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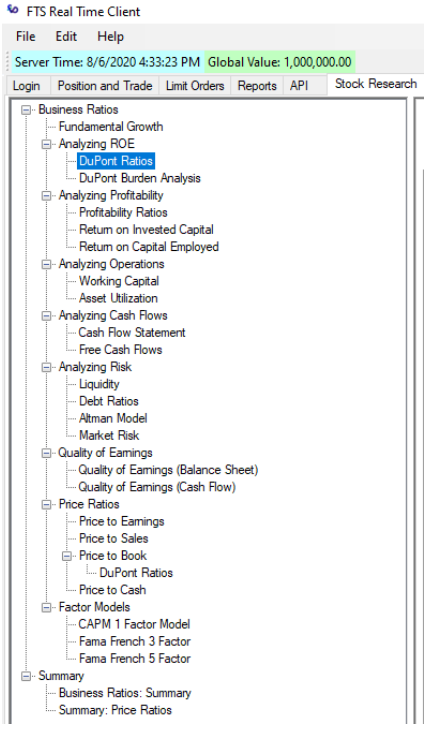


1. Fundamental Growth

What is it: Fundamental Growth is the highest-level Key Performance Indicator (KPI). It is sometimes referred to as the Reinvestment Rate because this ratio measures the rate at which the company reinvests the proportion of earnings retained from the current period.

Why it matters: A major decision that management makes for a profitable firm is what to do with the Net Income? Should it be paid out as a dividend, reinvested into the business or perhaps both? The more it is reinvested rather than paid out as dividends, the more the shareholder's equity stake grows. The rate at which it grows is measured by Fundamental Growth.

Definition: The performance measure results from the product of two terms. First, the Retention Ratio denotes as RR. RR is the proportion of current net income that is re-invested into the firm at the end of the current period. The second component is the Return on Equity which equals the rate of return generate from the current period's activities. Formally, this is defined as:

Fundamental Growth (Reinvestment Rate) = ROE * RR Return on Equity (ROE) = Net Income / Average Shareholders' Equity Retention Ratio = RR = 1 – Dividend Payout Ratio (DPR)

Discussion: This is the highest level KPI because it results from the three major decisions that management make. These are the:

Investment Decision
Financing Decision
Dividend Decision

To see the connection, we consider what these decisions impact.

The primary objective for the investment decision is to generate income and capital gain. That is, grow shareholders' wealth by increasing the shareholders' equity. As a result, the investment decision drives the numerator (Net Income) of ROE.

The financing decision determines how funds are sourced to make the investment decision. That is, funds can be sourced from issuing new debt, issuing more equity or retaining earnings. In other words, the financing decision directly influences the Shareholders' equity which is the denominator of ROE.

Finally, RR is directly related to the dividend decision because RR equals one minus the dividend payout ratio. Therefore, combined these three managerial decisions drive the Fundamental Growth ratio which equivalently the Reinvestment Rate.

Analyzing ROE

What is it: Return on Equity (ROE) is a summary performance measure that relates the bottom line of the income statement, Net Income, to the owners' equity section of the Balance Sheet. This provides a comprehensive measure of the return from the current period's activities given the net resources available. This is a leveraged return.

Why it matters: Being a leveraged return means that ROE results from two major decisions that management make for a firm: Investment and Financing decisions. The investment decision generates the net income (numerator of ROE) and the financing decision determines the amount of debt and equity in the balance sheet, and therefore the shareholders' equity. ROE results from the product of these two drivers, and thus at a glance the combined performance of these two decisions can be observed from the one important number.

Definition: ROE is defined as follows:

ROE = Net Income / Average Shareholders' Equity

Discussion: The drivers of this leveraged return can be separated using the mathematical trick of multiplying by a ratio equal to one and then re-arranging the two ratios to re-express in the form of the two driver ratios. This allows the separate effects upon ROE for both the Investment and Financing

decisions to be uncoupled. This mathematical trick can be repeated more than once. This is illustrated in the following sub-branches.

2.1 DuPont Ratios Sub-Branch

Consider multiplying ROE by (Sales/Sales) * (Average Total Assets/Average Total Assets) = ROE*1*1 = ROE. But now consider re-arranging all ratios to define an equivalent new set of ratios as follows:

ROE = (Net Income/Sales) * (Sales/Average Total Assets) * (Average Total Assets/Average Shareholders' Equity)

Each term in the decomposition has a specific meaning:

Net Income or Profit Margin = Net Income/Sales Asset Turnover Ratio or Asset Utilization Efficiency = Sales/Average Total Assets These first two terms can equivalently viewed as a single profitability measure ROA by eliminating Sales: ROA = (Net Income/Sales) * (Sales/Average Total Assets) = Net Income / Average Total Assets Financial Leverage Ratio= Average Total Assets/Average Shareholders Equity

Why Average Assets and not Average Sales or Total Assets?

The reason is to maintain consistency between how the numerator and denominators are being measured. A "flow variable" is measured between two points in time. For example, the flow of water over a waterfall, whereas a "stock variable" is measured at a point in time. (weight of a person). In accounting the Income Statement reports flow variables (Sales, Net Income etc.,.) whereas a Balance Sheet reports "stock variables" (Assets, Liabilities and Owners Equity). The above ratios are relating income statement measures to balance sheet measures. To maintain approximately consistent measurements the balance sheet measurements are converted to averages for the period covered as illustrated below.

Average Total Assets = (Beginning Period Total Assets + End Period Total Assets)/2

Net Income is measured for the same period and so both the numerator and denominator are measured in terms of flow (net income, a flow) dividend by (Average Total Assets, an approximation of a flow).

2.2 DuPont Burden Analysis Sub-Branch

The objective for extending the DuPont analysis is to provide a finer decomposition of the major firm decisions into the Investment, Financing and Tax decisions. The Extended DuPont analysis provides this by multiplying ROE by additional ratios that equal one that serve to allow finer deco positions to be performed. That is, EBIT/EBIT, EBT/EBT which allow new ratios to be introduced. These are: the Tax

burden ratio , (NI/EBT), and the Interest burden ratio, (EBT/EBIT). This provides a refinement of the profit ratio (NI/EBIT) into the tax and interest expense related components.

A second important partition can be made, for most companies, with Operating and Gross Margin. Gross margin is Sales less Cost of Sales divided by Sales. Cost of sales are costs directly associated with selling a unit of product. Typically, management has less control over these costs because they are directly affected by economy wide variables such as Consumer Inflation, Interest rates in general, and Producer Inflation. On the other hand, when moving from the Gross to Operating margin the difference will arise from firm specific variables that are more directly under of the control of management. For example, management decide how much they allocate to R&D, Marketing etc.,.

Formally, the Extended DuPont formula is calculated from the extended DuPont decomposition:

ROE = (Net Income after Tax/Earnings Before Taxes) * (Earnings Before Taxes/Operating Profit) * (Operating Profit/Gross Profit) * (Gross Profit/Sales) * (Sales/Total Assets) * (Total Assets/Shareholders' Equity)

The above extended decomposition results in the following final set of ratios:

ROE now decomposes into the following sub-components:
Net Income/Earnings Before Taxes (NI/EBT) = Tax Burden Ratio
Earnings Before Taxes/Earnings Before Interest and Taxes (EBT/EBIT) = Interest Burden Ratio
Earnings Before Interest and Taxes/Gross Profit (EBIT/GP) = Operating Profit Margin (Controllable Costs)
Gross Profit/Sales = Gross Margin
Asset Turnover Ratio or Asset Use Efficiency = Sales/Average Total Assets
Financial Leverage Ratio= Average Total Assets/Average Shareholders' Equity

Interpretation of the above Ratios

Tax Burden Ratio: If taxes are zero the tax burden equals one and so the lower this number, the higher the tax burden.

Interest Burden Ratio: If Interest Expense is zero then interest burden ratio equals one and therefore the higher the financial leverage, the lower is this number. The advantage of adjusting for taxes and interest is to gain finer information into how the both the financing and the tax decisions are driving ROE.

Operating Profit Margin: This is one of the most important performance measures because it is a direct measure of the profitability of a firm's operations. Higher is preferred to lower so long as it is sustainable. It should also be compared in conjunction with the Gross Margin to determine whether it is

controllable costs (such as sales and marketing, research and development) or whether it is the relatively uncontrollable costs (cost of sales) that are driving favorable or unfavorable outcomes.

Gross Margin: See operating margin for how to interpret this ratio.

Asset Turnover: This is part of the basic DuPont analysis and reflects the degree of efficiency with respect to asset utilization. Higher is more efficient.

Financial Leverage Ratio: Another basic DuPont measure and this reflects the relative degree of the use of liabilities to financing assets (e.g., debt versus equity as well as operating liabilities).

In summary the extended DuPont provides finer information about how management is performing not only in terms of their investment and financing decisions but now also in terms of managing their taxes.

2. Analyzing Profitability

What is it: Profitability is a relative term that measures how well management has implemented the firm's business model relative to the resources under their control. Analyzing profitability requires that you become more closely acquainted with the financial statements, the Balance Sheet and Income Statement, to analyze how well management has performed over a given period relative to the set of specific questions presented next.

Why it matters: The set of primary questions are as follows:
First, how efficient is performance relative to resources under management's control?
Second, how well is management doing in terms of increasing revenues and controlling expenses?
Third, how good is management's dividend decision? For example, are they hoarding cash when shareholders; would prefer that they are paying out the cash.
Fourth, is management working for the earnings? In other words, is working to apply resources to the firm's business model. The four primary performance measures for answering these questions are defined next.

Definitions: The major profitability ratios covered in this branch of the tree are as follows:

Sales (the top line) Gross Margin (GM) = Gross Profit / Sales Operating Profit Margin = Operating Profit or EBIT / Sales Net Operating Profit after Tax (NOPAT) margin = NOPAT /Sales Return on Invested Capital (ROIC) = Net Income attributable to shareholders' minus Dividends divided by the sum of Average Debt, Average Lease Obligations (i.e., debt equivalents) and Average Shareholders' Equity Return on Capital Employed (ROCE) = NOPAT divided by Capital Employed = Total Assets – (Short Term plus Long-Term Security Investments) – (Total Current Liabilities – Short-term Debt Obligations – Non-Current Debt Obligations)

Discussion: The analyzing profitability branch has three sub-branches. These three sub-branches cover the first two general profitability questions (general performance, revenue and cost control). The second and third sub-branches cover the dividend policy and business model questions.

3.1 Profitability Ratios Sub-Branch

The first sub-branch returns to and highlights the very important part of the income statement from top line to operating income (EBIT). To convert into ratios the scaling variable is Sales. Working down the Income Statement the first major profitability line item is Gross Profit and therefore Gross Margin:

Gross Profit = Sales – Cost of Sales Gross Margin = Gross Profit / Sales

The second major profitability line is Operating Income or EBIT and when scaled by Sales Operating Margin. The difference between Gross and Operating Margins is as discussed previously, due to the relatively less controllable versus more controllable costs. That is, Cost of Sales (less controllable) versus R&D, Sales and Marketing and Administrative costs that primarily drive the differences between Gross and Operating Profits.

Operating Profit (or EBIT) = Gross Margin – Selling and Administration – Research and Development – Other Operating expenses Operating Profit Margin = Operating Profit (or EBIT) / Sales

Finally, a third important margin relates to Operating Profit net of tax (NOPAT). This is a useful performance measure in Corporate Finance for evaluating investment projects as well as computing Free Cash Flows. The Net Operating Profit After Tax margin and associated margin is defined as follows:

Net Operating Profit After Tax (NOPAT) = Operating Profit (EBIT) * (1 – Corporate Tax Rate) NOPAT Margin = NOPAT / Sales

The next two sub-branches complete the popular set of profitability ratios listed below:

Return on Invested Capital (ROIC) Return on Capital Employed (ROCE)

3.2 Return on Invested Capital (ROIC) Sub-Branch

The ROIC calculator revisits the earlier question:

What should management do with Net Income and or previously accumulated Retained Earnings?

That is, how much should management pay out as a dividend and how much should management re-invest. Analysts may vary with respect to some specific details regarding how they define the denominator below, but the overall guiding question still remains the same:

Are the earnings that have been retained creating value for the enterprise?

The answer to this question depends upon what the return on invested capital is relative to the firm's After Tax Weighted Average Cost of Capital (WACC)? It is beyond the scope of this FSA tree support summary, to explain WACC. This concept is well covered in a Corporate Finance Course. However, the general principle guiding principle is if ROIC is greater than WACC then retaining earnings is expected to add value to the enterprise. Similarly, if ROIC is less than WACC then shareholders would prefer management to pay out dividends and not retain additional earnings.

Return on Invested Capital (ROIC) = Net Income attributable to shareholders' minus Dividends divided by the sum of Average Debt, Average Lease Obligations (i.e., debt equivalents) and Average Shareholders' Equity

The above focuses upon measuring the return from earnings retained. The numerator is net of dividends paid and the denominator is a measure of capital invested. Where analyst specific differences arise is in terms of the degree to which accounting standards imply that some adjustments need to be made for comparability purposes. For example, capital lease accounting measures an asset and a liability (and thus impacts invested capital) whereas operating leases don't. Some analysts attempt to adjust the numbers to better reflect operating leases.

3.3 Return on Capital Employed (ROCE) Sub-Branch

The final sub-branch addresses another important management related question. Warren Buffet has framed this question nicely as follows:

Is management generating returns by working for it in the sense of by implementing the firm's business model?

This question was especially relevant in the lead up to the 2008 financial crisis but it is equally valid today. For example, in the lead up to the financial crisis Sears was looking more like a hedge fund by entering into equity swaps and generating earnings from the run up in the financial markets prior to 2008 as opposed to its retailing business model. Sadly, although they were trading over $140 per share in 2007 their holding company is trading in 2020 around 16 cents per share!

As a result, for non-financial institutions the measure of Capital Employed eliminates financial assets and liabilities. In addition, the numerator focuses more sharply on the issue of working for returns by working with NOPAT as opposed to Net Income. This is because the focus is upon earnings generated from regular operations.

Return on Capital Employed (ROCE) = Net Operating Profit After Tax (NOPAT) divided by Capital Employed

NOPAT = EBIT*(1 – Effective Tax Rate)

Now interested in real assets and liabilities (capital employed) not financial assets and liabilities

Capital Employed = Total Assets – (Short Term plus Long-Term Security Investments) – (Total Current Liabilities – Short-term Debt Obligations – Non-Current Debt Obligations)

In other words, Capital Employed is a measure of *capital employed in regular operations* by stripping out financial assets and liabilities for a non-financial institution. A strong ROCE measure supports the conclusion that management is working for the returns being generated.

3. Analyzing Operations

What is it: A firm's operations are the activities it performs to providing the goods and/or services defined by the nature of their business. That is the firm's core business activities, such as manufacturing, distributing, retailing or service.

Why it matters: Operating activities leave their impact upon both the Income Statement and the Balance Sheet. Operating efficiency covers both working capital management (i.e., day-to-day activities, but also how efficiently the firm's fixed assets or capacity is being utilized. Working capital and asset utilization combined are the major driver of a firm's profitability.

Definitions: The major working capital ratios work with three primary accounts: Accounts Receivable, Inventory and Accounts Payable. Although there are various ways of representing these ratios as discussed in the sub-branches below the primary set are:

Days to Sell Inventory = 365/(COGS/((Inventory(t) + Inventory(t-1))/2))

Days to Collect Accounts Receivable = 365/(Sales/((Accounts Receivables(t) + Accounts Receivables(t-1))/2))

Days to pay Accounts Payable = 365/(COGS/((Accounts Payables(t) + Accounts Payables(t-1))/2))

Operating Cycle = Number of Days to Sell Inventory + Number of Days to Collect Accounts Receivable

Cash (Conversion) Cycle = Number of Days to Collect Accounts Receivable + Number of Days to Sell Inventory – Number of Days to Pay Payables

Operating Profit Margin = Operating Profit (EBIT)/Sales

Asset Utilization = Sales / Average Total Assets

Discussion: There are two major sub-branches for Analyzing Operations. These are Working Capital and Asset Utilization. The first is, Working capital.

4.1 Working Capital Sub-Branch

This calculator measures a firm's efficiency with respect to the day-to-day operations of the firm. In its basic form efficiency can be measured in terms of turnover and the number of turns for some period of time. For example, inventory sitting on a shop shelf for a long period of time implies s business is incurring a significant opportunity cost. This is because there is capital tied up in the inventory as well as a potential obsolescence effect that can creep in over time. As a result, the more frequent inventory turns over the more efficient the firm's inventory operations are. The same logic applies to the other major working capital accounts, which are Accounts Receivable and Accounts Payable but with one potential exception being Accounts Payable. For Accounts Payable increasing the number of turns enhances efficiency from the firm's creditors perspective because it means that they are getting paid faster. From the firm's management perspective this may or may not be the most desirable outcome.

For example, if enhancing the Accounts Payable efficiency, by settling quickly, translates into lower cost of sales this is desirable. On the other hand, if this creates a liquidity problem it is undesirable. Bottom line, the analysis and interpretation of working capital needs to be analyzed in conjunction with the earlier analysis of profitability.

Another dimension to analyzing the efficiency of working capital converts efficiency variables into time-based measurements. This has two immediate advantages illustrated in the following example:

Example

Which is more intuitive --- inventory turns 25 times per year on average or inventory turns over every 14.6 days?

In other words, the number of turns per year can easily be converted into days by dividing days in the year by average number of turns per year (e.g., 365/25 = 14.6 days).

Second, by converting turns for inventory, accounts receivable and accounts payable into days we have a common and meaningful unit of measure, which is time itself. As a result, we can combine the working capital individual measures to generate two new performance measures:

the "cash conversion cycle" and the "operating cycle."

This allows management's working capital strategy to be more sharply focused upon. From the above discussion, it can be seen that the working capital **calculator** provides an important set of ratios. First the base set of working capital ratios, for the three major components of working capital, are:

Inventory, Accounts Receivable and Accounts Payable,

Inventory turnover = COGS/((Inventory(t) + Inventory(t-1))/2)

Accounts receivable turnover = Sales/((Accounts Receivables(t) + Accounts Receivables(t-1))/2)

Accounts payable turnover = COGS/((Accounts Payables(t) + Accounts Payables(t-1))/2)

Next to convert the number of turns per period we can convert the above into their time equivalents. The assumption below is that 1 period equals 1 year.

Days to Sell Inventory = 365/(COGS/((Inventory(t) + Inventory(t-1))/2))

Days to Collect Accounts Receivable = 365/(Sales/((Accounts Receivables(t) + Accounts Receivables(t-1))/2))

Days to pay Accounts Payable = 365/(COGS/((Accounts Payables(t) + Accounts Payables(t-1))/2))

Now you may have noticed in the above that some ratios involve Cost of Sales (COGS) whereas others involve Sales. This is deliberate and designed to exploit the accounting for working capital to generate more accurate ratios. First, Inventory is recorded under historical cost accounting at the lower of cost or market. When inventory is sold the cost of sales reflects the lower of cost or market. Therefore, using COGS results in a more accurate measure than would be the case if COGS was replaced by Sales in the above definition. Similarly, the inventory cost number is what is paid to suppliers and so again for Accounts payable COGS is the preferred number to work with. Finally, for the case of credit sales to your customers they are paying retail and therefore using Sales in the above for Accounts receivable ratios is the most accurate.

Conversion Cycles

There are two important aggregate cycle time measures that are derived from the above conversion to days which are:

Operating Cycle: Average time between sales and collections.

= Number of Days to Sell Inventory + Number of Days to Collect Accounts Receivable

Cash (Conversion) Cycle: Days between cash disbursement from acquiring inventory (or services) and cash collections from selling this inventory (or services).

= Number of Days to Collect Accounts Receivable + Number of Days to Sell Inventory – Number of Days to Pay Payables

For the first measure the focus is on the average time taken sale to collection.

For the second measure the focus is on average time taken from inventory acquisition to collection from the sale of inventory.

As a finer point, the Operating Cycle we expect to remain positive however the Cash Conversion Cycle

working capital is a providing positive cash flows to the firm. This can be the case when you have some market power over your suppliers because it can only be achieved by consistently delaying Accounts Payable longer than the combined number of days for selling inventory and collecting Accounts Receivable. For a persistent example of this see Amazon's working capital calculator.

4.2 Asset Utilization Sub-Branch

In this sub-branch we consider the effect of Porters 5-Forces upon a firm's financial statements. First the four outer forces depicted in the figure below, to generate some degree of Competitive Rivalry:

Generally, we can predict that the more intense the competitive rivalry, the lower the profit margin and similarly, the less intense rivalry is the higher the profit margin. This is because if both suppliers and customers have a lot of bargaining power then a firm is squeezed on both the cost and revenue side of the income statement. Therefore, to compete the firm must achieve a high level of efficiency with respect to their asset utilization. On the other hand, if competitive rivalry is low then the opposite applies and a firm is expected to be able to sustain high profit margins. The high profits will either come from the Sales Revenue if the firm has bargaining power over Customers or lower costs if the firm has bargaining power over the Suppliers. These profits will be tempered by Porter's other two forces Threat of substitute products or new entrants. As a result, interpreting the results from this calculator requires that you understand the nature of the business that you are working with.

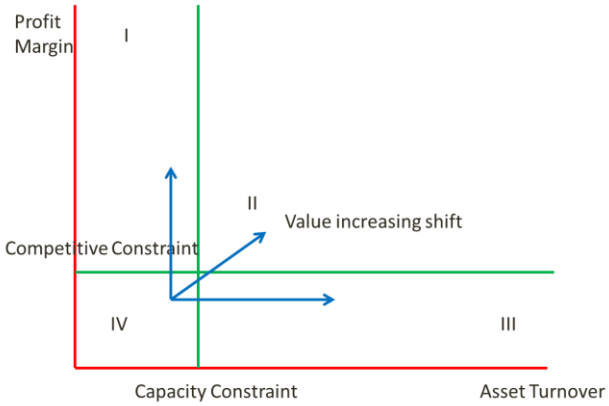
In this sub-branch you are able to work with individual stocks or you can start with the fundamentals and identify which set of stocks satisfy certain combinations of fundamentals. In particular, we focus upon a two- dimensional analysis: Operating Profit Margin by Asset Utilization

Operating Profit Margin = Operating Profit (EBIT)/Sales Asset Utilization = Sales / Average Total Assets

From the above pair we can assess how competitive rivalry impacts the financial statements of a firm or set of firms.

Financial Ratios and Competitive Rivalry

Consider plotting either Operating Profit Margin against Asset Utilization. The following broad regions can be identified:



I. Firms that are subject to capacity constraints but enjoy protection from competitors from strong barriers to entry into their markets. These firms experience relatively low competitive rivalry and higher profit margins.

II. Firms that are not subject to either competitive or capacity constraints relative to others. As a result, these firms face moderate to above moderate levels of competitive rivalry levels.

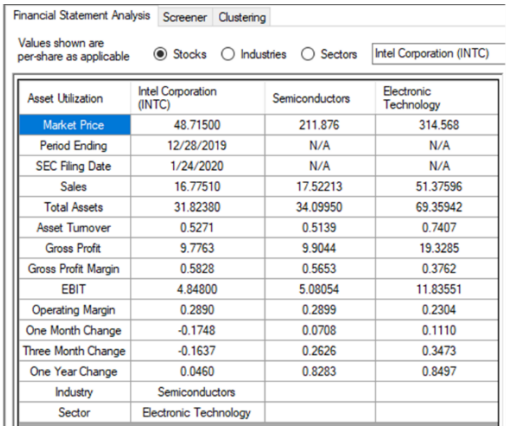
III. Homogenous products with few barriers to entry. In this segment competitive rivalry is intense and firms must compete via efficient utilization of their assets.

IV. Firms that are subject to both competitive and capacity constraints. These firms are likely to be in highly regulated industries such as utilities.

The boundaries for each of the above regions can only be assessed empirically. For example, take two firms that you know a priori fall into different regions such as Intel (region I) and Wal-Mart (region III), and plot them. The following example provides their numbers for year ending 2019.

Example: Intel versus Wal-Mart

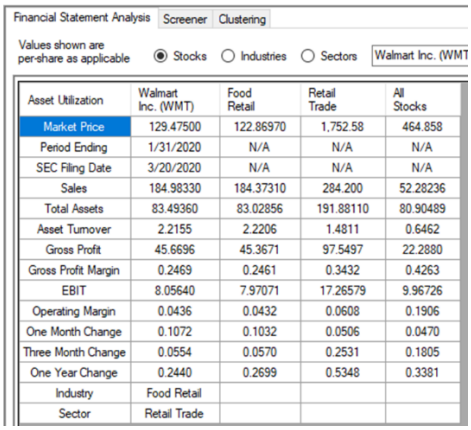
For example, contrast Intel to Wal-Mart. Intel has relatively low competitive rivalry compared to Wal-Mart. From the 2019 annual statements Operating Margin and Asset Utilization for Intel are 0.2890 and 0.5271 versus Wal-Mart 0.0436 and 2.2155. In the above figure we would judge Intel as falling within region I and Wal-Mart region III. Their calculators are displayed below:



Financial Statement Analysis | Screener | Clustering

Values shown are per-share as applicable — Stocks | Industries | Sectors — Intel Corporation (INTC)

Asset Utilization	Intel Corporation (INTC)	Semiconductors	Electronic Technology
Market Price	48.71500	211.876	314.568
Period Ending	12/28/2019	N/A	N/A
SEC Filing Date	1/24/2020	N/A	N/A
Sales	16.77510	17.52213	51.37596
Total Assets	31.82380	34.09950	69.35942
Asset Turnover	0.5271	0.5139	0.7407
Gross Profit	9.7763	9.9044	19.3285
Gross Profit Margin	0.5828	0.5653	0.3762
EBIT	4.84800	5.08054	11.83551
Operating Margin	0.2890	0.2899	0.2304
One Month Change	-0.1748	0.0708	0.1110
Three Month Change	-0.1637	0.2626	0.3473
One Year Change	0.0460	0.8283	0.8497
Industry	Semiconductors		
Sector	Electronic Technology		



Financial Statement Analysis | Screener | Clustering

Values shown are per-share as applicable — Stocks | Industries | Sectors — Walmart Inc. (WMT

Asset Utilization	Walmart Inc. (WMT)	Food Retail	Retail Trade	All Stocks
Market Price	129.47500	122.86970	1,752.58	464.858
Period Ending	1/31/2020	N/A	N/A	N/A
SEC Filing Date	3/20/2020	N/A	N/A	N/A
Sales	184.98330	184.37310	284.200	52.28236
Total Assets	83.49360	83.02856	191.88110	80.90489
Asset Turnover	2.2155	2.2206	1.4811	0.6462
Gross Profit	45.6696	45.3671	97.5497	22.2880
Gross Profit Margin	0.2469	0.2461	0.3432	0.4263
EBIT	8.05640	7.97071	17.26579	9.96726
Operating Margin	0.0436	0.0432	0.0608	0.1906
One Month Change	0.1072	0.1032	0.0506	0.0470
Three Month Change	0.0554	0.0570	0.2531	0.1805
One Year Change	0.2440	0.2699	0.5348	0.3381
Industry	Food Retail			
Sector	Retail Trade			

Stocks falling within the general regions can be further explored by applying the Smart Screener to select different combination levels of Asset Utilization and Operating Profit Margins.

4. Analyzing Cash Flows

What is it: The cash flow accounting statement provides a reconciliation of the change in the balance of cash and cash equivalents over the accounting period. Furthermore, this reconciliation is organized around into three categories of firm activities: Operating Activities, Investment Activities and Financing Activities. The first two categories result from management's investment decision and the last category covers management's financing and dividend decisions. An important set of cash flow related performance measures are constructed from this statement.

Why it matters: Ultimately a firm fails if it runs out of cash. As a result, monitoring cash flows from a bigger picture perspective is important for assessing the current and future well-being of the firm. There are two sub-branches. The first sub-branch focuses directly upon the cash flow statement to provide a performance measures related to the current overall well-being of the firm in relation to the major decisions made by management, The second sub-branch provides an important derived cash flow related number that is used for assessing both a firm's dividend policy and future well-being of the firm. This sub-branch is titled Free Cash Flows, "free" in the sense that it could be paid out without affecting existing operations of the firm.

Definition: Major performance measures for analyzing cash flows are:

Operating Activities including working capital (CFO) = Cash flows from Operations (including working capital)

Investing Activities including CAPEX and new investments (CFI) = Cash flows from maintaining existing capital investments (CAPEX) plus new acquisitions or dispositions.

Financing Activities including Dividend Payments (CFF) = cash flow allocated to paying down/from acquiring debts, Treasury stock purchases and cash dividends paid.

Annual Dividend = Cash dividends paid over the year

Free Cash Flow = Cash Flows from Operating Activities – Capital Expenditures (CAPEX)

Discussion: Cash flows are generated from the major firm activities, operations, investments and financing. In addition, there are various accepted methods for measuring and analyzing cash flows. In this branch there are two sub-branches, the Cash Flow Statement and Free Cash Flows.

5.1 Cash Flow Statement Sub-Branch

The cash flow statement provides a reconciliation of how cash and cash equivalents changed from the beginning to the end of the accounting period. It further provides a classification of changes into three types of activities:

Operating Activities including working capital (CFO)

Investing Activities including CAPEX and new investments (CFI)

Financing Activities including Dividend Payments (CFF)

Annual Dividend

Operating activities include operating income and operating income as well as the cash flow implications from the change in working capital which can be a source or use of funds. Investing activities include both capital expenditures to maintain existing capacity (e.g., Property. Plant and Equipment) but also cash outlays for new investments. Finally Financing Activities reflect new debt raised, existing debt paid down or rolled over. In addition, it includes Dividends paid. That is, it is a mixture of the financing and dividend activities which is why Annual Dividend is also provided to asses the impact of the dividend decision upon CFF.

Finally, a popular proxy ratio for cash flows is EBITDA (operating income adding back the non-cash expenses Depreciation and Amortization). This ratio is also provided in the calculator because it is useful to compare EBITDA and CFO because of what they include/exclude. One major difference is that EBITDA provides a proxy for operating cash flows excluding Working Capital and CFO is a measure of operating cash flows including working capital. Therefore, the impact of change in working capital upon cash flows is provided with this comparison.

5.2 Free Cash Flow Sub-Branch

Free cash flows is a proxy estimate for the cash that debt and equity holders could take out of a firm without affecting the *existing capacity and operations* of the firm. It is defined simply as:

Free Cash Flow = Cash Flows from Operating Activities – Capital Expenditures (CAPEX)

Capital expenditures represent the current outlay required for maintaining existing capacity. That is, it does not include new acquisitions for growth, which will affect future capital expenditures, but not current capacity. For example, a common estimate of CAPEX results from the amount spent on

maintaining plant, property and equipment. With this definition maintaining existing capacity is preserved.

A refinement of the Free Cash Flow concept is referred to as Free Cash Flow to Equity. This is a proxy for the amount of cash that equity-holders can take out of a firm without affecting the *existing capacity and operations* of the firm. It is defined simply as:

Free Cash Flow to Equity = Cash Flows from Operating Activities – Capital Expenditures (CAPEX) + Net Debt Issued

In other words, an adjustment is made to allow for the debt-holders to fund the firm's capital expenditures. As a result, the impact of the Net Debt Issued should be bound by CAPEX. That is, the debt-holders finance 100% but no more of the capital expenditures.

A Note on Dividend Policy

Stocks pay two types of dividends: Cash Dividends and Treasury Stock purchases. Both concepts of Free Cash Flow are useful for assessing a firm's dividend policy. A conservative assessment of dividend policy would apply the following test:

Cash Dividends + Treasury Stock Purchases <= Free Cash Flows

As a final note, Free Cash Flow to Equity is also a proxy for the dividend a firm could pay irrespective of whether or not it does pay this dividend. This latter measure adjusts CAPEX for the effects of debt financing and provides additional insight into the current dividend policy net of the financing decision.

5. Analyzing Risk

What is it: Risk analysis is the process of assessing the chance of an adverse event happening. There is a range of different types of adverse events that can affect a firm. At the highest (KPI) level the firm fails, but leading up to this final event are multiple correlated events such stock liquidity risk, solvency risk, credit risk and market risk. These are the four types of risk covered in this branch.

Why it matters: Ultimately a firm fails if it runs out of cash. As a result, the previous branch and this branch combined provide rich insight into the likelihood of such a negative event happening. If a firm fails then investors lose all or most of their investment plus there is a significant adverse impact upon all stakeholders, including employees, the local regions in which the firm operates and financial institutions. As a result, monitoring the financial well-being of a firm is most important. The sub-branches of this branch of the tree cover extracting information from the financial statements and capital markets, for this objective.

Definition: Major performance measures for analyzing cash flows are:

Liquidity (short-term) performance measures derived from current sections of the Balance Sheet

Solvency (long-term) performance measures derived largely from the non-current section of the Balance Sheet plus Income Statement

Altman Model – A model for assessing the probability of a firm failing within 2-years

Market Risk – theoretical results from the popular Capital Asset Pricing Model (CAPM) equilibrium model.

Discussion: This branch has four sub-branches:

Liquidity

Debt Ratios

Altman Model

Market Risk

6.1 Liquidity Sub-Branch

Every firm that fails ultimately does so because they run out of cash. Therefore, liquidity is most important to firms that do not have healthy operations. Again, this calculator needs to be interpreted within the larger context of whether the firm is viewed as a going concern. A going concern is not formally defined in accounting but it is often taken to assume that the firm is not expected to fail over the next 18-months. Another important distinction that needs clarifying is the difference between Liquidity Ratios and Solvency Ratios. Liquidity ratios adopts a short-term focus which requires assessing a firm's ability to repay its debts over the next twelve months. This is different from solvency ratios which are designed to assess the long term ability of a firm to repay its debts. The calculator associated with the Liquidity sub-branch therefore, adopts this short term focus.

The traditional liquidity ratios are derived from the balance sheet as follows:

Current Ratio = Current Assets/Current Liabilities

Quick Ratio = (Cash + Marketable Securities + Accounts Receivable)/Current Liabilities

Cash Ratio = (Cash + Marketable Securities)/Current Liabilities

From a measurement perspective it can be seen that these are defined directly from the latest balance sheet without the need to take an average because they are stock/stock (i.e., no flows involved). As the ratio moves from Current to Cash the liquidity test is more stringent. The Cash Ratio only includes assets that are either cash or near cash. The quick ratio near cash plus accounts receivable whereas the most relaxed ratio is the current ratio which is derived from the current part of the balance sheet.

Typically it is expected that the current ratio is greater 1 whereas the cash ratio may be below 1. If the Quick and Cash Ratios raise any flags then the additional line items in the Calculator become relevant.

These line items are EBITDA and Cash Flow from Operations. EBITDA is commonly used as a proxy measurement for cash flows because two major non cash expenses are added back to Net Income, namely Depreciation and Amortization expenses. In addition, cash flow from operations introduces another source of cash flows which arise from the working capital management.

In summary, if the traditional three ratios defined above raise any liquidity concerns then the next level of analysis is to investigate both EBITDA as well as Cash Flows from Operating activities to see whether there are any additional reasons to be concerned about the firm's liquidity. That is, the firms ability to repay its debts over the next 12-months.

6.2 Solvency Sub-Branch

Debt to Assets = (Long Term Debt + Debt Due within One Year) / Total Assets

Debt to Capital = (Long Term Debt + Debt Due within One Year) / (Shareholders' Equity + Long Term Debt + Debt Due within One Year)

Debt to Equity = (Long Term Debt + Debt Due within One Year) / Shareholders' Equity

Long Term Debt Ratio = (Long Term Debt / Shareholders' Equity)

In each case a higher ratio implies higher financial risk. Investors are interested in assessing financial risk because higher financial risk implies a higher cost of capital (WACC). This means that the firm not only pays more when borrowing money but also their stock price will reflect a higher expected return required by the capital markets. A higher expected return implies a higher implied discount rate when assessing a stock's intrinsic value (= present value of expected future dividends) and thus a lower intrinsic value.

A second major objective for measuring solvency is to evaluate the firm's default risk. The above solvency measures provide relevant information for this assessment plus an even more severe test is to measure a firm's ability to pay interest. That is, the degree to which current interest expense is covered by operating income provides a direct measure of default risk. Clearly, if the coverage ratio is much greater than 1 then there one would not expect default risk to be high especially if current operating earnings are expected to be sustained. However, if interest expense is greater that income from operations and this is expected to continue, then clearly management has a major problem to deal with. This is because creditors can wind up a company if they are not paid.

The times interest earned ratio is defined as follows:

Times Interest Earned = EBIT/Interest Expense

EBIT = Earnings Before Interest and Taxes (or Operating Income)

6.3 Altman Model (Credit Risk) Sub-Branch

The third sub-branch focuses more sharply upon the question regarding the impact upon credit risk and the cost of debt capital.

There is an entire industry that has evolved to make such assessments. In particular, major global players such as Moody's, Standard and Poor's and Fitch make continuous assessments of credit risk. These are reflected in terms of ratings. For example, the long-term ratios from high to low are (e.g., Standard and Poor's and Fitch):

AAA, AA+, AA, AA-, A+, A, A-, BBB+, BBB, BBB-, BB+, BB, BB-, B+, B, B-, CCC+, CCC, CCC-, CC, C, DDD, DD, D)

Standard and Poor's use RD, SD, D for the last three categories.

The acceptable grade for Corporates is Investment Grade and the bare minimum being BBB- for this all-important category. If a firm falls below investment grade then its cost of debt rises rapidly.

Although the major credit agencies do not publish their precise method for assessing default risk, there is a popular academic paper that proposed a simple model for predicting the risk of default within 24-months. This study was published in 1968 by Professor Altman and was based upon the results from a relatively small sample of 68 manufacturing firms. Half the sample had filed for bankruptcy and the other half were going concerns. The results from this study have withstood the passage of time and the model is still popular today. The model is defined from the following set of ratios which are combined as indicated to generate a "Z-Score."

$Z = 1.2X1 + 1.4X2 + 3.3X3 + 0.6X4 + 0.999X5$

Z = overall index

X1 = working capital/total assets,

X2 = retained earnings/total assets,

X3 = earnings before interest and taxes/total assets,

X4 = market (or book) value equity/book value of total liabilities,

X5 = sales/total assets

To interpret the Z-Scores the following rules have been suggested:

$Z > 2.99$ – "Safe" Zone

$1.81 < Z < 2.99$ – "Grey" Zone

$Z < 1.81$ – "Distress" Zone

In other words, a score below 1.8 means there is a reasonable probability that the company is headed for bankruptcy, while companies with scores above 3 indicate a going concern. These broad rules have been further refined to map into the AAA etc.,. credit ratings. The calculator provides these ratings.

6.4 Market Risk Sub-Branch

The Capital Asset Pricing Model (CAPM) is an asset pricing model that is discussed in every finance textbook. In this theory there are two sources of risk: Systematic and Unsystematic Risk. Market risk is systematic risk and is driven by economy wide events (e.g., recession, pandemics, global crises). Unsystematic sources of risk are driven by firm or industry specific sources. For example, if an airline's pilots go out on strike this is an example of an unsystematic source of risk.

In CAPM theory investors are rewarded for assuming systematic risk and are not rewarded for assuming unsystematic risk. The latter because investors can freely diversify away sources of unsystematic risk by forming a large portfolio. However, investors are paid to assume systematic risk which in CAPM translates into receiving a higher rate of *expected* return.

CAPM results from a market equilibrium and the expected return and cost of capital are two terms that are equivalent in the CAPM theory. This is because the cost of equity capital equals the investors' required rate of return and in the CAPM equilibrium expected returns equal investors' required rate of return. To close the loop another way of expressing "investors' required rate of return is to refer to it as the "cost of capital." Hence these terms will all be used interchangeably when discussing CAPM:

$k_e = r_f$ + Beta(Stock i) * Equity Premium = cost of capital or investors' required rate of return

In a market equilibrium (i.e., all stocks are efficiently priced)

E(Return) = $k_e = r_f$ + Beta(Stock i) * Equity Premium

In addition, you should note that the excess return from the market is the Equity Premium which equals for the market as a whole the expected return from the market as a whole net of the risk free rate ($E(R_M - r_f)$).

In practice there are many contenders for r_f because there is an entire term structure of interest rates that one can plot (i.e., r_f by time-to-maturity). In practice analysts often match the time-to=maturity with the investment horizon. For example, if your investment horizon is 10-years then the 10-year Treasury Note rate is appropriate.

Finally, the equity premium cannot be directly observed, however it is empirically inferable from time series data or it can be assessed from polling finance professionals. For the latter an extensive polling survey is conducted each year and is currently available on SSRN as follows:

Survey: Market Risk Premium and Risk-Free Rate used for 81 countries in 2020
15 Pages Posted: 25 Mar 2020
Pablo Fernandez
IESE Business School
Eduardo de Apellániz

Instituto de Estudos Sociais e Economicos (IESE)
Javier F. Acín
Independent

The 2020 reported results for the US are mean 5.6% and median 5.4%. It is noted that these numbers are relative to r_f being fixed along the yield curve (10-year in this case) and so if r_f was fixed to the short end then the equity premium is higher.

Currently, in the calculator the defaults are – the current 10-year constant maturity Treasury Note rate plus the median equity premium rate (5.4%). The current input values are displayed at the bottom of the Market Risk calculator.

Market Risk and Stock Beta

Market risk is often referred to as systematic risk because it is driven by economy wide events (e.g., recession, pandemics, global crises). Beta is a scaled measure of a firm's systematic risk. Operationally, beta measures the sensitivity of a stock's returns with respect to the broad-based market returns. That is, if the stock has the same market risk as the market as a whole then beta equals 1. If stock beta is less than 1 then the stock is assessed to have lower than average market risk and vice versa if higher than 1.

For example, consider CAPM when beta equals 1.

E(Return) = Cost of Capital = risk free rate + 1 * equity premium

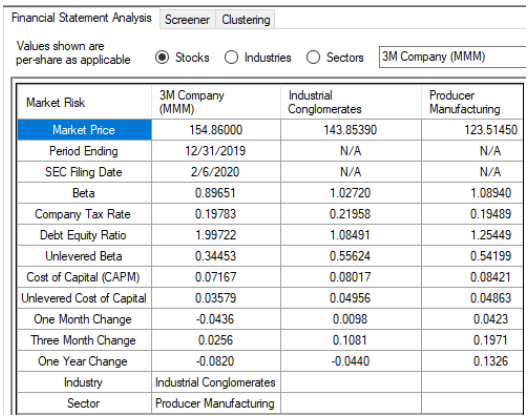
You should observe from the above that if the market risk is less than 1 (beta < 1) then the stock is predicted to have lower cost of capital and lower expected return than a stock whose beta is > 1.

However, there is one additional issue that arises when trying to compare stock betas (and thus cost of capital/expected returns) across stocks. This is that financial leverage also impacts the measure of beta. So one additional adjustment that analysts can do is to undo the effects of financial leverage (i.e., debt) upon beta. This allows the analyst to isolate the contribution of a firm's equity upon its market risk.

This is referred to as Unleveraged Beta and is defined as follows:

Unlevered Beta = ((Leveraged) Beta) / (1 + (1 – Tax Rate)*(Debt/Equity))

You can quickly see from the calculator that financial leverage has a significant impact upon regular beta. For example, the stock 3M is illustrated below:



Financial Statement Analysis | Screener | Clustering

Values shown are per-share as applicable — Stocks | Industries | Sectors — 3M Company (MMM)

Market Risk	3M Company (MMM)	Industrial Conglomerates	Producer Manufacturing
Market Price	154.86000	143.85390	123.51450
Period Ending	12/31/2019	N/A	N/A
SEC Filing Date	2/6/2020	N/A	N/A
Beta	0.89651	1.02720	1.08940
Company Tax Rate	0.19783	0.21958	0.19489
Debt Equity Ratio	1.99722	1.08491	1.25449
Unlevered Beta	0.34453	0.55624	0.54199
Cost of Capital (CAPM)	0.07167	0.08017	0.08421
Unlevered Cost of Capital	0.03579	0.04956	0.04863
One Month Change	-0.0436	0.0098	0.0423
Three Month Change	0.0256	0.1081	0.1971
One Year Change	-0.0820	-0.0440	0.1326
Industry	Industrial Conglomerates		
Sector	Producer Manufacturing		

6. Quality of Earnings

What is it: Accounting accruals, non-cash revenues and expenses, are the difference between cash and accounting income. Management have some flexibility with respect to their reporting of accounting accruals. As a result, comparing the difference between accounting and cash income has empirically been demonstrated to provide investors with value relevant information for predicting future earnings.

Why it matters: Given that accounting accruals have value relevant information for investors, and management has some flexibility with respect to estimating and reporting accruals, it is useful to measure the impact of accruals upon a firm's financial statements. Therefore, it is useful to assess the impact of accruals separately upon a firm's balance sheet and income statement.

Definition: Major performance measures for analyzing cash flows are:

Accruals Ratio (Balance Sheet) = Change in the Net Operating Assets over the accounting period scaled by the Average Net Operating Assets for the same period.

Aggregate Accruals (Cash Flow Statement) = Net Income – (Cash Flow from Operating Activities plus Cash Flows from Investing Activities)

Percent Operating Accruals = (Net Income – Cash Flow from Operations) / Net Income

Discussion: The final branch for Business Ratios is quality of earnings. A general objective of this branch is to allow a user to assess the degree to which management is using accounting accruals. Again, this branch needs to be evaluated in the broader context that the earlier profitability analysis branch provided. For quality of earnings there are two sub-branches. The first estimates the implied use of accruals using the balance sheet and the second sub-branch estimates this from the cash flow statement. First, let's understand what accounting accruals are.

What is the difference between accounting and cash income?

Accounting Income results from Matching Expenses to Revenues. This matching principle is central to the differences that arise between accounting and cash income because matching is independent of

whether or not cash flows actually occurred at the time of the transactions being matched. This is because the objective is to provide a more informative measure of period profits or income.

Cash Income on the other hand results from matching cash outflows to cash inflows.

Accounting Accruals are defined as the difference between these two important measures performance. As a result, accruals when combined with double entry accounting will impact both the Income Statement and the Balance Sheet.

For example, depreciation expense which recognizes an asset's service potential being consumed impacts both the Income statement and the balance sheet. With respect to the income statement it is an expense and with respect to the Balance sheet it serves to reduce the book value of some real asset. Amortizations are similar apart from being netted off against some intangible asset.

In the Indirect Form of the Cash Flow statement, the starting line item is Net Income and then non-cash (i.e., accruals entries) are added/subtracted to provide a measure of Cash Flows from Operating Activities (CFO). Over 99% of publicly listed companies in the US provide cash flow statements in this indirect form.

However, regardless of how the cash flow statement is reported combined the three statements provide relevant information for assessing the degree to which accruals are present both indirectly from the beginning and ending periods' balance sheets or directly from the Income and Cash Flow statements. The first sub-branch the calculator lets a user assess the role played by accruals indirectly by extracting information from the balance sheet. The second sub-branch lets a user assess the role played by accruals directly by extracting this information from the Income and Cash Flow statements.

7.1 Quality of Earnings (Balance Sheet) Sub-Branch

The definition of the Balance Sheet accruals ratio is:

Accruals Ratio = Change in the Net Operating Assets over the accounting period scaled by the Average Net Operating Assets for the same period.

The scaling is part of the above definition to permit comparison across firms.

Net Operating Assets is defined as:

(Total Assets less Cash and Short term Investments) – (Total Liabilities – Total Debt)

That is, items that management have relatively little reporting discretion over what is subtracted out of balance sheet items. This supports the interpretation of the balance sheet accruals ratio provides a measure that is related to management discretion and therefore the higher the ratio the higher the accruals and the lower the reporting quality relative to predicting future earnings or cash flows.

The balance sheet approach is more difficult to interpret because it is an indirect approach to inferring the influence of accruals on the financial statements. In the next sub-branch a more direct approach is provided.

7.2 Quality of Earnings (Cash Flows) Sub-Branch

This accruals ratio is computed directly from the difference between accounting net income and the cash flows generated from management implementing the firm's business model. For cash flows the measure combines the cash flows from both operating and investing activities. That is, the cash flows are measured net of capital expenditure items required to support the implementation of the business model in order to be relatively consistent with accounting income which includes depreciation and amortization charges.

The definition of the Cash Flows accrual ratio results from the following elements:

Aggregate Accruals = Net Income – (Cash Flow from Operating Activities plus Cash Flows from Investing Activities)

For comparison purposes this again is scaled by the average Net Operating Assets for the same period:

Accruals Ratio = Aggregate Accruals/ Average Net Operating Assets

Where Net Operating Assets is defined in the same way as presented earlier for the Balance Sheet accruals ratio.

This accruals ratio provides a more direct measure of the impact of accruals on the income statement relatively to the cash flow statement and so finally one of the most direct methods is referred to as the "Percent Operating Accruals." This is a variation of the traditional accrual ratios. Percent Operating Accruals measures Aggregate Accruals relative to Cash Flow from Operations as opposed to the sum of Cash Flow from Operations and Cash Flow from Investing activities. This difference is quite sensitive to accruals because the accrual entries are reversed by the accountants when measuring Cash Flow from Operating Activities. In addition to make the measure comparable across firms, the scaling variable is Net Income as opposed to Average Net Operating Assets. The idea behind this measure is to make this measure very sensitive to accruals by exploiting how the different accounting statements are prepared. It does suffer from a problem however, if net income is negative.

Percent Operating Accruals = (Net Income – Cash Flow from Operations) / Net Income

The higher the percent operating accruals the more significant the use of accruals are.

7. Price Ratios

What is it: Price ratios lets you assess a firm's value relative to its competitors or other related stocks, by combining fundamentals with its stock price. Relative valuation models avoid making you forecast the inputs required by the various intrinsic value models used for valuing stocks. However, although on the surface relative valuation using price ratios is very easy to apply because no forecasting is required, these same intrinsic value models allow differences among the price ratios of comparable stocks to be interpreted at a finer level. As a result, this branch guides your interpretation of price ratios within the context of the constant dividend yield model of intrinsic value. Finally, the major price ratios such as

Price/Earnings (P/E) ratio, and the Book/Price ratio are arguably among the most commonly demanded ratios by investors.

Why it matters: Relative valuation helps an investor to quickly identify stocks that are potentially under (or over) priced relative to their comparable peers. Furthermore, by combining this first pass analysis with the additional insights from the constant dividend growth model of intrinsic valuation helps to increase the likelihood for relative valuation to identify attractive investment opportunities.

Definition: Major performance measures for cash flows are:

P/E Ratio = Stock Price/Earnings per Share (EPS) using the most recent audited consolidated income statement
PEG Ratio = (P/E Ratio)/Constant Average Growth Rate
Book-to-price (or Book-to-Market) ratio = Shareholders' equity / Market Capitalization
Price-to-Sales
Price to Cash Flows

Discussion: The two primary tree branches are Business Ratios and Price Ratios. In the following sections Price Ratios are introduced.

8.1 Price to Earnings Sub-Branch

Arguably the most reported financial ratio is the Price to Earnings (P/E) Ratio.

What Does it Mean?

In words Price per share divided by Earnings per Share is the number of years it takes to recover the current stock price from current earnings assuming *zero* growth. This suggests that differences observed among a set of P/E ratios can be explained by differences in expected growth.

Two major forms for the P/E Ratio are covered in the P/E ratio calculator:

Forward P/E Ratio = Stock Price/ Forecast Earnings per Share (EPS) for Current Year
P/E Ratio = Stock Price/Earnings per Share (EPS) using the most recent audited consolidated income statement

To understand how growth drives the P/E ratio we consider a simple but powerful model of a stock's intrinsic value. This model defines intrinsic value as the present value of all future dividends discounted by the firm's cost of equity capital. However, by making the additional simplifying assumption that dividends grow at some constant average rate over time, this very general present value model reduces to the following simple form:

Intrinsic Value = Expected Next Period's Dividend divided by the cost of equity capital net of the constant average growth rate

Intrinsic Value = E(Dividend)/(k_e – g), where k_e is the cost of equity capital and g is the constant average growth rate.

The above form of the intrinsic value is simple but surprisingly powerful. This is because it immediately focuses attention upon three major drivers of intrinsic value. These are:

E(Dividend) which depends upon Expected future earnings

The discount rate which is referred to as the cost of equity capital

The constant average growth estimate

Estimating the above three major drivers is a much more manageable exercise than estimating all future dividends! However, one additional powerful implication that this simple model provides is that if we equate it to the observable stock price then we can extract the implied value for one of the above three variables. In other words we only need estimate two of the three major drivers and then one can back out the implied value for the third variable given the spot market price.

Example: What is the implied constant average growth rate given the spot price?

Let the spot stock price (p) equals the assessed intrinsic value and re-arrange the equation to express in the form of g = implies:

$P = E(Div)/(k_e - g) \Rightarrow g = k_e - E(Div)\ Yield = k_e - E(Div)/Price$

In other words, the average growth rate will equal the cost of equity capital minus the expected dividend yield.

What is k_e?

In finance theory a major breakthrough was formulating a theory of ke. This well-established theory is known as the Capital Asset Pricing Model (CAPM) and is described in every general finance textbook. CAPM provides a simple but powerful equation for k_e as described next:

$k_e = r_f + Beta(Stock\ i)*(Equity\ Premium)$

This equation asserts that the cost of equity capital equals the risk-free rate plus an adjustment for risk. The risk-free rate in reality is an entire yield curve which raises the question which rate?

As a rule of thumb one answer to this question is to ask yourself what is my investment horizon? If it is 10-years then the 10-Year Treasury Note rate would seem appropriate. Typically, either the 10-year or longer risk free rate is used for r_f.

The adjustment for risk term has two components: a firm specific component, beta, and an economy wide component, equity premium.

Beta is estimated from historical returns by applying regression analysis to typically 5-years of monthly returns. It is usually available from popular finance web sites such as Yahoo finance.

Equity premium cannot be observed but a useful survey conducted each year is provided in the SSRN. The most recent at the time of this writing is:

Survey: Market Risk Premium and Risk-Free Rate used for 81 countries in 2020, 25 Mar 2020, Pablo Fernandez, Eduardo de Apellániz and Javier F. Acín.

The current Equity Premium median for the US based upon the survey results reported in this paper is: 5.4% and so typically an estimate that is usually close to 5.5% is most common for the US equity premium value.

Closing the Loop between the Constant Dividend Growth Rate and a P/E Ratio

To close this loop, we next introduce some additional variables. First, assume that the firm has some constant target dividend payout ratio (DPR). Let the Dividends Per Share be denoted as DPS and Earnings Per Share be denoted as EPS. Each of these terms have subscripts which have been dropped to simplify notation:

Spot Price (P) = EPS*DPR*(1+g)/(k_e – g)
P/EPS = DPR*(1+g)/(k_e – g)
P/E(EPS) = P/(EPS * (1+g)) = DPR/(k_e – g)

In other words, the major theoretical driver of the two forms of the P/E ratio turn out to be primarily driven by the denominator (k – g). If (k_e – g) gets smaller, for example growth increases, the P/E grow larger and vice versa.

That is, the theory predicts both k_e and g matter!

PEG Ratio

A popular extension to the P/E ratio is known as the "PEG" ratio. This uses the constant growth as a scaling variable as follows:

PEG Ratio = (P/E Ratio)/Constant Average Growth Rate

A common variation, if available is to substitute the 5-year consensus analyst forecast for EPS as g.

Now the interpretation of the P/E ratio becomes the number of years to recover price from EPS controlling for growth differences. As a result, the P/E ratio is rendered more comparable. This ratio was popularized by Peter Lynch, who wrote in One Up on Wall Street (1989) that:

"The P/E ratio of any company that's fairly priced will equal its growth rate"

In other words, he asserts that an appropriate benchmark for PEG is 1. A cautionary note is beware of taking this too literally because as you saw above the major driver of P/E ratios is k_e – g as opposed to g by itself and the 10-year Treasury rate in June 1989 was 8.28%. However, as part of the calculator current aggregate numbers are provided for benchmarking purposes and which will reflect the current yield curve and growth. Today interest rates are low and therefore the P/E part will be higher.

Therefore, as a refinement of the PEG ratio the calculator also provides the PEKG ratio defined as follows:

PEKG Ratio = (P/E Ratio)/(k_e – Constant Average Growth Rate)

8.2 Price to Sales Sub-Branch

In this sub-branch the focus shifts to the top line number in the income statement, Sales. This is an important number because a firm cannot grow unless it is growing its revenues. Price to Sales is defined as:

Price to sales ratio = Stock price divided by Sales Revenue *per share*.

That is, the Price/Sales Ratio is a measure of the number of years to recover the stock price with zero sales growth. One rationale for working with the price to sales ratio is that Sales Revenue is the top line of the income statement and thus is relatively less subject to manipulation. It is useful to use in conjunction with the P/E ratios when evaluating stocks using price ratios.

8.3 Book to Price Ratio Sub-Branch

This ratio has been popularized by the careful empirical studies by Fama and French (F&F) and others. It is included in the F&F 3- and 5-factor models which are provided in a separate branch further down the tree. The Book-to-Price ratio is defined as follows:

Book-to-price (or Book-to-Market) ratio = Shareholders' equity / Market Capitalization

The empirical properties documented by Fama and French associated with this ratio are:

	High B/M	Low B/M
Returns	Higher	Lower
Risk	Higher	Lower
Type of firm	Value	Growth

As a result, the ratio can be used to classify stocks into growth or value stocks. This raises the immediate question what is high or low? To help answer this the calculator for this sub-branch provides the comparison of a stock's number relative to its Industry, Sector and All Stocks. As a result, the answer will depend upon what your level of analysis is.

As a potentially confusing point when various sources quote this ratio it is often quoted in two ways --- Book-to-Market and Market-to- Book. If quoted in the latter which is 1/Book-to-Market then the interpretation using the table provided must be reversed.

Theoretical Note

Does the theory reinforce the above empirical findings? To answer this question, consider again the constant dividend growth model.

Intrinsic Value = Market Capitalization (M) = E(Dividend)/(k_e – g)

M = Current Dividend*(1+g)/(k_e – g)

M = Net Income *DPR*(1+g)/(k_e – g)

Dividing both sides by book value of equity (B) results in:

M/B = ROE*(1+g)/(k_e – g)

Assuming stock is well priced

In other words, the B/M ratio is driven by ROE, k_e and g. That is, B/M is inversely related to growth and directly related to k_e

B/M => inversely related to Growth, and is directly related to k_e (risk).

This supports the F&F empirical results summarized in the summary table provided above.

Finally, to reinforce the above relationships between the fundamentals and Book to Market Ratio the FTS calculator provides in addition to the above ratio the standard *DuPont decomposition ratios*. This lets you check first hand predictions from the simple constant dividend growth model.

8.4 Price-to-Cash Ratio Sub-Branch

In this sub-branch the calculator provides two important measures of cash flow which are EBITDA and Cash Flows from operations. These two performance measures are described as follows:

EBITDA (Operating Earnings before Interest and Taxes) = Operating Income (EBIT) + Depreciation Expense + Amortization Expense

Cash Flows from Operating Activities = Cash generated from operations + cash generated from working capital management

EBITDA is a proxy for cash flows from operations and so the major difference is the exclusion/inclusion of working capital items. That is, working capital can be either a use of cash or source of cash.

For example, if Accounts Receivable increases over the period, this is a *use of cash*, because the cash has not been collected. Similarly, if Accounts Payable increases over the period, this is a *source of cash* because the firm has delayed paying creditors and thus saved paying out cash.

Finally, a second major line item in the Cash Flow Statement is Cash Flows from Investing activities. This includes capital expenditures, plus cash outflows/inflows from new investments and/or downsizing existing investments. From a cash flow perspective, net new investments will impact future earnings but not current period earnings. As a result, for the current period a third popular cash flow related concept is *Free Cash Flows*. This is cash that is earned by the enterprise in the sense of the "economic income" concept. This concept, first defined by the economist Hicks, is the amount that could be paid out by a firm such that at the end of the period the owners of the firm are as well off as they were at the beginning of the period.

In other words, Free Cash Flows can be used to assess the dividend a firm could pay irrespective of its cash or accounting dividend policy. This explains why a stock like Alphabet can have a market

capitalization over USD 1 trillion even though it pays no cash dividends. That is, Alphabet could pay a dividend but chooses to retain and re-invest its earnings back into it's business operations.

Free Cash Flow to the Firm (FCF) = Cash Flow from Operating Activities (CFO) – Capital Expenditures (CAPEX)

Capital Expenditure is the part of Cash Flows from Investing Activities that relate to maintaining existing capacity (e.g., cash flows associated with the change in Plant Property and Equipment for a traditional company.

The key ratios in this sub-branch are:

Price To CFO = Price / Cash Flow from Operations per share
Price to EBITDA = Price / EBITDA per share
Price to FCF = Price / FCF

8. Factor Models

What is it: A factor model predicts stock returns from one or more factors. These models are either derived from economic theory such as the Capital Asset Pricing Model (CAPM) or estimated empirically such as the Fama and French 3-factor model. The factor model branch illustrates both types of models (CAPM, Fama and French 3-factor model and Fama and French 5-factor model). The calculator associated with each model lets you engineer portfolios guided by the respective model.

Why it matters: Forming portfolios to manage risk and expected return is central to an investor's investment decision. The underlying theme for the whole tree diagram conceptual approach is to uncover relationships between fundamentals and returns. Each branch is designed to let you do this for the particular topic, covered by the branch. The Factor Models branch provides an extension of this same underlying theme but this time guided by some of the more widely cited theoretical and empirical work in Finance. No single model provides any guarantee of investing success but instead it is fair to argue that they serve to enhance the probability of success. One of the unique aspects of this software package is that it is designed to let you explore these issues personally and learn from experience.

Definition: Major factor models covered in the sub-branches are:

Capital Asset Price Model and forming portfolios based upon Beta
Fama and French 3-Factor Model – forming portfolios based upon Beta, Firm Size and the Book-to-Market Ratio
Fama and French 5-factor model – forming portfolios based upon Beta, Firm Size, Book-to-Market, Operating Profitability, and Asset Growth

Discussion: In finance theory there has been a lot of work, both theoretical and empirical, predicting returns from factors. The software here in no way attempts to provide a comprehensive coverage of this extensive literature. Instead it provides calculators for three popular models, CAPM, Fama and

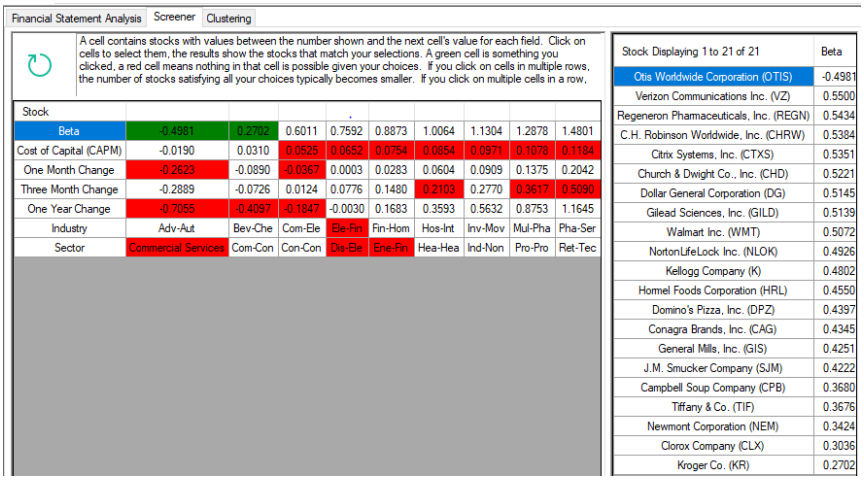
French 3-factor model and the more recent Fama and French 5-factor model. Each of these models has its own sub-branch of the Factor Model main branch.

9.1 CAPM 1 Factor Model Sub-Branch

Constructing a portfolio using CAPM is relatively straightforward given there is only factor – beta to consider. In the literature there is some controversy regarding the ability of beta to predict returns. Negative results from empirical studies raised the question "Is beta dead?"

Fisher Black in his article "Beta and Return" 1992 made the powerful observation that if Beta is dead it is actually more alive than ever. This is because the investment strategy would be to form a portfolio of low beta stocks and still earn the equity premium! In other words, if beta has no predictive ability then a low beta stock portfolio will reduce general market risk but still earn the equity premium which is approximately 5.5% over the 10-year risk free rate.

The FTS Smart Screener makes it very easy to conduct your own study of this right now! For example, if you want to examine the past 1-year returns from a portfolio of low beta stocks by selecting the two cells that turn green once selected, then the smart screener generates the following results:



That is, the two lowest intervals for beta generates the set of stocks to the right and you can see that all of the high positive returns are still available (i.e., One Year Change cells that are not red).

It is left as an exercise for you to explore in more depth the relationship between beta and returns by applying the Smart Screener.

9.2 Fama French 3-Factor Model Sub-Branch

A major empirical competitor to the CAPM model for predicting expected excess returns is provided from the extensive empirical work published by Fama and French. Currently, they have proposed two models from their results:

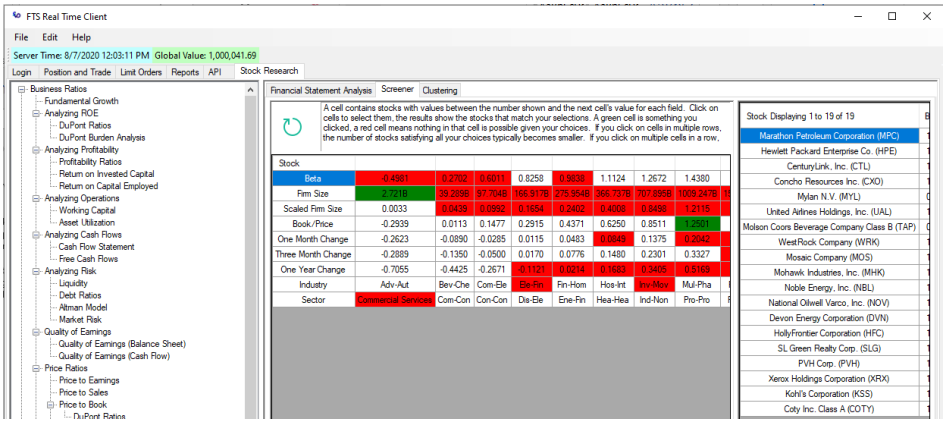
Fama and French Three Factor Model for expected excess returns net of the risk free rate: The three factors are Firm size, Book-to-Market values and Beta from CAPM

The above two sub-branches when combined with the Smart Screener and the Clustering tabs will allow you to construct portfolios that are tightly engineered relative to the Fama and French factors. The factors are Book-to-Market, Firm Size and Beta. Consider first Book-to-Market. As previously described in the Price Ratios branch the book-to-market has the following well documented properties:

	High B/M	Low B/M
Returns	Higher	Lower
Risk	Higher	Lower
Type of firm	Value	Growth

In other words, if the objective is to earn high expected returns then a high book-to-market stocks are desirable. Similarly, for small stocks. So considering just these two factors we can now apply the Smart Screener to test whether this has held over the last year:

By selecting the highest Book-to-Market cell and the lowest Firm Size cell (depicted in green below) results in the following:



The above does not look to be promising because the red cells are not feasible and you can see that only negative 1-year returns are feasible.

Again, you are left to explore these important questions further plus extend your explorations to the more recently proposed Fama and French 5-factor model.

9.3 Fama French 5-Factor Model Sub-Branch

A major empirical competitor to the CAPM model for predicting expected excess returns is provided from the extensive empirical work published by Fama and French. Currently, they have proposed a refinement of their 3-factor model. The Fama-French five-factor model adds two additional factors, profitability and investment. This resulted from evidence showing that the three-factor model was not capturing fully returns related to profitability and investment.

Fama and French Five Factor Model for excess returns net of the risk free rate:
The five factors are Firm size, Book-to-Market values, Beta , Operating Profitability and Asset Growth

It is noted that once profitability and investment are added then the book-to-market factor loses its significance. So this raises questions whether 5 or 4 factors are really needed.

The FTS Smart Screener allows you to explore these hypotheses as you relate the fundamental variables in the 5-factor model to returns.