Signaling safety

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Signaling theory——dividend policy does contain value-relevant information

- 直觉： changes in dividend policy convey information to the market
- 公司: managers support it in surveys
- 市场： The strong market reaction to announcements of dividend changes

traditional signaling model

- dividend changes signal changes in earnings or cash flows (in same directions)
- young and risky firms (with growth opportunities) should use dividends as signal more frequently

our novel signaling model

- dividend changes and repurchase announcements signal changes in cash-flow volatility (in opposite directions)
- implies safer firms (those with more stable profits) signal more frequently

empirically evidence

- return decomposition
- VAR

theoretically evidence

- general case（symmetric info & precautionaty motives）
- **asymmetric infomation (σ^2)**
- agency cost theory

empirically evidence

to insepct mechanism

- managers signal future changes in (cash flow) volatility through dividends
- cash-flow news drive payout policy, and payout policy conveys information about future cash-flow volatility to market

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一、Method——Stock return decomposition

- To test our hypotheses on changes in cash flows and discount rates following dividend changes, we require **measures of the first and second moment of expected cash flows and discount rates.**
- This method, initially developed by Campbell (1991) from **dividend discount model,** to **decompose returns into news originating from cash flows and discount rates.** Vuolteenaho (2002) extends the **VAR methodology** to the **individual firm level** .

资产定价、经济变量可以对收益率进行预测:

- Dividend discount model： 股利贴现模型（股价=未来现金流贴现值之和）
- Campbell and shiller : **对数线性模型**/收益分解模型（log股票收益率=log现金流-log贴现率）$\frac{D_t}{P_t}$
- **Vuolteenaho**： 选取 **B/M ratio**作为收益率代理变量，进行预测；并将该理论模型通过**VAR**应用于实证研究

- 现金流代理变量——公司基本面盈利能力：Dividend / ROA / **ROE** / ΔD
- 贴现率代理变量——市场对公司的判断： **(excess) stock return**

一、Method——Stock return decomposition

Approximate model of the book-to-market model：

- principal assumption:

  the B/M ratio is stationary. Barring the existence of such infinitely lived bubbles in asset prices, if price is high today, expected cash-flow fundamentals must be high and/or expected returns low.

- main assumption:
  1. Book equity, B, dividend, D, and market equity, M, are assumed to be strictly positive to allow log transformations.
  2. log book and market equity and log dividends and log book equity are cointegrated.
  3. clean-surplus accounting. Earnings and book equity must satisfy the identity:

$$B_t - B_{t-1} + D_t = \boldsymbol{X_t}$$

$$M_t - M_{t-1} + D_t = X'_t$$

  return on book equity relates to the book value of equity the same way as stock returns relate to the market value of equity.

一、Method——Stock return decomposition

Approximate model of the book-to-market model : 收益分解

$$log(\frac{B_{t-1}}{M_{t-1}}) = \theta_{t-1} \qquad log(\frac{B_t + D_t}{M_t + D_t}) = \rho\theta_t$$

$$\mathrm{roe}_t - (r_t + f_t) = log(1 + \frac{X_t}{B_{t-1}}) - log(1 + \frac{X'_t}{M_{t-1}}) = log(\frac{B_t+D_t}{B_{t-1}}) - log(\frac{M_t+D_t}{M_{t-1}}) = log(\frac{B_t+D_t}{M_t+D_t}) - log(\frac{B_{t-1}}{M_{t-1}}) = \rho\theta_t - \theta_{t-1}$$

$$\theta_{t-1} = \boldsymbol{\rho}\theta_t - roe_t + (r_t + f_t) = \boldsymbol{\rho}\theta_t - (roe_t - f_t) + r_t$$

$$\boxed{\theta_{t-1} = k_{t-1} + \sum_{s=0}^{\infty} \rho^s r_{t+s} - \sum_{s=0}^{\infty} \rho^s (roe_{t+s} - f_{t+s}). \qquad (1)}$$

express the B/M ratio as an infinite discounted sum of future profitability spread $(roe_t - f_t)$ and excess stock returns(r_t).

- θ_t is the log book-to-market ratio,$\theta_t = log(\frac{B_t}{M_t})$;
- roe is log return on equity, which we define as roe_t = log(1 + $\frac{X_t}{B_{t-1}}$);
- r_t denotes the excess log stock return,r_t = log(1 + R_t + F_t) – f_t ; $r_t + f_t = log(1 + \frac{X'_t}{M_{t-1}})$;
- R_t is the simple excess return; F_t is the interest rate, f_t is log of 1 plus the interest rate;
- k summarizes linearization constants, which are not essential for the analysis;
- ρ is a discount factor.

一、Method——Stock return decomposition

Approximate model of the book-to-market model : 异常收益分解

$$r_t = (roe_t - f_t) + \theta_{t-1} - \rho\theta_t \qquad \theta_{t-1} = k_{t-1} + \sum_{s=0}^{\infty} \rho^s r_{t+s} - \sum_{s=0}^{\infty} \rho^s (roe_{t+s} - f_{t+s}).$$

$$\boxed{r_t - \mathbb{E}_{t-1} r_t = \Delta\mathbb{E}_t \sum_{s=0}^{\infty} \rho^s (roe_{t+s} - f_{t+s}) - \Delta\mathbb{E}_t \sum_{s=1}^{\infty} \rho^s r_{t+s}.}$$

$$\boxed{r_t - \mathbb{E}_{t-1} r_t = \eta_{cf,t} - \eta_{r,t}.}$$

$$\begin{aligned} r_t - E_{t-1}r_t &= (E_t - E_{t-1})r_t = \Delta E_t[(roe_t - f_t) + \theta_{t-1} - \rho\theta_t] = \Delta E_t[(roe_t - f_t) - \rho\theta_t] \\ &= \Delta E_t\{(roe_t - f_t) - \boldsymbol{\rho}[k_t + \textstyle\sum_{s=0}^{\infty} \rho^s r_{t+s+1} - \sum_{s=0}^{\infty} \rho^s (roe_{t+s+1} - f_{t+s+1})]\} = \\ &= \Delta E_t\{(\mathbf{roe}_t - \boldsymbol{f}_t) - [\textstyle\sum_{\boldsymbol{s=1}}^{\infty} \rho^s r_{t+s} - \sum_{\boldsymbol{s=1}}^{\infty} \rho^s (roe_{t+s} - f_{t+s})]\} = \\ &= \Delta E_t\{\textstyle\sum_{\boldsymbol{s=0}}^{\infty} \rho^s (roe_{t+s} - f_{t+s}) - \sum_{s=1}^{\infty} \rho^s r_{t+s}\} = \eta_{cf,t} - \eta_{r,t} \end{aligned}$$

- returns can be high if we have news about higher current and future cash flows or lower future excess returns.
- We then introduce notation and write unexpected returns as the difference in cash-flow news, $\eta_{cf,t}$ and discount-rate news, $\eta_{r,t}$

一、Method——Vector autoregression

$$z_{i,t} = \boldsymbol{\Gamma}\, z_{i,t-1} + \mu_{i,t} \qquad \begin{pmatrix} r_{i,t} \\ \theta_{i,t} \\ roe_{i,t} \end{pmatrix} = \begin{pmatrix} a_{11} & a_{12} & a_{13} \\ a_{21} & a_{22} & a_{23} \\ a_{31} & a_{32} & a_{33} \end{pmatrix} \begin{pmatrix} r_{i,t-1} \\ \theta_{i,t-1} \\ roe_{i,t-1} \end{pmatrix} + \begin{pmatrix} \varepsilon_{t,r} \\ \varepsilon_{t,\theta} \\ \varepsilon_{t,roe} \end{pmatrix}$$

- $z_{i,t}$ be a vector of firm specific state variables describing a firm i at time t.
- **first element of $\boldsymbol{z_{i,t}}$ be the firm's stock return $\boldsymbol{r_{i,t}}$** , market - adjusted log return(log return - cross-sectional average log return).
- Σ denotes the variance-covariance matrix of $\mu_{i,t}$, and assume it's independent of the information set at time t – 1.
- vector e1'=[1 0 … 0]=[1 0 0]

$$r_{i,t} - E_{t-1} r_{i,t} = e1'\,\mu_{i,t} = \varepsilon_{t,r} = \eta_{cf,t} - \eta_{r,t}$$

$$\eta_{r,t} = \Delta E_t \sum_{s=1}^{\infty} \rho^s r_{t+s} = e1' \sum_{s=1}^{\infty} \boldsymbol{\rho^s \Gamma^s \mu_{i,t+s}} = e1'\,\rho\boldsymbol{\Gamma}(1-\rho\boldsymbol{\Gamma})^{-1}\mu_{i,t} = \lambda'\,\boldsymbol{\mu_{i,t}}$$

$$\eta_{cf,t} = (e1' + \lambda')\mu_{i,t}$$

$$Var_{(\eta_{cf,t})} = (e1' + \lambda')\,\Sigma\,(e1 + \lambda)$$

二、Data： firm-level

- Use **balance sheet data** from the quarterly Compustat file and **stock return data** from the monthly CRSP file.
- Defining **quarterly dividend changes** 、**dividend omissions and initiations** and **share repurchase(**in the past 40 years whereby share repurchases have become the dominant form of cash payouts.**)**.
- The sample period for dividend events is **1964–2013** because require sufficient post-event data to estimate the **VAR.**

$$r_{i,t} - E_{t-1}r_{i,t} = e1'\,\mu_{i,t} = \varepsilon_{t,r} = \eta_{cf,t} - \eta_{r,t}$$

$$\eta_{r,t} = e1'\,\rho\boldsymbol{\Gamma}(1-\rho\boldsymbol{\Gamma})^{-1}\mu_{i,t} = \lambda'\,\boldsymbol{\mu_{i,t}}$$

$$\boxed{(Var(\eta\_cf_{t:t+5} - Var(\eta\_cf_{t-5:t})/mean(Var(\eta\_cf_{t-5:t}))}$$

$$\eta_{cf,t} = (e1' + \lambda')\mu_{i,t}$$

$$Var_{(\eta_{cf,t})} = (e1' + \lambda')\,\Sigma\,(e1 + \lambda)$$

- We estimate for each dividend event **two VARs** before and after the quarter of the event using all firm observations with nonmissing data.
- We then create cash-flow and discount-rate news at the firm level using 60 months of data before and after the dividend event,winsorize the data at the 1% and 99% levels.
- We ensure across specifications that we have **nonoverlapping** data for the two VARs before and after dividend events and share repurchases .

三、Results

$$(roe_t^{GAAP} - f_t) - r_t + \theta_{t-1} = \boldsymbol{\rho}\theta_t$$

We find an estimate of **0.986**, which is almost identical to the estimate of Vuolteenaho (2002).

Table AI

Return on Equity (ROE) and the Approximate Identity

The table estimates an expansion point for the approximate identity relating the book-to-market ratio, stock return, and return on equity. The table shows regression estimates of profitability less stock return plus lagged book-to-market on future book-to-market.

The table contains two rows. The first row regresses the excess log clean-surplus ROE, $e_t^{CS} - f_t$, less excess log stock return, r_t, plus lagged log book-to-market, θ_{t-1}, on log book-to-market, θ_t. The second row regresses the excess log U.S. GAAP ROE, $e_t^{GAAP} - f_t$, less excess log stock return, r_t, plus lagged log book-to-market, θ_{t-1}, on log book-to-market, θ_t. f_t is log one plus the interest rate. Clean-surplus return on equity is calculated using the formula

$$e_t^{CS} = \log\left\{\left[\frac{(1+R_t+F_t)M_{t-1}-D_t}{M_t}\right]\left[\frac{B_t}{B_{t-1}}\right]+\left[\frac{D_t}{B_{t-1}}\right]\right\},$$

where M denotes market and B book equity, D dividends, and F the interest rate.

I use the 1954 to 1996 CRSP-COMPUSTAT intersection as the sample, in total 36,791 firm-years.

Accuracy of the approximation				
Y-variable	Intercept	Discount Coef. ρ	X-variable	R^2
$(e_t^{CS} - f_t) - r_t + \theta_{t-1}$	−0.000	0.967	θ_t	99.82%
$(e_t^{GAAP} - f_t) - r_t + \theta_{t-1}$	−0.017	0.987	θ_t	88.25%

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Descriptive statistics

	$\Delta Div > 0$				$\Delta Div < 0$			
	Nobs	Median	Mean	Std	Nobs	Median	Mean	Std
$\Delta \mathbb{Var}(\eta\_cf)/mean(\eta\_cf)$	2441	−0.13	−0.15	0.76	2461	0.06	0.07	0.83
$\Delta\eta\_cf$	2441	0.00	0.00	0.02	2461	0.00	0.00	0.02
$\Delta\eta\_dr$	2441	0.00	0.00	0.00	2461	0.00	0.00	0.00
BM ratio	2441	1.05	1.36	3.17	2461	1.10	1.48	2.97
Market cap	2441	0.45	4.34	19.23	2461	0.44	3.53	13.70
Delistings 5 years post-event	21				12			

	Initiations				Omissions			
	Nobs	Median	Mean	Std	Nobs	Median	Mean	Std
$\Delta \mathbb{Var}(\eta\_cf)/mean(\eta\_cf)$	1069	−0.21	−0.20	1.30	1233	0.05	0.06	0.88
$\Delta\eta\_cf$	1069	0.00	0.00	0.02	1233	0.00	0.00	0.01
$\Delta\eta\_dr$	1069	0.00	0.00	0.00	1233	0.00	0.00	0.00
BM ratio	1069	1.01	1.29	0.86	1233	1.39	1.93	2.76
Market cap	1069	0.20	1.67	5.34	1233	0.15	1.88	11.24
Delistings 5 years post-event	34				10			

Γ	r (1)	θ (2)	roe (3)
r	0.02	0.01	0.28
	(2.12)	(9.87)	(13.61)
θ	0.10	0.94	−0.65
	(4.07)	(223.29)	(−9.67)
roe	0.01	−0.02	0.36
	(2.02)	(−29.49)	(28.85)

$$\theta_{t-1} = k_{t-1} + \sum_{s=0}^{\infty} \rho^s r_{t+s} - \sum_{s=0}^{\infty} \rho^s (roe_{t+s} - f_{t+s}).$$

三、Results

——dividend changes signal changes in cash-flow volatility (in opposite directions)

	$\Delta Div > 0$ (1)	Initiation (2)	Pooled (3)	$\Delta Div < 0$ (4)	Omission (5)	Pooled (6)
	Panel A. Δ Cash-flow news: $\Delta\eta\_cf$					
	−0.0001	0.0000	0.0000	−0.0003	0.0001	−0.0002
	(−0.22)	(0.47)	(−0.37)	(−1.08)	(0.85)	(−0.82)
	Panel B. Δ Discount-rate news: $\Delta\eta\_dr$					
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
	(−0.70)	(1.22)	(−1.17)	(−0.81)	(0.93)	(−0.15)
	Panel C. Δ Variance cash-flow news: $\Delta\mathbb{V}\mathrm{ar}(\eta\_cf)$					
	−0.0015	−0.0027	−0.0019	0.0006	0.0005	0.0006
	(−9.65)	(−4.94)	(−8.63)	(4.38)	(2.42)	(4.95)
	Panel D. Δ Scaled variance cash-flow news: $\Delta\mathbb{V}\mathrm{ar}(\eta\_cf)/mean(\mathbb{V}\mathrm{ar}(\eta\_cf))$					
	−14.86%	−20.01%	−16.43%	7.29%	6.09%	6.89%
	(−9.65)	(−4.94)	(−9.33)	(4.38)	(2.42)	(4.95)
Nobs	2441	1069	3510	2461	1233	3694

三、Results——returns around dividend events

If dividend changes convey information about subsequent changes in cash-flow volatility, announcements of larger dividends should come with both larger cumulative announcement returns and larger subsequent changes in cash-flow volatility in the opposite direction.

	$\Delta Div > 0$			$\Delta Div < 0$		
	Large increase (1)	Small increase (2)	Δ (3)	Large cut (4)	Small cut (5)	Δ (6)
	Panel A. Δ Scaled variance cash-flow news: $\Delta \mathbb{V}ar(\eta\_cf)/mean(\mathbb{V}ar(\eta\_cf))$					
	−21.37% (−7.65)	−7.32% (−2.96)	−14.55% (−12.30)	7.50% (2.65)	0.38% (0.13)	8.01% (7.44)
Nobs	814	814		820	820	
	Panel B. Cumulative returns					
	0.80% (8.09)	0.57% (8.31)	0.33% (5.39)	−0.75% (−3.66)	−0.52% (−2.86)	−0.25% (−2.96)
Nobs	814	814		820	820	

四、Theoretical framework

1. general case —— **symmetric information** and a precautionary savings motive

——manager running a firm on behalf of risk-neutral investors & interest rate equals zero.

t=0

- gets endowment w_0
- invests $I_0 = w_0$

t=1

1. gets endowment w_1
2. manager decides how much D_1 to pay
3. Cash flow Y_1 = R · f(I_0) + ν is realized
4. invests $\boldsymbol{I_1} = w_1 + Y_1 - \boldsymbol{D_1}$

Y_1 = R · f(I_0) + ν

f(·) production function, f' > 0, f''< 0, and f''' > 0

ν ~ N(0, σ^2)

R: investment opportunity

$E(Y_1)$= Y , Y_1 ~ N (Y , $\boldsymbol{\sigma^2}$)

t=2

- cash flow Y_2 = R · f(I_1) + ν is realized and paid out

$$\underset{D_1}{Max} \quad D_1 + \mathrm{E}[Y_2]$$

Subject to

Y_2 = R · f(I_1) + ν

$D_1 \le w_1$

四、Theoretical framework

1. general case —— symmetric information and **a precautionary savings motive**

——manager running a firm on behalf of risk-neutral investors & interest rate equals zero.

t=0

$I_0 = w_0$

t=1

get w_1 , decide to pay D_1

CFs $\boldsymbol{Y_1} = \mathbf{R} \cdot \mathbf{f}(\boldsymbol{I_0}) + \boldsymbol{\nu}$ realized

$\boldsymbol{I_1} = \boldsymbol{w_1} + \boldsymbol{Y_1} - \boldsymbol{D_1}$

t=2

$\boldsymbol{Y_2} = \mathbf{R} \cdot \mathbf{f}(\boldsymbol{I_1}) + \boldsymbol{\nu}$

realized and paid out

$$Y_2 = \mathrm{R} \cdot \mathrm{f}(I_1) + \nu$$

$$f' > 0, f'' < 0, f''' > 0$$

$$E[Y_2] = E[R \cdot f(I_1) + \nu] = E[R \cdot f(I_1)] = R \cdot E[f(w_1 + Y_1 - D_1)]$$

$$E[f(Y_1)] < f(E[Y_1]) \quad \therefore E[f(Y_1)] = f(E[Y_1] - \frac{a}{2}\sigma^2) = f(Y - \frac{a}{2}\sigma^2)$$

$$E[Y_2] = R \cdot E[f(w_1 + Y - D_1 - \frac{a}{2}\sigma^2)]$$

$$a(I_1^*) \equiv a$$

a : the certainty equivalent coefficient in the sense of Arrow–Pratt

production function : $Y = w \cdot e^{-ak} + v$

$$\underset{D_1}{Max}\ D_1 + R \cdot E[f(w_1 + Y - D_1 - \frac{a}{2}\sigma^2)]$$

Subject to

$$Y_2 = \mathrm{R} \cdot \mathrm{f}(I_1) + \nu$$

$$D_1 \le w_1$$

$$\frac{\partial \sigma^2}{\partial D_1} < 0$$

四、Theoretical framework

2. asymmetric information

——manager running a firm on behalf of risk-neutral investors & interest rate equals zero.

t=0 | t=1 | t=2

t=0

$I_0 = w_0$

both have symmetric info on

$E(\sigma^2) = \sigma_p^2$

$E(v)$=0

t=1

1. get w_1
2. manager know true σ^2
3. decides how much D_1 to pay
4. k investors(hit by an idiosyncratic liquidity shock) **infer $\boldsymbol{\sigma^2}(\mathbf{D_1})$ from $\boldsymbol{D_1}$** and sell shares
5. Cash flow Y_1 = R · f(I_0) + ν realized
6. $\boldsymbol{I_1} = w_1 + Y_1 - \boldsymbol{D_1}$

t=2

- cash flow Y_2 = R · f(I_1) + ν realized and paid out
- (1-k) investors who hold shares know true σ^2 from it's realisation
- $R \cdot \mathrm{E}[\, f(w_1 + Y - D_1 - \frac{a}{2}\sigma^2)\,]$

siganl $\boldsymbol{D_1}$ is costly : forgone future investment

2. asymmetric information

t=0

$I_0 = \omega_0$

both have symmetric info on

$E(\sigma^2) = \sigma_p^2$

$E(v)$=0

t=1

1. ω_1
2. manager know true σ^2
3. decides how much D_1 to pay
4. k investors(hit by an idiosyncratic liquidity shock) infer $\sigma^2(D_1)$ from D_1 and sell shares
5. Cash flow Y_1 = R · f(I_0) + ν realized
6. $I_1 = \omega_1 + Y_1 - D_1$

t=2

- cash flow Y_2 = R · f(I_1) + ν realized and paid out
- (1-k) investors who hold shares know true σ^2 from it's realisation
- $R \cdot \mathrm{E}[\, f(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2)\,]$

$$\underset{D_1}{Max}\ W_1 = k\, V_1^s + (1-k)\, V_1^h$$

Subject to

Y_2 = R · f(I_1) + ν

$D_1 \leq w_1$

The perceived value of the firm at **time 1**

- $\{\omega_0, \omega_1, I_0, E(v) = 0, Var(v) = \sigma^2\} = \phi^h$

$$\boldsymbol{V_1^h} = D_1 + E\left(Y_2|\phi^h\right) = D_1 + E\left(R \cdot f(w_1 + Y_1 - D_1)\ |\phi^h\right)$$
$$= D_1 + R \cdot \mathrm{E}[\, f(\omega_1 + Y - D_1 - \frac{a}{2}\boldsymbol{\sigma^2})\,]$$

- $\{\omega_0, \omega_1, I_0, E(v) = 0, Var(v) = \sigma^2(D_1)\} = \phi^s$

$$\boldsymbol{V_1^s} = D_1 + E(Y_2|\phi^s) = D_1 + E(R \cdot f(w_1 + Y_1 - D_1)\ |\phi^s)$$
$$= D_1 + R \cdot \mathrm{E}[\, f(\omega_1 + Y - D_1 - \frac{a}{2}\boldsymbol{\sigma^2(D_1)})\,]$$

If $\sigma^2(D_1)$ is single-valued and if the market is rational,

$V_1^s = V_1^h$

$\sigma^2(D_1)$=σ^2

$$\frac{\partial \sigma^2(D_1)}{\partial D_1} < 0$$

2. asymmetric information

t=0

$I_0 = \omega_0$

both have symmetric info on

$E(\sigma^2) = \sigma_p^2$

$E(\nu)$=0

t=1

1. ω_1
2. manager know true σ^2
3. decides how much D_1 to pay
4. k investors(hit by an idiosyncratic liquidity shock) infer $\sigma^2(D_1)$ from D_1 and sell shares
5. Cash flow Y_1 = R · f(I_0) + ν realized
6. $I_1 = \omega_1 + Y_1 - D_1$

t=2

- cash flow Y_2 = R · f(I_1) + ν realized and paid out
- (1-k) investors who hold shares know true σ^2 from it's realisation
- **R** $\cdot \mathrm{E}[\, f(\omega_1 + \boldsymbol{Y} - D_1 - \frac{a}{2}\sigma^2)\,]$

siganl D_1 is costly : forgone future investment

$$\frac{\partial \sigma^2(D_1)}{\partial D_1} < 0$$

$$\frac{\partial^2 \sigma^2(D_1)}{\partial D_1 \partial Y} > 0$$

the same dividend should carry a **larger information content** for future changes in cash-flow volatility for firms with **smaller earnings.**

$$\frac{\partial^2 \sigma^2(D_1)}{\partial D_1 \partial R} < 0$$

the scope of using dividends to signal future declines in cash-flow volatility is **magnified** when **investment opportunities are larger.**

2. asymmetric information

t=0

$I_0 = \omega_0$

both have symmetric info on

$E(\sigma^2) = \sigma_p^2$

$E(v)$=0

t=1

1. ω_1
2. manager know true σ^2
3. decides how much D_1 to pay
4. investors **perfectly infer** $\boldsymbol{\sigma^2(D_1)}$ **from** $\boldsymbol{D_1}$
5. Cash flow Y_1 = R · f(I_0) + ν realized
6. $I_1 = \omega_1 + Y_1 - D_1$

t=2

- cash flow Y_2 = R · f(I_1) + ν realized and paid out
- investors know true σ^2 from it's realisation
- $\mathrm{R} \cdot \mathrm{E}[\, f(\omega_1 + Y - D_1 - \frac{a}{2}\sigma^2)\,]$

$$V = D_1 + \mathrm{E}[Y_2] = D_1 + R \cdot f(w_1 + Y - D_1 - \frac{a}{2}\sigma^2)$$

$$\Delta \mathrm{V} = D_1 - \mathrm{E}[D_1] + R \cdot \left[\mathrm{F}(\sigma^2) - \mathrm{F}(\sigma_p^2)\right] \approx \boldsymbol{D_1 - \mathrm{E}[D_1]} - \frac{a}{2}\boldsymbol{(\sigma^2 - \sigma_p^2)} R \cdot f'(w_1 + Y - D_1 - \frac{a}{2}\sigma_p^2)$$

$$\frac{\Delta \mathrm{V}}{\Delta \sigma^2} = -\frac{a}{2} R \cdot f'(w_1 + Y - D_1 - \frac{a}{2}\sigma_p^2) < 0$$

$$\frac{\Delta \mathrm{V}}{\Delta \mathrm{D}} = 1 > 0$$

larger dividend announcement returns should be associated with **larger** dividend changes and **larger subsequent reductions** in cash-flow volatility

四、Theoretical framework

3. agency cost theory : dividends can help address managerial agency problems

- The fact that cash is paid out to investors as dividends, rather than being wasted in managerial private benefits, represents good news for investors.
- In addition, paying dividends may expose companies to the possible need to raise external funds in the future, which may further shift control to outside investors and reduce agency problems.

siganl D_1 is costly : agency cost $\mathbf{C(D_1)}$

$$\frac{\partial \sigma^2}{\partial D_1} < 0$$

holding investment opportunities fixed :

- lower future cash-flow volatility implies a higher income available for paying dividends.
- lower future cash-flow volatility enables managers to extract more private benefits easier.

$$\frac{\partial^2 \sigma^2}{\partial D_1 \partial Y} < 0$$

for a given dollar of dividends, **larger current earnings** make extracting more private benefits easier.

$$\frac{\partial^2 \sigma^2}{\partial D_1 \partial R} > 0$$

smaller investment opportunities **magnify** the extent of agency problems.

五、Inspecting mechanism

5.1 Cross-sectional variation

$$\Delta Var(\eta\_cf_{it}) = \alpha + \boldsymbol{\gamma} \cdot \Delta D_{it} + \delta \cdot X_{it} + \varepsilon_{it}$$

$$\Delta Var(\eta\_cf_{it}) = \alpha + \beta_1 \cdot \Delta D_{it} + \beta_2 \cdot eps_{it} + \boldsymbol{\beta_3} \cdot \Delta D_{it} \cdot eps_{it} + \delta \cdot X_{it} + \varepsilon_{it}$$

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
ΔDiv	−0.26	−0.24	−0.37	−0.35	−0.15	−0.14	−0.25	−0.23
	(−5.55)	(−5.31)	(−5.94)	(−6.06)	(−4.92)	(−4.66)	(−5.01)	(−5.00)
eps		−0.17	−0.12	−0.17		−0.14	−0.10	−0.11
		(−1.56)	(−1.87)	(−2.71)		(−1.41)	(−1.75)	(−1.76)
$\Delta Div \times eps$			0.24	0.21			0.19	0.18
			(3.12)	(3.19)			(2.64)	(2.51)
Age				0.00				0.00
				(1.37)				(1.20)
Book-to-market				28.21				132.62
				(0.33)				(2.41)
Leverage				−0.35				−0.14
				(−2.54)				(−1.13)
Size				0.05				0.01
				(3.06)				(1.10)
Constant	0.03	0.12	0.08	−0.86				
	(0.45)	(1.22)	(1.01)	(−2.75)				
Year FE					X	X	X	X
Industry FE					X	X	X	X
R^2	2.06%	2.89%	3.89%	5.11%	30.60%	31.15%	31.80%	32.24%
Nobs	3127	3127	3127	3127	3127	3127	3127	3127

the cross-sectional change in cash-flow volatility following dividend changes is **muted** for firms with **larger earnings**

五、Inspecting mechanism

5.2 Indirect effect of cash-flow volatility

- direct effect on firm value today: $\frac{\Delta V}{\Delta\sigma^2} = -\frac{a}{2} R \cdot f' < 0$
- indirect effect on firm value today through future earnings :

$$\frac{\partial}{\partial\sigma^2} E[Y_2] = -\frac{a}{2} \cdot f'$$

WHY?

Jensen's inequailty:with a concave production technology, less volatile inputs translate into higher expected earnings, which in turn will influence the firm's market value.

- positively autocorrelated earnings : $\frac{\partial}{\partial Y} E[Y_2] = f'$

this effect is an order of magnitude smaller than the autoregressive coefficient of earnings, which is 0.6.

	(1)	(2)	(3)	(4)
eps	0.60		0.56	
	(5.09)		(4.64)	
$\mathbb{V}\mathrm{ar}(\eta\_cf)$		−0.04		−0.02
		(−2.23)		(−1.18)
Age			0.01	0.03
			(0.66)	(1.13)
BM			−0.02	−0.03
			(−0.64)	(−1.02)
Leverage			−0.01	0.01
			(−0.68)	(0.38)
Size			0.14	0.28
			(2.85)	(10.35)
Year FE				
Industry FE				
R^2	0.36	0.00	0.39	0.10
Nobs	3127	3127	3127	3127

$$eps_{it} = \alpha + \boldsymbol{\beta_1} \cdot eps_{it-1} + \boldsymbol{\beta_2} \cdot Var(\eta\_cf_{it-1}) + \delta \cdot X_{it} + \varepsilon_{it}$$

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5.3 Investment opporitunity

Decline in cash-flow volatility following dividend increases should be **more pronounced** for firms with larger investment opportunities because **larger investment opportunities magnify the scope of signaling with dividends**.

two proxies for investment opportunities：

1. the book-to-market ratio
2. idiosyncratic volatility

（four-quarter rolling basis relative to a Fama and French three-factor model using daily data）

According to our signaling model, we would expect that the **smaller** the book-to-market ratio and the **larger** the idiosyncratic volatility, **the larger the reduction** in cash-flow volatility following dividend changes.

五、Inspecting mechanism

5.3 Investment opportunity : the idiosyncratic volatility

According to our signaling model, we would expect that the smaller the book-to-market ratio and the larger the idiosyncratic volatility, the larger the reduction in cash-flow volatility following dividend changes.

	$\Delta Div > 0$			$\Delta Div < 0$		
	Large vol (1)	Small vol (2)	Δ (3)	Large vol (4)	Small vol (5)	Δ (6)
	Panel A. Δ Scaled variance cash-flow news: $\Delta \mathbb{V}\mathrm{ar}(\eta\_cf)/mean(\mathbb{V}\mathrm{ar}(\eta\_cf))$					
	−19.23% (−6.50)	−10.96% (−4.72)	−8.22% (−6.92)	11.90% (2.31)	4.52% (3.51)	6.36% (4.67)
Nobs	752	872	824	814		

	$\Delta Div > 0$			$\Delta Div < 0$		
	Large vol (1)	Small vol (2)	Δ (3)	Large vol (4)	Small vol (5)	Δ (6)
	Panel B. Announcement returns					
	0.83% (4.12)	0.66% (5.07)	0.19% (2.65)	−0.88% (−4.47)	−0.78% (−3.21)	−0.15% (−2.25)
Nobs	752	872	824	814		

split firms by their ex-ante idiosyncratic volatility excluding the middle tercile

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5.3 **Investment opportunity :** the book-to-market ratio

According to our signaling model, we would expect that the smaller the book-to-market ratio and the larger the idiosyncratic volatility, the larger the reduction in cash-flow volatility following dividend changes.

	$\Delta Div > 0$			$\Delta Div < 0$		
	Low BM (1)	High BM (2)	Δ (3)	Low BM (4)	High BM (5)	Δ (6)
	Panel A. Δ Scaled variance cash-flow news: $\Delta \mathbb{V}\mathrm{ar}(\eta\_cf)/mean(\mathbb{V}\mathrm{ar}(\eta\_cf))$					
	−16.61% (−6.30)	−11.85% (−4.46)	5.45% (6.80)	9.89% (3.51)	6.86% (2.31)	−2.84% (−3.91)
Nobs	812	813	819	819		
	$\Delta Div > 0$			$\Delta Div < 0$		
	Low BM (1)	High BM (2)	Δ (3)	Low BM (4)	High BM (5)	Δ (6)
	Panel B. Announcement returns					
exception	0.62% (4.08)	0.96% (5.46)	0.33% (6.47)	−1.01% (−4.44)	−0.55% (−3.05)	0.47% (7.75)
Nobs	812	813	819	819		

split firms by their ex-ante book-to-market ratio excluding the middle tercile

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5.4 Repurchase : similar to announcements of dividend increases and initiations

	Baseline (1)	Large repurchase (2)	Small repurchase (3)	Δ (4)
	Panel A. Δ Scaled variance cash-flow news: $\Delta \mathbb{V}ar(\eta\_cf)/mean(\mathbb{V}ar(\eta\_cf))$			
	−14.79%	−18.05%	−11.54%	−5.39%
	(−6.51)	(−5.65)	(−3.56)	(−13.19)
Nobs	2662	1331	1331	
	Panel B. Cumulative returns			
	1.91%	2.62%	1.19%	1.41%
	(12.11)	(10.15)	(6.68)	(36.01)
Nobs	2662	1331	1331	

Our novel result is that share repurchases and dividend announcements **convey very similar information** to the market regarding changes **in future cash-flow volatility**

五、Inspecting mechanism

5.5 Taxes

- In some signaling models, **the cost of the signal** is the dead-weight cost of the **taxes paid on dividends** relative to the (lower) **tax that would be paid on capital gains**.

- In other models , **differential taxation across different shareholders (institutions versus retail investors)** explains dividend policy as a way for corporations to attract institutions as large shareholders.

- however,since the Jobs and Growth Tax Relief Reconciliation Act of **2003** in the US, dividends are taxed at **the same rate as capital gains** even for individual investors (and for many classes of institutional investors, taxation has been the same since even before the Jobs Act).

	$\Delta Div > 0$ (1)	Initiation (2)	Pooled (3)	$\Delta Div < 0$ (4)	Omission (5)	Pooled (6)
	Panel C. 2003–2013					
	−11.31% (−2.99)	−31.85% (−5.27)	−18.84% (−5.80)	20.31% (3.91)	18.59% (3.05)	19.58% (4.95)
Nobs	848	491	1339	609	491	1100

六、Conclusion

——the **riskiness** of future cash flows is a central determinant of firms’ **payout policies**

Contributions:

1. we provide a host of new facts about cash-flow volatility and payout policy;
2. we offer a simple model to rationalize our empirical results.

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THANKS FOR YOUR WACTHING

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