Does relative efficiency matter? An analysis of market uncertainty

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Citation:

Table 1 Model Selection Process

Variable definitions		
Dependent Variable	Sign	Definition
Stock price volatility (ASPV)		Standard deviation of yearly stock return * Square root of trading days
Variables of Interest		
Relative efficiency	+	Technical efficiency score computed using data envelopment analysis
Control Variables		
1. Size & Firm performance		
Size	-	Natural logarithm of total assets
Firm Performance	-	Abnormal level of ROA (=ROA – industry median)
Firm value	-	Tobin's Q calculated using Chung and Pruitt(1994)
Foreign Operation	-	Size of gain/loss on Foreign operation
2. Business Risk		
Indebtedness	+	debt ratio (=total liabilities / total assets)
Loss	+	A dummy variable that takes 1 if a firm's net income is negative, 0 otherwise
3. Earnings Management		
AEM	+	Absolute value of discretionary accruals suggested by Dechow et al.(1995)
REM	+	AbCFO*(-1) + AbProd + AbSGA*(-1) suggested by Roychowdhury(2006)
4. Governance Structure		
Bigown	-	Biggest shareholder's share holdings(%)
Fore	-	Foreign investors' share holdings(%)
5. Fixed effect		
ID		Industry fixed effect
YD		Year fixed effect

Table 2 Sample selection

Panel A: firm efficiency and market efficiency sample from 2000-2015

Initial Sample	23,648
Excluding firms with insufficient obs. To compute FE scores	(8,928)
Potential Sample	14,720
Excluding firms with no financial data available	(929)
Final Sample	13,791

Panel B: Sample selection by year using a panel

Year	Obs.	Mean Volatility	Mean Efficiency	Year	Obs.	Mean Volatility	Mean Efficiency
2000	646	95.68	0.53	2008	891	68.86	0.69
2001	735	73.83	0.56	2009	897	61.29	0.60
2002	801	66.72	0.49	2010	904	50.32	0.77
2003	845	58.30	0.63	2011	904	56.92	0.73
2004	863	55.28	0.57	2012	906	50.68	0.73
2005	870	61.46	0.46	2013	906	42.96	0.75
2006	881	54.83	0.54	2014	911	43.33	0.77
2007	885	56.64	0.57	2015	916	55.65	0.77

Table 3 Univariate Analysis

Descriptive Statistics and Difference Tests (Investment grade vs Non-investment grade)

Var	(1) Full				(2) Safe firms Less volatile firms (Bottom 50%)				(3) Risky firms More volatile firms (Top 50%)				Diff (2)-(3)
	Obs.	Mean (Med)	Max (Min)	S.D	Obs.	Mean (Med)	Max (Min)	S.D	Obs.	Mean (Med)	Max (Min)	S.D	t (z)
ASPV	13761	58.64 (54.73)	134.54 (18.38)	23.59	7000	44.54 (42.73)	93.11 (18.38)	14.87	6761	73.24 (69.54)	134.54 (36.07)	22.03	-89.81*** (-76.57***)
Relative_Effi	14720	0.64 (0.79)	1 (0.06)	0.34	6984	0.65 (0.81)	1 (0.01)	0.34	7736	0.63 (0.77)	1 (0.00)	0.33	1.83* (3.02***)
Size	14733	18.70 (18.47)	23.10 (15.98)	1.48	7000	19.17 (18.94)	23.77 (16.61)	1.46	7733	18.28 (18.08)	22.45 (15.76)	1.36	38.47*** (39.36***)
Firm_Performance	13815	-0.00 (0.00)	0.23 (-0.29)	0.09	6535	0.01 (0.01)	0.20 (-0.18)	0.06	7280	-0.01 (-0.01)	0.25 (-0.35)	0.11	13.04*** (13.90***)
Tobin_Q	13406	0.44 (0.32)	2.18 (0.03)	0.448	6822	0.44 (0.33)	2.08 (0.04)	0.46	6584	0.45 (0.31)	2.35 (0.02)	0.51	1.24 (1.62)
Foreign_Operation	14313	0.03 (0.01)	0.17 (0)	0.47	6825	0.02 (0.01)	0.15 (0)	0.03	7488	0.03 (0.01)	0.21 (0)	0.65	1.51 (1.57)
BigOwn	14736	0.36 (0.37)	0.79 (0.00)	0.22	7000	0.39 (0.41)	0.79 (0.00)	0.19	7736	0.32 (0.33)	0.78 (0.00)	0.23	19.72*** (19.14)
Foreign	14736	0.06 (0.01)	0.54 (0)	0.11	7000	0.08 (0.02)	0.61 (0)	0.13	7736	0.03 (0.00)	0.47 (0)	0.08	25.01*** (29.53***)
Indebtedness	14733	0.43 (0.43)	0.95 (0.04)	0.35	7000	0.39 (0.39)	0.81 (0.04)	0.18	7733	0.47 (0.46)	1.07 (0.05)	0.46	-14.53*** (-20.87***)
Loss	14736	0.23 (0)	1 (0)	0.41	7000	0.16 (0)	1 (0)	0.36	7736	0.29 (0)	1 (0)	0.46	-19.94*** (-19.68***)
AEM	13922	0.07 (0.05)	0.38 (0.00)	0.08	6698	0.06 (0.04)	0.31 (0.00)	0.06	7224	0.09 (0.06)	0.38 (0.00)	0.09	-21.16*** (-17.00***)
REM	13922	-0.03 (-0.04)	1.11 (-0.69)	0.24	6698	-0.05 (-0.06)	1.07 (-0.62)	0.23	7224	-0.01 (-0.02)	1.11 (-0.69)	0.25	-8.99*** (-13.53***)
	(4) Top25% Volatility (Riskiest)				(5) Middle 50% Volatility				(6) Bottom 25% Volatility (Safest)				Diff(6)-(4)
ASPV	3628	83.17 (79.83)	134.54 (42.26)	21.93	6504	56.32 (54.55)	109.43 (29.27)	15.73	3629	38.26 (36.71)	79.93 (18.38)	12.69	-110.02*** (-79.63***)
Relative_Effi	4603	0.64 (0.78)	1 (0.01)	0.33	6499	0.64 (0.79)	1 (0.00)	0.34	3618	0.65 (0.81)	1 (0.01)	0.34	1.96** (2.63***)

Note: t indicates t value for mean-difference test.

z indicates wilcoxon z value for median-difference test.

*, **, *** indicate significance level at 10%, 5%, 1% respectively.

See Table 1 for variable definitions.

Table 4 Pearson Correlation

Var.	1.	2.	3.	4.	5.	6.
1. ASPV	1					
2. Relative_Efficiency	-0.11***	1				
3. Size	-0.39***	-0.00	1			
4. Firm_Performance	-0.21***	0.12***	0.09***	1		
5. Tobin_Q	-0.01**	0.07***	-0.11***	0.07***	1	
6. Foreign_Operation	0.04***	-0.02***	-0.01**	-0.05***	-0.01	1
7. BigOwn	-0.14***	-0.02**	0.07***	0.03***	-0.17***	-0.02**
8. Foreign	-0.24***	-0.00	0.42***	0.13***	0.18***	-0.00
9. Indebtedness	0.15***	-0.04***	0.05***	-0.12***	-0.18***	0.06***
10. Loss	0.23***	-0.09***	-0.13***	-0.36***	-0.00	0.03***
11. AEM	0.28***	0.01	-0.20***	-0.09***	0.07***	0.04***
12. REM	0.13***	0.01*	-0.01	-0.17***	0.05***	0.03***
	7.	8.	9.	10.	11.	12.
7. BigOwn	1					
8. Foreign	0.03***	1				
9. Indebtedness	-0.07***	-0.09***	1			
10. Loss	-0.12***	-0.11***	0.16***	1		
11. AEM	-0.11***	-0.07***	0.11***	0.18***	1	
12. REM	-0.05***	0.02***	0.03***	0.16***	0.11***	1

Note: *, **, *** indicate significance level at 10%, 5%, 1% respectively.
See Table 1 for variable definitions.

Table 5 Influence of firm efficiency on ASPV using efficiency score
Results of multivariate regression analysis

Model:

$$ASPV = \beta_1 Relative\_Effi_{i,t} + \beta_2 Size_{i,t} + \beta_3 Firm\_Performance_{i,t} + \beta_4 Tobin\_Q_{i,t} + \beta_5 Foreign\_Operation_{i,t}$$
$$+ \beta_6 BigOwn_{i,t} + \beta_7 Foreign_{i,t} + \beta_8 Indebtedness_{i,t} + \beta_9 Loss_{i,t} + \beta_{10} AEM_{i,t} + \beta_{11} REM_{i,t}$$
$$+ ID + YD + \varepsilon_{i,t}$$

Variables	Sign	Full
Relative_Effi	-	-6.92*** (-12.87)
Size	-	-5.17*** (-35.25)
Firm_Performance	-	-14.71*** (-6.15)
Tobin_Q	-	-1.84*** (-4.35)
Foreign_Operation	-	-4.74*** (-9.52)
BigOwn	-	-13.84*** (-12.50)
Foreign	-	-10.98*** (-6.13)
Indebtedness	+	10.40*** (14.69)
Loss	+	2.82*** (5.90)
AEM	+	49.03*** (20.58)
REM	+	9.24*** (10.57)
YD		*Included*
ID		*Included*
f value		408.39***
Adj. R2		0.2699
Obs.		12165

Note: *, **, *** indicate significance level at 10%, 5%, 1% respectively. Figures in parenthesis indicate z value
See Table 1 for variable definitions.

Table 6 Verification tests

Model:
$$Return_{i,t} = \beta_1 ASPV/Relative\_Effii_{i,t} + \beta_2 Size_{i,t} + \beta_3 Risk_{i,t} + \beta_4 Firm\_Performance_{i,t} + \beta_5 Foreign\_Operation_{i,t} + \beta_6 AEM_{i,t} + \beta_7 REM_{i,t} + ID + YD + \varepsilon_{i,t}$$

Panel A: Relationship between stock price volatility and stock return

	Sign	Full	Top25Effi	Middle50Effi	Bottom25Effi
Intercept	?	-0.83***(-5.79)	-0.88***(-3.58)	-0.60***(-4.25)	-1.23***(-3.07)
ASPV	+	0.01***(24.30)	0.01***(12.75)	0.01***(18.09)	0.02***(13.76)
Size	+	0.02***(3.15)	0.04***(2.87)	0.02***(2.68)	0.02(1.13)
Risk	-	-0.05**(-2.16)	-0.26***(-4.18)	-0.05(-1.00)	-0.03(-0.77)
Firm_Performance	+	0.884***(8.02)	0.66***(3.78)	0.64***(4.50)	1.30***(4.09)
Foreign_Operation	+	0.34***(4.07)	0.01(0.09)	0.30***(3.59)	0.80***(2.96)
AEM	-	-0.32***(-2.75)	-0.08**(-1.45)	-0.54***(-4.39)	-0.33(-1.08)
REM	-	-0.10***(-2.65)	-0.19***(-3.24)	-0.11***(-3.04)	-0.00(-0.04)
YD		Included	Included	Included	Included
ID		Included	Included	Included	Included
F value		193.46***	129.22***	154.30***	129.29***
Adj. R2		0.1476	0.1576	0.1590	0.1529
Obs.		13110	3357	6071	3682

Panel B: Relationship between relative efficiency and stock return

	Sign	Full	Top25Effi	Middle50Effi	Bottom25Effi
Intercept	?	0.59***(4.80)	0.24(1.18)	0.48***(4.05)	1.06***(2.91)
Relative_Effi	+	-0.08***(-3.29)	-0.11**(-2.39)	-0.08***(-3.43)	-0.09(-1.20)
Size	+	0.02***(3.08)	0.01**(2.47)	0.02**(2.43)	0.05**(2.44)
Risk	-	-0.01**(2.22)	-0.17***(-2.97)	-0.07*(-1.75)	-0.02(-1.41)
Firm_Performance	+	0.44***(4.51)	0.33**(2.18)	0.45***(3.35)	0.64**(2.03)
Foreign_Operation	+	0.23***(2.84)	0.06(0.55)	0.28***(3.36)	0.49*(1.80)
AEM	-	-0.18*(-1.73)	-0.28*(-1.72)	-0.18(-1.59)	-0.50*(-1.66)
REM	-	-0.02(-1.50)	-0.12**(-2.32)	-0.04(-1.12)	-0.13(-1.25)
YD		Included	Included	Included	Included
ID		Included	Included	Included	Included
F value		106.69***	104.61***	106.49***	102.21***
Adj. R2		0.1034	0.1088	0.1070	0.1041
Obs.		13843	3645	6441	3757

Variable Definition: *Return*: 12months cumulative monthly stock return, *ASPV*: Stock Price Volatility, *Relative_Effi*: Technical efficiency score computed using data envelopment analysis , *Size*: Natural logarithm of total assets, *Risk* : debt ratio (=total liabilities / total assets), *Firm_Performance*: Abnormal level of ROA (=ROA – industry median), *Foreign_Operation*: Size of gain/loss on foreign operation *AEM*: Absolute value of discretionary accruals suggested by Dechow et al.(1995), *REM*: AbCFO*(-1) + AbProd + AbSGA*(-1) suggested by Roychowdhury(2006)

Table 7 Most efficient group vs Most inefficient group analysis

Model:

$$ASPV_{i,t} = \beta_1 Relative\_Effi_{i,t} + \beta_2 Size_{i,t} + \beta_3 Firm\_Performance_{i,t} + \beta_4 Tobin\_Q_{i,t} + \beta_5 Foreign\_Operation_{i,t} + \beta_6 BigOwn_{i,t} + \beta_7 Foreign_{i,t} + \beta_8 Indebtedness_{i,t} + \beta_9 Loss_{i,t} + \beta_{10} AEM_{i,t} + \beta_{11} REM_{i,t} + ID + YD + \varepsilon_{i,t}$$

$$ASPV_{i,t} = \beta_1 Relative\_Effi_{i,t} + \beta_2 D\_TOP25_{i,t} + \beta_3 Top25\_Effi_{i,t} + \beta_4 Size_{i,t} + \beta_5 Firm\_Performance_{i,t} + \beta_6 Tobin\_Q_{i,t} + \beta_7 Foreign\_Operation_{i,t} + \beta_8 BigOwn_{i,t} + \beta_9 Foreign_{i,t} + \beta_{10} Indebtedness_{i,t} + \beta_{11} Loss_{i,t} + \beta_{12} AEM_{i,t} + \beta_{13} REM_{i,t} + ID + YD + \varepsilon_{i,t}$$

Variables	sign	(1) Top25 Efficiency	(2) Middle50 Efficiency	(3) Bottom25 Efficiency	(4) Top25 vs Bottom25
Relative_Effi	-	-4.91***(-4.30)	-7.27***(-9.22)	-7.93***(-7.41)	-8.06***(-7.59)
D_Top25effi					-2.32**(-1.98)
Top25effi_Effi					-3.54**(-2.27)
Size	-	-4.96***(-16.40)	-5.96***(-27.54)	-4.93***(-17.73)	-4.93***(-24..21)
Firm_Performance	-	-5.37(-1.18)	-14.12***(-3.47)	-24.13***(-5.58)	-15.09***(-4.89)
Tobin_Q	-	-0.38(-0.48)	1.51**(2.00)	-4.25***(-6.12)	-2.66***(-5.13)
Foreign_Operation	-	34.11***(4.58)	46.88***(5.82)	-2.57***(-4.34)	-3.41***(-6.38)
BigOwn	-	-14.21***(-6.45)	-9.79***(-5.99)	-15.96***(-7.81)	-15.69***(-10.46)
Foreign	-	-15.37***(-4.83)	-3.79(-1.43)	-16.42***(-4.28)	-14.77***(-6.06)
Indebtedness	+	13.46***(8.87)	24.08***(15.47)	5.49***(5.81)	7.53***(9.39)
Loss	+	4.21***(3.32)	0.04(0.06)	2.74***(3.59)	3.40***(5.23)
AEM	+	42.35***(9.35)	43.07***(11.24)	50.86***(12.15)	49.40***(16.14)
REM	+	5.72***(3.96)	10.39***(8.80)	7.69***(5.12)	6.89***(6.62)
YD		Included	Included	Included	Included
ID		Included	Included	Included	Included
f value		92.53***	169.29***	140.41***	207.82***
Adj. R2		0.2489	0.2483	0.3111	0.2936
Obs.		3083	5650	3432	6515

Note: *, **, *** indicate significance level at 10%, 5%, 1% respectively. Figures in parenthesis indicate t value

Table 8 High risk-High return (Most news sensitive) group vs Low risk-Low return (Least news sensitive) group

Model:

$$ASPV_{i,t} = \beta_1 Relative\_Effi_{i,t} + \beta_2 Size_{i,t} + \beta_3 Firm\_Performance_{i,t} + \beta_4 Tobin\_Q_{i,t} + \beta_5 Foreign\_Operation_{i,t} + \beta_6 BigOwn_{i,t} + \beta_7 Foreign_{i,t} + \beta_8 Indebtedness_{i,t} + \beta_9 Loss_{i,t} + \beta_{10} AEM_{i,t} + \beta_{11} REM_{i,t} + ID + YD + \varepsilon_{i,t}$$

$$ASPV_{i,t} = \beta_1 Relative\_Effi_{i,t} + \beta_2 D\_TopVola_{i,t} + \beta_3 TopVola\_Effi_{i,t} + \beta_4 Size_{i,t} + \beta_5 Firm\_Performance_{i,t} + \beta_6 Tobin\_Q_{i,t} + \beta_7 Foreign\_Operation_{i,t} + \beta_8 BigOwn_{i,t} + \beta_9 Foreign_{i,t} + \beta_{10} Indebtedness_{i,t} + \beta_{11} Loss_{i,t} + \beta_{12} AEM_{i,t} + \beta_{13} REM_{i,t} + ID + YD + \varepsilon_{i,t}$$

Variables	sign	(1) Top25 Volatility	(2) Middle50 Volatility	(3) Bottom25 Volatility	(4) Top25 vs Bottom25
Relative_Effi	-	-8.92***(-8.34)	-6.42***(-11.78)	-3.72***(-5.87)	-4.75***(-5.50)
D_TopVola					40.92***(43.73)
TopVola_Effi					-4.22***(-3.41)
Size	-	-5.41***(-17.07)	-3.62***(-23.34)	-1.26***(-7.08)	-2.84***(-16.31)
Firm_Performance	-	1.67(0.45)	-8.42***(-3.21)	-2.31(-0.62)	-2.10(-0.81)
Tobin_Q	-	-3.30***(-4.91)	-1.88***(-3.99)	-1.23**(-1.99)	-2.23***(-4.84)
Foreign_Operation	-	-0.99*(-1.79)	35.31***(7.82)	51.47***(6.69)	-1.31***(-2.94)
BigOwn	-	-3.16(-1.56)	-8.85***(-7.60)	-9.83***(-7.16)	-8.04***(-6.41)
Foreign	-	-13.52***(-2.71)	-5.02***(-2.69)	-1.92(-1.07)	-1.121(-0.55)
Indebtedness	+	2.53***(2.94)	10.53***(9.89)	10.15***(7.47)	3.38***(4.99)
Loss	+	-0.01(-0.01)	1.40***(2.82)	0.07(0.11)	0.18(0.33)
AEM	+	35.50***(9.83)	28.07***(10.53)	22.15***(5.96)	32.75***(12.58)
REM	+	2.77**(2.03)	3.66***(4.15)	1.60*(1.72)	4.69***(5.57)
YD		Included	Included	Included	Included
ID		Included	Included	Included	Included
f value		64.23***	134.24***	32.54***	936.55***
Adj. R2		0.1825	0.2040	0.1006	0.6563
Obs.		3176	5775	3214	6390

Note: *, **, *** indicate significance level at 10%, 5%, 1% respectively. Figures in parenthesis indicate t value

D_TOPVola: A dummy variable that takes a value of 1 if the most volatile group (top25 volatility), 0 if least volatile group (bottom 25% volatility), *TopVola_Effi*: Interaction term between relative efficiency score and *D_TopVola* dummy. See Table 1 for variable definitions.

Table 9 Safe vs Risky group analysis based on credit risk

Model:

$$ASPV_{i,t} = \beta_1 Relative\_Effi_{i,t} + \beta_2 Size_{i,t} + \beta_3 Firm\_Performance_{i,t} + \beta_4 Tobin\_Q_{i,t}$$
$$+ \beta_5 Foreign\_Operation_{i,t} + \beta_6 BigOwn_{i,t} + \beta_7 Foreign_{i,t} + \beta_8 Indebtedness_{i,t}$$
$$+ \beta_9 Loss_{i,t} + \beta_{10} AEM_{i,t} + \beta_{11} REM_{i,t} + ID + YD + \varepsilon_{i,t}$$

$$ASPV_{i,t} = \beta_1 Relative\_Effi_{i,t} + \beta_2 D\_IG_{i,t} + \beta_3 IG\_Effi_{i,t} + \beta_4 Size_{i,t} + \beta_5 Firm\_Performance_{i,t}$$
$$+ \beta_6 Tobin\_Q_{i,t} + \beta_7 Foreign\_Operation_{i,t} + \beta_8 BigOwn_{i,t} + \beta_9 Foreign_{i,t}$$
$$+ \beta_{10} Indebtedness_{i,t} + \beta_{11} Loss_{i,t} + \beta_{12} AEM_{i,t} + \beta_{13} REM_{i,t} + ID + YD + \varepsilon_{i,t}$$

Variables	sign	(1) IG (Safe)	(2) NIG(Risky)	(3) IG vs NIG
Relative_Effi	-	-5.80***	-8.38***	-8.84***
		(-8.70)	(-9.55)	(-10.41)
D_IG				-6.87***
				(-8.30)
IG_Effi				3.14***
				(2.90)
Size	-	-5.98***	-5.02***	-5.31***
		(-30.67)	(-21.88)	(-36.14)
Firm_Performance	-	-11.22***	-18.86***	-11.90***
		(-3.27)	(-5.48)	(-4.97)
Tobin_Q	-	1.75***	-7.75***	-1.33***
		(3.52)	(-9.24)	(-3.14)
Foreign_Operation	-	41.49***	-2.40***	-3.25***
		(5.96)	(-4.21)	(-6.28)
BigOwn	-	-7.53***	-18.41***	-12.93***
		(-5.14)	(-10.97)	(-11.69)
Foreign	-	-5.50***	-13.77***	-8.53***
		(-2.70)	(-3.56)	(-4.74)
Indebtedness	+	16.56***	5.31***	7.39***
		(10.15)	(5.97)	(9.68)
Loss	+	2.52***	0.58	0.95*
		(2.67)	(0.94)	(1.87)
AEM	+	45.83***	46.66***	47.79***
		(13.23)	(14.23)	(20.13)
REM	+	8.18***	6.91***	7.64***
		(8.53)	(5.30)	(9.82)
YD		*Included*	*Included*	*Included*
ID		*Included*	*Included*	*Included*
f value		191.69***	165.40***	357.51***
Adj. R2		0.2309	0.2623	0..2767
Obs.		7037	5128	12165

Note: *, **, *** indicate significance level at 10%, 5%, 1% respectively. Figures in parenthesis indicate t value
    D_IG: A dummy variable that takes a value of 1 if a firm is investment grade (CR score above 6 where 10 is the highest) ,0 if non-investment grade, *IG_Effi*: Interaction term between relative efficiency score and *D_IG* dummy.
    See Table 1 for variable definitions.

Table 10 Safe vs Risky group analysis based on market size

Model:

$$ASPV_{i,t} = \beta_1 Relative\_Effi_{i,t} + \beta_2 Size_{i,t} + \beta_3 Firm\_Performance_{i,t} + \beta_4 Tobin\_Q_{i,t}$$
$$+ \beta_5 Foreign\_Operation_{i,t} + \beta_6 BigOwn_{i,t} + \beta_7 Foreign_{i,t} + \beta_8 Indebtedness_{i,t}$$
$$+ \beta_9 Loss_{i,t} + \beta_{10} AEM_{i,t} + \beta_{11} REM_{i,t} + ID + YD + \varepsilon_{i,t}$$

$$ASPV_{i,t} = \beta_1 Relative\_Effi_{i,t} + \beta_2 D\_KOSPI_{i,t} + \beta_3 KOSPI\_Effi_{i,t} + \beta_4 Size_{i,t} + \beta_5 Firm\_Performance_{i,t}$$
$$+ \beta_6 Tobin\_Q_{i,t} + \beta_7 Foreign\_Operation_{i,t} + \beta_8 BigOwn_{i,t} + \beta_9 Foreign_{i,t}$$
$$+ \beta_{10} Indebtedness_{i,t} + \beta_{11} Loss_{i,t} + \beta_{12} AEM_{i,t} + \beta_{13} REM_{i,t} + ID + YD + \varepsilon_{i,t}$$

Variables	sign	(1) KOSPI	(2) KOSDAQ	(3) KOSPI vs KOSDAQ
Relative_Effi	-	-6.48***	-7.85***	-8.77***
		(-9.95)	(-8.86)	(-10.51)
D_KOSPI				-5.11***
				(-6.25)
KOSPI_Effi				2.25**
				(2.08)
Size	-	-3.08***	-8.55***	-4.53***
		(-16.70)	(-25.01)	(-27.40)
Firm_Performance	-	-7.46*	-18.09***	-15.12***
		(-1.93)	(-5.83)	(-6.33)
Tobin_Q	-	-4.17***	-1.84***	-2.28***
		(-5.97)	(-3.32)	(-5.37)
Foreign_Operation	-	-5.02***	26.31***	-4.73***
		(9.59)	(5.35)	(-9.53)
BigOwn	-	-19.88***	-6.22***	-13.96***
		(-13.87)	(-3.74)	(-13.63)
Foreign	-	-14.72***	-5.71	-10.73***
		(-7.32)	(-1.63)	(-6.00)
Indebtedness	+	10.85***	9.06***	10.52***
		(13.20)	(7.28)	(14.90)
Loss	+	3.74***	1.72**	2.64***
		(5.74)	(2.49)	(5.52)
AEM	+	62.19***	36.47***	47.92***
		(17.60)	(11.41)	(20.14)
REM	+	5.98***	4.98***	8.14***
		(5.66)	(4.20)	(10.41)
YD		Included	Included	Included
ID		Included	Included	Included
f value		205.10***	160.1***	353.33***
Adj. R2		0.2684	0.2270	0.2743
Obs.		6161	6004	12165

Note: *, **, *** indicate significance level at 10%, 5%, 1% respectively. Figures in parenthesis indicate t value
D_KOSPI: A dummy variable that takes a value of 1 if a firm is listed on KOSPI market ,0 if a firm listed on KOSDAQ market, *KOSPI_Effi*: Interaction term between relative efficiency score and *D_KOSPI* dummy.
See Table 1 for variable definitions.

Table 11 Sensitivity analysis based on 1) efficiency, 2) volatility decile rank

Model:

$$ASPV_{i,t} = \beta_1 Relative\_Effi_{i,t} + \beta_2 Size_{i,t} + \beta_3 Firm\_Performance_{i,t} + \beta_4 Tobin\_Q_{i,t} + \beta_5 Foreign\_Operation_{i,t} + \beta_6 BigOwn_{i,t} + \beta_7 Foreign_{i,t} + \beta_8 Indebtedness_{i,t}$$
$$+ \beta_9 Loss_{i,t} + \beta_{10} AEM_{i,t} + \beta_{11} REM_{i,t} + ID + YD + \varepsilon_{i,t}$$

Panel A: Sensitive Analysis By Relative Efficiency decile rank

	Most Efficient									Most inefficient
	10	9	8	7	6	5	4	3	2	1
Relative_Effi	-3.47	-6.04***	-6.00***	-5.67***	-7.73***	-6.22***	-7.95***	-4.75***	-11.52***	-11.11***
	(-1.29)	(-3.28)	(-3.66)	(-3.44)	(-4.76)	(-3.82)	(-4.84)	(-3.03)	(-6.04)	(-5.51)
Controls	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*
YD	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*
ID	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*
f value	41.05***	32.75***	36.67***	31.14***	30.49***	40.46***	41.09***	47.97***	41.73***	63.10***
Adj. R2	0.2677	0.2645	0.2621	0.2188	0.2080	0.2739	0.2718	0.2842	0.2872	0.3458
Obs.	1247	1014	1148	1235	1289	1192	1223	1341	1151	1325

Panel B: Sensitive Analysis By Volatility decile rank

	Most volatile									Least volatile
	10	9	8	7	6	5	4	3	2	1
Relative_Effi	-7.87***	-6.85***	-7.73***	-6.37***	-5.85***	-5.94***	-4.93***	-4.83***	-3.77***	-2.70***
	(-4.13)	(-4.55)	(-5.70)	(-5.31)	(-5.24)	(-5.18)	(-4.65)	(-4.79)	(-3.97)	(-3.07)
Controls	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*
YD	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*
ID	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*	*Included*
f value	21.83***	22.33***	26.16***	28.83***	32.23***	22.09***	20.65***	17.02***	16.70***	10.76***
Adj. R2	0.1635	0.1668	0.1985	0.2060	0.2185	17.39	0.1605	0.1337	0.1355	0.0776
Obs.	1029	1239	1174	1234	1280	1166	1200	1225	1198	1420

Note: *, **, *** indicate significance level at 10%, 5%, 1% respectively. Figures in parenthesis indicate t value. See Table 1 for variable definitions.