A SYNTHESIZED DISTRIBUTION MODEL: ASYMMETRIC INFORMATION, AGENCY PROBLEM, AND INTERTEMPORAL OPTIMIZATION

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Abstract

A firm's policy of distribution over current and future time periods influences the capital structure of the firm and its profitability. Managers decide on the amount of effort input in such a context of financial structure to maximize their utility. Nevertheless, shareholders' preferred distribution of income is determined by the goal of corporate value maximization. The study aims to reach an optimal level of income distribution and reinvestment over current and future periods in which both the manager's utility and shareholders' corporate value have been maximized. The study adopts Lagrange's multipliers method and the discounted cash flow valuation model of corporate value maximization. By processing a method of mathematical deduction and optimization, the study aims to reach an optimal equilibrium level of the dividend distribution model and explore key factors in the model for the determination of the distribution of income. As a result, the study concluded an optimal dividend distribution model, in which six factors jointly determine a theoretical equilibrium of optimization. These factors consist of the capital structure of the firm, the tax shield from debt financing, the growth rate of the dividend, dividend tax, the investment strategy of the principal, and the cost of capital.

Keywords: Company Finance, Corporate Governance, Agency Problem, Dividend Policy

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1. INTRODUCTION

The relationship between dividend policy, agency problems, corporate value, asymmetric information, and taxes is a complex and multifaceted area of study within the field of corporate finance. Dividend policy refers to the decision-making process by which companies determine the allocation of profits to shareholders in the form of dividends. This decision is influenced by various factors, including agency problems, which arise due to conflicts of interest between managers and shareholders, as well as the impact of asymmetric information and taxation considerations. Understanding the interplay between these factors is essential for analyzing the effects of dividend policy on corporate value and shareholder wealth.

Agency problems are a common challenge in corporate finance and have a direct impact on dividend policy decisions. These problems arise due to the separation of ownership and control in publicly traded companies, where managers (agents) make decisions on behalf of shareholders (principals). Managers may have different goals and

incentives than shareholders, leading to a potential misalignment of interests. This misalignment can result in suboptimal dividend policies, where managers prioritize their own objectives, such as personal benefits or pursuing growth opportunities, over maximizing shareholder wealth. Resolving agency problems through effective corporate governance mechanisms is crucial to ensure that dividend policies are aligned with shareholder interests and ultimately enhance corporate value.

Asymmetric information also plays a significant role in dividend policy decisions. Asymmetric information occurs when one party has superior information compared to others involved in a transaction. In the context of dividend policy, companies often possess private information about their prospects, such as expected earnings or investment opportunities. This information asymmetry can lead to challenges in determining the appropriate dividend amount. Companies with positive insider information may choose to increase dividend payouts as a signaling mechanism to convey their confidence to shareholders. Conversely, companies with negative information may reduce or eliminate dividends to avoid sending negative signals. Asymmetric information can impact corporate value by influencing shareholder perceptions and market valuations of the company's shares.

Taxation considerations also have an impact on dividend policy decisions and corporate value. Different tax regimes treat dividend income and capital gains differently. In jurisdictions, where dividend income is taxed at higher rates than capital gains, companies may choose to retain earnings rather than distribute them as dividends. Retaining earnings allows shareholders to benefit from capital gains, which are taxed at more favorable rates. This tax preference for capital gains can influence the dividend payout ratio and affect the company's capital structure decisions. Additionally, taxes on dividends can directly reduce the amount of cash received by shareholders, potentially impacting their wealth and overall corporate value.

Understanding the relationships between dividend policy, agency problems, corporate value, asymmetric information, and taxes is vital for corporate decision-makers, investors, and researchers. It provides insights into how various factors influence dividend policy decisions, how agency problems can affect shareholder wealth, the impact of information asymmetry on market valuations, and the tax implications of dividend distributions. By examining these relationships, stakeholders can gain a deeper understanding of the dynamics that shape dividend policies and their consequences for corporate value and shareholder returns.

This study aims to answer the following research questions:

RQ1: How do agency problems, asymmetric information, investment decisions, and capital structure impact corporations' dividend policies?

RQ2: What factors are key determinants for corporate dividend decision-making?

The structure of this paper is as follows. Section 1 introduces the topic and provides an overview of the relationship between dividend policy, agency problems, corporate value, asymmetric information, and taxes. Section 2 reviews the relevant literature on dividend policy, agency problems, corporate value, asymmetric information, and taxes. This section provides a comprehensive analysis of existing studies, theories, and empirical findings related to these concepts. It discusses different perspectives and theories that have been proposed in the literature, providing a foundation for the subsequent analysis. Section 3 presents the methodology that has been used to conduct theoretical research on the relationship between dividend policy, agency problems, corporate value, asymmetric information, and taxes. Section 4 presents the research results obtained from the mathematical analysis. Section 5 discusses the implications and significance of the research findings. It explores the theoretical and practical implications of the relationships between dividend policy, agency problems, corporate value, asymmetric information, and taxes. Section 6 presents the conclusion of the paper. It summarizes the main findings, revisits the research questions, and provides a comprehensive synthesis of the research insights. This section may also offer recommendations for practitioners, policymakers, and investors based on the study's findings. The final section also considers the limitations of the study and suggests potential avenues for future research.

2. LITERATURE REVIEW

Numerous studies have been conducted to gain a better understanding of distribution theory. Miller and Modigliani (1961) demonstrated that the distribution of earnings to shareholders does not impact the value of a firm. Based on the assumptions of a perfect capital market, rational behavior, and perfect certainty, a dividend expresses definite irrelevance in the valuation of shares. Even according to the research of Brav et al. (2005), payout policy has no obvious clientele effects. However, the irrelevance attached to ideal assumptions has failed to explain the uncertain phenomenon of dividend policy in practice. The fallacy of "the bird in the hand" theory states that an investor considers future capital gains as uncertain and prefers the current dividend. Harakeh et al. (2020) demonstrated a different result of "asymmetric information" between the United States' and the United Kingdom's dividend policies. Margono and Gantino (2021) contributed the most important empirical findings that dividend policy and funding decision demonstrates a significant impact on share prices. This showed the necessity for studies about whether dividends signal information to shareholders with different characteristics of tax preferences and whether investors change their decisions to hold or sell because of accepting those signals, which, in turn, change the behavior of share prices and returns. Regarding this signaling effect, Bozos et al. (2011) find a significant interaction between economic conditions and the information content of dividends. Furthermore, Berezinets et al. (2019) suggest in the Russian market, investors, on average, reacted negatively to announcements of increased, as well as decreased dividends. Nevertheless, Seyedimany (2019) disagreed with the significance of dividend policy and rejected the signaling power of dividend announcements. Dong et al. (2019) demonstrated that no evidence of dividend announcement drift is found.

According to agency theory, managerial executives propose a dividend policy to the board of directors, which is relevant to a firm's cost of capital, and shareholders make decisions about the allocation of dividends and reinvestment between today and the future. There are various studies relevant to the field. Lumapow and Tumiwa (2017) demonstrated that corporate governance structure has a positive and insignificant effect on firm value as a mediated dividend policy and dividend policy has a positive and insignificant effect on firm value. In addition, a strong presentation of agency problems favors a high level of dividend distribution. Kanojia and Bhatia (2022) addressed that financial regulators need to improve the corporate governance framework to enhance the disbursement of dividends and mitigate the agency problem. Based on the pecking order theory, advanced by Martinez et al. (2019), a firm chooses financial alternatives based on the cost of capital. Internal financing from retained earnings has the lowest cost of capital, while external financing, including debt financing, has a relatively higher level of cost. However, external financing alleviates the agency problem by enhancing supervision from debtholders. Meanwhile, Tran (2020) illustrated that shareholders recognizing this risk need to force managers to pay more dividends in order to mitigate the agency problem. In addition, Ngo et al. (2020) showed that managers in weakly governed firms are more likely to initiate customized dividends to meet outside large shareholders' needs while simultaneously using costly external capital to finance new investment projects. More specifically, Nguyen Trong and Nguyen (2021) approved that debt or dividend policy separately can moderate the negative effect of overinvestment on firm performance. But when these two policies are combined, the positive interaction impact of each policy will be lessened due to the substitution between debt and dividend policy.

The prior findings, with diversified viewpoints and various conclusions, either with or without contradiction, cycle the crux of the matter called agent problems and are simply understood as the roles of and relations between executives and shareholders. Nevertheless, dividend policy is not only the policy determined solely by the "front" side of the firm but also the operations and functions that generate or degenerate the ability of firms to make dividend policy, according to Ouma (2012). Dang et al. (2021) found that dividend policy has a significant impact on the corporate value of companies that implement a higher dividend payout policy. Conversely, firms that do not pay dividends or pay low dividends do not experience a significant impact of dividend policy on corporate value. In addition, Skinner and Soltes (2011) stated that dividend payers have higher earnings quality than dividend non-payers which means dividend does have signaling power of firms' performance.

If the firms' performance, agency problem, investment decision, and corporate valuation, are relevant to dividend policy, it is necessary to consider a synthesized model aiming at an optimal equilibrium of dividend level. A firm's performance is impacted by managers' activities and financial resources availability. Under agency problems, managers' goal is to maximize personal utility which impacts the firm's performance. However, corporate value maximization is the goal of shareholders. The study aims to develop a theoretical mathematical model incorporating the principals' wealth maximization (which is reflected by corporate value maximization) and the agency's utility maximization. It is expected that the mathematical results may provide theoretical guidance and practical implication for the dividend policies of corporations. In addition, it is also expected to contribute to the future evolution of the corporate valuation approach.

To answer the previously formulated research questions, the following research hypotheses were established:

H1: Agency problems have a significant impact on corporations' dividend policies, with higher agency costs leading to lower dividend payouts.

H2: Asymmetric information influences corporations' dividend policies, with firms facing higher information asymmetry tending to have lower dividend payouts.

H3: Investment decisions play a role in corporations' dividend policies, as companies with higher investment opportunities tend to retain more earnings and have lower dividend payouts.

H4: Capital structure affects corporations' dividend policies, with firms with higher leverage ratios tending to have lower dividend payouts.

H5: Key determinants for corporate dividend decision-making include profitability, cash flow generation, firm size, growth opportunities, and tax considerations.

3. RESEARCH METHODOLOGY

Based on the previous literature review, it is evident that a firm's distribution policy (dividend payment) is relevant to long-term financing strategies, personal and corporate income taxes, agency problems, and asymmetric information. Under imperfect market assumptions allowing wealth transformation among the periods and the existence of agent problems, a firm's objective function relative to dividend policy is not identical to the utility goal of principals who are aiming to maximize utility by allowing wealth transfers between current and future time periods. Meanwhile, the different utility goals of the principal and agent raise the question of deviations from equilibrium and remind us to seek optimum dividend policies for different scenarios.

Financial leverage allows firms to shield tax expenses while changing future cash flows. It is probably the most rational strategy for reducing financial costs if the firm can generate more benefits from borrowing than interest expenses that should be paid for debt. At the same time, principals consider the cost of financial leverage as an enhancement of power for monitoring executives, especially at a higher degree of asymmetric information. In the case of high information asymmetry, the most effective channel for shareholders or principals to protect their wealth goal is to constrain cash flow availability for the agent, which adds more pressure on the agent, who is therefore forced to seek more debt. Meanwhile, with asymmetry problems, shareholders with full information and shareholders without full information perform differently

according to their marginal personal tax rate due to utility goals. All those actions are guided by the utility goals of shareholders. To achieve this goal, it is acceptable for shareholders to sacrifice today's utility in exchange for a future incremental utility. With increased cash payments for dividends, the shareholders must pay more personal tax, which, in turn, reduces consumption capacity. Therefore, in certain situations, shareholders prefer retaining a return for a future higher payment than receiving a dividend as the current term's return, as argued by Pan et al. (2021).

Methods: The study aims to reach an optimal level of income distribution and reinvestment over current and future periods in which both the manager's utility and shareholders' corporate value have been maximized. The study adopts Lagrange's multipliers method and the discounted cash flow valuation model of corporate value maximization. By processing a method of mathematical deduction and optimization, the study aims to reach an optimal equilibrium level of the dividend distribution model and explore key factors in the model for the determination of the distribution of income.

A firm j decides on the output y_0^j at the beginning of current period and at the end of the current period debt financing B^j incurs transaction cost T_B. The transaction cost is broadly defined as a combination of all expenses including brokerage commission, documentary expenses, and interest expenses. Meanwhile, the firm j has equity financing at the amount of $\tilde{e}^j$ with transaction costs of T_e. The following is available capital for the firm j for the current period:

$$X_0^j = p_0 y_0^j + (1 - T_B)B^j + (1 - T_e)\tilde{e}^j - D_0^j \tag{1}$$

where, p is the price, the vector is the states of contingency. Due to uncertainty, the prices of different commodities change differently in each state of the economy. Firm j can decide on a production plan that specifies input and output vectors $y_s^j \in R^L$ in each state $s \in S$.

Moreover, considering external opportunities, the firm decides the output according to the market situation, say prices of input and output. Internally, the firm makes an output plan in line with the capacity of the firm, such as the efficiency of productivity of itself and the efforts of the agent. For this capacity, the study considers the productivity of the firm, and the simultaneous efforts contributed by managers. Assuming the technology of A and the efforts contribution of managers of E, $\delta = ln(AE)$ is the efficiency or productivity of the operations of the firm. Consequently, y is a function of productivity, efforts, and cash flow availability, as follows:

$$y^j = f(\delta, X) = f(A, E, X) \tag{2}$$

The level of output at the end of the current period is related to the amount of investment made at the start of the period, which is an initial capital contribution made by the principals (defined as X). Furthermore, the output is influenced by operational efficiency, which is a function of technology and executive effort contribution. For consistency, the study retains the same productivity function for current and future periods. In a future period, a firm needs to fulfill the payment of debt principle with an interest return promised after a corporate tax. A free cash flow available for firm j's shareholders at the state of s in a future term can be defined as follows in Eq. (3).

A goal of firm j is to maximize free cash flows generated from the two-period operation, which determines the corporate value as follows in Eq. (4).

$$X_s^j = p_s y_s^j - [1 + r_s(1 - \tau_B)]B^j - D_0^j(1 + g^j)(1 + \tilde{e}^j) \tag{3}$$

$$\begin{aligned} V_j = \left(X_0^j + D_0^j\right) + \left(\frac{1}{1+r}\right)\left(\frac{1}{1+\tilde{e}^j}\right)\left[X_s^j + D_0^j(1+g^j)(1+\tilde{e}^j)\right] = \left[p_0 y_0^j(p_0, \delta^j) + (1 - T_B)B^j + (1 - T_e)\tilde{e}^j\right] + \\ + \left(\frac{1}{1+r}\right)\left(\frac{1}{1+\tilde{e}}\right)\left\{p_s y_s^j(p_s, \delta^j) - [1 + r_s(1 - \tau_B)]B^j\right\} \end{aligned} \tag{4}$$

From Eq. (4) above, a firm makes a decision on alternatives of financing by issuing debt B and/or additional shares $\tilde{e}$, and dividend distributions, given productive efficiency δ and price p_s. With more equity shares issued or repurchased it explicitly dilutes, or anti dilutes earnings per share (*EPS*). It is worth reminding that in Eq. (4), a financing strategy of debt and equity is servicing production needs and dividend payments simultaneously. From an agency problem theory, an increasing debt helps to enhance monitoring effects and therefore implicitly improves efforts contribution from executives which causes a firm's output to increase. This channeling effect from D to E to Y is implied in $\delta(A, E(D))$.

From a macro perspective, an individual is playing the role of both shareholders and consumers. Individuals made a decision over the consumption level over current and future periods, which represents the willingness to tradeoff between current and future periods. Meanwhile, individuals choose an investment portfolio to maximize wealth. An individual i possesses a state-contingent initial endowment $\omega^i := (\omega_0^i, \omega_1^i, \dots, \omega_s^i)$ with a utility function of a state-contingent consumption bundle $Q^i(y^i) := Q^i(y_0^i, y_1^i, \dots, y_s^i)$. Due to a change of equity financing, an individual i changes an initial shareholding $\tilde{k}^i := (\tilde{k}_1^i, \dots, \tilde{k}_j^i, \dots, \tilde{k}_J^i)$ into a new shareholding $k^i := (k_1^i, \dots, k_j^i, \dots, k_J^i)$. A goal for an individual as a consumer and a shareholder is to decide an optimal level of consumption and investment $(y^i, B^i, \tilde{e}^i)$ to maximize the utility implied by consumption bundle Q.

$$arg\,Max\left\{\begin{array}{l} Q(y_0^i, y_1^i, \ldots, y_s^i) \quad |p_0 y_0^i + B^i + \sum_{j\in J} k_j^i \tilde{e}^j \le p_0 \omega_0^i + \sum_{j=J}\left[\tilde{k}_j^i(\tilde{e}^j + D_0(1-\tau_p)\right], \\ p_s y_s^i \le p_s \omega_s^i + (1+r_s)B^i + \sum_{j\in J} k_j^i\left[(X_0^j + \frac{1}{1+r}X_s^j) + D_0(1+g)(1+\tilde{e}^j)(1-\tau_p)\right] \end{array}\right\} \tag{5}$$

In Eq. (5), a marginal rate of personal income tax on dividends is represented by maximizing personal utility. It is explicit that personal income tax on dividends is higher than on capital gains. There is an initial wealth budget constraint that limits what an individual can consume and invest in current or future periods, resulting in an output price and an equity price. A dividend paid to shareholders in the current period affects what people can consume and invest in the future. In a future time, the same constraint is a level of wealth, including interest and/or dividends received from what was invested in the current time. Given a transformation or a delayed consumption between current and future time periods, the two constraints in two periods act differently due to the operation activities which causes a wealth change. The following functions represent wealth levels for current and future periods.

$$\begin{aligned} W_0^i &= \sum_{j\in J} \tilde{k}_j^i(\tilde{e}^j + D_0^j(1-\tau_p)) - \sum_{j\in J} k_j^i\,\tilde{e}^j - B^i \\ W_s^i &= \sum_{j\in J} k_j^i\left[(1+r)X_0^j + X_s^j + D_0^j(1+g)(1+\tilde{e}^j)(1-\tau_p)\right] + (1+r_s)B^i \end{aligned} \tag{6}$$

It is the marginal rate of substitution that determines the willingness to reallocate amounts of consumption and investment to maximize the entire utility of an individual. When an individual changes their investment strategy, it is assumed that by a change in average proportional ownership instead of a specified change in ownership. It means changing investment preferences from the perspective of macro market scope. On the other hand, a manager's effort is part of his or her personal costs for utility maximization. The study adopts an effort function, recommended by Bhattacharyya (2003), as follows:

$$\frac{1}{2}ME^2 \tag{7}$$

where, let M be a constant parameter and E be an effort from the manager. It is explicit that the high effort is accompanied by high costs from managers.

Consequently, a manager, as an individual, has the maximization goal as follows in Eq. (8).

From the objective function, a manager decides on a long-term financing strategy including dividend policy, debt or equity financing strategy, and personal effort contribution. Therefore, a manager decides on a combination of variables $(D, B, \tilde{e}, E)$ for maximizing utility. In addition, labor law requires a minimum contractual wage for managers as part of constraints. The utility of the agent managers is achieved from salary after the deduction of effort costs.

$$Max\left[P(X_0 + \frac{1}{1+r}\frac{1}{1+\tilde{e}^j}X_1)\right] + \left\{(1-P)\left[D_0(1-\tau_P) + \frac{1}{1+r}D_0(1+g)(1+\tilde{e})(1-\tau_P)\right]\right\} - \frac{1}{2}ME^2 \tag{8}$$

4. RESULTS

From the perspective of information asymmetry and the agency problem, high distribution implies dependence on debt financing, which enhances monitoring power. The degree of agency problems, rather than the free cash flow generation of operations, determines the optimal level of compensation for managers. Given corporate governance and mechanism with a degree of asymmetric information and an agency problem, it is plausible that the optimal compensation contracted must be based on the free cash flow generation capacity of that two-period operation. It implies that an equilibrium of optimal compensation incorporates a trade-off between interactive effects from operational value and the agency problem.

$$MAX\left\{\begin{array}{l} W = \left\{P\left[p_0 y_0 + (1-T_B)B + (1-T_e)\tilde{e} - D_0 + \frac{1}{1+r}\frac{1}{1+\tilde{e}}\begin{bmatrix} p_s y_s - [1+r_s(1-\tau_B)]B \\ -D_0(1+g)(1+\tilde{e}) \end{bmatrix}\right]\right\} \\ +\left\{(1-P)\left[D_0(1-\tau_p) + \frac{1}{1+r}\frac{1}{1+\tilde{e}}D_0(1+g)(1-\tau_p)\right]\right\} - \frac{1}{2}ME^2 \end{array}\right\} \tag{9}$$

Proposition 1: It is mathematically derivatized that, with the first order's derivative of dividend and debt, respectively, a degree of the firm's agent problems can be implicitly derivatized as follows:

$$P = \frac{(1-\tau_p)[(1+g) + (1+r)(1+\tilde{e})]}{(1+g)\left[(1-\tau_p) + (1+\tilde{e})\right] + (1+r)(1+\tilde{e})(1-\tau_p+1) - p_s y_D'} \tag{10}$$

$$P = \frac{D_0(1+g)(1-\tau_p)}{(1+r)(1+\tilde{e})^2(1-T_e) - p_s y_s + (1+\tilde{e})p_s y_{\tilde{e}}' + D_0(1+g)(1-\tau_p)} \tag{11}$$

According to Eq. (10), a degree of asymmetry and agency problem represented by $(1-P)$ can be mathematically quantified as joint determinations of serial factors explicitly and implicitly, such as constant rate of dividend growth, personal income tax, equity financing, market return, output price. A marginal income tax has joint effects with a degree of agency problems through equity financing and dividend growth. It is plausible with a diversified ownership structure, a high degree of agency problem due to lack of large shareholding. If the transaction cost of equity issuing increases, with a decreased proportion of equity financing agency problem, implicitly declines. It is contradictory to the cash flow hypothesis that a large equity financing benefits the "pet projects" of executives. As a theoretical result, a tax shield of debt financing is not explicitly presented in the equation of the degree of agency problems. From the equilibrium, it is an executive's decision given all the variables excluding the tax shielding effect. However, tax shield affects the relative scale of optimal equity and debt financing.

Proposition 2: Holding the market rate of return and output price to be constant, the profile of executive effort demonstrates a concave shape given a certain degree of asymmetry information and equity financing.

$$E^* = \frac{P p_s y_E'}{M(1+r)(1+\tilde{e})} \tag{12}$$

It defines a function for efficiency as E and executives' effort is incorporated in the function.

A salary basis contracted requires effort to be a positive variable. A variation in the effort is due to a degree of agency problem and asymmetric information. However, an agency (executive) will contribute zero effort if the basic salary is less than the reservation wage $\widetilde{w}_R$ required. Zero efforts will be not sustainable because a loss does not satisfy required dividend payments. There is a possibility that equity issuing and degrees of agent problems hold a significant relationship as in Proposition 1 $(\Delta\tilde{e} > 0, \Delta P < 0)$, it obscures that the impacts on the efforts will be inconclusive due to an unclear net effect from nominator (P) and denominator ($\tilde{e}$), which can be positive or negative. For a call of a better understanding about the efforts of agents, it is assumed that the price of output ($p = 1$), the market rate of return ($r = 0.8$), and the parameter of effort ($M = 2$), are held constant.

Proposition 3: Marginal rate of substitution $(\frac{Q_{y_0}'}{Q_{y_s}'} = \frac{(1+r)p_0}{p_s} = MRS)$, investment strategy measured by an initial average proportion of equity investment and a newly adjusted average proportion of equity investment $\bar{k}$, and personal income tax are key determinants for an optimal dividend policy. From the perspective of shareholders, consumption budgets are conditions for utility maximization where a Lagrange equation with budget constraints covers current and future periods.

$$L(y_0, y_s, B, \tilde{e}, \lambda_1, \lambda_2) = Q(y_0, y_s) - \left\{ \begin{array}{l} \lambda_1 \left[p_0 y_0 + B + \sum k_j^i \tilde{e}^j - p_0 w_0 - \sum \tilde{k}_j^i (\tilde{e}^j + D_0(1-\tau_p)) \right] \\ +\lambda_2 \left[p_s y_s - p_s w_s - (1+r_s)B - \sum k_j^i \left[\begin{array}{l} (x_0^j + \frac{1}{1+r} x_s^j) \\ +D_0(1+g)(1+\tilde{e})(1-\tau_p) \end{array} \right] \right] \end{array} \right\} \tag{13}$$

For generality, the study assumes portfolio investment with variations in the average proportion of investment in firms by letting the original average proportion in each firm j as $\bar{\tilde{k}}$ and the new average proportion in each firm as $\bar{k}$. It implies that the optimal dividend for shareholders is theoretically relevant to their investment preference.

$$D_0^* = \frac{(1+r)(\bar{k}-\bar{\tilde{k}})}{\bar{k}(1+g)(1-\tau_p)} \quad \text{or} \quad D_0^* = (\frac{p_0}{p_s} MRS)(1 - \frac{\bar{\tilde{k}}}{\bar{k}}) \frac{1}{(1+g)(1-\tau_p)} \tag{14}$$

On the right side of Eq. (14), a marginal rate of substitution and the investment preference change possess determination power on an optimal dividend policy for shareholders.

Optimal dividend distribution is positively correlated to the investment preference of investors, which can be caused by changes in risk aversion. For achieving optimal capital structure, market rates of return and output prices impact the decisions of dividend distribution. There are three factors relative to debt that influences an optimal level of equity. These three factors are the marginal output of debt financing, the transaction cost of issuing debt, and the tax shield effect from debt.

The result suggests a lower scale of optimal equity financing when a high tax shield and a high level of marginal output are presented. In addition, it implies that a high transaction cost T_B of debt financing encourages a firm to rely more on equity issuing instead of debt financing. Furthermore, it results that there is no contradiction between a firm and the agent in terms of the equity financing policy. Nevertheless, it is worth reminding that a high level of equity financing further diversifies

ownership concentration and results in a high degree of asymmetry information and agent problems.

Proposition 4: If there is no or less of an agent problem, $V_D' < 0$ and $D^* = 0$, with a dividend increase, the marginal value of the firm will be decreasing and the optimal level of the dividend distribution for the firm equals zero. With the assumption of perfect mechanisms, because of a negative sign of marginal output in the following Eq. (15), the marginal value of the firm shows a negative sign:

$$y_D' = \frac{-\delta}{\theta + p_0 \delta \, ln(\theta) + (1 - T_B)B + (1 - T_e)\tilde{e} - D} \tag{15}$$

where, with a positive cash flow in the denominator and a negative sign in the numerator, a high dividend distribution is negatively related to the marginal output of the firm. It results that a marginal corporate value is as follows:

$$V_D' = \frac{1}{1+r}\frac{1}{1+\tilde{e}}(p_s y_D') \tag{16}$$

5. DISCUSSION

The relationship between dividend policy, asymmetric information, agency problems, and investment decisions is intricate and interconnected. Each factor influences the others and ultimately shapes a company's approach to dividend distribution. Asymmetric information plays a significant role in dividend policy. When companies possess private information about their prospects, they face a dilemma in determining the appropriate dividend amount. If positive insider information exists, a company may choose to increase dividend payouts to signal its confidence to shareholders. Conversely, if negative information is present, the company may opt to reduce or eliminate dividends to avoid sending a negative signal. The presence of asymmetric information can create uncertainty for shareholders, impacting their valuation and investment decisions.

Agency problems arise due to conflicts of interest between managers and shareholders. Managers may have different objectives and incentives than shareholders, leading to suboptimal dividend policies. In some cases, managers may prioritize retaining earnings for personal benefits or for investing in projects that maximize their own interests rather than shareholder wealth. These agency problems can result in a divergence between what shareholders expect in terms of dividends and what management decides to distribute. Implementing mechanisms such as performance-based incentives, effective monitoring systems, and strong corporate governance practices can help align the interests of managers and shareholders and mitigate agency costs.

Investment decisions also play a crucial role in dividend policy determination. Companies with profitable investment opportunities may choose to retain earnings rather than distribute them as dividends. By reinvesting earnings, companies aim to generate higher returns and enhance shareholder value in the long run. This approach aligns with the notion that firms should prioritize internal investment to generate growth. On the other hand, companies with limited investment opportunities or excess cash reserves may opt to distribute more dividends to shareholders. The availability of external financing options, such as debt or equity markets, can also influence investment decisions and subsequent dividend policies.

The relationship between these factors is complex and dynamic. Asymmetric information can create challenges in determining the appropriate dividend amount, while agency problems can result in dividend policies that do not align with shareholder expectations. Investment decisions impact dividend policies by determining the availability of funds for distribution and the company's growth prospects. Moreover, the interplay between these factors can also affect the overall financial health and capital structure of the firm.

Understanding and managing these relationships is crucial for companies to strike the right balance in their dividend policies. Effective communication and transparency can help mitigate the impact of asymmetric information on dividend decisions. Implementing strong corporate governance mechanisms can align the interests of managers and shareholders, reducing agency costs. Additionally, careful evaluation of investment opportunities and their potential impact on cash flow can guide companies in determining an appropriate dividend policy that maximizes shareholder value while supporting future growth.

There are two incentive constraints that have been derived from the optimization process. The first is a constraint for the utility maximization problem for executives that takes agency problems and information asymmetry into account. As a result, a debt policy is not theoretically presented in executive incentive constraints, which is most likely since high debt financing implies low equity financing. Because fewer shares were issued, a dilution effect was avoided, resulting in a higher level of monitoring due to the retained concentrated ownership structure. Furthermore, the mathematical results imply a theoretical understanding that the issuing of new equity and the distribution of dividends signal a significant role in the utility maximization of executives. Equity's issuing of change affects the degree of asymmetry, and executives' efforts adjust accordingly. It is true that debt financing enhances the monitoring power over the performance of executives and causes financial stress and stringent scrutiny. With an increase in debt financing, the need for equity financing is less demanding. A small scale of equity financing remains, monitoring power through concentrated ownership. Although it demonstrated a double safe from high debt financing and low ownership dilution, a new level of agency problem can be forged when executives adjust their efforts and

influence dividend policies. High efforts result in high productivity and, therefore, high profitability. With high profitability and low dividend distribution, debt or equity financing are less necessary. Consequently, the initial agency problem is coming back into the cycle. A second constraint is cash flows, which flow into the hands of individuals in an economy as salary compensation and dividend distribution, determining how the utility is maximized over current and future periods, given factors, such as a marginal rate of substitution, investment strategy, and personal income tax.

6. CONCLUSION

From theoretical mathematical deduction, a new key factor, which is the marginal output of equity, was discovered. When the tax shield from debt is low or the transaction cost from debt is high, the marginal output of equity is high. Nevertheless, a high level of equity is not always preferred by firms. The actual high cash flow received from issuing equity after the deduction of transaction costs reduces the marginal output of the equity. If the factors of transaction costs and tax shields favor equity issuing by increasing marginal output, equity issuing is not always favored at a high level because increasing the level of equity also means decreasing the rate of marginal output.

A theoretical result has been reached with the optimal equilibrium of different agencies and diverse approaches to financing. A group of shareholders pursuing a profitable investment opportunity is deciding on an allocation strategy for wealth among the current and future. An indicator measuring the change in firm investment is mathematically significant to both investment and consumption decisions. Investment decisions affect a firm's cost of capital as well as its value, according to the discounted free-cash-flow method. Furthermore, consumption decisions affect a firm's profitability, which affects the firm's value. It is a theoretical cycle demonstrated in which a combination of consumption and investment decisions determines how capital flows into a firm. If it flows in as sales from consumption, it generates revenue, so indirectly, the value will be increasing. If, on the other hand, it comes in as an investment, it is a source of capital, and the rate of return required to receive it in the future determines the firm's value. The required rate of return for future revival is a measure of willingness to postpone consumption or the marginal rate of substitution between current and future periods. In such a context, a combination of current and future consumptions and investments is a decision to maximize the utility of individuals acting as both consumers and shareholders.

In addition, both corporate income tax and personal income tax play a significant role. Tax savings favor debt financing over equity financing from the perspective of corporations. On the other hand, a marginal personal income tax influences an individual's decision to consume or invest in the current or future period. As theoretically approved by the study, it is evident that marginal personal income tax does have a negative impact on the optimal dividend policy, in which both firms' and shareholders' optimal level of dividend payment is lower if marginal rates of personal income tax are high. In addition, a firm starts with a low current dividend if a distribution policy promises a high growth rate of dividends in the future. It is understandable that, to please shareholders, it is plausible to assume that the company is willing to maintain a constant, increased rate of dividend change rather than set up a high current dividend distribution with a decreased rate of growth. It is not sustainable to promise a high level of growth in the rate of future dividends. The study aimed to pursue an optimal dividend equilibrium by constructing a two-period model incorporating a combination of factors, including the matter for consideration, a long-term financial strategy or capital structure of the firm, a promised constant rate of dividend growth, the market rate of return, a corporate tax shield, a marginal rate of personal income tax, and a marginal rate of substitution between today and future consumption. It implies that all six measurement factors must be integrated to arrive at a conclusive mathematical level of optimal dividend level.

There are certain limitations regarding the study. Conducting empirical research on dividend policy requires access to financial data from various companies. However, obtaining comprehensive and accurate dividend data for a large sample can be challenging. The dynamics of financial markets and investor preferences can change over time, impacting the relevance of certain dividend policies. It is recommended for future perspective that Integrating behavioral finance theories into the study of dividend policy could shed light on how cognitive biases influence dividend decisions and investor perceptions.

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