MEASURINGG THE FIRM VALUE BY DISCOUNTED CASH FLOWS: PRINCIPLES AND ISSUES OF VARIOUS MODELS

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Abstract: This paper comprises an examination of the principles of company evaluation using in the discounted cash flow models. In this context, we take into account both the evaluation of the entire business and the alternative of equity valuation by discounted dividends and free cash flows. Although the discounted cash flows to equity can be seen as a better alternative to determine the firm's market value when the dividends are established according to the available cash, the disadvantage of using that approach is that the cash flows related to debt have to be considered explicitly in the model. Also, if we consider the indirect equity valuation, the convergence of the result with the value obtained by applying direct evaluation technique will depend on the correctness of evaluating the firm and the suppositions used about firm's leverage and expected net income.

JEL classification: G32, G35.

Key words: value of firm; equity value; debt value; cash flow; dividend; operating income.

1. Introduction

The value of an asset can be regarded as the present value of cash flows that are generated in its operations. In fact, the company acquires different assets in the hope of obtaining, in the future from their exploitation, of net revenue flows. In this paradigm, it becomes obvious that the market value of assets that generate higher and predictable net inflows from operations will be more valuable than the assets that generate lower and volatile cash flows.

According to the present value of net cash flows, the notion of value of an asset is not new. The preoccupation in the domain regarding valuation of various assets has been manifested for the first time centuries ago, as a result of knowing the value of money in time. However, the modern valuation techniques were developed by Fisher in the two volumes published: "The Rate of Interest" (1970) and "The Theory of Interest" (1930). In these two books, the author considers four alternative models in analyzing the investment projects. He argued that in the valuation of multiple investment projects, one must choose the variant that presents: (i) the highest present value using

the market interest rate as a discount rate; (ii) a present value of benefits which exceeds the present value of costs; (iii) a "rate of return on sacrifice" higher than the market interest rate; (iv) a rate of return superior to the higher cost, and the last must exceed the market interest rate (when comparing two investment projects of different capital expenditures). We notice the fact that the two approaches belong to the decisional rule of net present value (NPV), the third represents a variant of internal rate of return (IRR) approach, and the last belongs to the marginal rate of return.

In the modern financial theory and practice, we may evaluate the entire business by discounting the net cash flows obtained by the firm before debt payments, and after the reinvestment operations, the discounting rate used in calculations being the composite cost of financing, respectively the total cost of capital. A viable alternative is to evaluate the equity stake in the business; that implies equity valuation taking into account cash flows at the disposal of the company after paying its debts to the creditors and after the reinvestment operations, using the cost of equity as a discounting rate.

In the present paper, we analyze in section 2 the equity evaluation models, their applicability and the convergence conditions of the obtainable results. In section 3 we examine the evaluation models of the entire business and their practical applicability. Section 4 comprises a comparative analysis of the methods of equity and entire business valuations and section 5 concludes.

2. EQUITY VALUATION MODELS

2.1 The dividend discount model for equity evaluation

The dividend discount model represents the earliest variant of discounted cash flow models. The expected cash flows to shareholders are discounted, using an appropriate discount rate that incorporates the equity risk in the company. In the first variants of the model, a limited point of view of cash flows to shareholders is adopted, taking into account the dividend levels only. Afterwards, even the rebuying of shares in these the cash flows can be introduced in the model.

When the investors buy stock in publicly traded companies, they expect to get two series of earnings: dividends on the entire duration of assets holding and gains on shares that result by selling the assets. Since the price of stock in the future is also determined by the level of future dividends, the present value of a stock, P_0, admitting holding titles for an indefinite duration will be:

$$P_0 = \sum_{t=1}^{\infty} \frac{D_t}{(1+k_e)^t} \quad (1)$$

in which: $D_1,...,D_n$ – dividend per share estimated to be paid at the end of every year; k_e – the cost of equity. Since the projection of future dividends cannot be carried out in perpetuity, except in theory at the most, in practice one take into account their growth

rate in the future. In the model designed to value stocks in a stable-growth company, which distributes increasing dividends with a constant rate *g*, the price of a share can be determined using the Gordon model:

$$P_0 = \frac{D_1}{k \quad g} \tag{2}$$

The model is applicable to the firms characterized by a stable growth, which can be maintained at that state for a very long period of time. Since the growth rate of dividends is expected to last forever, one must take into account that it cannot be higher than the economic growth rate of the sector where the firm operates. Also, in applying the above equation one must observe the growth rate of other measures of firm's performance, which can increase at the same dividend growth rate. A realistic appraisal of dividend growth rate must be achieved according to the earnings growth rate, being decisive for the resulted market value.

For example, we can consider consequences in the long-run by considering a firm with annual growth of earnings of 5% for an indefinite period of time, while the annual rate of dividend growth is 6%. The level of dividends will exceed the amount of firm's earnings. On the other hand, if we estimate a profit growth rate higher than the dividend growth rate, the latter will tend towards zero in the long-run. As a result, since the model requires a dividend growth rate, we must also estimate the earnings growth so that an adequate result of the company value to be achieved.

A number of variants of the discounted dividend models were developed over time, in answering the demand for more flexibility in its application, including for the firms with significant growth. A first extension of the model uses two phases of growth: an initial phase, which is not one of a stable growth and the following growth phase characterized by a stable growth for an infinite period of time. The variant of the model can be adapted to evaluate the firms that register decreases of the growth rate for a short period of time, followed by a stable growth phase. In this case, the value of a share corresponds to the present value of the dividends paid out to the shareholders during the non-stable growth phase and the current price of a share at the end of the emphasized growth phase:

$$P_0 = \sum_{t=1}^{n} \frac{D_t}{(1+k_e)^t} + \frac{P_n}{(1+k_e)^n} \tag{3}$$

in which: $P_n = \frac{D_{n+1}}{(k \quad g)^n}$; *g* - the stable growth rate after a number of n years.

More complex variants of the model consider several growth phases, including various factors with impact on the company value. However the principle of the model remains unchanged, respectively evaluating the shares is realized by discounted dividends.

The critiques of the discounted dividend models are focused on a few reduced number of variables regarded as having impact on the market value of a share. On the other hand, the use of the model is justified by the fact that dividends represent the only financial flow of "value" that the shareholders dispose of as a result of the investments made.

Without denying the importance of other factors with impact on the market value of shares, we consider that including a reduced number of variables in the model can be regarded, in addition, as an advantage of the model, at least by comparison with other models such as the discounted cash flow to equity model. Normally, we need estimations regarding the level of capital expenses, fixed assets depreciation, working capital etc. in the discounted cash flow to equity model, alongside cash inflows. However, in the dividend model, we need information regarding the dividends paid out in the last year and, according to them, we can appreciate their tendency (growth rate) in the future. Eventually, the firms can set the dividends at levels that they are above of any oscillations of the expected earnings. Thus, unlike the free cash flow to the firm or equity, which oscillates according to the levels of income and expenses, including investments, the dividend level can remain constant in the case of many companies. As a consequence, the results obtained using the models based on dividends are more stable.

Nevertheless, the applicability of the discounted dividends model presents a series of limits. Many companies can decide to preserve the available cash, by reducing dividends. As a consequence, the cash flows to equity exceed the level of dividends. Since the shareholders are paid with dividend, their level will be used by investors to evaluate the shares on the capital market, and undervalue the growing firms. On the other hand, there are also firms on the capital market that pay more in dividends than they have available in cash, as a result of funding the difference with new loans or issuing shares. In these cases, the use of the discounted dividend model can lead to an excessive optimistic equity values, once it is assumed that the companies can be financed from external sources to cover the perpetual cash deficits in order to pay the shareholders.

In our opinion, the discounted dividend model can be used in the following situations:

- when its use leads to an estimate of the basic value of companies which have free cash flows to equity that exceed dividends;
- when estimating the market value of shares issued by the growing firms which, although they hold-back cash as a result of the investments needs, they aim at adapting the amount of dividends paid out to the available cash;
- in the sectors where it is difficult or impossible to estimate the cash flows available to the firms, the dividends representing the only cash flow which can be estimated with a certain accuracy degree.

The accuracy of an evaluation model depends on the manner in which: (i) explains the variation of the assets price in any moment in time; (ii) explanations can

be formulated regarding the possible differences that exist between the estimated values by applying the model and real market prices.

In the literature there are different conclusions regarding the applicability of the discounted dividends model, especially at the level of the capital market as a whole. Shiller (1981) has noticed an excessive volatility of the share price in order to be explained by the variation in time of dividends; in other words, the variation of the market price is much more emphasized than the variation of the present dividend value. In their turn, Poterba and Summers (1988) have claimed that the risk premium varies in time, and Famma and French (1988) have noticed that the dividend yield is much more variable than the dividends. In the study carried out for a longer period of time between 1871-2003, Foerster and Sapp (2005) conclude that the dividend discount model reasonably explains the index variation S&P 500, although the investors evaluate differently the future level of dividends.

2.2 Extended equity evaluation models

In the previous model it is assumed that the firms pay out dividends according to the earnings levels. However, in many situations, the firms have to reduce or to stop paying out dividends in order to finance investment projects or, they can buy back the shares issued previously on the market, the shareholders receiving in cash the equivalent value of the titles held. In the extended models of equity valuation by discounting the dividends we aim at incorporating these characteristics, considering the future level of dividends to be estimated in the following manner:

- by including the dividends obtained by shareholders, together with the stock buybacks;
- by computing the cash that could have been received by shareholders as dividends according to the residual cash flow to equity, after debt payments and reinvestment operations.

The models that incorporate the stock buybacks are a result of observation regarding the behavior of companies to proceed, in some situations, to reacquiring the shares as a means of paying the shareholders. In this case, we have to adjust the definition of dividends to include stock buybacks and to value stocks based on the value resulted, so that the modified payout ratio becomes:

$$\text{Modified payout ratio} = \frac{\text{Dividends + Stock buybacks}}{\text{Net income}} \quad (4)$$

Also, the growth rate, *g*, may be computed as follows:

$$g = \text{The modified payment rate of dividends} \times \text{ROE} \quad (5)$$

in which: ROE – rate of return on equity.

When applying this variant, we must take into account that a firm can buy back a part of its shares in a certain year, followed by stopping its operations in the

following years. That is why it is necessary to calculate an average of the modified payout ratio for a period that corresponds to the cyclical activity of this operation.

The discounted cash flow to equity model does not represent a radical deviation from the discounted dividend model. In this case, we consider the free cash flows to equity, CF_e, that belongs to stockholders as being potential dividends rather than actual dividends. The free cash flow to equity incorporates the cash flow after the debt payments and the reinvestment needs, expressed as follows:

CF_e = Net income - Capital expenditures + Depreciation - Change in non cash working capital - (Debt issued - Debt repayments) (6)

If the firm buybacks a part of its issued stocks, we adjust the model by adding buybacks to the free cash flow to equity. In this case, repurchasing the shares by issuing company may be the consequence of the excess cash accumulated, as a result of not paying out CF_e as dividends. The model is applicable to the publicly and non-publicly traded firms.

As with the discounted dividends model, there may be variations on the cash flows to equity in time, requiring estimating the rate of growth. If we assume a constant rate of CF_e, the value of equity under the constant growth model is a function of the expected CF_{e1} in the next period, the rate of return and the stable growth rate:

$$P_0 = \frac{CF_{el}}{(k_e \quad g)} \quad (7)$$

The equity valuation by discounting the free cash flow can be also applied in two or multi-stage versions. The growth rates used in the model has to be less or equal to the expected growth rate in the economy in which the firm operates.

The free cash flow to equity discount model can be viewed as an alternative to the discounted dividends models. However, the two models can lead also to different outcomes for the equity value. Hence, it becomes necessary to define the context in which the two approaches lead to the same result or, alternatively, to different results and, also, to explain the results obtained.

We can observe that the two models lead to the same result on the value of equity in two situations: (i) the free cash flows to equity are equal to the dividends; (ii) when $CF_e > D$, and the excess of cash (CF_e - D) is reinvested in projects that have zero net present value.

The two models can also provide different estimates regarding the value of equity, when $CF_e > D$, and the excess cash, (CF_e – D) is reinvested by the firm in investment projects that earn a rate of return below the interest rate of the financial market or, in negative present value assets. In these cases, the value of equity resulted from the CF_e model will be greater than the value obtained from the discounted dividends model.

The difference between CF_e and D may lead to various implications on the firm and stock prices. If dividend payments are less than CF_e, the excess cash accumulated may reduce the debt-equity ratio under its optimum level, causing a loss

in value of the firm. Conversely, if $D > CF_e$, dividends can be paid out by issuing new shares, contracting new loans or reducing investment expenditures, which lead the value of the firm to decline. For example, in terms of contracting new loans to pay dividends, the firm is a subject to an additional cost of capital and the loan growth over its optimal level will decrease the market value of the firm. Moreover, if paying too much in dividends, that fact can lead to capital rationing constraints where the investment level will decrease and a loss of value will be registered.

Establishing the same growth rates will lead to a higher market value of the shares if the $CF_e > D$ or, to a lower value if the $CF_e < D$. In general, if the firm pays lower cash dividends than the corresponding level of CF_e, the expected growth rate will result higher in the discounted dividends model, but the annual cash flows will be higher in the model by discounting the CF_e.

When different results are obtained for the shares price in applying the two models, two questions arise: (i) what does reflect the difference resulted from the application of the two models?; (ii) which of the two models is more appropriate for valuing the market price of shares? Most often, one can observe a higher market value of shares resulted from the application of the discounted CF_e model than using the discounted dividend model. We adhere to the A. Damodaran's (2002) point of view that the difference may be due to the phenomenon of firm control (by managers or a group of shareholders), highlighting a controlled dividend policy to satisfy the various interests. As for which of the two models is more appropriate for valuing the market price of shares, the answer it depends on the probability that a firm can be taken over or its management changed. If this probability is significant, the more appropriate are the discounted CF_e models. Conversely, if the probability of control is reduced due to firm's size and/or legal or market restrictions on takeovers, the dividend discount model will lead to the appropriate benchmark for comparison.

3. FIRM DISCOUNTED CASH FLOW MODELS

In principle, we can value the equity or the entire business. The value of the firm can be estimated by discounting free cash flows to the firm, using the total cost of capital as a discount rate:

$$\text{The value of firm} = \sum_{t}^{\infty} \frac{CF_{F1}}{(1+k)^t} \quad (8)$$

in which: k – the total cost of capital; CF_{F1} – the expected free cash flow to the firm in year 1. In the most common definition, the CF_F can be computed as follows:

CF_F = After-tax operating income - (Capital expenditure - Depreciation) - Change in non-cash working capital (9)

The total cost of capital depends on the different costs of financing and on the financing mix used in the financial structure of the firm:

$$k = k_e \times \frac{E}{(E + B)} + k_b \times \frac{B}{(E + B)}$$

(10)

in which: k – total (weighted average) cost of capital; k_e – the cost of equity; k_b – the net cost of debt; $E/(E + B)$ – the proportion of equity of the total funds; $B/(E + B)$ – proportion of debt of the total funds used by the firm.

We observe that the market value of firm is dependent, inter alia, on the net operating cash flows and the total cost of capital (which varies depending on the rate of debt). As a result, the model is flexible, permitting the evaluation of firms as a function of various debt ratios, including their changes over time. In fact, the major strength of this model is the ease to estimate the value of firms depending on the financing mix in the firm's financial structure.

As with the previous models, the CF_E model is a result of assumptions about the growth rate level and the modality in which that is likely to continue. At a constant growth rate, g, of the expected CF_F, the value of firm can be determined as follows:

$$\text{The value of firm} = \frac{CF_{F1}}{k - g}$$

(11)

Using a constant capital cost for a growing business requires that the debt ratio to remain constant over time. That means that the tax benefits associated with the interest deductibility will increase at the same rate, being discounted with a specific risk rate.

As with all models of stable growth, the results vary depending on the assumptions about the expected growth rate. That sensitivity of the result to the growth rate is increased by the discount rate used in the valuation. However, the value of the firm, according to the previous equation, is a function of capital expenditures relative to the fixed assets depreciation. If the reinvestment rate is not a function of growth rate, the level of CF_F will be increased (or decreased) by reducing (or increasing) the amount of capital expenditures relative to depreciation. Also, if the reinvestment rate is estimated from the return on capital, the variation of the latter will have a significant impact on the value of firm.

The value of firm by discounting the cash flows may include variants in two or three growth stages. The most common variant, however, is that the value of the firm is estimated by using equation (8).

When a firm reaches the steady state after n years of growth and continues its growth at a constant rate g, the firm's value can be determined using the following equation:

$$\text{Value of operating assets of the firm} = \sum_{t=1}^{n} \frac{CF_{Ft}}{(1 + k)^t} + \frac{\left[CF_{Fn+1} / (k - g)\right]}{(1 + k)^n}$$

(12)

According to some authors (Copeland, 2000; Koller, 2005), the above equation expresses the value of the operating assets of firm, whereas the cash flow used are cash flows from operating assets. As a result, any other assets that do not generate operating revenues are not yet valued using previous equation. For the same reason, the cost of capital used should reflect only the operational risk of firms.

Following this reasoning, to obtain the value of equity, we must first calculate the value of assets that do not generate operating income (available cash, bank accounts, and marketable financial assets). The value of equity can be computed by summing all (operating and non-operating) assess values and then subtracting out the debt value. If the firm has assets that are not used in service, or other assets that do not involve receipts and payments flows, those assets can be evaluated separately and the values obtained should be added up to the value of operating assets.

4. COMPARATIVE ANALYSIS OF EQUITY AND FIRM EVALUATION MODELS BY DISCOUNTING THE CASH FLOWS

The evaluation of entire business, unlike equity evaluation by discounting CF_e, leads to estimate the market value of firm, not just the value of equity. However, the value of equity can be calculated by subtracting debts from the market value of firm:

$$\text{Value of equity} = \text{Value of firm} - \text{Value of debt} \quad (13)$$

Hence, we can evaluate the entire business or just the equity since this model can be viewed as an alternative way of valuing equity. However, the values of equity obtained from the two alternatives may lead to the same result or not, depending on the assumptions that are used in the two models.

The amount of debt is not explicitly considered in the evaluation model of firm, in absolute values, whereas CF_e represents the cash flow before the debt payments to creditors. The debt should be considered, however, to estimate the value of equity by discounting the CF_e. Given that the future debt ratios can vary significantly over time, it becomes more advantageous to use the entire business valuation model since it does not require estimates, which are difficult to perform, regarding the level of future loans and their repayment. However, although the value of loans is not considered explicitly in the model of valuing the firm, we need the debt ratios and interest rates in order to estimate the total cost of capital. Since the absolute level of debt is more difficult to be estimated than the expected debt ratios, the value of equity resulted from the model of valuing the firm leads, in our view, to the appropriate results.

The value of equity resulted from the value of firm can be equal to the value obtained directly from the equity valuation if we use the same assumptions about the firm indebtedness. In this respect, consider, for example, a firm that does not record growth with an annual operating income of € 120,000, and 16% income tax rate. With the market value of equity of € 300,000, the cost of equity of 14% and the market value of debt of € 700,000, a pre-tax cost of debt of 10%, the total cost of capital, *k*, will be:

$$k = 14\% \times \frac{300,000}{1,000,000} + 10\%(1 - 0.16) \times \frac{700,000}{1,000,000} = 10.08\%$$

If we assume that the operating income of firm is constant on an undefined period of time, the market value of firm that has no reinvestment or growth is:

$$\text{Value of firm} = \frac{\text{Operating income} \times (1 - u)}{\text{Total cost of capital}} =$$

$$= \frac{120,000 \times (1 - 0,16)}{0,1008} = 1,000,000 \text{ €}$$

The value of equity results by subtracting out the value of debt:

Value of equity = 1,000,000 – 700,000 = 300,000 €

We can, also, value equity directly, by estimating of net income:

The net income = (The operating income – Interest rate × Debt)(1-u) =

= (120,000 – 0.10 × 700,000)(1-0.16) = 42,000 €

The value of equity can be obtained by discounting the net income by using the cost of equity as follows:

$$\text{Value of equity} = \frac{\text{Net income}}{\text{Vost of equity}} = \frac{42,000}{0,14} = 300,000 \text{ €}$$

In the above example, the two results of equity value coincide because of the following simplifications that we make implicitly or explicitly:

- the values of equity and debt that are used in the total cost of capital calculations are equal to those obtained from the application of evaluation models;
- the interest expenses are equal to the interest rate multiplied by the market value of debt. If the company has previously contracted debt, with interest expenses that are different from the value used, the values of equity will not converge in the two scenarios;
- there are no extraordinary income/expenses and financial revenues that affect the net income. Including those items in the net profit formula can rise to different values of equity resulted from the direct and indirect calculation.

5. CONCLUSIONS

In this paper we approach the evaluation method of firm by discounting the cash flows, considering models, the variants of models and their practical applicability. In principle, the value of a firm can be determined as an entire business. Alternatively, we can compute the value of equity, where we add the value of debt.

From the latter perspective, the alternatives are either by discounting dividends or free cash flows to equity. The convergence of results that are obtained by applying the two variants depends on the ratio between dividends paid out to shareholders and the potential dividend payment reflected by the free cash flow left over all debt

payments and reinvestment needs. Outside of convergent results, the market value of firm can be under-valued or over-valued.

While discounting the free cash flow to equity can be regarded as a better alternative in determining the market value of firm if we consider that the company will pay out dividends according to the available cash, the disadvantage of using the free cash flow to equity approach is that cash flows related to debt have to be considered explicitly in the model, that are difficult to assess in absolute terms.

We have notices some drawbacks by using the model of entire business evaluation that can be eliminated ins some circumstances. From the numerical example presented we can observe that if we apply the model of indirect evaluation of equity, the result will converge with the estimated value from direct evaluation if the firm is fairly priced and if we make consistent assumptions about the firm's leverage and expected net income.

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