STOCK VALUATION MODELS

-PART I-

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INTRODUCTION

Many stock valuation models have been proposed in the financial literature. Some of them rely on correlation-regression techniques, while others derive from financial market theory. The most common models are actuarial models.

Actuarial models themselves are divided into several categories:

- Based on the time horizon, whether it is finite or infinite;
- Based on the type of growth, which can be either one-time or continuous;
- Based on the financing of growth, depending on whether retained earnings are included or not;
- Based on the explanatory variable: dividend, profit, or net income;
- Finally, based on the discounting method, where the rate may be constant or variable over time.
- As a result, there is a great diversity of models, each based on different assumptions and corresponding to specific situations, which may sometimes appear contradictory.

Theory on valuation

An overall important question in accounting and finance is whether a stock's market price accurately reflects its intrinsic value. Financial theory defines intrinsic value as the present value of all its expected future cash flows generated by the asset, discounted at a rate that accounts for both the time value of money and the risk associated with those cash flows. Theoretically, in an efficient market, stock prices should converge to this intrinsic value, as investors actively process available information and adjust their valuations to reflect the true worth of an asset

I. General (Fundamental) Model of Stock Valuation

The **General (Fundamental) Model** is based on the concept that a stock's value is derived from its future cash flows, discounted to the present value. It falls under the **Discounted Cash Flow (DCF) approach**, which assumes that the intrinsic value of a stock is equal to the present value of all expected future cash flows generated by the company.

The intrinsic value of a stock (P_0) is calculated using the **Discounted Cash Flow (DCF) formula**:

$$P_0 = \sum_{t=1}^{n} \frac{CF_t}{(1+r)^t}$$

where:

- P_0 = intrinsic value of the stock today
- CF_t = expected future cash flow at time t (this could be dividends, earnings, or free cash flows)
- r = required rate of return (or discount rate)
- n = number of years in the valuation period

The equality of price and value can be expressed as follows:

$$P_t = V_t = \sum_{t=1}^{\infty} \frac{CF_t}{(1+r)^t}$$

where P_t is the price at time $t = 1$ and V_t is the fundamental value at time $t = 1$, CF is the cash flow (dividends or free cash flow) and r is the discount rate.

Assumptions of the Fundamental Model

1.Future Cash Flows Can Be Estimated:

1. The model assumes that the company's future cash flows can be projected with reasonable accuracy.

2.Time Value of Money Applies:

1. Money today is worth more than the same amount in the future due to potential investment returns.

3.Investors Require a Return on Investment:

1. The discount rate (r) represents the return investors expect, considering risk and opportunity cost.

4.Stable Economic and Business Environment:

1. The model assumes no extreme market shocks or unexpected disruptions.

Applications of the Model

The **General Fundamental Model** is widely used in **equity valuation** and **corporate finance**, particularly in:

A. Discounted Dividend Models (DDM)

1. Used when a company pays dividends regularly.
2. Special case: **Gordon Growth Model** (GGM), which assumes constant dividend growth

B. Discounted Earnings Models

1. Used when dividends are irregular or reinvested. The company's future earnings per share (EPS) are discounted.

C. Discounted Free Cash Flow Models (FCF)

1. Used in investment banking and valuation of growth companies:

$$P_0 = \sum_{t=1}^{n} \frac{FCF_t}{(1+WACC)^t}$$

Here, WACC (Weighted Average Cost of Capital) is used as the discount rate.

D. Valuation of Companies, Mergers & Acquisitions, and IPOs

1. Helps estimate a company’s fair value before major financial decisions.

Strengths of the Fundamental Model

- **Theoretically Sound:** Based on financial fundamentals and cash flow expectations.
- **Widely Used in Investment Analysis:** Adopted by analysts, investment firms, and corporations.
- **Applicable to Various Types of Firms:** Can be used for companies that pay dividends or reinvest profits.

Limitations of the Fundamental Model

- **Difficult to Predict Future Cash Flows:** Estimating future earnings and dividends is challenging.
- **Sensitive to Assumptions:** Small changes in growth rates (g) or discount rates (r) can drastically alter valuation.
- **Not Suitable for Startups or Highly Uncertain Markets:** Works best for stable, mature companies with predictable cash flows.

The **General Fundamental Model** is a powerful tool for stock valuation, providing a **rational approach** to determining a company's worth based on expected future performance. However, it **requires accurate cash flow projections** and a **well-justified discount rate** to be effective.

II. The Gordon Growth Model (GGM)

The Gordon growth model (GGM) is a formula used to determine the intrinsic value of a stock based on a future series of dividends that grow at a constant rate. It is a popular and straightforward variant of the dividend discount model (DDM). The GGM assumes that dividends grow at a constant rate in perpetuity and solves for the present value of the infinite series of future dividends.

Because the model assumes a constant growth rate, it is generally only used for companies with stable growth rates in dividends per share.

Gordon Growth Model Formula

The Gordon growth model formula is based on the mathematical properties of an infinite series of numbers growing at a constant rate. The three key inputs in the model are dividends per share (DPS), the growth rate in dividends per share, and the required rate of return (ROR).

$$P = \frac{D_1}{r - g}$$

where:

P = Current stock price

g = Constant growth rate expected for dividends, in perpetuity

r = Constant cost of equity capital for the company (or rate of return)

D_1 = Value of next year's dividends

Importance of the Gordon Growth Model

The GGM attempts to calculate the fair value of a stock irrespective of the prevailing market conditions and takes into consideration the dividend payout factors and the market's expected returns. If the value obtained from the model is higher than the current trading price of shares, then the stock is considered to be undervalued and qualifies for a buy, and vice versa.

The Assumptions of the Gordon Growth Model:

The Gordon Growth Model assumes the following conditions:

- The company’s business model is stable; i.e. there are no significant changes in its operations
- The company grows at a constant, unchanging rate
- The company has stable financial leverage
- The company’s free cash flow is paid as dividends

The Limitations of the Gordon Growth Model:

The assumption that a company grows at a constant rate is a major problem with the Gordon Growth Model. In reality, it is highly unlikely that companies will have their dividends increase at a constant rate. Another issue is the high sensitivity of the model to the growth rate and discount factor used.

The model can result in a negative value if the required rate of return is smaller than the growth rate. Moreover, the value per share approaches infinity if the required rate of return and growth rate have the same value, which is conceptually unsound.

Furthermore, since the model excludes other market conditions such as non-dividend factors, stocks are likely to be undervalued despite a company's brand and steady growth.

Variations of the Gordon Growth Model

1. Zero-Growth Model (No Growth)

- Used for companies that pay a **fixed** dividend without growth.
- Formula:

$$P_0 = \frac{D}{r}$$

2. Two-Stage Growth Model (Changing Growth Rates)

- Useful for companies with a **high-growth phase** followed by a **stable phase**.
- First, value the dividends during the **high-growth phase** using the standard **DCF formula**

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

- where Pn is the terminal value found using the Gordon model.

3. Multi-Stage Growth Model

•Extends the **Two-Stage Model** to multiple growth phases.

•Commonly used for companies like tech firms that **start with high growth but slow down over time**.

The Gordon Growth Model (GGM) is a useful tool for valuing stocks of companies that pay regularly growing dividends. However, it has limitations when dividends are unstable or growth is unpredictable. For real-world applications, analysts often adjust the model or use multi-stage versions to account for changes in growth.

III. Discounted Cash Flow (DCF) Model

The **Discounted Cash Flow (DCF) Model** is one of the most widely used **valuation methods** in finance. It estimates the **intrinsic value** of a company, stock, or project by discounting expected future cash flows to their **present value**.

This model is based on the principle that **the value of an asset is equal to the present value of all future cash flows it will generate**.

Formula of the DCF Model

The general formula for the **DCF Model** is:

The intrinsic value of a stock is calculated as:

$$P_0 = \sum_{t=1}^{n} \frac{FCFE_t}{(1+r_e)^t} + \frac{TV}{(1+r_e)^n}$$

where:

- P_0 = Intrinsic value of the stock today
- $FCFE_t$ = Free Cash Flow to Equity (FCFE) at time t
- r_e = Cost of equity (discount rate, usually calculated using CAPM)
- TV = Terminal value, representing the stock's value after the forecast period
- n = Number of years in the forecast period

Terminal Value (TV) Calculation (Gordon Growth Model - GGM):

$$TV = \frac{FCFE_{n+1}}{r_e - g}$$

where:

- g = Long-term growth rate of FCFE

Steps to Calculate the DCF Stock Valuation

Step 1: Calculate Free Cash Flow to Equity (FCFE)

FCFE represents the cash available to shareholders after covering capital expenditures and debt payments:

$$FCFE = Net\ Income + Depreciation - Capital\ Expenditures - Changes\ in\ Working\ Capital + Net\ Borrowing$$

Step 2: Estimate Future FCFE

- Project FCFE for the next **5 to 10 years** based on expected company growth.
- Use historical data and financial projections to estimate future FCFE values.

Step 3: Determine the Discount Rate (r_e)

- Use the **Capital Asset Pricing Model (CAPM)** to calculate the cost of equity:

$$r_e = R_f + \beta(R_m - R_f)$$

where:

- R_f = Risk-free rate (e.g., government bond yield)
- β = Stock's beta (systematic risk)
- R_m = Expected market return

Step 4: Calculate Terminal Value (TV)

- Apply the **Gordon Growth Model (GGM)** for companies expected to grow indefinitely.

VI. Solomon Model of Stock Valuation

The **Solomon Model** is a stock valuation approach that extends the **discounted cash flow (DCF) framework** by incorporating risk factors and variations in growth over time. It is **less widely known** than models like the **Gordon Growth Model (GGM)** but provides a **more flexible valuation framework** for stocks, especially those in uncertain markets.

Equation of the Solomon Model

The general structure of the **Solomon Model** follows a **multi-stage discounted cash flow (DCF) approach**:

$$P_0 = \sum_{t=1}^{n} \frac{CF_t}{(1+r_t)^t} + \frac{P_n}{(1+r_n)^n}$$

where:

- P_0 = **Intrinsic value** of the stock today.
- CF_t = **Cash flows (dividends or earnings) at time** t.
- r_t = **Risk-adjusted discount rate** for year t (varies over time).
- n = **Number of years in the projection period.**
- P_n = **Terminal value (value at the end of the forecast period), calculated using a standard valuation formula like the Gordon Growth Model.**

Assumptions of the Solomon Model

The **Solomon Model** is based on the following assumptions:

1.Future cash flows can be projected, but they may not grow at a constant rate.

2.Risk factors vary over time, requiring a changing discount rate (rt).

3.The company eventually reaches a stable phase, where it can be valued using a long-term growth model.

4.The market considers both near-term and long-term risks, so discount rates reflect changing economic conditions.

Applications of the Solomon Model

- Valuing companies with fluctuating growth rates.
- Estimating stock value when risk levels change over time.
- Used in investment banking and financial analysis for more accurate stock valuation.
- Better suited for companies in high-growth or uncertain markets than static models like the Gordon Growth Model.

Strengths of the Solomon Model

- More realistic than simple dividend models like Gordon Growth because it allows for variable growth.
- Accounts for changes in risk by adjusting the discount rate (rtr t) over time.
- Applicable to both dividend-paying and non-dividend-paying companies.

Limitations of the Solomon Model

- More complex than Gordon Growth or standard DCF models.
- Requires multiple assumptions about future growth and discount rates.
- More difficult to apply in practice due to the need for detailed projections.

Conclusion:

The Solomon Model is a more flexible alternative to simple stock valuation models like Gordon Growth. It is useful when: A company’s dividend or cash flow growth is not constant. Risk factors change over time. A more realistic, multi-stage valuation approach is needed.

THANKS