Reliability of Price-earnings Ratio as a Valuation Technique: a Critical View

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Abstracts

An implicit assumption underlying price-earning ratio technique is that, its behavior overtime is stationary. The finding of this paper indicates that stationarity of price-earnings ratio hold only when security valuation is consistent with the dividend capitalization model of Gordon. The paper also shows that there is inconsistency between non-stationary behavior of price-earnings ratio and popular views held by practitioners, that is, higher earnings growth prospects lead to a higher price-earnings ratio, and higher risk exposure leads to a lower price-earnings ratio.

Introduction:

In the wake of economic liberalization, companies are relying more and more on capital markets, as corporate restructuring (mergers, divestiture etc) are becoming common place, and joint ventures and strategic alliances are gaining popularity. In these exercises, a crucial issue to be addressed is: how should a company or a division thereof be valued?

The price-earnings ratio is one of the popular security valuation techniques. Under this approach practitioners estimate expected earning per share and multiply it by appropriate price earning ratio to estimate intrinsic value of a security. While there are varieties of practices in determining the appropriate price-earning ratio multiple, the underlying premise of all these approaches is that the price-earning ratio multiple is stationary or converge to a constant value over time.

Despite the restrictive condition of stationarity the price-earning ratio remains the most widely reported indicator in financial media, and the one strongly endorsed by leading consultancy organizations. The popularity of the price-earnings ratio approach seems to stem from two main advantages:

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(i) Since the price-earnings ratio reflects the price per dollar of earnings, it provides a convenient measure for comparing the prices of shares which have different levels of earnings per share.

(ii) The estimates required for using the price-earnings ratio approach are fewer in comparison with the estimates required when applying other valuation approaches.

While there is obvious attraction for practitioners to make use of the price-earnings ratio as a valuation technique, it must be emphasized that this approach does not have a sound conceptual basis as the estimate of price-earning ratio multiple lacks a firm theoretical underpinnings. In this paper we set up a dynamic structure to investigate the behavior of price-earnings ratio overtime.

The paper is divided into four sections: section one is an introduction to the paper while section two defines the research problem more clearly as it relates to the current practice regarding P/E ratio. Section three, illustrates the dynamic behavior of price-earning ratio and investigates its stationary behavior. The final section concludes the paper.

Price-Earnings Ratio in Practice:

The procedure commonly employed by investment analysts to estimate the intrinsic value of a security using price-earnings ratio approach typically consists of the following steps:

a- Estimating the earnings per share.
b- Forecasting the earnings growth rate.
c- Assessing the risk exposure to determine an appropriate discount rate
d- Establishing an appropriate price-earnings ratio.
e- Developing a value anchor and a value range by multiplying projected earnings per share by the price-earnings ratio multiple.

Earnings growth prospects and risk exposure (included in the discount rate) are key value drivers of price-earnings multiple. Given that price-earnings ratio follows stationary behavior one would expect higher growth prospects lead to a higher price-earning ratio, and higher risk exposure leads to a lower price-earnings ratio.

In calculating the appropriate price-earning ratio multiple it is usually assumed (Whiteck and Kisor (1978)) the price-earning ratio is additive

function of variables that influence the price-earning ratio, and using multiple regression analysis, the average relationship between price-earning ratio and the independent variables is estimated. The calculated average price-earning ratio from the regression result is considered the appropriate price-earning ratio multiple.

The problem with the regression approach in determining the price-earnings ratio multiple is that the estimated coefficients values are not deemed to be reliable estimates if the dynamic path of the dependent variable in the regression model, which is the price-earning ratio in our case, turns to be non-stationary. There are two alternative approaches to investigate the stationary behavior of price-earning ratio. One approach is to set up price-earnings ratio in dynamic setting and investigate its behavior overtime. The other approach is to search the residual behavior of well specified time series regression model and assess its conformity with stationary behavior. In this paper we adopted the former approach and concluded that stationary behavior of price-earnings ratio hold only under a very restrictive condition[1].

The Dynamic of Price-Earnings Ratio:

Suppose the value of a dividend paying firm consist of the discounted stream of expected future dividends for a finite period of n years, plus the discounted market price of its share at the end of the nth period. Therefore the share price of the firm is expressed as

$$P_j = \sum_{t=j+1}^{n} \rho^{-t} b_t e_t + \rho^{-n} p_n$$

$$= \sum_{t=j+1}^{n} \rho^{-t} b_t e_t + \rho^{-n} m_n e_n \qquad (1)$$

Where,

ρ =One plus an appropriate discount rate reflecting risk exposure
P_j=market price of a share at the end of period j
b_t= payout ratio of each share for period t
e_t=earning per share at period t.
m_n=price-earning ratio at time t

[1] / An empirical research conducted by Goyal and Welch (2002) on U.S data concludes non-stationary behavior of dividend-price ratio and earning-price ratio.

Since,

$$e_t = e_0(1+g_1)(1+g_2).....(1+g_t)$$

$$= e_0 \prod_{T=1}^{n} \delta_t \qquad (2)$$

Where δ_t stand for $(1+g_t)$, and g_t is earning growth rate at time t.
Substituting equation (2) into equation (1) we get:

$$p_j = e_0 \sum_{t=j+1}^{n} \rho^{-t} b_t \prod_{T=1}^{t} \delta_t + \rho^{-n} m_n e_0 \prod_{t=j+1}^{n} \delta_t \qquad (3)$$

Divide both sides of equation (3) by e_j to get:

$$m_j = e_0 \sum_{t=j+1}^{n} \rho^{-t} b_t \prod_{T=j+1}^{t} \delta_t + \rho^{-n} m_n \prod_{t=j+1}^{n} \delta_t \qquad (4)$$

Expanding the right-hand side of equation (4), and taking into account j=0,1,2.....we get:

$$m_j = \rho^{-1} b\delta + \rho^{-1}\delta_{j+1} \sum_{t=j+2}^{n} \rho^{-(t+1)} b_t \prod_{T=j+2}^{t} \delta_T + \rho^{-1}\delta_{j+1} m_n \rho^{-(n+1)} \prod_{t=j+2}^{n} \delta_t \qquad (5)$$

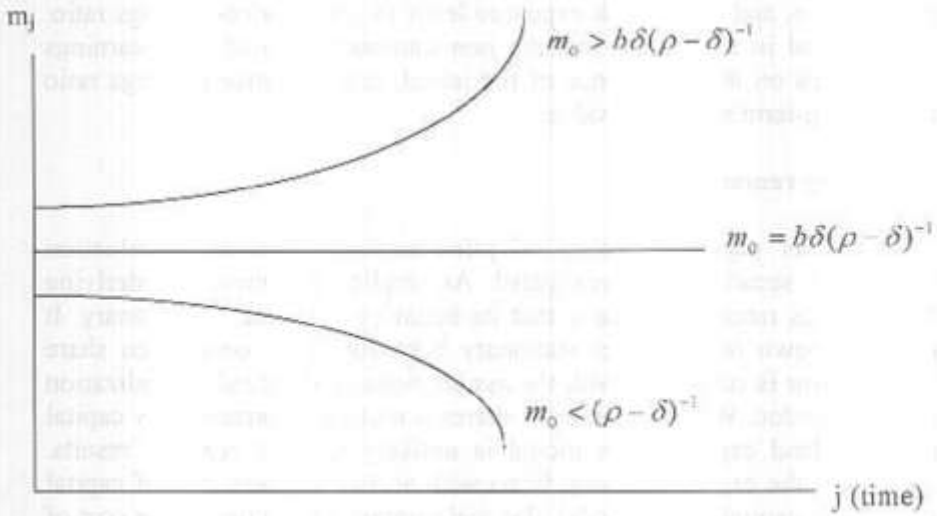
In light of equation (4) and assuming $\delta_{j+1}=\delta$, equation (5) can be reduced into:

$$m_j = \rho^{-1} b\delta + \rho^{-1}\delta m_{j+1} \qquad (6)$$

Equation (6) represents a non-homogenous first-order difference equation. Its solution characterizes the dynamic behavior of price-earning ratio. The solution of equation (6) (see the appendix for details) yields:

$$m_j = \left(m_0 - \frac{b\delta}{(\rho-\delta)}\right)\left(\frac{\rho}{\delta}\right)^j + \frac{\delta b}{(\rho-\delta)} \qquad (7)$$

The first term on the RHS of equation (7) encompass the short-term cyclical behavior, whereas the last term is the long term stationary solution. The dynamic behavior of equation (7) indicates a non-stationary path of the price-earnings ratio as m_j diverge from its stationary solution, as depicted in the following figure, when $\rho>\delta$:



As can be verified from equation (7) stationary behavior of price-earnings ratio hold only when $m_j = m_0 = (\rho-\delta)^{-1}\delta b$. Since simplification of $m_0 = (\rho-\delta)^{-1}\delta b$ results in the dividends capitalization model of Gordon, $p_0 = (\rho-\delta)^{-1} be_1$, then we deduce that stationarity of price-earnings ratio is satisfied only when security valuation is consistent with the dividend capitalization model. However, it should be noted that there are a number of cases where intrinsic values of securities are expected to diverge from values based on the dividend capitalization approach. When investors are primarily motivated by capital gain motives, as opposed to dividend income motives, shares valuation based on the dividend model yield unrealistic values. Since a priori knowledge of dividend stream is essential part of the

dividend capitalization model, in the absence of pre-announced dividend policy for firms share values influenced by the ad hoc assessment of future dividend stream. It has to be noted that the dividends capitalization model is based on the explicit assumption that cost of capital, or discount rate, is greater than the earning growth rate. This restriction excludes growing firms with access to relatively cheap capital source.

It should be realized that the non-stationary behavior of price-earnings ratio, as shown in the figure above, invalidates the common view held by practitioners that higher earnings growth prospects leads to higher price-earnings ratio, and higher risk exposure leads to lower price-earnings ratio. It is indicated in the figure, that the non-stationary path of price-earnings ratio depends on the divergence of the initial value of price-earnings ratio from its long-term stationary value.

Concluding remarks:

In this paper reliability of price-earnings ratio as a valuation technique of securities is investigated. An implicit assumption underlying price-earnings ratio technique is that its behavior overtime is stationary. It has been shown in the paper stationary behavior holds only when share price behavior is consistent with the assumptions of dividend capitalization model of Gordon. When demand for shares is motivated primarily by capital gains, dividend capitalization model is unlikely to yield realistic results. Similarly in the case of growing firms with access to lower cost of capital the dividend capitalization model also yield unrealistic values as the cost of capital becomes less than the earnings growth rate.

The paper also shows that non-stationary behavior of price-earnings ratio invalidates the commonly held views that higher growth prospect lead to a higher price-earnings ratio multiple, and a higher risk exposure leads to a lower price earnings ratio multiple.

Appendix

Equation (6) can be re-written as:

$$m_j - \rho^{-1}\delta m_{j+1} = \rho^{-1} b\delta \qquad (a1)$$

To solve for the homogenous part of equation (a1), let $m_j = ah^j$

Then, $Ah^j - \rho^{-1}\delta h^{j+1} = 0$, *or* $h = \rho\delta^{-1}$, **therefore** $m_j = A\left(\frac{\rho}{\delta}\right)^j$

To solve for the non-homogenous part of equation (a1), let $m_j = k$, *then* $k - \rho^{-1}\delta k = \rho^{-1}\delta b$ **or** $k = b\delta(\rho - \delta)^{-1}$ **then** $m_j = b\delta(\rho - \delta)^{-1}$

Combining the homogenous and the non-homogenous solutions yield,

$$m_j = A\left(\frac{\rho}{\delta}\right)^j + b\delta(\rho - \delta)^{-1} \qquad (a2)$$

Let j=0, to get $m_0 = A + b\delta(\rho - \delta)^{-1}$ **or,** $A = m_0 - b\delta(\rho - \delta)^{-1}$

Then substituting the last equation for the unknown A in equation (a2) we get equation (6).

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