Required Business Performance® Methodology*

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- The RBP® and RBP® probability methodologies are the subject of a Transparent Value LLC patent application filed with the United States Trademark and Patent Office.

1. Outline

This paper describes how Transparent Value derives Required Business Performance (RBP) and RBP Probability (RBPP), which measures the likelihood that future sales will grow to the level implied from current stock price. The next section briefly summarizes the literature on valuation and intrinsic equity value estimates. Section 3 describes price-implied expectations: knowing that prices aggregate diverse sources of public and private information, investors can use prices to impute expected future performance of key value drivers. Section 4 describes the process that leads to the RBPP which expresses price-implied expectations of future sales as a risk-adjusted probability. Section 5 reports sensitivity analyses for three case studies.

2. Intrinsic Firm Value Estimates

Investors can make portfolio choice decisions in many ways: They may (i) generate measures of intrinsic value of the firm, (ii) base their investment strategy on technical analysis, or (iii) rely on price momentum or other fundamental signals such as accounting earnings momentum to guide their investments.[1] The intrinsic value approach estimates what the firm is worth without reference to current stock market value. This intrinsic value approach presumes that price is what you pay but value is what you get. If intrinsic firm value exceeds (falls below) current market value, one interpretation is that the firm is undervalued (overvalued). This section reviews some common ways to derive intrinsic value of equity.

Estimates of intrinsic value of equity can be derived from dividends, free cash flows, accounting book values or accounting earnings. First, intrinsic value of equity might be derived from the expected discounted value of all future dividends of the firm. Many implementations of the dividend discount model presume a terminal value date and require measuring the anticipated value that a shareholder receives when selling the shares. Other implementations do not explicitly require a terminal value estimate but

[1] The list of fundamental signals is large as documented by Ou and Penman (1989), Lev and Thiagarajan (1993) and Abarbanell and Bushee (1997, 1998).

instead make assumptions about dividends in the long run. One common way to capture terminal value is the Gordon growth model which assumes that earnings grow at the same rate in perpetuity. Under the Gordon growth model, intrinsic value or terminal value of equity becomes the ratio of future dividends divided by the difference between the discount rate and the growth rate. To apply this approach to equity valuation, only the firm's discount rate and the firm's growth rate in dividends need to be estimated. The Gordon growth model, however, cannot immediately be applied to firms that have yet to pay any dividends, e.g., Microsoft. Since dividends are not a primitive measure of value creation, a firm could be profitable without paying any dividends. Instead of paying dividends, these firms reinvest all their earnings in its operations leading to stock price increases to the benefit of equity investors. Consequently, value of equity is often derived from free cash flows or accounting earnings.

As an alternative to measuring intrinsic value of equity as the expected discounted value of all future dividends, intrinsic value of equity can be estimated as the expected discounted value of all future free cash flows. Again, the Gordon growth model is typically invoked by assuming constant growth rates of free cash flows beyond the forecast horizon. Intrinsic value of equity is then derived from estimated firm value by deducting the current market value of debt. Since analysts do not usually offer forecasts of future free cash flows, this approach calculates forecasts of future free cash flows from rolling forecasts of future income statements, future capital expenditures, and future balance sheets, among others.

In addition, intrinsic value of equity could be estimated from accounting measures. One such accounting-based approach, the residual income valuation model, generates firm value estimates from accounting-based valuation as the sum of current accounting book value and the expected discounted sum of future abnormal earnings.[2] There are three common implementations of the residual income valuation models that each makes different mutually exclusive assumptions about future earnings beyond the analysts' forecast horizon. First, Return-On-Equity (ROE) may be expected to remain constant in

[2] Abnormal earnings are also referred to as residual income or Economic Value Added®. See Ohlson (1995).

perpetuity. Second, analysts forecast of Return-On-Equity may be expected to move after the forecast horizon linearly towards the industry median ROE by the twelfth year after which the residual incomes remain constant in perpetuity. Third, analysts forecast of Return-On-Equity may be expected to continue to grow at some constant rate.[3]

An alternative accounting-based approach ignores book value and relies on analysts earnings forecasts.[4] One example of this approach is the Price-Earnings-to-Growth (PEG) ratio defined as the forward price-earnings ratio divided by the percentage long term growth rate in projected earnings per share forecasts.

In theory, identical estimates of intrinsic value of equity should result based on dividends, free cash flows, or accounting earnings.[5] In practice, however, the different implicit assumptions in the common implementations of these valuation models, in particular regarding terminal values – the evolution of future Return-On-Equity after the forecast horizon – can lead to differences in the accuracy of estimates of intrinsic value of equity.

3. Price-implied Expectations

Rappaport and Mauboussin (2001) introduce the idea of price-implied expectations. They argue that the approach of deriving intrinsic value of the firm ignores important information embedded in current stock prices. They, therefore, propose to compute the implied parameters from current market value. This section next briefly summarizes what other information might be reflected in current market prices and then outlines how one can impute parameters from market prices. Finally, Required Business Performance is introduced.

3.1 Information in Current Prices

Whatever the view on efficient markets, most agree that prices reflect, albeit imperfectly, publicly available information as well as private information. While individual investors

[3] Examples of the first approach includes Frankel and Lee (1998), Liu, Nissim, and Thomas (2002), and Ali, Hwang, and Trombley (2003). Examples of the second approach include Lee, Myers, and Swaminathan (1999) and Gebhardt, Lee, and Swaminathan (2001). Finally, Claus and Thomas (2001) take the third approach by assuming that the long term growth rate in 3% below the risk free rate.
[4] See Ohlson and Juettner-Nauroth (2005).
[5] See Francis, Olsson and Oswald (2000) and Lundholm and O'keefe (2001).

can differ in their views on the firm value, they can be more or less bullish on any given stock, the market price observed at any point in time reflects the views of many different investors. The source of individuals' disagreement in assessment of value is their interpretation of public information and possibly any private information that they may have.

There are multiple sources of public information. First, the financial statements of the firm are one source of public information. On the one hand, financial statements gain perceived reliability and credibility because they are audited while on the other hand they may not be timely. Based on financial statements – including the balance sheet, income statements and statement of cash flows – investors can predict future dividends or, equivalently, predict the future free cash flows. This process generates an individual investors' estimate of firm value. Second, stock market participants also interpret other public information about the firm. For example, patent approval is likely favorable news while executives divesting equity may be viewed as unfavorable news. Each new piece of public information is weighted by some investors in reassessing firm value. Third, analysts that cover a firm or industry may issue analyst reports that summarize their views on the firm. Such reports often include quarterly earnings forecasts and a target price, the price level at which the analyst expects firm value at some future date.[6] Other information intermediaries, like credit rating agencies may also affect some investors' assessment of firm value, and hence the stock price of the firm. Finally, the media or casual communications on internet news boards among investors may affect interpretations.

In addition, individual investors may possess private information. It is possible that observed market prices reflect transactions by insiders who illegally trade based on private information. More benevolently, investors and analysts may expend resources on collecting private information that might facilitate superior interpretation of the publicly available information.[7]

3.2 Derivation of Price-implied Expectations

[6] See Bradshaw (2002).
[7] See Coval and Moskowitz (1999), among others.

Observed market prices are a function of a multitude of factors labeled generically as either public information or private information:

$$P_t = f\left(public\ Information;\ private\ Information\right)$$

where P_t is the stock price per share and f represents a generic function. Based on the discussion in section 3.1 above, the public information is publicly observable and includes the firm's financial statements from all previous years, while the private information is unobservable. One way to re-express how prices are formed is as follows:

$$P_t = f\left(V_t, other\ public\ Information; private\ Information\right) \quad (1)$$

where V_t is an unobservable variable that is critical for assessing the future performance of the firm. Rappaport and Mauboussin's concept of price-implied expectations (PIE) implies that investors can infer what the market expects. They derive:

$$V_t = g\left(P_t, other\ public\ Information; private\ Information\right) \quad (2)$$

using the inverse function $g = f^{-1}$, with slight abuse of notation. Since *how* investors assess the market value of equity is generally quite complex, the price-implied expectations are derived through a complicated numerical procedure.[8] Nonetheless, to illustrate Rappaport and Mauboussin's concept of price-implied expectations (PIE) through two simplistic examples: The PEG model and the Gordon growth model. In each example, these models are presumed to correctly capture what is important to investors, such that the observed market price should equal our intrinsic value of equity. From this the market's implied expectations towards a variable can be imputed.

3.2.1 PEG Ratio Example

The PEG ratio is defined as: $PEG = \frac{P / EPS}{100 * G}$, where P is the price per share, EPS is the forward Earnings Per Share, and G is the percentage growth rate in EPS. Suppose that

[8] For example, chapter 5 of Rappaport and Mauboussin (2001) derive the price implied expectations towards the forecast horizon through a numerical procedure.

one is a natural level for the PEG ratio (one rule of thumb is that such PEG ratios result in hold recommendations from analysts). If the observed market prices are correct when PEG ratios are at this benchmark of one, investors can again infer from the forward price-earnings ratio the price-implied expectations towards the percentage growth rate in EPS, G. That is G can be imputed.

3.2.2 Gordon Growth Model Example

The Gordon growth model measures intrinsic value of equity as $\frac{Div}{(r-g)}$ per share, where Div represents the per share total dividends, g is the growth rate in dividends which is assumed constant, and r the (appropriately risk-adjusted) cost of equity capital. If capital markets are fully efficient, observed market price per share, P, is correct and should be equal to the intrinsic value of equity per share. Investors can readily observe the market price per share at any point in time. If further investors are confident about the expected dividends and the cost of capital, then they can solve for the implied growth rate.[9] As stock prices increase (decrease), the investors' implied growth rate would also increase (decrease). Thus, price-implied expectations approach allows each investor to infer what constant dividend growth rate a marginal investor anticipates at any point in time.

Consider an investor calculating both (i) the price-implied expectations (PIE) towards the growth rate in EPS, G, based on the PEG model and (ii) the PIE towards the growth rate in dividends per share, g, based on the Gordon growth model. Of course, the PIE from different models will differ. The reason is that these models impose different views on the firm's future profitability.

Continuing with the Gordon growth model, suppose instead investors were certain about both the expected dividends and the growth rate, but investors were uncertain about the appropriately risk-adjusted cost of capital. In that case, investors would instead solve for

[9] The resulting price-implied expectations of the growth rate is: $g = r - Div/P$.

the implied cost of equity capital. As stock prices increase (decrease), the price-implied expectations regarding the risk-adjusted cost of equity capital would decrease (increase).

4 Required Business Performance

Transparent Value extends the price-implied expectations' approach to generate a risk-adjusted probability called Required Business Performance Probability (RBPP). The RBPP is the result of a two stage process. The first stage identifies the required business performance (RBP); the revenue necessary to support a given stock price for a given company. RBP methodology is a reverse discounted free cash-flow analysis using a company's stock price, income, balance sheet and cash-flow statements to determine what the stock's current price implies in terms of future free cash flow and revenue. RBP is used as a benchmark against which to measure management's ability to perform in the future. The second stage then assesses the probability of the firm achieving the RBP. The RBPP is the likelihood that the management of a company, based upon its past performance in business, will meet its RBP.

The first stage is based on the methodology that is founded on the principal that the stock price of a company must be transparently linked to management's ability to perform. Rather than calculating the value of the stock using the traditional DCF formula, the RBP methodology reverses the DCF process and works backwards to solve for the required business performance (revenue and business model growth rates) to defend a particular valuation.

The second stage of this process initially estimates the empirical distribution of gross change in sales over the most recent 12 quarters. Changes in sales revenues[10] are assumed to be log-normally distributed. This distributional assumption is compelling for multiple reasons. First, similar to stock price, sales revenues are non-negative variables. Second, sales revenues have been assumed log-normally distributed in the accounting literature. One reason is that sales revenues is the product of two components – the output quantities sold and the sales prices per unit – each of these components could also

[10] Changes in sales revenues are defined as quarterly sales divided by sales of the same quarter in the previous fiscal year.

be viewed as log normally distributed.[11] This means that price-implied forecasted sales naturally decompose into quantity effects and price effects. Finally, the assumption that stock prices are log normally distributed is standard in finance and implicit in the Black and Scholes option pricing model. Consequently, making the log normal assumption for underlying fundamental variables generates a natural link between fundamentals and observed market prices.[12]

Once the best log-normal distribution has been fitted to the historical data of gross sales increases, the PIE sales forecast is located at some percentage between 0% and 100% in this distribution. This percentage is the RBPP. Since this process that leads to RBPP is complex, the next section tests intuition by presenting three case studies.

5 Sensitivity Analysis

This section reports the result of sensitivity analyses on the price-implied probability measure, RBPP. The purpose is twofold: First, we illustrate the sensitivity of the RBPP to hypothetical changes in the inputs; Second, we confirm our intuition about the direction and magnitude of these hypothetical changes. We report the results from three separate sensitivity analyses with respect to per share stock price, discount rate, and operating margin. As one would expect, the implied probability of sustaining performance decreases when ceteris paribus (i) the stock price increases, (ii) risk goes up, as measured by the weighted average cost of capital, and (iii) the operating margin ratio declines. We present the analysis for three separate companies to illustrate that these hypothetical analyses rely on firm-specific inputs whose variability is different between these companies. Nonetheless, the results exhibit striking similarities that appear representative of the methodology.

5.1 Sensitivity to Stock Price Changes

In this section, we report the results with varying stock prices to create hypothetical scenarios of what the RBPP would have been if ceteris paribus only the stock prices had

[11] See Hilliard and Leitch (1975).
[12] Note that the price-implied sales revenues are risk-adjusted because the discount rate is risk adjusted, similar in spirit to risk-neutralized distributions used in finance.

been different. We present these graphs in figures with RBPP in percent on the vertical axis and stock prices on the horizontal axis. From these hypothetical experiments, three common patterns are as expected and evident from casual inspection. First, the RBP varies as a smooth non-linear curve that is monotonically decreasing in the stock price. Second, as the hypothetical stock price decreases towards zero, the RBPP goes to one. Third, as the hypothetical stock price increases sufficiently, the RBPP goes to zero. As a result, all graphs are inverted S-shapes.

Consider Office Depot Inc. ("Office Depot") which had a stock price of $18.80 per share as of November 19, 2007. Based on that stock price – and also based on WACC and other financial statement data available on that date – the actual RBPP was 92.30%. This is indicated by the point B in Figure 1. Holding all other inputs fixed, we then decreased and increased the stock price up to 25%. This created the softly downwards sloping blue curve. From this experiment, it appears that a hypothetical one percent marginal increase in the stock price from its actual 2007 of $18.80 level would lead to a 2% decrease in the RBPP.[13] We repeated this experiment for Office Depot using the stock price of $41.44 per share as of November 20, 2006 and using the appropriate WACC and financial statement information for that date. Based on that stock price – and also based on WACC and other financial statement data available on that date – the actual RBPP was 38.00%. This is indicated by point A in Figure 1. Again, by varying the stock price hypothetically away from its actual level by increasing and decreasing up to 25%, we see a red downwards sloping curve going through point A, similar to the blue curve for 2007. As expected, the inverted s-curve has shifted towards the left as the stock price declined between 2006 and 2007. From this experiment, a hypothetical one percent marginal increase in the stock price from its 2006 level of $41.44 appears to result in a 1% decrease in the RBPP. While the marginal sensitivity of implied probabilities to stock price changes is lower in 2006 than in 2007, this is not automatic since other fundamental inputs have also changed. Put differently, if the blue line had been extended to include $41.44, its slope would have been even lower than the red line.

[13] This represents the approximate slope – or sensitivity - of the blue curve at point B.

Consider next Google Inc. ("Google") trading at $625.85 and $495.05 and price per share as of November 19, 2007 and November 20, 2006, respectively. The implied probabilities were 98.82% and 99.9% for November 2007 and 2006 respectively. The information is indicated by the points A and B for 2006 and 2007, respectively. Figure 2 reports the results of hypothetical scenario analyses. We see that the implied probabilities appear extremely insensitive to changes in Google's stock price and remain similar from 2006 to 2007. Specifically, a hypothetical one percent marginal increase in the stock price from its actual level results in a 0.1% decrease in the RBPP for both 2006 and 2007.

Third, consider Microsoft Corporation ("Microsoft") which was trading at $33.96 with an actual RBPP of 78.75% on November 19, 2007, as indicated by the point B in Figure 3. Similarly, Microsoft's actual price per share of $29.89 and actual RBPP of 38.3% on November 20, 2006, are indicated by the point A and the dotted red lines in Figure 3. We find that a hypothetical one percent marginal increase in the stock price from its actual level would have resulted in a .3% and 1% decrease in the RBPP in 2007 and 2006, respectively.

It is worth reiterating that RBPP changes result from price movements as well as from the arrival of other information. Comparing 2006 to 2007, we see that Microsoft's stock price increased by 14% while the RBPP more than doubled increasing by 206%. We separate the 206% increase in RBPP into two effects: change in price and change in other information, where the latter includes new financial statement information and changes in WACC. To quantify these two effects, we consider the hypothetical benchmark where only stock price changed while all other information used for calculating RBPP remains the same. In this hypothetical benchmark case where RBPP is calculated on November 20, 2006 using the price as of November 19, 2007, the hypothetical RBPP would have been 25.29%. This hypothetical benchmark is indicated by the point C in Figure 4. As expected the hypothetical RBPP is lower because the higher stock price leads to higher price implied sales which in turn are less likely to be attainable. Comparing points A and C, observe see that the increase in stock price would have led to a 34% decline in the RBPP. Second, comparing points C and D, we can gauge the effect on RBPP of all other

information holding the stock price fixed at its level as of November 19, 2007. This second comparison reveals that RBP would have been higher by 211% due to new non-price information used for calculating RBPP. In summary, the above analysis attributes the 206% increase in Microsoft's RBPP during 2007, which corresponding to moving from points A to B in Figure 4, into two components: 66% price effect and 311% information effect.[14] While stock price movements do lead to revisions in Microsoft's RBPP, the arrival of other information also leads to material revisions in RBPP.

5.2 Sensitivity to Changes in Discount Rates

In this section, we report the results of varying the discount rate to investigate the hypothetical effect on the implied probabilities holding all other factors constant. We present these results in figures with implied probabilities on the vertical axis and the WACC on the horizontal axis. From these hypothetical experiments, three common patterns arise as expected and appear evident from casual inspection. These three patterns are the same as for the hypothetical changes in stock price. First, the WACC is a smooth non-linear curve that is monotonically decreasing in the stock price.[15] Second, as the hypothetical WACC decreases towards zero, the RBPP goes to one. Third, as the hypothetical WACC increases sufficiently, the RBPP goes to zero. As a result, all graphs are inverted S-shapes.

Consider Office Depot which on November 19, 2007, had a WACC of 9.4% and an actual RBPP was 92.30%, as indicated by the two black lines in Figure 5. Holding all other inputs fixed, we then decreased and increased the WACC up to 25% to calculate hypothetical RBPP, resulting in the blue downwards sloping curve. From this hypothetical experiment, we find that a hypothetical one percent marginal increase in the WACC from its actual 2007 level of 9.4% would lead to a 3% decrease in the RBPP.

[14] That is, 206% = (1 - 34%) * (1 + 211%). = 66% * 311%. Note that an alternative decomposition using point D in Figure 4 the hypothetical benchmark suggests a less pronounced price effect for Microsoft during 2007.

[15] As is well-known, it is theoretically possible that an increase in the discount rate can have a non-monotonic effect on the present value of future cash flows when the signs of the future cash flows alternate. This would require negative correlation in future free cash flows over time which is uncommon in practice.

We repeated this experiment for Google, using as starting point their WACC of 11.4% and actual RBPP of 98.82% as of November 19, 2007, as indicated in Figure 6. Performing similar hypothetical calculations, results in the blue curve and we find that a hypothetical one percent marginal increase in the WACC of Google from its actual 2007 level of 11.4% would lead to a 1% decrease in the RBPP.

Repeating this analysis for Microsoft, we start with their WACC of 9.5% and actual RBPP of 78.75% as of November 19, 2007, as indicated in Figure 7. For Microsoft, we find by moving along the blue curve, that a hypothetical one percent marginal increase in the WACC of Microsoft from its actual 2007 level of 9.5% would lead to an approximate 3.5% decrease in the RBPP.

5.3 Sensitivity to Changes in Operating Margins

In this section, we report the results of varying the operating margin to create hypothetical scenarios of the implied probabilities. As above, we present graphs in figures with implied probabilities (RBPP) on the vertical axis and operating margins on the horizontal axis. From these hypothetical experiments, three common patterns emerge exactly as expected and evident from casual inspection. First, the RBPP is a smooth non-linear curve that is monotonically increasing in the operating margins, that is, higher operating margins render it more likely that the firm can meet the performance implicit in its current market value. Second, as the hypothetical operating margins decreases towards zero, the RBPP goes to zero. Third, as the hypothetical operating margins increases sufficiently, the RBPP goes to one. As a result, all graphs are S-shapes.

Consider Office Depot which had an operating margin ratio of 4.8% as of November 19, 2007. Based on the actual inputs as of that date, the RBPP was 92.3% same as reported above and indicated by the dotted lines. The hypothetical effect of alternative operating margins results in the S-shaped pattern in Figure 8. Further, the graph reveals that a hypothetical one percent marginal increase in the operating margin ratio of Office Depot from its actual 2007 level of 4.8% would lead to a 5% increase in the RBPP.

Again, we repeated this experiment for Google and Microsoft. For Google, we use as starting point the actual operating margin ratio of 31.4% and actual RBPP of 98.82% as of November 19, 2007. Figure 9 reveals that a hypothetical one percent marginal increase in the WACC of Google from its actual 2007 level of 31.4% would lead to a .4% increase in the RBPP. Repeating this analysis Microsoft, we start with their actual operating margin ratio of 36.9% and actual RBP of 78.75% as of November 19, 2007, as indicated by the dotted blue line in Figure 10. For Microsoft, we find that a hypothetical one percent marginal increase in the operating margin ratio of Microsoft from its actual 2007 level of 36.9% would lead to a 2% increase in the RBPP.

7. Summary

Transparent Value applies a systematic method to identify an implied risk-adjusted probability measure, Required Business Performance Probability (RBPP), which represents the likelihood that a firm's future sales can meet the expected sales implied by the observed market prices. The sensitivity analyses illustrate three characteristics of RBPP: Ceteris paribus, a stock price decrease leads to an increase in the RBPP. Second, an exogenous decrease in the risk adjusted discount rate leads to an increase in the RBPP. Third, improved operating margins lead to an increase in the RBPP. The magnitude of the sensitivities of RBPP varies across firms depending on, among others, their industry and life cycle as illustrated by the three sensitivity analyses.

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Figure 1: Sensitivity of RBPP to changes in price for Office Depot

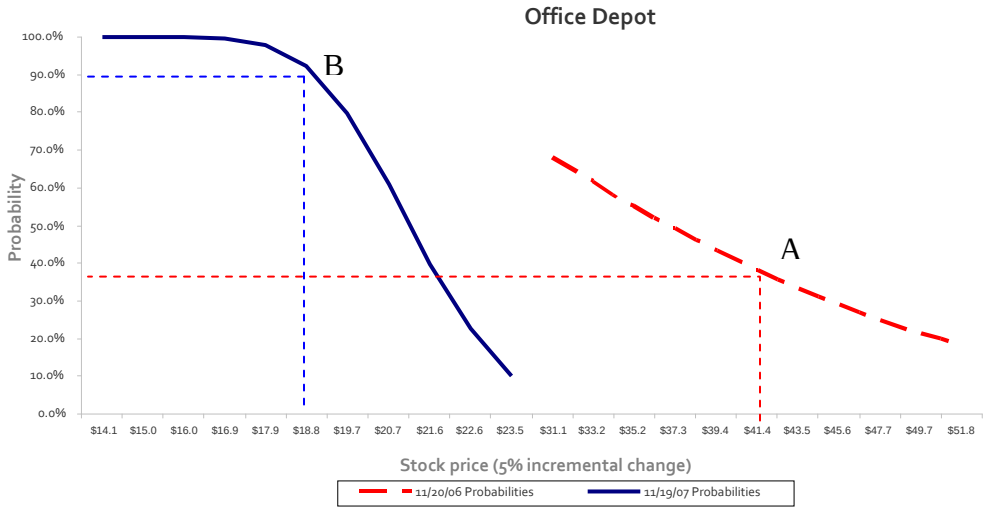

Figure 2: Sensitivity of RBPP to changes in price for Google

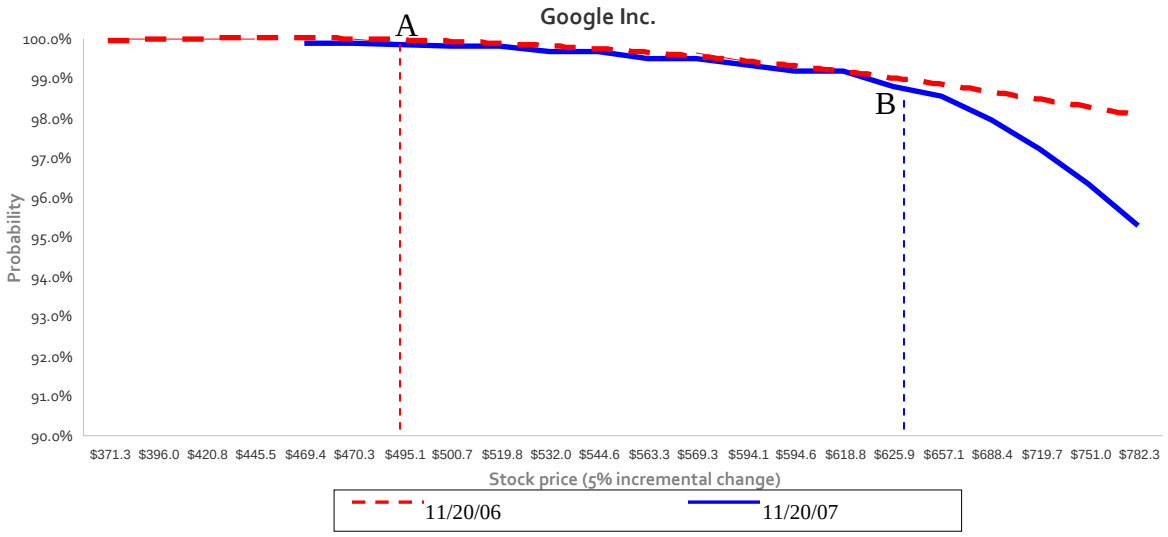

Figure 3: Sensitivity of RBPP to changes in price for Microsoft.

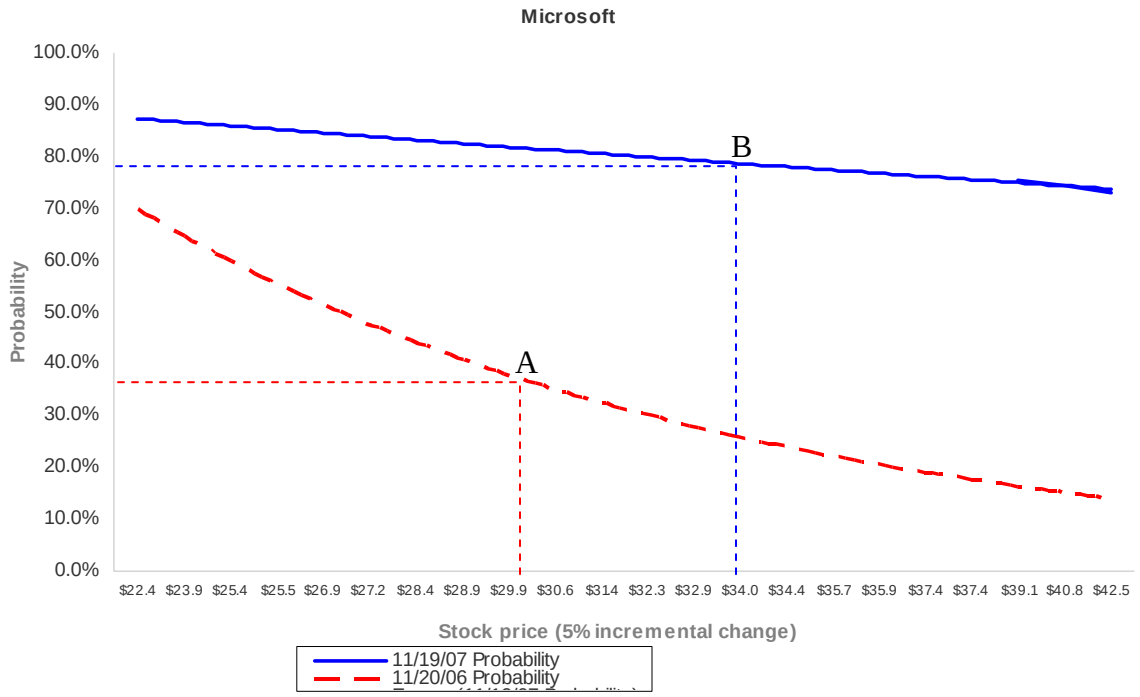

Figure 4: Sensitivity of RBPP to changes in price for Microsoft.

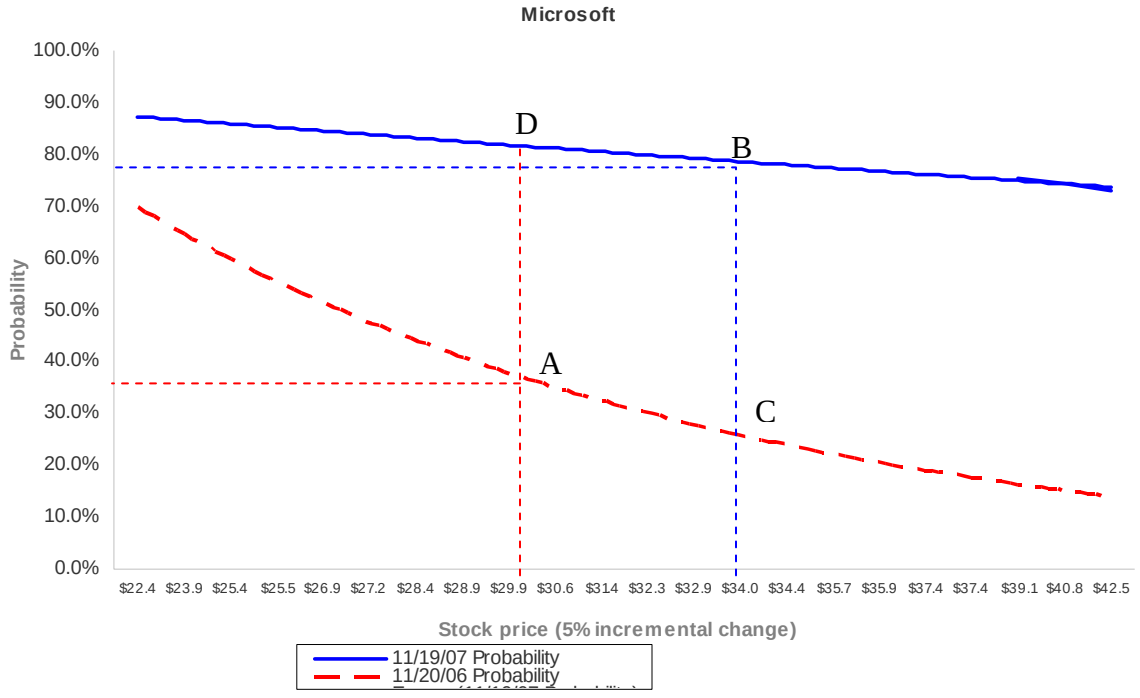

Figure 5: Sensitivity of RBPP to changes in weighted Average Cost of Capital (WACC) for Office Depot

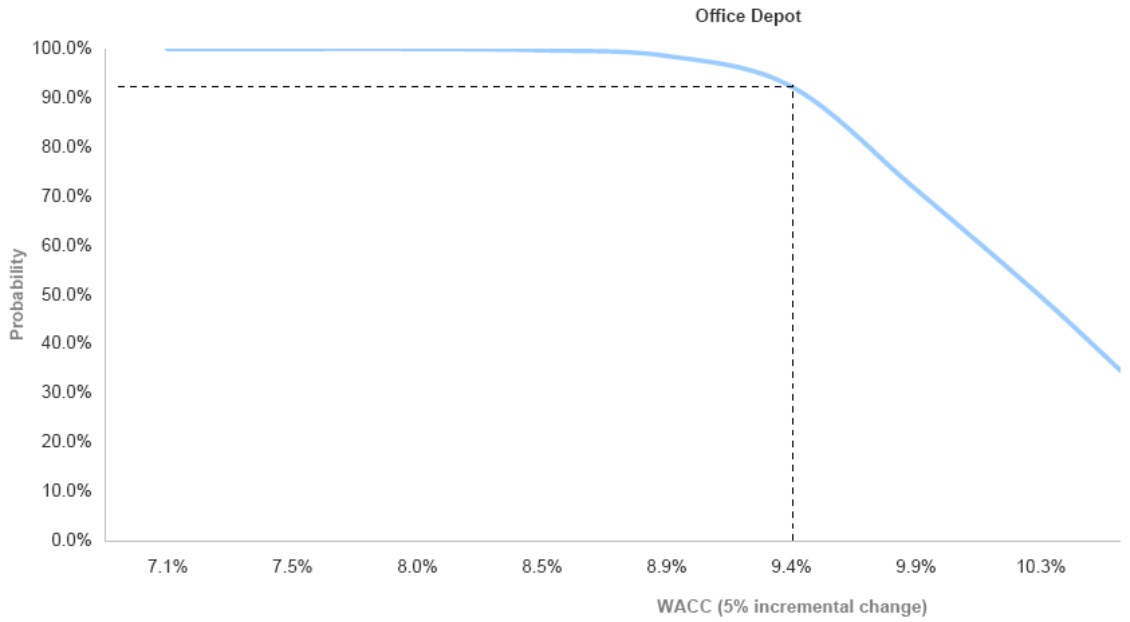

Figure 6: Sensitivity of RBPP to changes in weighted Average Cost of Capital (WACC) for Google

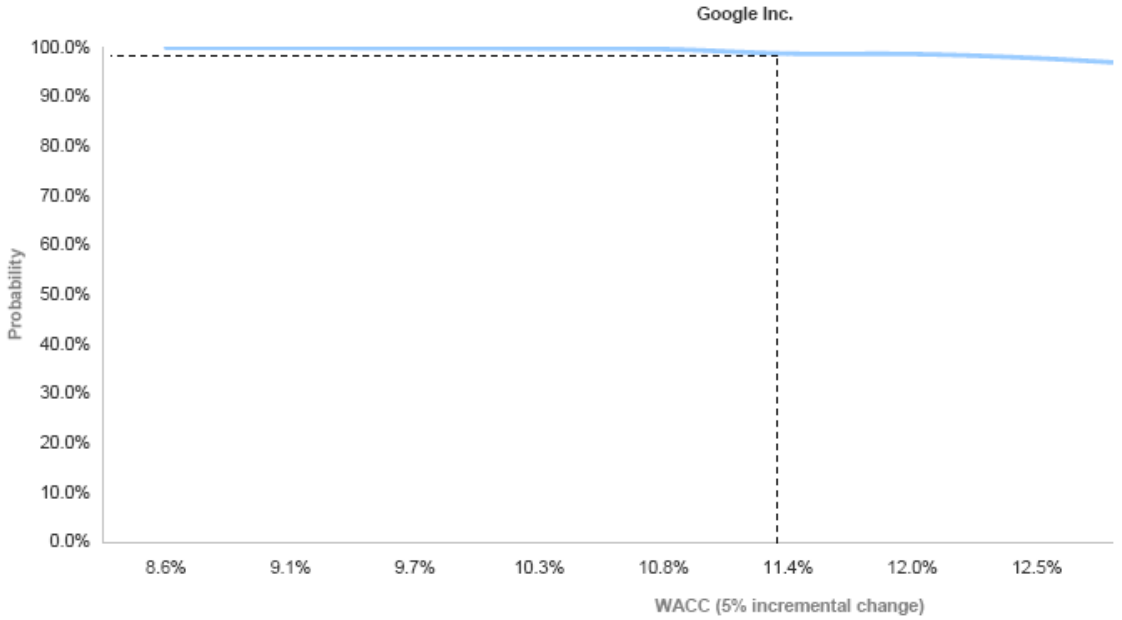

Figure 7: Sensitivity of RBPP to changes in weighted Average Cost of Capital (WACC) for Microsoft

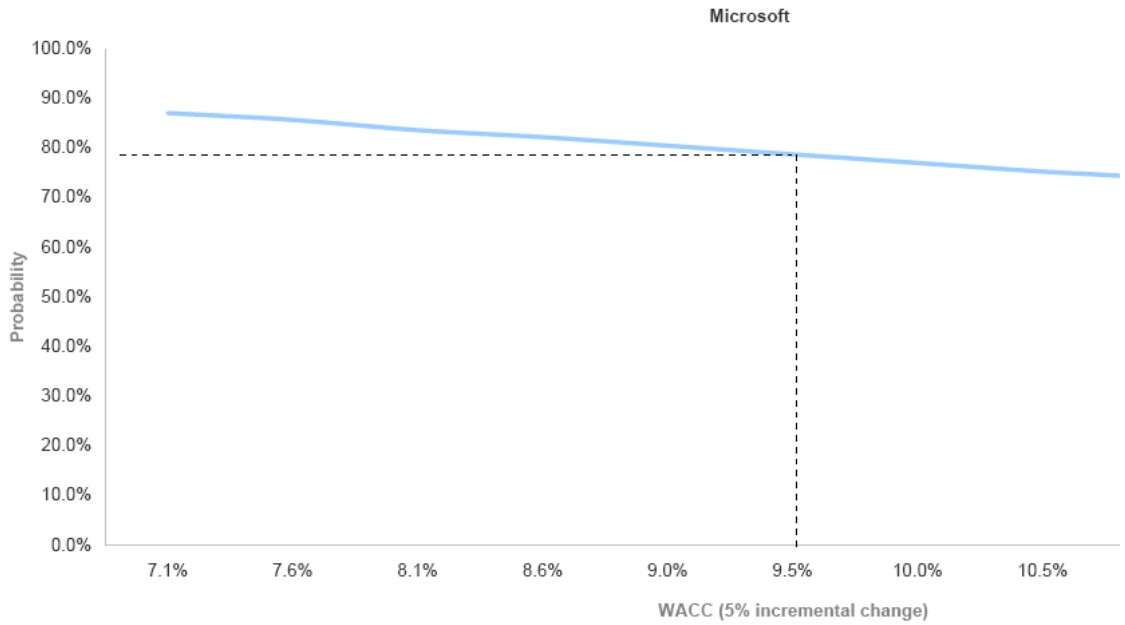

Figure 8: Sensitivity of RBPP to changes in operating margins for Office Depot

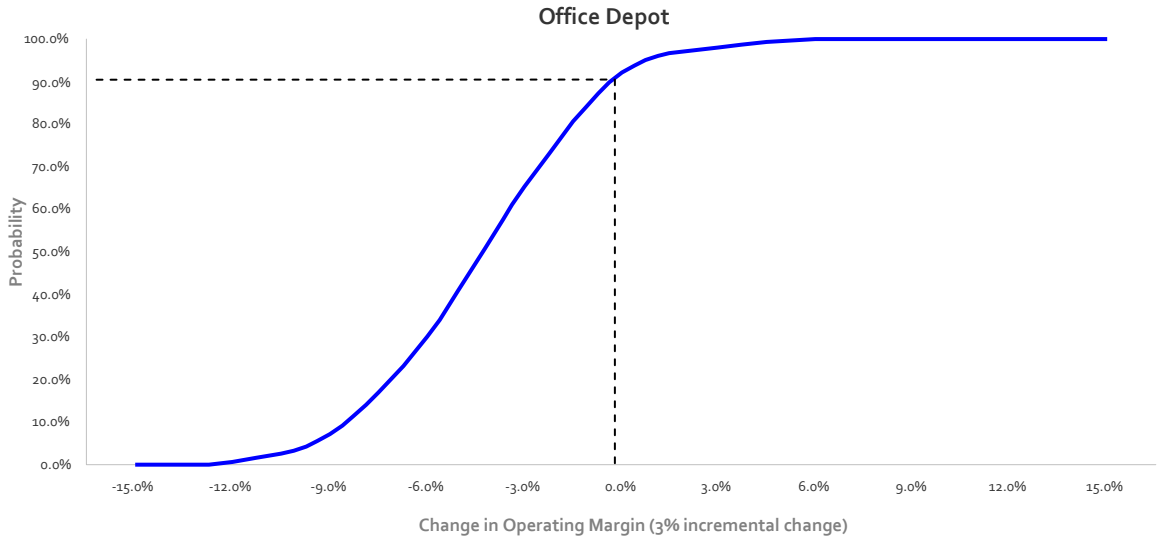

Figure 9: Sensitivity of RBPP to changes in operating margins for Google

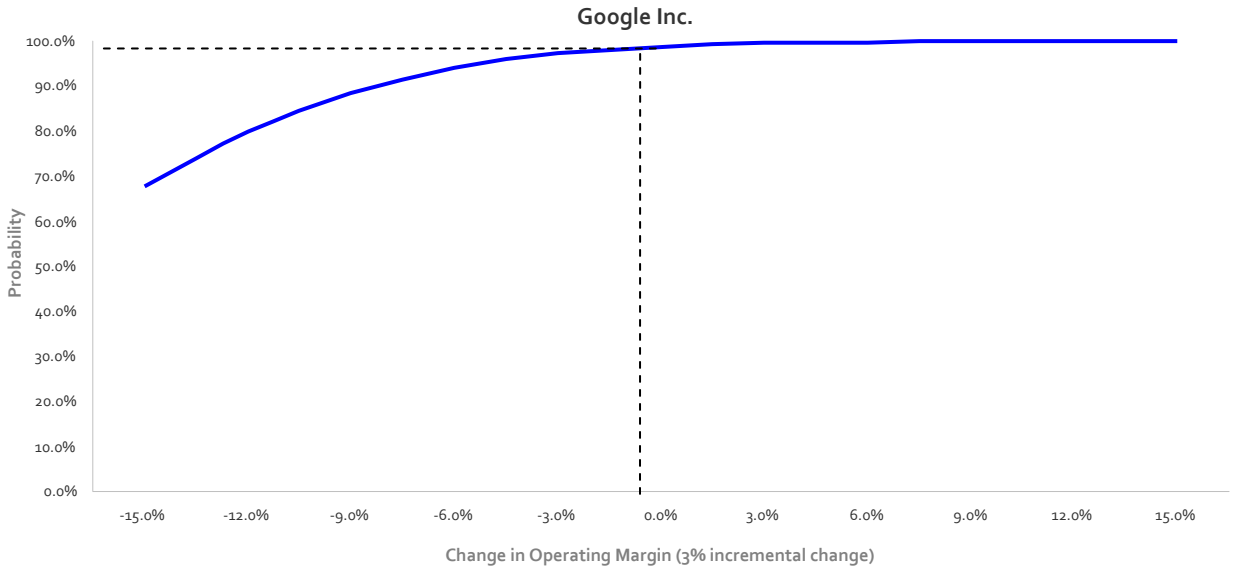

Figure 10: Sensitivity of RBPP to changes in operating margins for Microsoft