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Corporate Risk Management and Dividend Signaling Theory

Georges Dionne
Karima Ouederni

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Georges Dionne[1,*], Karima Ouederni[1]

[1] Interuniversity Research Centre on Enterprise Networks, Logistics and Transportation (CIRRELT), and Department of Finance, HEC Montréal, 3000, Côte-Sainte-Catherine, Montréal, Canada H3T 2A7

Abstract. This paper investigates the effect of corporate risk management on dividend policy. We extend the signaling framework of Bhattacharya (1979) by including the possibility of hedging the future cash flow. We find that the higher the hedging level, the lower the incremental dividend. This result is in line with the purported positive relation between information asymmetry and dividend policy (e.g., Miller and Rock, 1985) and the assertion that risk management alleviates the information asymmetry problem (e.g., DaDalt et al., 2002). Our theoretical model has testable implications.

Keywords. Signaling theory, dividend policy, risk management policy, corporate hedging, information asymmetry.

* Corresponding author: Georges.Dionne@cirrelt.ca

1 Introduction

Signaling theory states that changes in dividend policy convey information about changes in future cash flows (e.g., Bhattacharya, 1979, Miller and Rock, 1985). Dividend signaling suggests a positive relation between information asymmetry and dividend policy.[1] In other words, the higher the asymmetric information level, the higher is the sensitivity of the dividend to future prospects of the firm. Several empirical studies attempt to test the informational content of dividend changes, yet they disagree about the sign and the significance of the effect of information asymmetry on dividend policy (see Allen and Michaely, 2003, for a survey).

Another strand of literature suggests that corporate risk management alleviates information asymmetry problems and hence positively affects the firm value. Information asymmetry between managers and outside investors is one of the key market imperfection that makes hedging potentially beneficial. DeMarzo and Duffie (1995) and Breeden and Viswanathan (1989) argue that hedging reduces noise around earnings streams and thus decreases the level of asymmetric information regarding the firm value. DaDalt et al. (2002) provide empirical evidence supporting these theoretical studies.

In this paper we exploit the documented interaction between the level of information asymmetry and the dividend policy, along with its interaction with corporate risk management. We argue that risk management alleviates the asymmetric information problem, which is a main determinant of dividend policy. Though many studies that examine dividend policy determinants include several measures of information asymmetry, none, to our knowledge, consider hedging among these measures. Extending the signaling framework of Bhattacharya (1979), we provide theoretical support for the effect of corporate risk management on dividend payout policy. We find a negative relation between the hedge ratio and the incremental dividend payout.

The remainder of the article is organized as follows. In the next section we present the theoretical model and its implications. The third section concludes.

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[1] Evidence that information asymmetry positively affects dividend policy has also been documented by the free cash flow theory (e.g., Lang and Litzenberger, 1989).

2 The model

We assume that the firm operates in a dividend signaling world as modeled in Bhattacharya (1979). We assume that shareholders have a single-period planning horizon and the manager operates in the best interest of current shareholders. The model is developed in terms of marginal analysis for a new project taken on by the firm. We assume that the manager is better informed than outside investors about the firm's future prospects. Thus the manager is the only agent informed about the distribution of the new project future cash flow (x). He attempts to signal his private information via the commitment of an incremental dividend (D). Dividends are taxed at the rate τ while capital gains are not taxed. There is a penalty (β) incurred by shareholders in case of cash flow shortfall to cover the committed dividend. β could be considered as the cost of external financing. When the cash flow (x) exceeds the committed dividend, the amount of future external financing is reduced by (x-D) and vice versa.

We extend the model by assuming that it is possible for the manager to hedge a fraction (h) of the future cash flow using a linear strategy. The reasoning behind this extension is simple. Outside investors often use estimates of earnings and cash flows as measures of firm value. Hedging reduces the noise around earnings and future cash flows by reducing the exposure of the firm to factors beyond the manager's control. Consequently, hedging lessens the asymmetric information regarding firm value by reducing the noise in evaluation measures. We expect that the more willing the firm is to hedge its future cash flow, the less informative the dividend changes and the lower the manager's incentives for costly signaling through dividends. We make the implicit assumption that corporate hedging activity is observable by outside investors. This assumption is realistic given the implementation of many disclosure requirement regulations by the Financial Accounting Standards Board (FASB) since the beginning of the '90s (e.g., FAS105, FAS107, FAS119, FAS133, FAS138 and FAS161).

Equation (1) illustrates the new uncertain cash flow resulting from the linear hedging strategy:

$$\tilde{x}_1 = hx_0 + \left(1 - h\right)\tilde{x} \tag{1}$$

where $0 \leq h \leq 1$ is the hedge ratio and x_0 the expected cash flow.

The incremental part of the objective function of current shareholders is given by equation (2). The four terms in the equation are respectively: (i) the rise in the firm's liquidation value *V(D)*; (ii) the after-tax promised dividend; (iii) the expected gain when the hedged cash flow

is greater than the committed dividend; and (iv) the expected loss when the hedged cash flow is lower than the committed dividend:

$$W(D,h) = \frac{1}{1+r}\left[\begin{array}{l} V(D) + (1-\tau)D + \int_{x_D}^{\overline{x}}(x_0 h + (1-h)x - D)f(x)dx \\ +(1+\beta)\int_{\underline{x}}^{x_D}(x_0 h + (1-h)x - D)f(x)dx \end{array}\right] \qquad (2)$$

where r is the after-tax interest rate; $V(D)$ the response liquidation value of the firm resulting from the commitment and the payment of D, and x_D the minimum cash flow needed to pay the promised dividend without penalty. Its value is given by equation (3):

$$x_D = \frac{D - hx_0}{(1-h)} \qquad (3)$$

2.1 Optimal dividend for a given hedge ratio

Following Bhattacharya (1979) we assume that the future cash flow is uniformly distributed over [0, t]. Thus the maximization problem is reduced to:

$$\max_{D} W(D,h) = \frac{1}{1+r}\left[V(D) - \tau D + \frac{t}{2} - \frac{1}{8}\beta\frac{(2D-th)^2}{(1-h)t}\right] \qquad (4)$$

The first order condition solves:

$$V'(D^*) = \tau + \beta\frac{(2D^* - th)}{2(1-h)t} \qquad (5)$$

At the optimum, the marginal profit from the dividend increase (the increase of the firm value) equals its marginal cost (taxes and expected cost of external financing).

The second order condition is given by equation (6):

$$\frac{\partial^2}{\partial D^2}W(D,h) = \frac{1}{1+r}\left[V''(D) - \frac{\beta}{(1-h)t}\right] \qquad (6)$$

Since $V(D)$ is increasing and concave, h lower than one is a sufficient condition for the second order condition to be satisfied. The hedge ratio h lies between 0 and 1 given that speculation and over hedging are not considered in this model.

2.2 Signaling equilibrium

The signaling equilibrium demands that $V(D^*(t))$ must be "equal to the true value of future cash flows for the project whose cash flows are signaled with dividend D"(Bhattacharya (1979), p. 264). Under the assumption of a stationary dividend, the equilibrium function $V(D^*(t))$ is given by equation (7):

$$V\left(D^*\left(t\right)\right) = K\left[\frac{t}{2} - \tau D^*\left(t\right) - \frac{1}{8}\beta\frac{\left(2D^*\left(t\right) - th\right)^2}{\left(1-h\right)t}\right] \qquad (7)$$

where $K=1/r$.

Differentiating equation (7) with respect to t and substituting for $V'(D^*)$ from equation (5), we obtain:

$$\left(K+1\right)\left[\tau + \frac{\beta D}{\left(1-h\right)t} - \frac{1}{2}\beta\frac{h}{\left(1-h\right)}\right]\frac{dD}{dt} = K\left[\frac{1}{2} - \frac{1}{8}\frac{\beta h^2}{\left(1-h\right)} + \frac{\beta D^2}{2\left(1-h\right)t^2}\right] \qquad (8)$$

Assuming a linear solution for the first order differential equation (8), $D(t) = A \times t$, we obtain the following quadratic equation:

$$\frac{\left(K+2\right)}{\left(K+1\right)}A^2 + \left(\frac{2\tau}{\beta}\left(1-h\right) - h\right)A - \frac{K}{\beta\left(K+1\right)}\left(1-h\right) + \frac{1}{4}\frac{K}{\left(K+1\right)}h^2 = 0 \qquad (9)$$

The positive root of the quadratic equation is equal to:

$$A = -\frac{2\tau\left(1-h\right) - \beta h}{\beta} \times \frac{\left(K+1\right)}{2\left(K+2\right)} + \qquad (10)$$

$$\frac{\left(K+1\right)}{2\left(K+2\right)} \times \sqrt{\left(\frac{2\tau\left(1-h\right) - \beta h}{\beta}\right)^2 - \frac{K\left(K+2\right)}{\beta\left(K+1\right)^2}\left(\beta h^2 - 4\left(1-h\right)\right)}$$

When $h=0$ we obtain the corresponding values for (9) and (10) in Bhattacharya (1979).

A is the incremental dividend payout. It also illustrates the sensitivity of dividend increases to earnings prospects. For reasonable values of tax rate ($\tau \leq 40\%$) and external financing cost ($\beta \leq 20\%$), A is decreasing in the hedge ratio. In Figure 1, we show the function with some feasible parameters. We observe a negative effect of the hedge ratio on the incremental dividend payout. This result is intuitive. It is in line with studies suggesting that cash flows' predictability decreases the marginal gain from costly signaling through dividends (e.g.,

Chang et al. 2006) and the assertion that corporate hedging decreases cash flows volatility and thus increases their predictability.
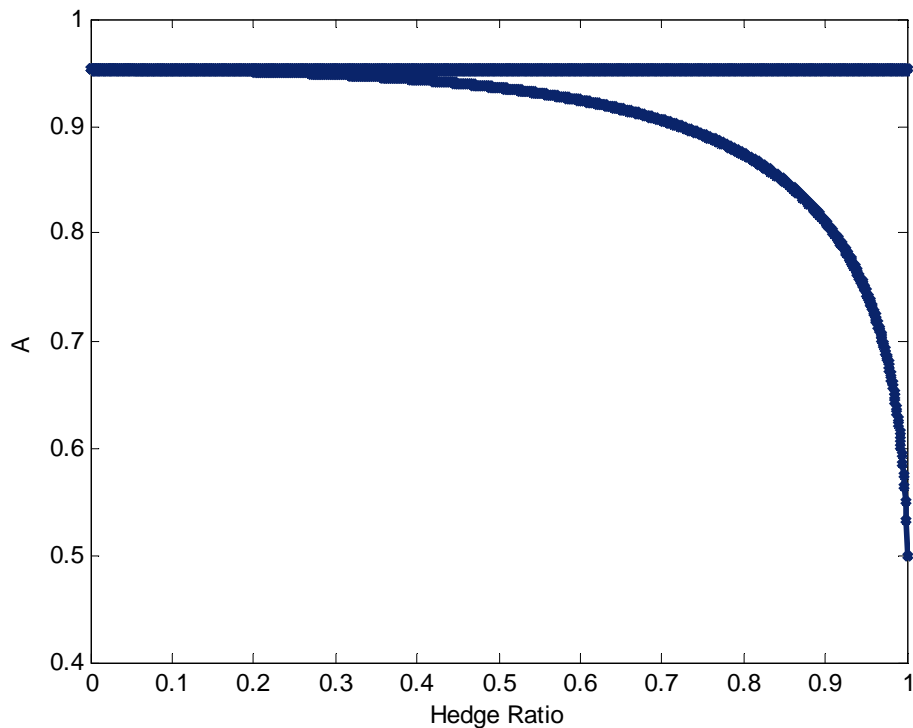
Figure 1

The curve illustrates *A* for 0<*h*<1, $\tau = 40\%$; $\beta = 20\%$ and $r = 5\%$. The straight line illustrates *A* for *h*=0 (Bhattacharya, 1979).

Notice that *A* is not strictly decreasing in the hedging level for all values of tax rates and external financing costs. For high but less feasible values of $\tau > 40\%$ and $\beta > 20\%$, *A* first increases and then decreases in *h*. For all values of the parameters, *A* always converges to 0.5 when *h* is near 1.

2.3 Optimal hedge ratio

Another way to emphasize the interaction between the dividend policy and the corporate hedging policy is to maximize the incremental shareholders' wealth in (4) with respect to the hedge ratio. The first and second order conditions along with the signaling equilibrium condition provide the following optimal hedge ratio (See appendix for details):

$$h^* = 2(1 - \frac{D}{t}) \tag{11}$$

The optimal hedge ratio is decreasing in the dividend payout ratio. This result is in line with empirical studies suggesting a negative effect of the dividend policy on the hedge ratio (e.g., Dionne and Garand, 2003). It is also in line with dividend signaling theory intuition. It suggests that managers with higher expectations about future performance of the firm distribute higher dividends while reducing their hedge ratio. Thus, in a signaling world shareholders are better off when the firm deviates from the full hedging strategy. Finally, (11) indicates clearly that D and h are interdependent decision variables. In fact we can verify that

$$0 < h^* < 1 \text{ as } 1 > \frac{D}{t} > \frac{1}{2}.$$

3 Conclusion

The findings of this paper reconcile dividend signaling theory with risk management theory. We contribute to the dividend signaling literature by emphasizing the interaction between corporate risk management policy and dividend policy. The interaction between these two corporate policies has received less attention in the literature despite their common link to information asymmetry. Using an extension of Bhattacharya's signaling model, we find that the hedging of future cash flows reduces the sensitivity of dividends to future earnings. A straightforward implication of this result is that the informational content of dividend changes decreases with the hedge ratio. It leads to the empirical test of whether corporate risk management reduces the power of dividend changes to predict future changes in earnings. It thus represents a new test of the dividend signaling theory.

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Appendix

The first order condition of the maximization of (4) with respect to *h* equals:

$$\frac{\partial}{\partial h}W(D,h) = \frac{1}{1+r}\left[-\frac{1}{8}\beta\frac{-2t(1-h)(2D-th)+(2D-th)^2}{(1-h)^2 t}\right] = 0$$

$$\Leftrightarrow \; (2D-th)(-2t(1-h)+(2D-th)) = 0$$

The second order condition with respect to *h* is equal to:

$$\frac{\partial^2}{\partial h^2}W(D,h) = -\frac{1}{8}\beta\frac{1}{1+r}\left(\frac{2t^2(1-h)^2 - 8Dt + 4t^2h - 2t^2h^2 + 8D^2}{(1-h)^3 t}\right)$$

The maximization problem has two complementary solutions:

$$h^* = \begin{cases} 2\dfrac{D}{t} & if \; \dfrac{D}{t} < \dfrac{1}{2} \\[2mm] 2\left(1-\dfrac{D}{t}\right) & if \; \dfrac{D}{t} > \dfrac{1}{2} \end{cases}$$

When we substitute for *h=2 D/t* in the equilibrium payout ratio (10) we get:

$$A\Big|_{h=2\frac{D}{t}} = \frac{1}{2}\frac{K}{(K+1)\tau}$$

It is straightforward to show that *A* is bigger than 0,5. Notice that *A=D*/t* and when it is bigger than *1/2* the second order condition of the maximization of shareholders' wealth with respect to *h* is not satisfied so we do not retain this potential solution.

When we substitute for *h=2 (1-D/t)* in the equilibrium payout ratio (10) we get:

$$A\Big|_{h=2-2\frac{D}{t}} = \frac{1}{2}\frac{K(1+\beta)}{(1+K)(\tau+\beta)}$$

It is straightforward to show that for feasible values of *β* and *τ*, *A* is bigger than 0,5 which satisfies the second order condition of the maximization of shareholders' wealth with respect to *h*.