive, though not significant.

The coefficient of *Big4* is significantly positive at the 5% level, which is not consistent with our prediction. We note that Big 4 audit firms provide service to 82.7% of the firms listed on the first section of the TSE and to 92.7% of our sample firms. This high proportion may result from the fact that larger firms, which tend to be audited by Big 4 auditors, are more likely to be the target of the online flaming.

Table VI presents the result of the balancing test based on Welch's t-test. Before matching, the mean of all variables but one (*Loss*) is significantly different between our sample firms with *Enjo*=1 and control firms with *Enjo*=0. After matching, the mean of all variables is not different from zero between two groups. In other words, control firms have characteristics similar to sample firms.

TABLE V
CHARACTERISTICS OF FLAMED FIRMS

Variable	Coefficient	z-Statistic
Constant	-6.271	-9.913 ***
Age	-0.173	-2.270 **
Big4	0.759	2.308 **
Loss	0.252	1.240
Size	0.385	9.891 ***
PBR	0.069	2.154 **
No. of observations	1,704	
McFadden R^2	0.229	
S.E. of regression	0.202	
Akaike info criterion	0.310	
LR statistic	153.363 ***	

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

TABLE VI
BALANCING TESTS

	Before Matching			After Matching		
Variables	*Enjo*=1	*Enjo*=0	t-stat	*Enjo*=1	*Enjo*=0	t-stat
Age	3.753	3.948	2.423 **	3.753	3.718	-0.287
Big4	0.976	0.819	-8.148 ***	0.976	0.988	0.580
Loss	0.095	0.091	-0.136	0.095	0.107	0.254
Size	12.795	10.701	-11.248 ***	12.795	12.661	-0.557
PBR	1.793	1.142	-3.143 ***	1.793	2.053	0.679

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

TABLE VII
MARKET REACTIONS TO FLAMING

	Event window	Obs.	CAAR		SCAAR	
Sample (A)	(0, 0)	188	-0.598	***	-0.266	***
			(-3.899)		(-3.978)	
	(0, +1)	185	-1.051	***	-0.311	***
			(-4.811)		(-4.233)	
Control (B)	(0, 0)	188	-0.326	**	-0.163	**
			(-2.311)		(-2.233)	
	(0, +1)	185	-0.281		-0.112	
			(-1.397)		(-1.519)	
(A) - (B)	(0, 0)	188	-0.272		-0.103	
			(-0.823)		(-0.782)	
	(0, +1)	185	-0.770	*	-0.199	
			(1.437)		(-0.129)	

Notes:
1. ***, **, and * indicate statistical significance at the 1%, 5%, and 10% levels, respectively.
2. Figures in parenthesis are test-statistic including J_1-stat for *CAAR*, J_2-stat for *SCAAR*, and t-stat for differences between (A) and (B).

B. *Event study analysis*

Table VII presents the results for the event study analysis. For sample firms, both *CAAR*s and *SCAAR*s are significantly negative at the 1% level in all windows. For control firms, both *CAAR*s and *SCAAR*s are also negative in all windows and significant at the 5% level in a one-day window (0, 0). The differences between sample and control firms, (A) – (B), are negative for both *CAAR*s and *SCAAR*s in all windows, but significant at the 10% level only for *CAAR* in the two-day window (0, +1).

These results are consistent with the notion that stock prices of both sample and control firms tend to decline around the day on which online flaming begins, but the degree of the decrease in stock prices is somewhat larger for sample firms than for control firms.

C. *Firm characteristics affecting CARs*

Table VIII presents the results of the least squares regressions to estimate *CAR* (0, +1). The White test and variance inflation factors indicate that Models 1 and 2 are exempt from heteroscedasticity and multicollinearity. Independent variables include the five variables presented in Table I (*Enjo, Loss*, *PBR*, *Age*, and *Size*), and seven additional variables (*ROA*, *Sales*, *Employment*, *Foreign*, *Retail*, *IT*, and *Electronics*). [5]

ROA is a return on assets; *Sales* is sales growth; *Employment* is a logarithm of the number of employees; *Foreign* is the foreign shareholders ratio; and *Retail*, *IT*, and *Electronics* are industry dummy variables, which take 1 if the firm is classified as retail, IT, or electronics industry, and 0 otherwise.

[5] Independent variables are based on the fiscal year in which the firm is flamed on the Internet.

TABLE VIII
FACTORS AFFECTING ABNORMAL RETURNS

Variable	Model 1 Coefficient	Model 1 t-Statistic	Model 2 Coefficient	Model 2 t-Statistic
Constant	-3.241	-0.917	-3.218	-0.915
Enjo	-1.363	-1.925 *	-1.364	-1.929 *
ROA	0.146	1.939 *	0.148	2.079 **
Loss	1.288	1.103	1.288	1.105
PBR	-0.541	-3.218 ***	-0.539	-3.276 ***
Age	-0.151	-0.380	-0.157	-0.407
Sales	0.029	1.654 *	0.029	1.655 *
Size	0.288	0.789	0.267	1.038
Employment	-0.030	-0.084		
Foreign	-0.006	-0.200	-0.006	-0.200
Retail	1.699	1.600	1.690	1.603
IT	1.559	1.838 *	1.574	1.901 *
Electronics	1.153	0.992	1.131	1.000
Obs.	339		339	
Adjusted R-squared	3.40%		3.69%	
S.E. of regression	5.268		5.260	
F-statistic	1.990 **		2.177 **	
Durbin-Watson stat	1.992		1.990	

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

Our target variable is *Enjo*, which is significantly negative at the 10% level for two models. These results are consistent with the notion that sample firms are more likely to become a target of online flaming than control firms.

D. The effect of the contents of flaming on CARs

One may argue that the impact of flaming on stock prices could depend on the contents of flaming. To assess the effect of the contents, we conduct regressions to estimate the *CAR* (0, +1) of sample firms by including four variables that capture the contents of flaming: *Scandal*, *Claim*, *Job-related misconduct*, and *Off-the-job misconduct*. We also include the twelve variables presented in Table VIII: *Enjo, Loss*, *PBR*, *Age*, *Size*, *ROA*, *Sales*, *Employment*, *Foreign*, *Retail*, *IT*, and *Electronics*.

Scandal is a dummy variable that takes 1 for the firms involved or connected with big scandals reported by the mass media, such as Tokyo Electric Power Corp. (the Fukushima Daiichi Nuclear Accident in 2011), Olympus (the accounting fraud in 2011), and so on. *Claim* is a dummy variable that takes 1 for claims on products or services. *Job-related misconduct* and *Off-the-job misconduct* are dummy variables that take 1 for incidents of misconduct associated with the job and irrelevant to the job, respectively. The former variable includes information leaks, problematic work conditions, and so on. The latter includes inappropriate remarks on personal blogs, etc.

Table IX presents the results of the least squares regressions to estimate the *CAR* (0, +1) of sample firms. Models 1 and 2 use White heteroscedasaticity-consistent standard errors and covariance, while the variance inflation factors indicate that both models are exempt from multicollinearity.

TABLE IX
FACTORS AFFECTING ABNORMAL RETURNS OF SAMPLE

Variable	Model 1 Coefficient	Model 1 t-Statistic	Model 2 Coefficient	Model 2 t-Statistic
Constant	-6.385	-1.546	-5.475	-1.398
Scandal	-11.320	-2.007 **	-11.262	-1.985 **
Claim	-0.602	-0.573	-0.107	-0.106
Job-related misconduct	-0.244	-0.205	0.124	0.114
Off-the-job misconduct	0.907	0.709	1.247	0.994
ROA	0.275	2.875 ***	0.266	2.862 ***
Loss	3.798	1.511	3.188	1.411
PBR	-0.538	-2.303 **	-0.574	-2.434 **
Age	0.026	0.055	-0.121	-0.243
Sales	0.008	0.371	0.009	0.434
Size	0.429	1.663 *	0.461	1.840 *
Foreign	-0.026	-0.798	-0.040	-1.255
Retail	0.950	0.941		
IT	1.329	1.555		
Electronics	0.007	0.004		
Obs	180		180	
Adjusted R-squared	18.85%		19.76%	
S.E. of regression	6.256		6.221	
F-statistic	3.970 ***		5.008 ***	

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

Among the four variables that capture the contents of flaming, only *Scandal* is significantly negative at the 1% level for both models. In other words, big corporate scandals reported by the mass media tend to decrease the stock prices of flamed firms, but the effects of the other contents are not significantly different from zero.

IV. DISCUSSION

The empirical results reported above reveal the characteristics of firms flamed on the Internet and their stock price decline around the times of the online flaming. Our results are consistent with the notion that flamed firms will likely experience a decline in future cash flow.

We admit that the statistical significance of our second results is at least 10%, which is not strong. The weak statistical significance may partly result from the fact that relatively few investors have time to notice the online flaming in the short event window. In other words, information asymmetry among investors may make initial market responses relatively weak.

To support this idea, our second regression analysis suggests that only big corporate scandals reported by the mass media have significantly negative effects on the stock prices of flamed firms, while the short-term impact of the other contents is not significantly different from zero.

These results indicate that if more popular media such as newspapers or TV report the issue of flaming later, market reactions may become larger as more investors decide to sell their stocks of flamed firms. Thus, further research is needed to investigate how online flaming settles down, and how market reactions change overtime

as the incidents are reported by mass media at later periods.

V. CONCLUSION

In this study, we examine flaming on the Internet using Japanese data on flamed firms listed on the first section of the TSE from 2006 to September, 2013. Based on a probit model, we find that younger and/or larger firms with higher PBR are more likely to become the target of online flaming. In addition, the event study shows that stock prices of the target firms tend to decline for the initial dates of online flaming. In other words, the value of flamed firms can be expected to decrease.

It is important to note, however, that another regression analysis shows that only big corporate scandals reported by the mass media have significantly negative effects on the stock prices of flamed firms, while the short-term impact of other contents may not affect those prices. Considering these results, future research should investigate how online flaming settles down and how market reactions change over time as incidents are reported by the mass media at a later period.

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