A Model of Optimal Dividend Policy to Maximize Shareholder Wealth When Taxes are Considered

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Abstract

This article theoretically analyzes how a firm maximizes the value of shareholders' wealth with its dividend policy. Corporate dividend policy is one of the major puzzles in modern finance. The overall question is whether a company should pay out a dividend at all. However, the large majority of listed companies pays a dividend and also carries sophisticated dividend policies. In this paper, we outline when it is optimal for a company to pay out a dividend and when it should reinvest the profit from operations. The model takes taxes into consideration by estimating the value of a company, i.e., its present value after tax deductions, which is used as an objective function. Four different taxes are considered. The analysis shows the terms on which it is profitable to receive a dividend payout or to reinvest at an arbitrary time. Under the assumption of a unique maximum net present value, the terms at the time for the maximum net present value are also presented.

Keywords: Dividend; Financing; Management; Reinvestment; Taxes

JEL Code: C61, E62, G31, G35

Introduction

One of the main questions of modern finance is how a company's dividend policy affects shareholders' wealth [1]. In this study, we construct a model that assumes the main assumptions of Miller-Modigliani's [2] classical articles of dividend policy, with the addition of taxes. The aim is to analyze how a firm maximizes the value of shareholders' wealth with its dividend policy versus the reinvestment of the profits from operations when taxes are considered. This is equivalent to maximizing the market value of the firm. Consequently, the netgp present value, i.e., the present value after any deductions for taxes, is used as an objective function in the study.

The basic idea of a dividend was initially to make equity seem like a loan, where the dividend would give the equity investor a tangible return, thereby enabling a value calculation of shares [3]. Dividends would then be comparable to each other, and stock dividends could consequently be viewed as an indicator of company value, in that it shows the relationship between cash-flow and price. The dividend issue was treated early on by many economic scientists including Lintner [4], Gordon [5-7], Miller and Modigliani [2], Farrar and Selwyn [8-12].

Since the seminal theoretical paper by [2], in which the authors showed the irrelevance of a dividend in a frictionless world, the obvious basis regarding a dividend is why companies should pay it out at all. However, the vast majority of companies pay dividends, and they also apply a sophisticated dividend policy. Why the real world is not like the academic model is not explained by the Miller-Modigliani (MM) irrelevance argument. However, there are several explanations complementing the MM irrelevance argument given by the academic literature: the signaling theory [13,14] claims that a dividend is a means to communicate company information to its shareholders about the company's future; the agency theory [15,16] claims that dividends are rooted in the conflicting interests within a company of different stakeholder groups - stockholders, management, and bondholders; the clientele theory [17,18] claims that a dividend is paid out to satisfy the payout demands from a heterogeneous dividend clientele; and the catering theory [19,20] claims that stock market mispricing might influence individual firms' investment decisions. Here, managers cater

to investors by paying dividends when investors prefer dividend payers and omitting dividends when investors prefer non-payers.

Surveys of dividend policy provide a good understanding of the minds of the people responsible for companies' dividend policies. In 1956, a survey study by Professor John Lintner detailed what is considered to be the foundation of modern understanding of dividend policy. The study was conducted in detail by interviewing the managers directing the dividend policies of 28 companies. The main findings were that managers used long-run target payout ratios to determine dividends, and they changed the company's dividends only when they believed that the company's permanent earnings had changed. Since then, several researchers have used the survey method to learn more about the factors that influence the construction of dividend policy [21,22]. In a study by Brav [23] the authors compared the treatments of dividends and stock repurchases. The study was performed by surveying financial executives with an instrument that focuses on both dividends and repurchases. The study was further developed by conducting one-on-one interviews with a number of CFOs. The findings showed that dividend policy is still very conservative, while stock repurchase is more flexible. Additionally, it was shown that companies perceived large penalties for cuts and only small rewards for increases.

The structure of this article is as follows: in Section 2, we present the most important and relevant research on dividend policy; in Section 3, we present the model; in Section 4, we give an analysis of the model; in Section 5, we present an example of a practical case based on the model; and in Section 6, we draw the conclusions of the study.

Previous Research

The tax burden on dividends is due partially to the tax on company

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profits and the tax treatment of the dividend recipient. To understand the complexity of dividend policy, the taxes on dividends should be compared to the effective capital gains tax. Typically, when the tax on a dividend exceeds the tax on capital gains, companies will prefer to retain earnings or to repurchase shares [24-26].

In principle, research shows that taxes affect dividend policy. However, exactly how much impact taxes have on dividend policy is a matter of debate among scholars. Brav [23] and [27] argue that taxes do not have a dominant effect on the dividend decisions for most companies. In contrast, [28] argue that taxes can have a significant impact on corporate dividend decisions. Alzahrani and Lasfer showed that companies in countries with a double taxation tax system pay significantly lower dividends than companies in countries with partial-imputation systems. Because taxes are different depending on the type of shareholders, corporate shareholders and institutional investors prefer dividends before capital gains, whereas smaller shareholders prefer capital gains. Therefore, the large shareholders may use their power to directly influence dividend payouts for tax reasons [17].

Historically, capital gains have been taxed at a lower rate than dividends, which means that investors often prefer capital gains over dividends. Furthermore, capital gains are not taxed until shares are actually sold; therefore, investors can control when capital gains are realized and when taxes are paid. Investors, however, cannot control dividends because it is the board of the related company that decides on the distribution. Many scholars have evaluated the tax effect on dividend policy from the tax change that the U.S. Congress passed in 2003. According to the adopted legislation, dividends are taxed at the same rate as long-term capital gains. Studies, such as those of Chetty and Saez [29-31], have found significant increases in dividend payouts and initiations following the adoption of the legislation. Chetty [29] found that the aggregate regular dividends increased by 20 % within 1.5 years of the introduction of the legislation, prompting the authors to conclude that the tax cuts caused this increase.

In corporate finance, a finance manager generally has two operational decision areas to consider: the investment (or capital budgeting) and the financing decisions. The capital budgeting decisions concern the choice of what long-term assets the company should acquire, while the financing decisions concern how these assets should be financed. A third decision area arises, however, when the company begins to generate profits. How much of the earnings should the company distribute as dividends to shareholders, and how much should the company reinvest in the business? The ultimate goal of managers should be the maximization of shareholder wealth, so every action taken by the managers should consequently be to maximize the wealth of the shareholders. The managers do not just have to consider how much of the company's earnings are needed for investments, but they also have to consider the effect of their decisions on shareholder wealth [32].

Shareholder wealth is defined as the present value of expected future returns to shareholders. These returns are either regular dividend and/or represent revenue from the sale of shares. Shareholder wealth is measured as the market value of the company's shares. The goal of maximizing shareholder wealth is a long-term goal, where shareholder wealth is a function of all future monetary returns to the shareholders. To make decisions that maximize shareholder wealth, management must take into account the long-term effects on the company and not just focus on short-term effects [33].

Model

The starting point in building our tax-including model is the assumptions of [2]; the authors assumed an ideal economy characterized by rational behavior and perfect certainty (deterministic approach) and to some extent under risk (stochastic perspective). Their proposition also assumed that no transaction costs exist and that individuals and corporations borrow at the same rates. A limitation in the analysis is that the sum of funds used for dividends and investments is equal to the profits from operations. Thus, neither external financing nor share repurchase is considered.

In their 1986 article, Shleifer and Vishny discuss the dividend puzzle using four taxes. In this article we consider four taxes similar to the ones outlined by Sheifer and Vishny: a) corporate tax when dividend payout is received; (b) shareholder's personal income tax on dividends; (c) corporate tax when reinvestment is made; and (d) shareholder's capital gains tax.

Concepts and notations

In this study, the net present value, i.e., the present value after deduction for taxes, is used as an objective function. In accordance with this, total net present value over time t , $PV(t)$, is the sum of the net present values of dividends $PV_D(t)$ and gains of reinvestments $PV_R(t)$. Thus, $PV(t) = PV_D(t) + PV_R(t)$.

In the study, the following concepts and denotations are used.

'Gross' means 'with no deduction for taxes'; 'net' means 'after deduction for taxes'.

t denotes an arbitrary terminal time point,

s denotes time point ending period s in the discrete model; time in the continuous model where $0 \leq s \leq t$,

$G(s)$ denotes the shareholder's gross profit from operations in period s ; it is assumed to be non-negative,

$q(s)$ denotes dividend ratio, i.e. relative dividend fraction of the firm's gross profit at time point s where $0 \leq q(s) \leq 1$; q is decision function,

$1-q(s)$ denotes retention ratio, i.e. relative reinvestment fraction of the firm's gross profit at time point s where $0 \leq q(s) \leq 1$,

$r(s)$ denotes market-required rate of return in period s (interest rate); same notation in both the discrete and continuous models, but for consistency with slightly different values,

$\delta(s)$ denotes discount factor in period s in the discrete model, i.e.,

$$\delta(s) = (1 + r(s))^{-1},$$

$g(s)$ denotes rate of return on reinvestment in period s (growth rate); same notation in the discrete and continuous model, but for consistency with slightly different values

$\gamma(s)$ denotes growth factor in period s , the discrete model, $\gamma(s) = 1 + g(s)$. Different tax rates, c , all $0 \leq \tau_i(s) < 1$.

$\tau_1(s)$ denotes corporate tax rate on gross profit in period s , when dividends are received,

$\tau_2(s)$ denotes personal income tax rate on gross dividend payout in period s ,

$\tau_3(s)$ denotes corporate tax rate on gross profit in period s , when reinvestment is made,

$\tau_4(s)$ denotes capital gains tax rate, i.e. personal income tax rate in period s on the capitalized reinvestments after a deduction for corporate tax; $\tau_4(s) = \tau_4(t)$ for all $S \leq t$ where t is sale date

$PV(t)$ denotes total net present value over t periods,

$PV_D(t)$ denotes net present value of dividends over t periods,

$PV_R(t)$ denotes net present value of capital gains of reinvestments over t periods.

Net present value of dividends

The net dividend in period s equals $G(s)q(s)(1-\tau_1(s))(1-\tau_2(s))$ for $s = 0, 1, \dots$

By discounting and summing over s we obtain

$$\begin{aligned} PV_D(t) &= G(0)q(0)(1-\tau_1(0))(1-\tau_2(0)) \\ &+ G(1)q(1)(1-\tau_1(1))(1-\tau_2(1))\delta(1) + \\ &+ G(2)q(2)(1-\tau_1(2))(1-\tau_2(2))\delta(1)\delta(2) + \dots \\ &+ G(t)q(t)(1-\tau_1(t))(1-\tau_2(t))\delta(1) \dots \delta(t) = \\ &= \sum_{s=0}^t G(s)q(s)(1-\tau_1(s))(1-\tau_2(s)) \prod_{u=1}^s \delta(u) \end{aligned} \quad (1)$$

where $\delta(0)=1$.

For convenience, we now make the discrete expression (1) continuous in time; thus, a change occurs from discontinuous to continuous time. Then, $\delta(u)$ is replaced by the continuous version $\exp(-r(u))$. We obtain

$$PV_D(t) = \int_0^t G(s)q(s)(1-\tau_1(s))(1-\tau_2(s)) \cdot \exp\left\{-\int_0^s r(u)du\right\} ds \quad (2)$$

Net present value of reinvestments

The net reinvestment gain at time point s equals $G(s)(1-q(s))(1-\tau_3(s))$. This is increased by future growth up to time t , where it is taxed by the ratio $\tau_4(t)$ and discounted back to time $s=0$. With the convention $\tau_4(s) = \tau_4(t)$ for $0 \leq s \leq t$ we obtain

$$\begin{aligned} PV_R(t) &= G(0)(1-q(0))(1-\tau_3(0))(1-\tau_4(0)) \prod_{u=1}^t \gamma(u) \prod_{u=1}^t \delta(u) + \\ &+ G(1)(1-q(1))(1-\tau_3(1))(1-\tau_4(1)) \prod_{u=2}^t \gamma(u) \prod_{u=1}^t \delta(u) + \dots + \\ &+ G(t)(1-q(t))(1-\tau_3(t))(1-\tau_4(t)) \prod_{u=1}^t \delta(u) = \\ &= \prod_{u=1}^t \delta(u) \sum_{s=0}^t G(s)(1-q(s))(1-\tau_3(s))(1-\tau_4(s)) \prod_{u=s+1}^t \gamma(u) \end{aligned} \quad (3)$$

where $\prod_{u=1}^t \gamma(u)$ is defined as 1.

As above, a change is made from discrete to continuous time, and simultaneously $\delta(u)$ and $\gamma(u)$ are replaced by their continuous analogues r and g . We obtain

$$PV_R(t) = \exp\left\{-\int_0^t r(u)du\right\} \cdot \int_0^t G(s)(1-q(s))(1-\tau_3(s))(1-\tau_4(s)) \cdot \exp\left\{\int_s^t g(u)du\right\} ds \quad (4)$$

Net present value of both dividends and reinvestments

Adding formulas (2) and (4) results in

$$\begin{aligned} PV(t) &= \int_0^t G(s)q(s)(1-\tau_1(s))(1-\tau_2(s)) \cdot \exp\left\{-\int_0^s r(u)du\right\} ds + \\ &+ \exp\left\{-\int_0^t r(u)du\right\} \cdot \int_0^t G(s)(1-q(s))(1-\tau_3(s))(1-\tau_4(s)) \cdot \exp\left\{\int_s^t g(u)du\right\} ds \end{aligned} \quad (5)$$

Analysis

Rearranging (5) by assembling all terms that contain the decision function q we obtain

$$\begin{aligned} PV(t) &= \exp\left\{-\int_0^t r(u)du\right\} \cdot \int_0^t G(s)(1-\tau_3(s))(1-\tau_4(s)) \cdot \exp\left\{\int_s^t g(u)du\right\} ds + \\ &+ \int_0^t G(s)q(s)(1-\tau_1(s))(1-\tau_2(s)) \cdot \exp\left\{-\int_0^s r(u)du\right\} ds - \\ &- \exp\left\{-\int_0^t r(u)du\right\} \cdot \int_0^t G(s)q(s)(1-\tau_3(s))(1-\tau_4(s)) \cdot \exp\left\{\int_s^t g(u)du\right\} ds = \\ &= \exp\left\{-\int_0^t r(u)du\right\} \cdot \int_0^t G(s)(1-\tau_3(s))(1-\tau_4(s)) \cdot \exp\left\{\int_s^t g(u)du\right\} ds + \quad (6a) \\ &+ \int_0^t G(s)q(s)h(s) \cdot \exp\left\{-\int_0^s r(u)du\right\} ds \quad (6b) \end{aligned}$$

where $h(s) = (1-\tau_1(s))(1-\tau_2(s)) - (1-\tau_3(s))(1-\tau_4(s)) \cdot \exp\left\{\int_s^t (g(u)-r(u))du\right\}$.

Consider $PV(t)$ as a functional of $q(\cdot)$; all other functions are given. The term (6a) is independent of q . Because $G(s)$ and $\exp\left\{-\int_0^s r(u)du\right\}$ are non-negative, it is found that $PV(t)$ is maximized by choosing $q(s)=t$ whenever $h(s)>0$, and $q(s)=0$ whenever $h(s)<0$. Because all τ_i fulfill $0 \leq \tau_i < 1$, the optimum for an arbitrary time s is obtained by choosing

$$q(s) = \begin{cases} 1 & \text{if } \exp\left\{\int_s^t (g(u)-r(u))du\right\} < \frac{(1-\tau_1(s))(1-\tau_2(s))}{(1-\tau_3(s))(1-\tau_4(s))} \\ 0 & \text{if } \exp\left\{\int_s^t (g(u)-r(u))du\right\} > \frac{(1-\tau_1(s))(1-\tau_2(s))}{(1-\tau_3(s))(1-\tau_4(s))} \end{cases} \quad (7)$$

We can write $\exp\left\{\int_s^t (g(u)-r(u))du\right\} = \frac{1+g_T(s,t)}{1+r_T(s,t)}$, where $g_T(s,t)$ is the total rate of return on reinvestment during the period s to t , and $r_T(s,t)$ is the corresponding total market-required rate of return (taxes not included). The time length t can be chosen arbitrarily but fixed.

Taking the derivative of $PV(t)$ with respect to t (in points of differentiability), we obtain

$$PV'(t) = \exp\left\{-\int_0^t r(u)du\right\} \cdot G(t) \cdot \left[\frac{q(t)(1-\tau_1(t))(1-\tau_2(t))}{(1-q(t))(1-\tau_3(t))(1-\tau_4(t))} + (g(t)-r(t)) \cdot PV_R(t) \right] \quad (8)$$

The first term is the present value of the sum of net dividends and net reinvestment at t . $PV_R(t)$ in the second term is the present value of the accumulated, capitalized net reinvestments up to t (see (4)), $g(t)$. $PV_R(t)$ is the present value of the revenue of this reinvested capital, and $r(t) \cdot PV_R(t)$ is the present value of the cost to keep this capital. At optimum, $q(t)$ is either 0 or 1, and the first term is then the present value of either the net dividend ($q(t)=1$) or the net investment ($q(t)=0$), in both cases after taxes. We now extend our model to include the assumption that the rate of return on reinvestment in period s depends on the size of the reinvestment. To do this, $G(s)$ is divided into monetary units ordered from 0 and upwards. The rate of return at time t of the v th unit reinvested at time s is denoted $g(s,t,v)$, and the dividend ratio of the v th unit at time s is denoted $g(s,v)$.

Then, (6) is extended as follows

$$\begin{aligned} PV(t) &= \exp\left\{-\int_0^t r(u)du\right\} \cdot \int_0^t (1-\tau_3(s))(1-\tau_4(s)) \int_0^{G(s)} \exp\left\{\int_s^t g(s,u,v)du\right\} dv ds + \\ &+ \int_0^t \int_0^{G(s)} q(s,v)h(s,v) \cdot \exp\left\{-\int_0^s r(u)du\right\} dv ds \end{aligned}$$

Where

$$h(s, v) = (1 - \tau_1(s))(1 - \tau_2(s)) - (1 - \tau_3(s))(1 - \tau_4(s)) \cdot \exp\left\{\int_s^t (g(s, u, v) - r(u)) du\right\}.$$

In the same way as above, it is observed that $PV(t)$ is maximized by choosing

$$q(s, v) = \begin{cases} 1 & \text{if } \exp\left\{\int_s^t (g(s, u, v) - r(u)) du\right\} < \frac{(1 - \tau_1(s))(1 - \tau_2(s))}{(1 - \tau_3(s))(1 - \tau_4(s))} \\ 0 & \text{if } \exp\left\{\int_s^t (g(s, u, v) - r(u)) du\right\} > \frac{(1 - \tau_1(s))(1 - \tau_2(s))}{(1 - \tau_3(s))(1 - \tau_4(s))} \end{cases} \quad (9)$$

If g and r are continuous functions and g is non-increasing, the solution (9) gives an upper limit $\dot{v} = \dot{v}^*(s, t)$ for optimal reinvestment.

So far all functions are considered to be known. Let this assumption be relaxed by assuming that the growth and interest rates are random variables and that we want to maximize the expected value of the present value $PV(t)$. The same arguments as above lead to the same decision rules (7) and (9), but with the left hand side replaced by its expected value. Because by Jensen's inequality [34] the expected value $E(\exp\{U\}) \geq \exp\{E(U)\}$ for any random variable U , $q(s)=0$ more often than expressed by inserting the expected rates in the rules (7) and (9). The expectation is then taken conditionally on the r and g processes up to time s . Thus, the random rates of growth and interest should increase the retention rate compared to known rates if the expected rates are the same.

An Example of a Practical Case

Above, we have theoretically shown the "equilibrium" terms on which it is profitable to change from receiving dividends to reinvestment or vice versa, when four different taxes are considered. In the simple example below, we will calculate the average annual rate of return on reinvestment — under the above-mentioned terms — during a ten-year period under the following hypothetical terms:

- corporate tax rate on gross profit (τ_1) is 28 % when a dividend is received,
- personal income tax rate on gross dividend payout (τ_2) is 30 %,
- corporate tax rate on gross profit (τ_3) is 20 % when reinvestment is made,
- capital gains tax rate (τ_4) is 20 %,
- annual market-required rate of return is 5 % during the period, and
- annual rate of return on reinvestment is g % during the period.

According to the discrete version of the solution (7), we obtain the breakpoint between $q=0$ and $q=1$ when $\frac{1.0g^{10}}{1.05^{10}} = \frac{(1-0.28) \cdot (1-0.30)}{(1-0.20) \cdot (1-0.20)}$, which gives $g=2.521\ldots$

In this case, the average annual rate of return on reinvestment is 2.5 % during the period and is thus equivalent to a market-required annual rate of 5 %.

Conclusions

Assuming that the sum of funds used for dividends and reinvestments is equal to the profits from operations, we find from (7)

that the value of the shareholders' wealth (i.e., equivalent to the value of the firm) is affected by dividend policy in a world both with and without taxes. Dividend/reinvestment policy is irrelevant in this respect only if the ratio $\frac{1+g_T(s,t)}{1+r_T(s,t)}$ is equal to the ratio $\frac{(1-\tau_1(s))(1-\tau_2(s))}{(1-\tau_3(s))(1-\tau_4(s))}$ of tax rates; $g_T(s,t)$ is the total rate of return on reinvestment during the period s to t ; and $r_T(s,t)$ is the corresponding total market-required rate of return.

We find from (7) that it is advantageous for shareholders to receive dividend payouts at time s , when the ratio is less than the ratio $\frac{1+g_T(s,t)}{1+r_T(s,t)}$ of tax rates.

Otherwise, if this relationship is larger, it is better to reinvest.

However, in the case of random rates of growth and interest, the retention rate should be increased compared to the known rates of return, if the expected rates are the same.

The derivative of $PV(t)$ (see (8)) set equal to zero determines the relationship between the included components at the time of maximum net present value. Here we assume that the present value, as a function of time, has a unique maximum. Then, the time for the maximum net present value occurs when the sum of the net dividends and the net reinvestment is equal to the difference between the cost to keep the accumulated net reinvested capital and the revenue of the same capital.

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