Market Risk-Adjusted Dividend Policy and Price-to-Book Ratio

Tarek Ibrahim Eldomiaty

Professor of Finance

British University in Egypt

Faculty of Business Administration, Economics and Political Science

PO Box – 43 - 11837

Cairo

EGYPT

(Tel: +202 2687-5892/3)

(Fax: +202 26875889 / 97)

E-mail: tarek.eldomiaty@bue.edu.eg

Dec 2011

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Abstract

This paper offers a new mathematical formulation that addresses the relationship between expected price-to-book ratio, dividend per share, dividend payout ratio, systematic and unsystematic risks. The sample includes the non-financial firms in the DJIA covering the period 1997-2006. The general results show that expected price-to-book ratio is: (1) positively associated with squared current stock price, (2) negatively associated with squared expected book value per share; squared unsystematic risk-adjusted dividend per share; squared systematic and unsystematic dividend payout ratio (e.g., negative signaling). The paper contributes to the current literature in two ways. First, systematic and unsystematic risks are to be considered when deciding on the dividend per share and dividend payout ratio. Second, the relationship between expected price-to-book ratio and the risk-adjusted dividends per share and dividend payout ratio is intrinsically nonlinear, which is not addressed in the relevant literature.

JEL classification: G32, G35

Key Words: Dividend Signaling Hypotheses, Systematic Risk, Unsystematic Risk, Price-to-Book Ratio, DJIA

Introduction

The advances in the literature of corporate finance have raised the necessity to further examine two issues. First, what are the impacts of different types of risks on the financial decisions? Second, what are the impacts of corporate financial decisions on the market? This paper develops a mathematical formulation that integrates the basic components of a dividends policy (dividends per share and dividends payout ratio) and shareholder value. This integration includes also the impacts of systematic and unsystematic risks on shareholder value.

Shareholders' reaction towards dividends has been subject to an on-going research. The literature cites mixed results: positive and negative effects on stock returns. These effects are known in the literature as "Dividends Signaling Hypotheses." This paper examines the effects of dividends per share and dividends payout ratios on price-to-book ratio (being used as a proxy for the shareholder value). The paper adopts the risk-return approach which is a new approach suggested by the author for testing the dividend signaling hypothesis.

The return part considers the two elements of a dividend policy: dividend per share and dividend payout ratio. The risk part considers the systematic and unsystematic risk.

Concerning the return part, the Dividend Yield (DY) ratio is employed to come up with a relationship between dividends and shareholder value. The mathematical derivation is described in part II. The risk part considers the use of dividend yield as a suggested method for the calculation of systematic and unsystematic risk in addition to the conventional approach that uses the stock returns.

Objectives of the Study

This paper aims at examining the objectives that follow.

1. Examine the effects of the dividends per share on price-to-book ratio.
2. Examine the effects of the dividend payout ratio on the price-to-book ratio.
3. Examine the effects of systematic risk-adjusted dividends on price-to-book ratio.
4. Examine the effects of unsystematic risk-adjusted dividends on price-to-book ratio.

5. Examine the most important factors (among the above mentioned factors) that can be used to improve price-to-book ratio.

Contribution of the Study

This study contributes to the current literature as follows.

1- The study offers a mathematical formulation that adjusts dividends according to the systematic as well as the unsystematic risks.
2- The study offers an integrated model that recognizes both dividends and risk-adjusted dividends.
3- The study offers a mathematical formulation that links risk-adjusted dividends to price-to-book ratio which is used in the literature as one proxy for shareholder value.

The paper is organized as follows. Section I discusses the theoretical background of dividends decisions. Section II discusses the elements of the methodology such as a mathematical formulation that integrates expected price-to-book ratio, dividends per share, dividends payout ratio, systematic risk and unsystematic risk. Section II includes also the development of research hypotheses and model estimation. Section III reports and discusses the results. Section IV concludes.

Corporate Dividend Policy: Theoretical Background

Explaining dividend policy has been one of the most difficult challenges facing financial economists. For long time this topic has been studied without being understood completely, there is still the unsolved question which factors influence the dividend policy and how are those factors interacting. Black (1976) states that: “The harder we look at the dividend picture, the more it seems like a puzzle, with pieces that just don’t fit together”. The situation is almost the same today. Allen and Michaely (1995) concluded that “much more empirical and theoretical research on the subject of dividends is required before a consensus can be reached”.

The first empirical study of dividend policy was provided by Lintner (1956), who surveyed corporate managers to understand how they arrived at the dividend policy.

He concluded that managers usually have reasonably definitive target payout ratios. Miller and Modigliani (1961) prove under conditions of perfect capital markets, that Firm's value is independent of its dividend policy. Unfortunately markets are not perfect and previous studies suggest that the dividend policy continues to affect the value of common shares as suggested by dividend discount model.

Dividend Signalling: The Effect of Information Asymmetry

The dividend discount model was very proactive starting point to the extent that series of research papers examined many aspects of the relationship between dividends and stock prices. Consequently, a theory of information asymmetry has been developed and progressed that provides generic explanation of the mutual effects between changes in prices and changes in dividends. The literature on information asymmetry, its effects and applications were nobelized due to the works of George A. Akerlof (1970), Andrew M. Spence (1973, 1974) and Joseph E. Stiglitz (1981) and Greenwald and Stiglitz (1986).

In the context of corporate finance, it is widely accepted that firm's managers have more information regarding the future performance of the firm than its shareholders do. Watts (1973) propose that management may use dividends to convey information to the market and shareholders. Thus, dividend payments decrease the firm's information asymmetries. Bhattacharyya (1979) argues that managers have insider information about the distribution of the paper cash flow and therefore can, signal this knowledge to the market through their choice of dividends. Bhattacharyya concludes that the better the news, the higher are the dividends. Bhattacharyya (1979) argues that some investors need periodic cash income from their investments. For such investors, the alternatives include receiving periodic dividends or selling small portions of their investments. However, selling securities incurs transaction costs. For some investors it may be more cost efficient to have management pay dividends to generate income instead of shareholders generating their own income by periodically selling small portions of their holdings.

Significant research in signalling paradigm of dividend policy is presented by Miller and Rock (1985), John and Williams (1985), Ambarish *et al.* (1987), and Williams (1988). These signalling models typically characterize the informational asymmetry by bestowing the manager or the insider with information about some aspects of the future cash flow. The equilibrium in these models shows that the higher the expected cash flow the higher is the dividend. Bar-Yosef and Venezia (1991) came up with a rational equilibrium expectation model. It states that Bayesian investors expect that dividends will be proportional to cash flows because managers have advance information about the future cash flow. Thus, investors update their belief about the cash flow. Brennan and Thakor (1990) focus on new questions in this topic assuming that there are two classes of shareholders - informed and uninformed. They show that in a tender offer the uninformed shareholder always tenders, whereas the informed holds onto his/her shares. The situation is reversed in an open market operation, where the informed shareholder always sells his/her holding and the uninformed never does.

Benartzi et al., (1997) show that a firm's stock price changes with changes in its dividend policy. Yet, the factors that affect this relation continue to be topics of debate and academic research. The propositions that are attempting to explain the dividend policy include arguments suggesting that (1) the dividend policy serves as a signal of future earnings growth, (2) investors feel that cash in hand is superior to an unrealized capital gain, (3) investors value dividends when the alternative ways to distribute money to shareholders are more costly, and (4) as a way to decrease the potential waste of resources by management. The issues of dividend policy have been examined as well. Fama and French (2001) argue that transaction costs have decreased over time. Therefore, the desirability for dividends may have decreased as some investors are now creating their own homemade dividend. Bhattacharyya (2000, 2007) state that research on the effects of dividends still puzzling.

Dividend Payouts and "Signaling Effect"

Early literature (Graham and Dodd 1951; Durrand 1955) focuses on how the dividend payout ratio affects common stock prices. It concludes that firms can affect the market value of their common stock by changing their dividend policy. Subsequent studies reveal that the relationship between dividends and stock prices is enormously complex and inconclusive. By isolating the impact on systematic risk, conclusions about how firm value is affected by dividend policy in the absence of other mitigating factors, can be drawn. Several empirical studies have focused on how dividend policy affects stock price volatility and the firm's level of systematic risk. A negative relationship is found between payout ratios and firms' betas in studies by Beaver, et al. (1970) and Ben-Zion and Shalit (1975). The thinking behind this theory stems from how variances in dividends affect the timing of an asset's cash flows. Dyl and Hoffmeister (1986) argue that dividend policy affects security duration and, ultimately, the riskiness of the underlying stock.[1] A high dividend paying stock has a shorter duration because of more near-term cash flow. The earlier one receives payment, the less susceptible is the value of a capital asset to changes in the discount factor. With the dividend in hand, investors are subject to less interest rate risk, thus reduced level of systematic risk. All other things being equal, the reduced level of systematic risk will influence the firm's cost of capital and, eventually, the firm's stock price (Gordon, 1959).

The practice of dividends payout is examined by Brav, et al., (2005) who surveyed and interviewed 384 financial executives to determine why they pay dividends. The results of their survey indicate the predictable reasons that include avoidance of negative consequences, signaling, common stock valuation, making the firm less risky. Nevertheless, no quantifiable reason is given for how or why the firm becomes less risky even though financial executives continue to site it as a reason for paying dividends.

The study of Carter and Schmidt (2008) fills this gap in the literature and addresses the concerns raised by Dyl and Hoffmeister (1986) by providing a mathematical model illustrating the relationship between dividend yield and systematic risk. A significant inverse relationship between a firm's dividend yield and the corresponding level of systematic risk has been found. This confirms that a firm's dividend yield should be considered as a determining factor in the assessment of a firm's level of systematic risk. Moreover, individual firms may be able to affect the risk level of their common stock by altering their dividend policy. In so doing, firms may be able to realize the benefits of a lower cost of

[1] Duration, as demonstrated by Macaulay (1938), is the elasticity of the value of a capital asset with respect to changes in the discount factor. It is calculated as the weighted average of the length of time needed to recover the current cost of the asset.

capital and broader access to long term capital markets. At this point, their model is not robust with regard to signaling effects. This offers a chance for further research on the signaling issue.

Fama and French (2001) document changes in managerial behavior towards dividends over the past 25 years. They find that firms that pay dividends usually have specific characteristics that distinguish them from other firms. Once they control for these characteristics, they find that firms that posses them have a declining propensity to pay dividends. Furthermore, they report that these characteristics are becoming less common in firms who are now listing on stock exchanges. DeAngelo, et al., (2004) consider the same time period that is examined by Fama and French (2001) and find that the total payout of dividends in real dollars has actually increased. This leads to the conclusion that fewer firms are paying dividends, but those who do pay dividends are actually paying larger amounts. In addition, DeAngelo, et al., (2000) consider the role of special dividends in the payout policies. They observe that the use of special dividends as a way to distribute earnings has been declining. They hypothesize that share repurchases may have replaced special dividends as a method of returning money to shareholders when the firm does not want to commit to a higher dividend level. However, they conclude that special dividends are used less often because they served as a substitute to regular dividends. Allen and Michaely (2003) provide an extensive review of the payout policies of corporations including both share repurchases and dividend payments. They suggest that, historically, dividends have been the most important form of payout but share repurchases are becoming a more important part of a firm's payout policy. For example the average dividend and share repurchases payouts (payout is defined as dividends paid or expenditure on repurchases divided by the firm's earnings) in the 1970s were 38% and 3% respectively. In the 1980s the average dividend payout increased to 58% while the average share repurchase payout increased 9 times to 27%. In addition, corporations smooth dividends relative to earnings, which is not surprising as Lintner (1956) came to the same conclusion. Lintner found that management sets the dividend policy first, and then adjusts other policies as needed. For example, if a firm was undertaking a large investment that requires more cash than was available, management would not consider cutting the dividend but would instead look for other sources of capital. The market reacts positively to firms that either increase their dividends or initiate a share repurchase. In contrast, the market reacts negatively to a firm that decreases its payout policy.

Methodology and Data

The methodology is designed to examine the effects of the two components of a dividend policy (dividend per share and dividends payout ratio) on the expected Price-to-Book ratio. The latter is used in this paper as a proxy for shareholder value. As indicated earlier, the main objective is to design a dividend policy that takes into account systematic and unsystematic risks. The methodology is outlined in figure 1 that follows.

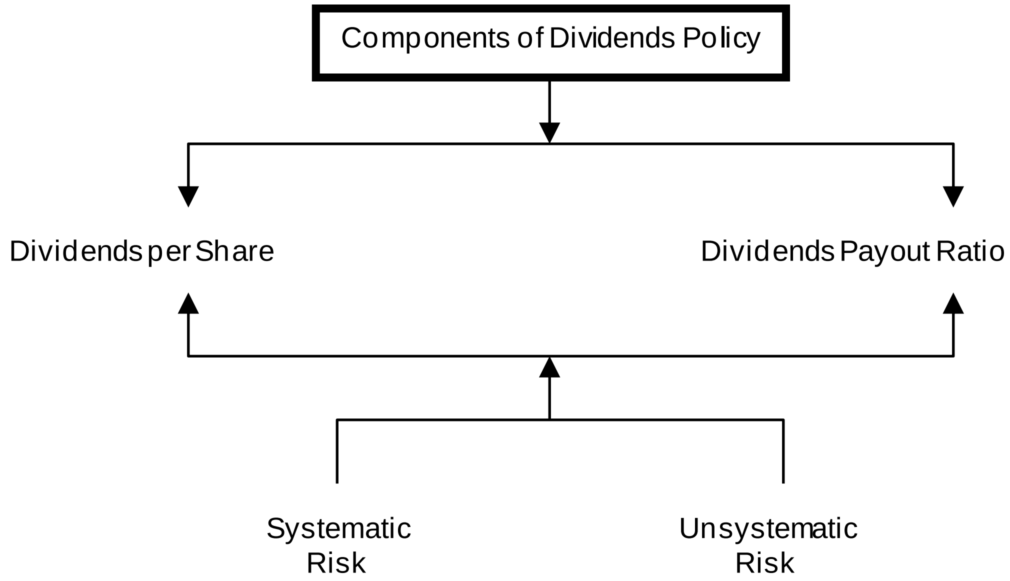

Figure 1: Components of Risk-Adjusted Dividend Policy

Figure 1 indicates that the design of risk-adjusted dividend policy requires the examination of dividends per share and dividends payout ratio that take into account systematic and unsystematic risks. This paper suggests an extended new approach that is based on using dividends yield for the calculation of both types of risks. This is not to replace the stock returns rather is to examine what type of information (stock returns and/or dividends yield) to be employed when designing a risk-adjusted dividends per share and dividends payout ratio. The data include the non-financial firms listed in the Dow Jones Industrial Average (DJIA). The data covers the years 1997-2006. The data are obtained from the Reuters© finance center.

Approaches for Calculating Systematic and Unsystematic Risks

The conventional approach for calculating stocks' risks (systematic and unsystematic) depends on the use of stock returns which account for mainly changes in stock prices. In this paper, the systematic and unsystematic risks are estimated as follows (Ben-Horim and Levy, 1980; Bohren, 1997).

$$\text{Systematic Risk} = \beta \times \sigma_M \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots(1)$$

$$\text{Unsystematic Risk } \beta' = \sigma_j \text{ - Systematic Risk} \ldots\ldots\ldots\ldots\ldots\ldots(2)$$

The total market risks (beta) are calculated as follows.

$$\beta = \frac{COV(R_j, R_M)}{\sigma_M^2} \ldots\ldots\ldots\ldots(3)$$

Where the return is calculated as the natural logarithm of changes in stock prices as follows $R_t = \ln\left(\frac{P_t}{P_{t-1}}\right)$

How is the link between Dividends and Price-to-Book ratio Value Developed?

The Dividend Yield $DY_t = \frac{D_t}{P_t}$ is used to derive a simple mathematical formulation that can be used to examine the effects of Dividends per Share (DPS) and Dividend Payout Ratio (DPR) on price-to-book ratio (being a proxy for shareholder value). The formulation is based on transforming the conventional Dividend Yield ratio into 'Risk-based Dividend Yield.' The abbreviations and definitions of the variables used in the mathematical formulation are summarized in the table that follows.

Abbreviation	Definition
DY_{t+1}	Expected Dividend Yield
DY_t	Current Dividend Yield
DPS_t	Current Dividends per Share
DPS_{t+1}	Expected Dividends per Share
DPR_t	Current Dividends Payout Ratio

DPR_{t+1}	Expected Dividends Payout Ratio
P_t	Current Stock Price
CV	Coefficient of Variation
B_{t+1}	Expected Book Value per Share
σ	Standard Deviation
ψ_{DPS}	Average dividends per share
ψ_{DPR}	Average dividend payout ratio
ψ_{SR}	Average stock returns
β	Systematic component of stock's risk
β'	Unsystematic component of stock's risk
S	Small-size firms (Dummy)
M	Medium-size firms (Dummy)
L	Large-size firms (Dummy)
T	Time (Dummy)

The idea of the model suggests a risk-adjusted dividend yield that corporate managers can use to develop a risk-based dividend policy. The latter includes the effects of systematic and unsystematic risk. This idea requires that dividend yield is to increase according to the 'coefficient of variation' $\left(\frac{\sigma_j}{\overline{R}_i}\right)$. The latter combines the advantage of addressing the risk-return relationship and the advantage of dividing the total risk (standard deviation) into systematic and unsystematic risks. In this sense, the risk-adjusted dividend yield would add value to shareholders. The development of the model is as follows.

$$DY_{t+1} = DY_t(1 + CV_t)$$

$$\frac{DPS_{t+1}}{P_{t+1}} = \frac{DPS_t}{P_t}(1 + CV_t)$$

Multiplying both sides by B_{t+1}

$$\frac{B_{t+1}\ DPS_{t+1}}{P_{t+1}} = \frac{B_{t+1}}{P_t} DPS_t\left(1 + CV_t\right)$$

$$\frac{P_{t+1}}{B_{t+1}\ DPS_{t+1}} = \frac{P_t}{B_{t+1}\ DPS_t\left(1 + CV_t\right)}$$

$$\frac{P_{t+1}}{B_{t+1}} = \frac{P_t\ DPS_{t+1}}{B_{t+1}\ DPS_t\left(1 + CV_t\right)}$$

$$\frac{P_{t+1}}{B_{t+1}} = \frac{P_t}{B_{t+1}} \times \frac{DPS_{t+1}}{DPS_t\left(1 + CV_t\right)} \text{..............................(5)}$$

Equation (5) addresses the relationship between (DPS) and expected shareholder value $\frac{P_{t+1}}{B_{t+1}}$. In order to address the relationship between (DPR) and expected shareholder value, the right-hand side of equation (5) is to be multiplied by $\frac{EPS_{t+1}}{EPS_{t+1}}$ as follows.

$$\frac{P_{t+1}}{B_{t+1}} = \frac{P_t}{B_{t+1}} \times DPR_{t+1} \times \frac{EPS_{t+1}}{DPS_t\left(1 + CV_t\right)}$$

It is also required that the denominator of the last term at the right-hand side to be multiplied by $\frac{EPS_t}{EPS_t}$ in order to convert the DPS_t into DPR as follows.

$$\frac{P_{t+1}}{B_{t+1}} = \frac{P_t}{B_{t+1}} \times DPR_{t+1} \times \frac{EPS_{t+1}}{DPS_t\left(1 + CV_t\right)\frac{EPS_t}{EPS_t}}$$

$$\frac{P_{t+1}}{B_{t+1}} = \frac{P_t}{B_{t+1}} \times DPR_{t+1} \times \frac{EPS_{t+1}}{EPS_t} \times \frac{1}{DPR_t\left(1 + CV_t\right)}$$

$$\frac{P_{t+1}}{B_{t+1}} = \frac{P_t}{EPS_t} \times DPR_{t+1} \times \frac{EPS_{t+1}}{B_{t+1}} \times \frac{1}{DPR_t\left(1 + CV_t\right)}$$

$$\frac{P_{t+1}}{B_{t+1}} = \frac{PE_t \times ROE_{t+1} \times DPR_{t+1}}{DPR_t\left(1 + CV_t\right)} \text{.........................(6)}$$

In equation (5), DPS_{t+1} represents the expected dividends. The term $DPS_t\left(1 + CV_t\right)$ represents the risk-adjusted dividends based on a coefficient of variation (CV). This term $DPS_t\left(1 + CV_t\right)$ is calculated assuming two types of risks. The first type is a stock return-based systematic and unsystematic risk. The second type is a dividend yield-based systematic and unsystematic risk. The objective is to examine the significance of the expected dividends DPS_{t+1} and the risk-adjusted dividends $DPS_t(1+CV_t)$. The latter term is solved as follows taking into account that the total risk of a stock (σ) is divided into its two main components: systematic risk (β) and unsystematic risk (β').

$$\text{Risk - adjusted Dividends} = DPS_t\left(1+\frac{\sigma}{\psi}\right)$$

$$\text{Risk - adjusted Dividends} = DPS_t\left(1+\frac{\beta}{\psi}+\frac{\beta'}{\psi}\right)$$

$$\text{Risk - adjusted Dividends} = DPS_t + \left(DPS_t\,\frac{\beta}{\psi}\right)+\left(DPS_t\,\frac{\beta'}{\psi}\right)$$

The term $DPS_t + \left(DPS_t\,\frac{\beta}{\psi}\right)$ represents the systematic risk-adjusted dividend per share and the term $DPS_t + \left(DPS_t\,\frac{\beta'}{\psi}\right)$ represents the unsystematic risk-adjusted dividend per share. Equation (5) is re-written as follows.

$$PB_{t+1} = \frac{P_t}{B_{t+1}} \times \frac{DPS_{t+1}}{DPS_t + \left(DPS_t\,\frac{\beta}{\psi_{DPS}}\right)+\left(DPS_t\,\frac{\beta'}{\psi_{DPS}}\right)} \text{..................}(7)$$

Where $\frac{\beta}{\psi}$ = systematic coefficient of variation and $\frac{\beta'}{\psi}$ = Unsystematic coefficient of variation.

Equation (6) is also re-written in terms of systematic and unsystematic risks as follows

$$PB_{t+1} = \frac{PE_t \times ROE_{t+1} \times DPR_{t+1}}{DPR_t + \left(DPR_t\,\frac{\beta}{\psi_{DPR}}\right)+\left(DPR_t\,\frac{\beta'}{\psi_{DPR}}\right)} \text{...................}(8)$$

Research Hypotheses

In terms of dividend per share, two hypotheses are developed as follows.

H_1: "A positive relationship exists between expected dividend per share and expected price-to-book ratio."

H_2: "A negative relationship exists between systematic and unsystematic risk-adjusted dividend per share and expected price-to-book ratio."

In terms of dividends payout ratios, another three hypotheses are developed as follows.

H_3: "A positive relationship exists between expected price-to-book ratio and the product of expected dividend payout ratio, expected return on equity and current price-earnings ratio."

H_4: "A negative relationship exists between systematic and unsystematic risk-adjusted dividend payout ratio and expected price-to-book ratio."

Model Estimation

Since the data are cross section-time series panel, the Hausman specification test (Hausman, 1978; Hausman and Taylor, 1981) is required to determine whether the fixed or random effects model should be used. The test looks for the correlation between the observed x_{it} and the unobserved λ_k, thus is run under the hypotheses that follow.

$$H_0 : \text{cov}(x_{it}, \lambda_k) = 0$$
$$H_1 : \text{cov}(x_{it}, \lambda_k) \neq 0$$

Where x_{it} = regressors, and λ_k =error term.

The results of the test show that the coefficient of λ_k is significant at 1% level. Therefore, the random effect model is relevant and appropriate. The issue of linearity versus nonlinearity is addressed and examined as well. Regression Equation Specification Error Test, RESET (Ramsey, 1969; Thursby and Schmidt, 1977; Thursby, 1979; Sapra, 2005; Wooldridge, 2006) is employed to test the two hypotheses that follow.

$$H_0 : \hat{\gamma}^2, \hat{\gamma}^3 = 0$$
$$H_1 : \hat{\gamma}^2, \hat{\gamma}^3 \neq 0$$

The null hypothesis refers to linearity and the alternative refers to nonlinearity. The results of the F test $(\alpha = 5\%)$ show that the F statistic is greater than the critical value leading to the rejection of the null hypothesis, thus a nonlinear model is appropriate.[2] The estimating equation of the random effect nonlinear model takes the form of Least Squares Dummy Variables (LSDV) that follows.

$$\mathbf{y}_{tk} = \alpha_k + \sum_{i=1}^{k} \beta_{ik} \mathbf{X}_{itk}^2 + \lambda_k + \upsilon_{tk}$$

Where t = 1, …..,n

k = number of firms in each group.

$\mathbf{y}_{tk}$ = Expected Price-to-Book ratio.

$\mathbf{X}_{itk}$ = Intrinsic components of equations 3 and 4 in addition to the dummies for the size effect (firm-specific) and time.

λ_k = Random error term due to the individual effect.

υ_{tk} = Random error.

Equation 7 is structured and examined as follows.

$$PB_{t+1} = \alpha + P_t^2 + B_{t+1}^2 + DPS_{t+1}^2 + \left[DPS_t \left(\frac{\beta}{\psi} \right) \right]^2 + S + M + L + T \ldots\ldots\ldots\ldots\ldots (9)$$

$$PB_{t+1} = \alpha + P_t^2 + B_{t+1}^2 + DPS_{t+1}^2 + \left[DPS_t \left(\frac{\beta'}{\psi} \right) \right]^2 + S + M + L + T \ldots\ldots\ldots\ldots\ldots (10)$$

Equation 8 is structured and examined as follows.

$$PB_{t+1} = \alpha + PE_t^2 + ROE_{t+1}^2 + DPR_{t+1}^2 + \left[DPR_t \left(\frac{\beta}{\psi} \right) \right]^2 + S + M + L + T \ldots\ldots\ldots\ldots\ldots (11)$$

$$PB_{t+1} = \alpha + PE_t^2 + ROE_{t+1}^2 + DPR_{t+1}^2 + \left[DPR_t \left(\frac{\beta'}{\psi} \right) \right]^2 + S + M + L + T \ldots\ldots\ldots\ldots\ldots (12)$$

The General Method of Moments (GMM) is recommended in the literature of econometrics due to its superiority to the OLS and GLS in cases of α is distributed randomly across the panel (Sargan, 1958; Newey, 1985; Ogaki, 1992; Greene, 2000; Hayashi, 2000; Chay and Powell, 2001; Baum, et al., 2003; Altonji, et al., 2005; Kleibergen, 2005; Lee, 2007).

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[2] $F-\text{statistic} = \frac{(SSE_R - SSE_U) \div J}{SSE_U \div (T - K)}$ where SSE_R and SSE_U are the sum squared errors for the restricted and unrestricted models respectively, J refers to the two hypotheses under consideration, T is the number of observations, and K is the number of regressors.

The *J* test (denoted to Hansen's *J*) is used for testing the 'overidentifying restrictions.'[3] (Davidson and MacKinnon, 1981, 1993; Hansen, 1982; Hansen et al., 1996; Baum et al., 2007). The value *J* of the GMM objective function evaluated at the efficient GMM estimator is distributed as χ^2 with (*L*-*K*) degrees of freedom under the null hypothesis that the full set of orthogonality conditions are valid.

Results and Discussion

This section shows the results of the four regression runs for equations 7 and 8. This section is divided into two parts. Part 1 reports and discusses the effects of dividends per share on price-to-book ratio. Part 2 reports and discusses the effects of dividends payout ratio on price-to-book ratio. Each part reports and discusses the effects of systematic and unsystematic risks on price-to-book ratio.

Part 1: The Effects of Risk-Adjusted Dividend per Share on Price-to-Book Ratio

This part examines the intrinsic determinants of the expected price-to-book ratio. The examination separates the effects of systematic and unsystematic risks. The results are reported in tables 1 and 2.

Table 1: Systematic Risk-Adjusted Dividend per Share and Price-to-Boob Ratio

Predictors	Estimates
Constant	4.10
(Systematic risk-adjusted Dividend per Share)^2	-0.00526 (-0.96)
$(\text{Current Stock Price})^2$	0.000416 (5.88)***
$(\text{Expected Book Value per Share})^2$	-0.00282 (-6.07)***
$(\text{Expected Dividend per Share})^2$	0.088314 (1.47)

[3] This is known variously as the Sargan Statistic, Hansen J statistic, Sargan-Hansan J test or simply a test of overidentifying restrictions.

Medium-size firms (Dummy)	0.8899 (4.13)***
Large-size firms (Dummy)	1.543 (5.71)***
Time	-0.075 (-3.37)**
$\overline{R}^2$	0.2877
N	410
J-statistic	0.00
Durbin-Watson	0.746459
Theil Inequality Coefficient	0.188635

*** Significant at 1% significance level.

** Significant at 5% significance level.

* Significant at 10% significance level.

The table shows the regression coefficients (stepwise-backward). The dependent variable is the expected price-to-book ratio. The t-statistics are shown between brackets. The multicollinearity is examined using the Variance Inflation Factor (VIF) and the variables associated with VIF > 5 are excluded. Outliers are detected and excluded as well. The heteroskedastic effects are corrected using the White's HCSEC which improves the significance of the GMM estimates.

Table 1 reports the results for the effects of expected dividend per share and the associated predictors on the expected PB ratio. The table reports the results of regression equation (9) that examines the systematic risk-adjusted dividend per share. The results show that the squared expected dividend per share has a positive impact on PB ratio. Nevertheless, the squared systematic risk-adjusted dividend per share is statistically insignificant. The other predictors, namely the squared current stock price and squared expected book value per share are statistically significant. Moreover, the trends of those two predictors are similar to the expected relationships structured in equation (7). That is, the coefficient of the squared current stock price is positive and that of squared expected book value per share is negative. Regarding firm size (firm-specific variable), the results also show that PB ratio is positively associated with the medium and large size firms only. The effect of time is negative indicating that firms' PB ratio has been declining over time. The overall conclusion drawn from table 1 is that the systematic risk-adjusted dividend per share is not statistically significant. Nevertheless, the examination of the unsystematic risk presents different results as shown in table 2.

Table 2: Unsystematic Risk-adjusted Dividend per Share and Price-to-Boob Ratio

Predictors	Estimates
Constant	4.036645
$(\text{Unsystematic Risk - adjusted Dividend per Share})^2$	-0.0035 (-3.25)***
$(\text{Current Stock Price})^2$	0.000412 (5.853666)***
$(\text{Expected Book Value per Share})^2$	-0.0028 (-6.08722)***
$(\text{Expected Dividend per Share})^2$	0.088021 (1.43856)
Medium-Size Firms (Dummy)	0.924659 (4.335966)***
Large-Size Firms (Dummy)	1.53038 (5.845419)***
Time	-0.07121 (-3.22015)***
$\overline{R}^2$	0.296031
N	408
J-statistic	0.00
Durbin-Watson	0.782076
Theil Inequality Coefficient	0.186366

*** Significant at 1% significance level.

** Significant at 5% significance level.

* Significant at 10% significance level.

The table shows the regression coefficients (stepwise-backward). The dependent variable is the expected price-to-book ratio. The t-statistics are shown between brackets. The multicollinearity is examined using the Variance Inflation Factor (VIF) and the variables associated with VIF > 5 are excluded. Outliers are detected and excluded as well. The heteroskedastic effects are corrected using the White's HCSEC which improves the significance of the GMM estimates.

Table 2 reports the results for the effects of expected dividend per share and the associated predictors on the expected PB ratio. The table reports the results of regression equation (10). The coefficient of the squared unsystematic risk-adjusted dividends per share is negative and statistically significant. This result also conforms to the expected sign of the unsystematic risk-adjusted dividends per share according to its structured relationship in equation (7). The trends of the squared current stock price and squared expected book value per share are similar to the expected structured relationships in equation (7). The negative effect of time on PB ratio is still persistent. The overall conclusion drawn from table 2 is that the unsystematic risk-adjusted dividend per share is significantly associated with expected PB ratio.

Part 2: The Effects of Risk-Adjusted Dividends Payout Ratio on Price-to-Book Ratio

This part reports the results of examining the effects of dividend payout ratio on expected price-to-book ratio. The dividend payout ratio and its associated predictors are structured in equation (8), which is examined using regression equations (11) and (12). Table 3 reports the effects of the expected dividend payout ratio and systematic risk-adjusted dividend payout ratio on the expected PB ratio. Table 4 reports the effects of the expected dividend payout ratio and unsystematic risk-adjusted dividend payout ratio on the expected PB ratio.

Table 3: Systematic Risk-Adjusted Dividend Payout Ratio and Price-to-Boob Ratio

Predictors	Estimates
Constant	4.174
$(\text{Systematic Risk - adjusted Dividend Payout Ratio})^2$	-0.00035 (-4.412)***
$(\text{Current Price - to - Earnings ratio})^2$	0.0004 (0.557)
$(\text{Expected ROE})^2$	12.5413 (0.851)
$(\text{Expected Dividend Payout Ratio})^2$	0.00545

	(0.910)
Medium-size Firms (Dummy)	1.7071 (6.346)***
Large-size Firms (Dummy)	3.10111 (8.951)***
Time	-0.11993 (-4.227)***
$\overline{R}^2$	0.1731
N	431
J-statistic	0.000
Durbin-Watson	0.586098
Theil Inequality Coefficient	0.23136

*** Significant at 1% significance level.

** Significant at 5% significance level.

* Significant at 10% significance level.

The table shows the regression coefficients (stepwise-backward). The dependent variable is the expected Price-to-book ratio. The t-statistics are shown between brackets. The multicollinearity is examined using the Variance Inflation Factor (VIF) and the variables associated with VIF > 5 are excluded. Outliers are detected and excluded as well. The heteroskedastic effects are corrected using the White's HCSEC, which improves the significance of the GMM estimates.

Table 4: Unsystematic Risk-Adjusted Dividend Payout Ratio and Price-to-Boob Ratio

Predictors	Estimates
Constant	4.160033
$(\text{Unsystematic Risk - adjusted Dividend Payout Ratio})^2$	-0.000661 (-5.5578)***
$(\text{Current Price - to - Earnings ratio})^2$	0.0005 (0.5148)
$(\text{Expected ROE})^2$	12.66181 (0.8567)
$(\text{Expected Dividend Payout Ratio})^2$	0.005384 (0.9133)

Medium-size Firms (Dummy)	1.7137 (6.361)***
Large-size Firms (Dummy)	3.1113 (9.0016)***
Time	-0.1195 (-4.215)***
$\overline{R}^2$	0.1727
N	431
J-statistic	0.000
Durbin-Watson	0.5870
Theil Inequality Coefficient	0.2314

*** Significant at 1% significance level.

** Significant at 5% significance level.

* Significant at 10% significance level.

The table shows the regression coefficients (stepwise-backward). The dependent variable is the expected Price-to-book ratio. The t-statistics are shown between brackets. The multicollinearity is examined using the Variance Inflation Factor (VIF) and the variables associated with VIF > 5 are excluded. Outliers are detected and excluded as well. The heteroskedastic effects are corrected using the White's HCSEC, which improves the significance of the GMM estimates.

The results reported in tables 3 and 4 present unique insights that are outlined as follows.

1. In terms of systematic and unsystematic risks, the squared risk-adjusted dividend payout ratio is negatively and statistically significant to the expected PB ratio.
2. The squared current PE ratio, squared expected ROE and squared expected dividend payout ratio are statistically insignificant.
3. The effect of firm size is still persistent: e.g., medium and large size firms are associated with PB ratio positively.
4. The negative effect of time presents a valid conclusion regarding the declining PB ratio over time which is a similar result to that reported in tables 1 and 2.
5. In terms of the explanatory power $\overline{R}^2$, the dividend payout ratio equations present less explanatory power than the dividend per share equations.

Conclusion

This paper offers an approach that integrates Price-to-Book (PB) ratio, dividends per share, dividends payout ratio, systematic and unsystematic risks. The relationship between expected PB ratio and dividends is categorized in the literature of corporate finance as "Dividends Signaling Hypotheses." The new approach suggested in this paper extends the signaling relationship to take into account the elements of systematic and unsystematic risks. The underlying assumption states that since dividends send signals to shareholders, the changes in prices imply changes in systematic and unsystematic risks as well. The general results conclude that the intrinsic components of expected PB ratio are functioning the same way as structured in the mathematical model summarized in equations 7 and 8, although the statistical significance varies across the components. The role of dividends is quite clear that negative relationships exist between PB ratio and (a) the unsystematic risk-adjusted dividends per share, (b) the systematic and unsystematic risk-adjusted dividend payout ratio. The above mentioned relationship between dividends per share, dividend payout ratio and both types of risks is summarized in the figure 2.

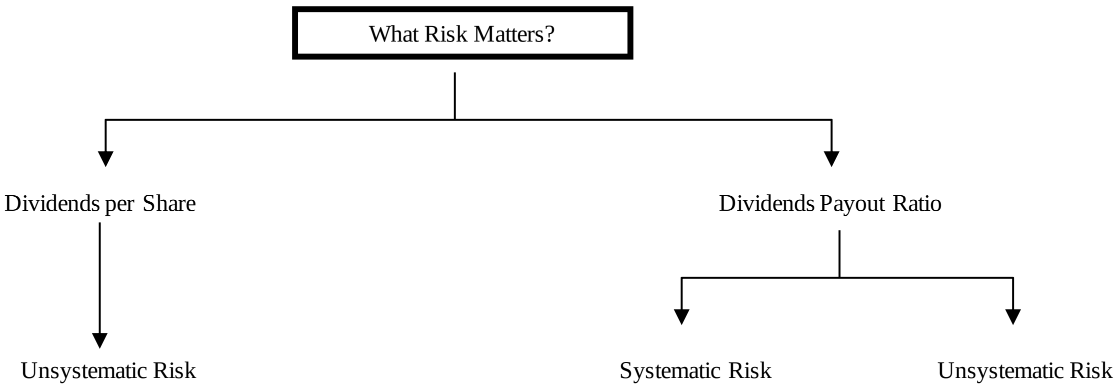

Figure 2: Dividends, Systematic and Unsystematic Risks.

In terms of signaling, the paper provides clear and significant evidence that the squared unsystematic risk-adjusted dividends per share and the squared systematic and unsystematic risk-adjusted dividend payout ratio are negatively associated with expected PB ratio being considered a proxy for shareholder value. This conclusion conforms to other related studies that dividends carry negative signals to the market.

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Appendix

Thirty Companies of the Dow Jones Industrial Average Index

Company	Symbol	*Industry*
3M	MMM	Diversified industrials
Alcoa	AA	Aluminum
American Express	AXP	Consumer finance
AT&T	T	Telecommunication
Bank of America	BAC	Institutional and retail banking
Boeing	BA	Aerospace & defense
Caterpillar	CAT	Construction and mining equipment
Chevron Corporation	CVX	Oil and Gas
Cisco Systems	CSCO	Computer networking
Coca-Cola	KO	Beverages
DuPont	DD	Commodity chemicals
ExxonMobil	XOM	Integrated oil & gas
General Electric	GE	Conglomerate
Hewlett- Packard	HPQ	Diversified computer systems
The Home Depot	HD	Home improvement retailers
Intel	INTC	Semiconductors
IBM	IBM	Computer services
Johnson & Johnson	JNJ	Pharmaceuticals
JPMorgan Chase	JPM	Banking
Kraft Foods	KFT	Food processing
McDonald’s	MCD	Restaurant & bars
Merck	MRK	Pharmaceuticals
Microsoft	MSFT	Software
Pfizer	PFE	Pharmaceuticals
Procter & Gamble	PFE	Non-durable household products
Travelers	TRV	Insurance
United Technologies Corporations	UTX	Aerospace, heating/cooling, elevators
Verizon Communications	VZ	Telecommunication
Wal-mart	WMT	Broadline retailers
Walt Disney	DIS	Broadcasting & entertainment