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Continuing value in firm valuation by the discounted cash flow model

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Abstract

The discounted cash flow model, like other firm valuation models, proceeds in two periods. For each year in the explicit forecast period, there is an individual forecast of free cash flow. On the other hand, all of the years in the post-horizon period are represented through one single continuing value formula, being the steady-state value of the firm's productive assets at the horizon. Continuing value is typically derived by applying the Gordon formula to a simple extrapolation of free cash flow at the end of the explicit forecast period. This paper examines the components of continuing value, in particular capital expenditures and tax savings due to depreciation of property, plant and equipment (PPE). The estimation of two somewhat elusive parameters related to capital expenditures, equipment economic life and capital intensity, is discussed. A further analysis indicates that a substantial part of continuing value derives from cash flow associated with already acquired equipment. Also, the error resulting from assuming steady-state rather than lumpy capital expenditures is identified. Implementation issues relating to the explicit forecast period are also commented on.

Keywords: Valuation; Free cash flow; Steady state; Discounting; Accounting data

1. Introduction and overview

The discounted cash flow model is one member of a whole family of related models for firm valuation. It values the equity of a firm by discounting free cash flow from the firm's operations to a present value of the productive assets of the firm, and then subtracts the value of the firm's interest-bearing debt to arrive at the value of the equity as a residual.[2] Other members of the same family are the discounted dividend model and the residual income model (and a few other ones). All of these models are equivalent in the sense that they

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[2] It is assumed in this very brief summary, and in what follows, that the firm has zero excess marketable securities, e.g., after netting against interest-bearing debt.

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provide the same equity value, although under very stringent consistency conditions (Fernández, 2002; Penman, 1998; Young et al., 1999). Among the members of this family, the discounted cash flow model has traditionally been a dominant one in practice, although subject to competition in recent years from the residual income model (Lundholm and O'Keefe, 2001, p. 315). The discounted cash flow model has been popularized in an influential book written by an author team associated with the McKinsey consulting company (Copeland et al., 2000).

It is a basic property of firm valuation models that the forecasting of a firm's financial performance is split into two periods. The first period, appropriately labelled the explicit forecast period, consists of perhaps 10–15 individual years. It provides forecasted annual values of the selected valuation attribute (i.e., cash flow from operations in the case of the discounted cash flow model), typically derived from forecasted annual income statements and balance sheets. The second period, often referred to as the post-horizon period, is represented through an infinite discounting operation that provides a continuing value at the beginning of the first post-horizon year. The idea is that the firm is developing in a steady state, as it moves into the post-horizon period. This means that the selected valuation attribute is extrapolated, under an assumption about constant firm growth, starting from the value that is attained in the last year of the explicit forecast period. In other words, the selected valuation attribute is not derived from annual forecasted financial statements in the post-horizon period (except possibly for the first year of that period).[3]

The purpose of this paper is to examine the finer structure of the continuing value formula in the discounted cash flow model. It is clear from the definition of annual free cash flow from operations that several components are included. Two of those components, capital expenditures and tax savings due to depreciation of property, plant and equipment (PPE), are emphasized, since they are somewhat complex. One reason for this complexity is that capital expenditures may be lumpy, so one needs to be clear about the meaning of steady-state development of free cash flow in the post-horizon period. Another reason is a need for precision in relating steady-state capital expenditures and associated tax effects to more basic parameters such as assumed real growth of the firm, inflation, and equipment economic life. The emphasis on capital expenditures and tax savings from depreciation appears to be novel. For instance, this paper is rather different from the discussion of continuing value in the discounted cash flow model by Copeland et al. (2000, Chapter 12).

The outline is as follows. The next section discusses steady-state free cash flow from operations, with particular emphasis on the two components mentioned, capital expenditures and tax savings from depreciation of PPE. It is shown how these two components can be modelled in a reasonably consistent fashion, starting from assumptions about steady-state real growth of the firm's operations, inflation, PPE economic life, PPE life for depreciation for tax purposes, and capital intensity. Two of the parameters just mentioned, PPE economic life and capital intensity, are not necessarily immediately observable from the published financial statements of an individual company.[4] However, estimates can be obtained, if one has access to aggregated financial statements for a large set of companies. This is discussed in Section 3, based on an extensive data set from Statistics Sweden. Section 4 completes the continuing value formula for the firm's operations by adding the discounting part. There is also a brief comparison with a continuing value formula in Copeland et al. (2000, Chapter 12).

The continuing value formula is broken down into further components in Section 5. It is now possible to identify groups of components relating to the continuation of the firm's existing activities, as opposed to components relating to real growth. One can then study the relationship between value derived from the firm's existing PPE and value from replacing existing PPE as it wears out, or value from growth due to capital expenditures beyond what is required to replace existing PPE. It is also possible to identify the error in the continuing value formula that is due to the steady-state assumption. In other words, there is a more exact continuing value formula that takes into account the actual capital expenditures assumed to have taken place in the

[3] The terminology explicit forecast period, post-horizon period, and continuing value is used for instance by Copeland et al. (2000) and by Ohlson and Zhang (1999). Annual forecasts of the valuation attribute should be interpreted as expected values under some scenario.

[4] Published financial statements are also referred to as historical statements in what follows.