Dividend Policy and Consumption Risk

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Abstract

In this paper, we study the theoretical relationship between dividend policy and risk, in an intertemporal context. We use the fundamental framework of the consumption capital asset pricing model (CCAPM) to demonstrate that the dividend payout ratio of a stock (dividends divided by earnings) is negatively related to its covariance between dividends and consumption, cumulated over many periods. This result is consistent with the long-run definition of consumption risk, recently proposed in the literature. This result also suggests that long-run consumption risk influences dividend policy. In short, our model indicates that the target payout ratio of a firm can be estimated with a simple and easy-to-apply formula.

Keywords: Intertemporal model, CCAPM, Dividend policy, Payout ratio, Consumption risk, Long-run risk

1. Introduction

It is often asserted that dividends are negatively related with risk. For example, Beaver et al. (1970), Rozeff (1982), and Lapointe (1996) conclude that the dividend payout ratio (dividends divided by earnings) is lower for high-risk stocks, while Pettit (1977), Eades (1982), and Baskin (1989) report a similar relationship with the dividend yield (dividends divided by price). In addition, Bajaj and Vijh (1990) and Michaely et al. (1995) show that the beta level changes after unexpected variations of a regular dividend. Similarly, Jagannathan et al. (2000) find that firms that only pay dividends show lower earnings volatility than firms that only repurchase. Furthermore, Grullon and Michaely (2002) and PÀstor and Pietro (2003) stress that firms that pay dividends have a lower variability of return on assets than firms that do not pay dividends. Evidence also confirms the notion that firms that increase dividends do so when they become more mature and less risky (Grullon et al. 2002; Julio and Ikenberry 2004). Moreover, using survey and field interviews, Brav et al. (2005) find that nearly 40% of managers believe that dividends make stocks less risky. Finally, Carter (2008) provides a mathematical model that illustrates the relationship between dividends and systematic risk.

As noted by Hoberg and Prabhala (2009) and Hussainey et al. (2011), the two following arguments lead us to expect a negative relationship between dividends and risk[1]. First, if firms are risk averse and prudent, then those operating in a high level of uncertainty will pay lower dividends to have enough retained earnings for bad earnings years. Second, managers know that stock markets exhibit a negative reaction to dividend cuts[2]. As a result, high-risk firms will avoid raising or initiating dividends, since risky firms are more likely to face a scenario in which decisions must be reversed and penalized by the market.

The purpose of this paper is to examine the theoretical relationship between risk and dividend policy, in an intertemporal context. We use the fundamental framework of the consumption capital asset pricing model (CCAPM) of Rubinstein (1976), Lucas (1978), and Breeden (1979) to explore the effect of consumption risk on dividend payout ratio[3].

The development of our model can be summarized as follows. We assume a representative investor maximizes his time-separable utility function and establish that stock price is equivalent to the present value of all future dividends. Then, we isolate the contribution of each dividend payment in the price of the share and divide this value by the corresponding expected earnings. Afterward, using the basic properties of covariance, we aggregate to the entire market and sum over several periods.

In this manner, we show that the dividend payout ratio of a stock is negatively related to its long-run risk, defined as the covariance between dividends and consumption, cumulated over many periods. This relation implies that the dividend payout ratio approaches 100% when risk approaches zero, equals the market payout ratio when risk equals one, and tends to zero when risk tends to infinity (the relation can be illustrated by a curve that approaches an axis *asymptotically*). This relation also indicates that long-run consumption risk influences dividend policy.

The previous definition of risk is of particular interest. Indeed, for many authors, the relevant measure of consumption risk in stocks is not necessarily the risk of current-period changes in consumption only, but the risk of changes in consumption over many periods. For instance, Bansal and Yaron (2004) argue that consumption and dividend growth rates include a small long-run component that can resolve the equity premium puzzle. Likewise, Bansal et al. (2005) show that long-run covariance between dividends and consumption (cash flow beta) accounts for more than 60% of the cross-sectional variation in risk premia. In addition, when investor horizon tends to infinity, Bansal et al. (2009) demonstrate that the risk of an asset is determined almost exclusively by the long-run cointegration between its dividends and consumption. Furthermore, Bergeron (2011) suggests that risk, estimated by the long-run covariance between dividends and consumption, influences the intrinsic value of a stock[4].

However, none of the above mentioned studies investigated the effect of long-run consumption risk on dividend payout ratio.

For managers, the principal applications of our work naturally concern the choice of a firm's dividends. This payment will depend on the firm's earnings, the dividend payout ratio in the economy, and the firm's level of long-run risk. If this level is superior (inferior) to one, then the corresponding payout ratio will be inferior (superior) to the average for other firms.

Starting from the representative investor's choice problem, section 2 describes the economy. Section 3 derives the relationship between the dividend payout ratio and the consumption long-run risk, in an intertemporal context. Section 4 concludes the paper.

2. The economy

In the hypothetical economy, the representative investor maximizes the time-separable utility function:

$$E_t \sum_{s=0}^{\infty} \delta^s U(\tilde{C}_{t+s}) , \tag{1}$$

where δ is the time discount factor ($0 < \delta < 1$), $\tilde{C}_{t+s}$ is the aggregate consumption at time $t+s$ ($s = 0, 1, 2, \ldots, \infty$), and $U(\bullet)$ is an increasing concave and derivable function[5]. The result of this problem leads us to the following equation (see Rubinstein 1976):

$$P_{it} = E_t \sum_{s=1}^{\infty} \delta^s \frac{U'(\tilde{C}_{t+s})}{U'(C_t)} \tilde{D}_{i,t+s} , \tag{2}$$

where P_{it} represents the price of stock i ($i = 1, 2, \ldots, N$) at time t, and $\tilde{D}_{i,t+s}$ represents the dividends of stock i at time $t+s$ ($s = 1, 2, \ldots, \infty$)[6]. Eq. (2) reveals that the price of a stock equals the present value of all future dividends. Here, the stochastic discount factor corresponds to the intertemporal marginal rate of substitution between t and $t+s$ ($\tilde{M}_{t+s}$). Given that $\tilde{M}_{t+s} \equiv \delta^s U'(\tilde{C}_{t+s}) / U'(C_t)$, Eq. (2) becomes:

$$P_{it} = E_t \sum_{s=1}^{\infty} \tilde{M}_{t+s} \tilde{D}_{i,t+s} . \tag{3}$$

If we isolate the element k in the summation, the relation now becomes:

$$P_{it} = E_t[\tilde{M}_{t+k} \tilde{D}_{i,t+k}] + E_t \sum_{\substack{s=1 \\ s \neq k}}^{\infty} \tilde{M}_{t+s} \tilde{D}_{i,t+s} . \tag{4}$$

This permits us to write that:

$$P_{it} - E_t \sum_{\substack{s=1 \\ s \neq k}}^{\infty} \tilde{M}_{t+s} \tilde{D}_{i,t+s} = E_t[\tilde{M}_{t+k} \tilde{D}_{i,t+k}]. \tag{5}$$

Eq. (4) and Eq. (5) simply suggest that the contribution of any future dividend payment to stock price can be represented by the actual value of this particular payment. This also suggests that the actual value of each dividend payment can be expressed by the difference between stock price and the present value of the other dividends.

3. Dividends, earnings, and long-run risk

In this section, we show that a firm's dividend policy choice depends on its long-run risk level. First, we divide each expected dividend payment by its corresponding expected earnings. Second, we link the dividend distribution with the covariance between dividends and consumption, for one period. Third, we aggregate over many periods to obtain a negative relationship between dividends and risk, on the long-run.

3.1 Dividends and earnings

To connect the expected dividends with the expected earnings, we first divide Eq. (5) by $\bar{X}_{i,t+k} \equiv E_t[\tilde{X}_{i,t+k}]$, where $\tilde{X}_{i,t+k}$ represents the earnings of stock *i* at time $t+k$. It then follows that:

$$(P_{it} - E_t \sum_{\substack{s=1 \\ s \neq k}}^{\infty} \tilde{M}_{t+s} \tilde{D}_{i,t+s}) / \bar{X}_{i,t+k} = E_t[\tilde{M}_{t+k} \tilde{D}_{i,t+k}] / \bar{X}_{i,t+k}. \tag{6}$$

Adding $E_t[\tilde{M}_{t+k}]$ to both sides of Eq. (6) yields:

$$E_t[\tilde{M}_{t+k}] - E_t[\tilde{M}_{t+k} \tilde{D}_{i,t+k} / \bar{X}_{i,t+k}] = E_t[\tilde{M}_{t+k}] + (E_t \sum_{\substack{s=1 \\ s \neq k}}^{\infty} \tilde{M}_{t+s} \tilde{D}_{i,t+s} - P_{it}) / \bar{X}_{i,t+k} \tag{7}$$

or:

$$E_t[\tilde{M}_{t+k}(1 - \tilde{D}_{i,t+k} / \bar{X}_{i,t+k})] = E_t[\tilde{M}_{t+k}] + (E_t \sum_{\substack{s=1 \\ s \neq k}}^{\infty} \tilde{M}_{t+s} \tilde{D}_{i,t+s} - P_{it}) / \bar{X}_{i,t+k}. \tag{8}$$

Thus, Eq. (8) gives, after simple manipulations, a particular form of the Euler equation in which the central random variables are driven by the aggregate consumption and dividends. That is:

$$E_t[\tilde{M}_{t+k} \tilde{Y}_{i,t+k}] = 1, \tag{9}$$

where $\tilde{Y}_{i,t+k} \equiv \dfrac{1 - \tilde{D}_{i,t+k} / \bar{X}_{i,t+k}}{E_t[\tilde{M}_{t+k}] - E_t[\tilde{M}_{t+k} \tilde{D}_{i,t+k} / \bar{X}_{i,t+k}]}$.

3.2 Aggregate level for one period

At the aggregate level, for one period, we can also write that:

$$E_t[\tilde{M}_{t+k} \tilde{Y}_{m,t+k}] = 1, \tag{10}$$

where the index *m* represents the market portfolio. Therefore, Eq. (9) minus Eq. (10) gives:

$$E_t[\tilde{M}_{t+k}(\tilde{Y}_{i,t+k} - \tilde{Y}_{m,t+k})] = 0, \tag{11}$$

and the definition of covariance permits us to write that:

$$COV_t[\tilde{M}_{t+k}, \tilde{Y}_{i,t+k} - \tilde{Y}_{m,t+k}] = -E_t[\tilde{M}_{t+k}] E_t[\tilde{Y}_{i,t+k} - \tilde{Y}_{m,t+k}]. \tag{12}$$

Rearranging Eq. (12) indicates that stock *i* can be related to the entire market in the following manner:

$$E_t[\tilde{Y}_{i,t+k}] = E_t[\tilde{Y}_{m,t+k}] + \frac{COV_t[\tilde{M}_{t+k}, \tilde{Y}_{m,t+k}]}{E_t[\tilde{M}_{t+k}]} - \frac{COV_t[\tilde{M}_{t+k}, \tilde{Y}_{i,t+k}]}{E_t[\tilde{M}_{t+k}]}. \tag{13}$$

In accordance with the previous form of the Euler equation, we can rewrite Eq. (13) in this way:

$$\begin{aligned} E_t[1-\tilde{D}_{i,t+k}/\bar{X}_{i,t+k}] &= (E_t[\tilde{Y}_{m,t+k}] + COV_t[\tilde{M}_{t+k}, \tilde{Y}_{m,t+k}]/E_t[\tilde{M}_{t+k}]) \\ &\text{x}\,(E_t[\tilde{M}_{t+k}] - E_t[\tilde{M}_{t+k}\tilde{D}_{i,t+k}/\bar{X}_{i,t+k}]) \\ &+ COV_t[\tilde{M}_{t+k}, \tilde{D}_{i,t+k}/\bar{X}_{i,t+k}]/E_t[\tilde{M}_{t+k}]. \end{aligned} \tag{14}$$

Integrating the definition of covariance into the second line of Eq. (14) shows that:

$$\begin{aligned} E_t[1-\tilde{D}_{i,t+k}/\bar{X}_{i,t+k}] &= (E_t[\tilde{Y}_{m,t+k}] + COV_t[\tilde{M}_{t+k}, \tilde{Y}_{m,t+k}]/E_t[\tilde{M}_{t+k}]) \\ &\text{x}\,(E_t[\tilde{M}_{t+k}] - E_t[\tilde{M}_{t+k}]E_t[\tilde{D}_{i,t+k}/\bar{X}_{i,t+k}] - COV_t[\tilde{M}_{t+k}, \tilde{D}_{i,t+k}/\bar{X}_{i,t+k}]) \\ &+ COV_t[\tilde{M}_{t+k}, \tilde{D}_{i,t+k}/\bar{X}_{i,t+k}]/E_t[\tilde{M}_{t+k}]. \end{aligned} \tag{15}$$

Hence, after algebraic manipulations, we have:

$$\begin{aligned} E_t[1-\tilde{D}_{i,t+k}/\bar{X}_{i,t+k}] &= (E_t[\tilde{Y}_{m,t+k}]E_t[\tilde{M}_{t+k}] + COV_t[\tilde{M}_{t+k}, \tilde{Y}_{m,t+k}])E_t[1-\tilde{D}_{i,t+k}/\bar{X}_{i,t+k}] \\ &+ (E_t^{-1}[\tilde{M}_{t+k}](1-COV_t[\tilde{M}_{t+k}, \tilde{Y}_{m,t+k}]) - E_t[\tilde{Y}_{m,t+k}]) \\ &\text{x}\;\; COV_t[\tilde{M}_{t+k}, \tilde{D}_{i,t+k}/\bar{X}_{i,t+k}] \end{aligned} \tag{16}$$

or:

$$E_t[1-\tilde{D}_{i,t+k}/\bar{X}_{i,t+k}] = \frac{E_t^{-1}[\tilde{M}_{t+k}](1-COV_t[\tilde{M}_{t+k}, \tilde{Y}_{m,t+k}]) - E_t[\tilde{Y}_{m,t+k}]}{1-E_t[\tilde{Y}_{m,t+k}]E_t[\tilde{M}_{t+k}] - COV_t[\tilde{M}_{t+k}, \tilde{Y}_{m,t+k}]} \, \frac{COV_t[\tilde{M}_{t+k}, \tilde{D}_{i,t+k}]}{\bar{X}_{i,t+k}}. \tag{17}$$

By multiplying each side by $\bar{X}_{i,t+k} \equiv E_t[\tilde{X}_{i,t+k}]$, we get:

$$E_t[\tilde{X}_{i,t+k}] - E_t[\tilde{D}_{i,t+k}] = \frac{E_t^{-1}[\tilde{M}_{t+k}](1-COV_t[\tilde{M}_{t+k}, \tilde{Y}_{m,t+k}]) - E_t[\tilde{Y}_{m,t+k}]}{1-E_t[\tilde{Y}_{m,t+k}]E_t[\tilde{M}_{t+k}] - COV_t[\tilde{M}_{t+k}, \tilde{Y}_{m,t+k}]} \, COV_t[\tilde{M}_{t+k}, \tilde{D}_{i,t+k}] \tag{18}$$

Also, by dividing each side by $\bar{D}_{i,t+k} \equiv E_t[\tilde{D}_{i,t+k}]$, we obtain:

$$\frac{E_t[\tilde{X}_{i,t+k}]}{E_t[\tilde{D}_{i,t+k}]} =$$

$$1+\frac{E_t^{-1}[\tilde{M}_{t+k}](1-COV_t[\tilde{M}_{t+k},\tilde{Y}_{m,t+k}])-E_t[\tilde{Y}_{m,t+k}]}{1-E_t[\tilde{Y}_{m,t+k}]E_t[\tilde{M}_{t+k}]-COV_t[\tilde{M}_{t+k},\tilde{Y}_{m,t+k}]}\,COV_t\left[\tilde{M}_{t+k},\frac{\tilde{D}_{i,t+k}}{\bar{D}_{i,t+k}}\right] \tag{19}$$

or, after manipulations:

$$\frac{E_t[\tilde{X}_{i,t+k}]}{E_t[\tilde{D}_{i,t+k}]} =$$

$$1+\frac{E_t^{-1}[\tilde{M}_{t+k}](1-COV_t[\tilde{M}_{t+k},\tilde{Y}_{m,t+k}])-E_t[\tilde{Y}_{m,t+k}]}{1-E_t[\tilde{Y}_{m,t+k}]E_t[\tilde{M}_{t+k}]-COV_t[\tilde{M}_{t+k},\tilde{Y}_{m,t+k}]}\,COV_t[\tilde{M}_{t+k},\tilde{G}_{i,t+k}] \tag{20}$$

with, $\tilde{G}_{i,t+k} \equiv (1+\tilde{g}_{i,t+k})/E_t[1+\tilde{g}_{i,t+k}]$ and $\tilde{g}_{i,t+k} \equiv \tilde{D}_{i,t+k}/D_{it}-1$, where variable $\tilde{g}_{i,t+k}$ represents the dividend growth rate between t and $t+k$ for stock i.

By multiplying each side of Eq. (20) by $COV_t[\tilde{M}_{t+k},\tilde{G}_{m,t+k}]$ we can write:

$$\frac{E_t[\tilde{X}_{i,t+k}]}{E_t[\tilde{D}_{i,t+k}]} =$$

$$1+\frac{E_t^{-1}[\tilde{M}_{t+k}](1-COV_t[\tilde{M}_{t+k},\tilde{Y}_{m,t+k}])-E_t[\tilde{Y}_{m,t+k}]}{1-E_t[\tilde{Y}_{m,t+k}]E_t[\tilde{M}_{t+k}]-COV_t[\tilde{M}_{t+k},\tilde{Y}_{m,t+k}]}\,COV_t[\tilde{M}_{t+k},\tilde{G}_{m,t+k}]$$

$$\text{x}\;\; COV_t[\tilde{M}_{t+k},\tilde{G}_{i,t+k}]/COV_t[\tilde{M}_{t+k},\tilde{G}_{m,t+k}] \tag{21}$$

with, $\tilde{G}_{m,t+k} \equiv (1+\tilde{g}_{m,t+k})/E_t[1+\tilde{g}_{m,t+k}]$ and $\tilde{g}_{m,t+k} \equiv \tilde{D}_{m,t+k}/D_{mt}-1$, where variable $\tilde{g}_{m,t+k}$ represents the dividend growth rate between t and $t+k$ for the market portfolio.

To simplify Eq. (21), we suppose that the dividends and the aggregate consumption are bivariate normally distributed. This assumption permits us to use Stein's lemma (Rubinstein 1976, p. 421) and rewrite Eq. (21) as follows[7]:

$$\frac{E_t[\tilde{X}_{i,t+k}]}{E_t[\tilde{D}_{i,t+k}]} =$$

$$1+\frac{E_t^{-1}[\tilde{M}_{t+k}](1-COV_t[\tilde{M}_{t+k},\tilde{Y}_{m,t+k}])-E_t[\tilde{Y}_{m,t+k}]}{1-E_t[\tilde{Y}_{m,t+k}]E_t[\tilde{M}_{t+k}]-COV_t[\tilde{M}_{t+k},\tilde{Y}_{m,t+k}]}\,COV_t[\tilde{M}_{t+k},\tilde{G}_{m,t+k}]$$

$$\text{x}\;\; COV_t[\tilde{G}_{t+k},\tilde{G}_{i,t+k}]/COV_t[\tilde{G}_{t+k},\tilde{G}_{m,t+k}] \tag{22}$$

with, $\tilde{G}_{t+k} \equiv (1+\tilde{g}_{t+k})/E_t[1+\tilde{g}_{t+k}]$ and $\tilde{g}_{t+k} \equiv \tilde{C}_{t+k}/C_t-1$, where variable $\tilde{g}_{t+k}$ represents the growth rate between t and $t+k$ for aggregate consumption.

For the market portfolio, we have:

$$\frac{E_t[\tilde{X}_{m,t+k}]}{E_t[\tilde{D}_{m,t+k}]} =$$

$$1+\frac{E_t^{-1}[\tilde{M}_{t+k}](1-COV_t[\tilde{M}_{t+k},\tilde{Y}_{m,t+k}])-E_t[\tilde{Y}_{m,t+k}]}{1-E_t[\tilde{Y}_{m,t+k}]E_t[\tilde{M}_{t+k}]-COV_t[\tilde{M}_{t+k},\tilde{Y}_{m,t+k}]}\ COV_t[\tilde{M}_{t+k},\tilde{G}_{m,t+k}], \tag{23}$$

since $COV_t[\tilde{G}_{t+k},\tilde{G}_{m,t+k}]/COV_t[\tilde{G}_{t+k},\tilde{G}_{m,t+k}]=1$.

The equation (23) can thus be arranged and presented as a simple linear relationship. That is:

$$\frac{E_t[\tilde{X}_{i,t+k}]}{E_t[\tilde{D}_{i,t+k}]} = 1+\lambda_{t+k}\beta^d_{i,t+k}, \tag{24}$$

where:

$\lambda_{t+k} \quad \equiv (E_t[\tilde{X}_{m,t+k}]/E_t[\tilde{D}_{m,t+k}])-1$;

$\beta^d_{i,t+k} \quad \equiv COV_t[\tilde{G}_{t+k},\tilde{G}_{i,t+k}]/COV_t[\tilde{G}_{t+k},\tilde{G}_{m,t+k}]$.

Parameter λ_{t+k} is determined by the expected market earnings on dividends. It is assumed to be positive, if we accept that aggregate earnings are superior to aggregate dividends[8].

Given the available information at time *t*, the parameter $\beta^d_{i,t+k}$ represents the covariance, at time *t+k*, between the dividend growth rate of asset *i* and the consumption growth rate, divided by the corresponding covariance for the market. As the *consumption beta* in Mankiw and Shapiro (1986) our parameter $\beta^d_{i,t+k}$ presents an average of one (it equals one for the market). In addition, our parameter is remindful of Abel (1999), who argues that assets with large covariance between dividend and consumption growth rates have larger risk premia. Lastly, as the *dividend beta* in Bansal et al. (2002, p. 5) it measures how sensitive an asset's dividend is to aggregate consumption.

3.3 Many periods

For many periods, summing from $k = 1$ to $k = K$ yields:

$$\sum_{k=1}^{K}\frac{E_t[\tilde{X}_{i,t+k}]}{E_t[\tilde{D}_{i,t+k}]} = \sum_{k=1}^{K}(1+\lambda_{t+k}\beta^d_{i,t+k}). \tag{25}$$

Now, if we accept the usual assumption that firms, given the available information at time *t*, expect to maintain a stable dividend policy, then we can suppose that the dividend payout ratio (or its inverse) is stationary[9]. More precisely, if we suppose that: $X_{it}/D_{it} = E_t[\tilde{X}_{i,t+k}]/E_t[\tilde{D}_{i,t+k}]$ and that $X_{mt}/D_{mt} = E_t[\tilde{X}_{m,t+k}]/E_t[\tilde{D}_{m,t+k}]$, for $k = 1, 2, 3, \ldots, K$, then:

$$K\frac{X_{it}}{D_{it}} = K+\lambda_t\sum_{k=1}^{K}\beta^d_{i,t+k}, \tag{26}$$

or:

$$\frac{X_{it}}{D_{it}} = 1+\lambda_t\beta^d_{it}, \tag{27}$$

where X_{it} and D_{it} represent respectively the earnings and the dividends of stock *i* at time *t*, while X_{mt} and D_{mt} represent the corresponding values for the entire market, and where:

$\lambda_t \equiv (X_{mt} / D_{mt}) - 1$, and $\beta_{it}^d \equiv \sum_{k=1}^{K} \beta_{i,t+k}^d / K$.

We term the parameter β_{it}^d the *long-run dividend beta* of asset *i*, given the available information at time *t*. It represents the arithmetic average (over many periods) of $\beta_{i,t+k}^d$ (k = 1, 2, 3, …, K). Rearranging Eq. (27), we get:

$$D_{it} = \frac{X_{it}}{1 + \lambda_t \beta_{it}^d} . \tag{28}$$

Eq. (28) shows that the normal dividend of a stock is determined by its earnings, adjusted for the level of the payout ratio in the economy and the long-run dividend beta of the stock. Since the last parameter has a negative effect on the dividend, and since dividends are supposed to be lower for stocks with higher risk[10], we can argue that the long-run dividend beta represents a potential measure of risk. Moreover, this parameter supports the long-run definition of consumption risk recently proposed in the literature (see Bergeron (2011), Bansal et al. (2009), Bansal et al. (2005), Bansal and Yaron (2004), and others). More particularly, it supports the work of Bansal et al. (2005), for whom risk is measured by the covariance between dividend and consumption growth rates over serial periods (this risk measure is called the *cash flow beta*).

Dividing each side of Eq. (28) by X_{it} finally relates the dividend policy of the firm (expressed by the dividend payout ratio) to its long-run consumption risk (expressed by the long-run dividend beta), that is to say:

$$d_{it} = \frac{1}{1 + \lambda_t \beta_{it}^d} , \tag{29}$$

where d_{it} is the dividend payout ratio of stock *i* at time *t*: $d_{it} \equiv D_{it} / X_{it}$.

In short, Eq. (29) shows that the dividend payout ratio of a stock is negatively related to its long-run dividend beta (or its long-run risk), defined as the covariance between dividends and consumption, cumulated over many periods[11].

In this manner, a firm with a long-run dividend beta of one should opt for a target dividend payout ratio identical to the market, while a firm considered more (less) risky should opt for a payout ratio less (more) important than the average. In the extreme case of a firm with a long-run dividend beta approaching zero, the payout ratio should approach 100%, and total earnings should be distributed as dividends. On the contrary, if the firm's risk level or long-run dividend beta tends to infinity, the payout ratio should tend to zero. In brief, according to Eq. (29), if the horizontal axis represents risk, and the vertical axis represents the payout ratio, then the inverse dividend-risk relationship should be illustrated by a curve that approaches an axis *asymptotically*.

Furthermore, since the dividend payout ratio depends on the available information on a particular date, it will be revised at each period.

4. Conclusion

We have examined the relationship between dividend policy and risk in an intertemporal economy. Using the CCAPM framework, we have shown that the dividend payout ratio of a stock is negatively related to its long-run dividend beta. Thus, we have concluded that riskier firms are more likely to reinvest their earnings or pay fewer dividends.

We believe that our theoretical model provides an additional element to support the inverse relationship observed between dividends and risk. Also, it clarifies the relationship in a simple equation. Moreover, it shows the importance of a long-run definition of consumption risk for interpreting the difference in dividend distribution across firms. Finally, it leads to practical applications that may be useful for managers and investors, if we accept that the target dividend payout ratio chosen by the firm should correspond to our model.

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Notes

Note 1. Hussainey et al. (2011) find, in the United Kingdom, a negative relationship between dividend payout ratio and payout volatility.

Note 2. See, for example, Charest (1978).

Note 3. Campbell and Cochrane (2000) consider that the CCAPM represents one the major advances in financial economics. This point of view is also asserted by Cochrane (2005) and Li (2010).

Note 4. See also Parker and Julliard (2005), Hansen et al. (2008), Malloy et al. (2009), Bansal and Kiku (2011), and Beeler and Campbell (2012).

Note 5. In this paper, the operators E_t, VAR_t, and COV_t refer respectively to mathematical expectations, variance, and covariance, where index t implies that we consider the available information at time t. Furthermore, the tilde (~) indicates a random variable.

Note 6. The premium (U') is a derivative of a function.

Note 7. See proof in appendix A.

Note 8. See, table 1 in Foerster and Sapp (2011).

Note 9. In appendix B we relax the assumption of a stable dividend policy.

Note 10. Recall that, for many authors, dividends are lower for stocks with higher risk. See, again, Hussainey et al. (2011), Hoberg and Pradhala (2009), Carter (2008), etc.

Note 11. See appendix C for a numerical example.

Appendix A

In Appendix A, we demonstrate how Eq. (21) can be simplified and reduced to Eq. (22). We suppose that dividends and aggregate consumption are bivariate normally distributed. This assumption permits us to use Stein's lemma (Rubinstein 1976, p. 421), which establishes that: *for random variables* x *and* y, *and for differentiable function* f(x); COV[y, f(x)] = E[f'(x)]COV[y, x], *if* x *and* y are *bivariate normally distributed*.

Indeed, from Eq. (2) and Eq. (21), we have:

$$\frac{E_t[\tilde{X}_{i,t+k}]}{E_t[\tilde{D}_{i,t+k}]} =$$

$$1 + \frac{E_t^{-1}[\tilde{M}_{t+k}](1 - COV_t[\tilde{M}_{t+k}, \tilde{Y}_{m,t+k}]) - E_t[\tilde{Y}_{m,t+k}]}{1 - E_t[\tilde{Y}_{m,t+k}]E_t[\tilde{M}_{t+k}] - COV_t[\tilde{M}_{t+k}, \tilde{Y}_{m,t+k}]} COV_t[\tilde{M}_{t+k}, \tilde{G}_{m,t+k}]$$

$$\text{x} \quad \frac{COV_t[U'(\tilde{C}_{t+k}), \tilde{G}_{i,t+k}]\delta^k / U(C_t)}{COV_t[U'(\tilde{C}_{t+k}), \tilde{G}_{m,t+k}]\delta^k / U(C_t)}. \tag{A1}$$

From Stein's lemma, we get:

$$\frac{E_t[\tilde{X}_{i,t+k}]}{E_t[\tilde{D}_{i,t+k}]} =$$

$$1 + \frac{E_t^{-1}[\tilde{M}_{t+k}](1 - COV_t[\tilde{M}_{t+k}, \tilde{Y}_{m,t+k}]) - E_t[\tilde{Y}_{m,t+k}]}{1 - E_t[\tilde{Y}_{m,t+k}]E_t[\tilde{M}_{t+k}] - COV_t[\tilde{M}_{t+k}, \tilde{Y}_{m,t+k}]} COV_t[\tilde{M}_{t+k}, \tilde{G}_{m,t+k}]$$

$$\text{x} \quad \frac{COV_t[\tilde{C}_{t+k}, \tilde{G}_{i,t+k}]E_t[U''(\tilde{C}_{t+k})]}{COV_t[\tilde{C}_{t+k}, \tilde{G}_{m,t+k}]E_t[U''(\tilde{C}_{t+k})]}. \tag{A2}$$

Multiplying each side of Eq. (A2) by $E_t[\tilde{C}_{t+k}]$ yields:

$$\frac{E_t[\tilde{X}_{i,t+k}]}{E_t[\tilde{D}_{i,t+k}]} =$$

$$1 + \frac{E_t^{-1}[\tilde{M}_{t+k}](1 - COV_t[\tilde{M}_{t+k}, \tilde{Y}_{m,t+k}]) - E_t[\tilde{Y}_{m,t+k}]}{1 - E_t[\tilde{Y}_{m,t+k}]E_t[\tilde{M}_{t+k}] - COV_t[\tilde{M}_{t+k}, \tilde{Y}_{m,t+k}]} COV_t[\tilde{M}_{t+k}, \tilde{G}_{m,t+k}]$$

$$\text{x} \quad \frac{COV_t[\tilde{C}_{t+k} / E_t[(\tilde{C}_{t+k})], \tilde{G}_{i,t+k}]}{COV_t[\tilde{C}_{t+k} / E_t[(\tilde{C}_{t+k})], \tilde{G}_{m,t+k}]}, \tag{A3}$$

which is equivalent to Eq. (22), since $\tilde{G}_{t+k}$ equals $\tilde{C}_{t+k} / E_t[(\tilde{C}_{t+k})]$.

Appendix B

In Appendix B, we relax the assumption of a stable dividend policy. In fact, from Eq. (25), we have:

$$\sum_{k=1}^{K} \frac{E_t[\tilde{X}_{i,t+k}]}{E_t[\tilde{D}_{i,t+k}]} = K + \sum_{k=1}^{K} \lambda_{t+k} \beta_{i,t+k}^{d} \ . \tag{B1}$$

Multiplying by $\sum_{k=1}^{K}\lambda_{t+k}$ on each side, yields:

$$\sum_{k=1}^{K}\frac{E_t[\tilde{X}_{i,t+k}]}{E_t[\tilde{D}_{i,t+k}]} = K + \sum_{k=1}^{K}\lambda_{t+k}\sum_{k=1}^{K}w_{t+k}\beta_{i,t+k}^{d} \tag{B2}$$

where $w_{t+k} \equiv \lambda_{t+k}\sum_{k=1}^{K}\lambda_{t+k}$, with $\sum_{k=1}^{K}w_{t+k}$ = 1.

Dividing by K on each side of Eq. (B2) shows that:

$$\bar{\phi}_{it} = 1 + \bar{\lambda}_t\bar{\beta}_{it}^{d}, \tag{B3}$$

where:

$$\bar{\phi}_{it} \equiv \sum_{k=1}^{K}\frac{E_t[\tilde{X}_{i,t+k}]}{E_t[\tilde{D}_{i,t+k}]}/K, \quad \bar{\lambda}_t \equiv \sum_{k=1}^{K}\lambda_{t+k}/K, \quad \bar{\beta}_{it}^{d} \equiv \sum_{k=1}^{K}w_{t+k}\beta_{i,t+k}^{d}.$$

Thus:

$$\bar{d}_{it} = \frac{1}{1+\bar{\lambda}_t\bar{\beta}_{it}^{d}}, \tag{B4}$$

with $\bar{d}_{it} \equiv 1/\bar{\phi}_{it}$, where $\bar{d}_{it}$ can be viewed as the inverse of the arithmetic average (over many periods) of the earnings/dividends ratio of stock i, given the available information in time t, or, to put it differently, the long-run target payout ratio of stock i. In the same manner, $\bar{\lambda}_t$ can be viewed as the corresponding average ratio for the market, while $\bar{\beta}_{it}^{d}$ can be viewed as the weighted average of the coefficients $\beta_{i,t+k}^{d}$ (k = 1, 2, 3, …, K).

In brief, as Eq. (29), Eq. (B4) shows that the target dividend payout ratio of a stock is negatively related to its long-run dividend beta (or its long-run risk), defined as the covariance between dividends and consumption, cumulated over many periods. However, in appendix B, the assumption of a stable dividend policy is not required.

Appendix C

In Appendix C, we present a numerical example in which we assume we need to estimate the target dividend payout ratio for a risky firm that has a long-run dividend beta of 1.25. From Table 1 in Foerster and Sapp (2011), we know that the average payout ratio in the United States was 54% between 1982 and 2010. Thus, we can assert that λ_t = 0.54^{-1} -1, and conclude that the target payout ratio for this firm should be approximately 48.43%, since Eq. (29) shows that:

$$0.4843 = \frac{1}{1+(0.54^{-1}-1)1.25}.$$