

EDF™ CASE STUDY

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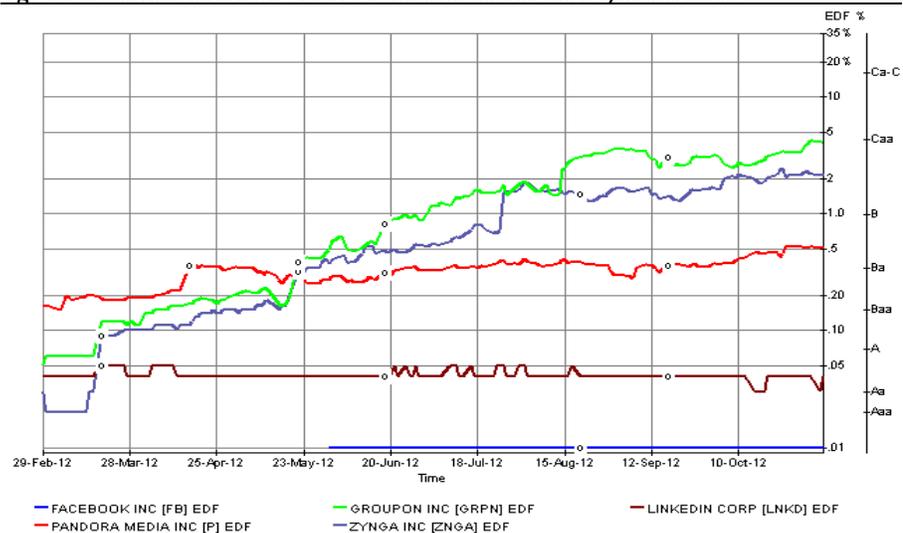
Facebook Inc.

Equity Performance Since IPO Distracts from Strong Underlying Credit Quality

Summary

- Facebook is the leading social networking company worldwide. Facebook is an unrated company, and does not have any traded bonds or CDS from which to infer its credit risk. However, using Moody's Analytics' Expected Default Frequency (EDF)™ model for public firms, which utilizes firms' liability information and equity prices, we can estimate probabilities of default.
- Facebook exhibits very strong credit quality, with a one-year EDF measure of 0.01% (1 bp) as of 6 November. That EDF level translates to a Aaa implied rating on Moody's rating scale. Its EDF measure has been unaffected by the approximately 40% decline in its share price since its May IPO. Not only is Facebook's credit risk low in absolute terms, but it is in the 8% of firms with the lowest EDF measures in the Internet Information Providers sector.
- Facebook's 1 bp probability of default is supported by low financial risk and high, but relatively favorable business risk. Its market leverage (financial risk) is just 2.53%, while its asset volatility (business risk), currently at 25.37%, is in the 25th percentile of its industry sector. Indeed, because of its current near-zero leverage, Facebook could issue up to USD 3.4 billion of long-term debt without affecting its Aaa EDF-implied rating. Facebook's EDF level and implied rating is also robust to a 61% decrease in its share price and an 30% increase in its asset volatility.

Figure 1: Facebook's 1-Year EDF Measure vs. Selected Industry Sector Peers



Lots to "Like" about FB's Credit Quality

The performance of Facebook, Inc.'s public shares, if not its very business model, has been the subject of almost daily discussion in the financial press since the social networking company's initial public offering in May. Indeed, one would have to live under the proverbial rock to not know that its share price has fallen significantly since the IPO. Until its nearly 20% rally on 24 October, Facebook was that stock that investors (or at least the financial media) loved to hate. What has garnered no notice, however, is that, despite the performance of its shares, Facebook's credit quality is very high, stable, among the best among its industry peer group and among US companies generally.

Because Facebook lacks an agency credit rating and does not have traded bonds or CDS from which to infer risk from market spreads, Moody's Analytics' public Expected Default Frequency (EDF) model provides a unique tool to assess the credit risk of the company. Although Facebook cannot default on debt in any formal sense, it does, like all firms, still possess that unobservable quality that we call credit risk. Trade creditors, counterparties to financial transactions, and even other stakeholders like labor have an interest in estimating a company's latent credit quality. Indeed, if Facebook were ever to raise capital through private or public debt markets, a reliable estimate of its default probability would be required for setting terms and pricing.

Using financial statement information and equity price data, the public EDF model produces a probability of default over various time horizons, typically one year.¹ As of 6 November, 2012 Facebook's one-year public EDF credit measure stood at 0.01% (1 bp), reflecting the firm's relatively strong credit fundamentals and its leading position in its industry. Although the company is not rated by Moody's Investors Service, its current EDF level is consistent with an implied rating² of Aaa, on par with other tech industry giants such as Google and Apple.

Figure 2: Facebook's 1-Year EDF Measures vs. Internet Information Provider Industry Sector

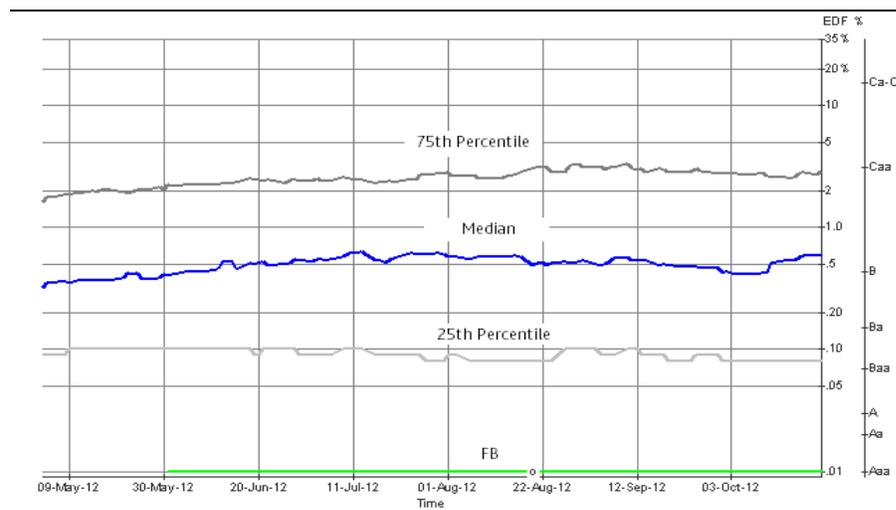


Figure 1 on the cover of this report shows Facebook's EDF measure since June 2012, the earliest date for which we are able to calculate an EDF measure. As the graph shows, Facebook's one-year EDF measure has remained at 0.01% since June. Also shown in the same graph are the EDF measures for a selected group of Facebook's industry sector peers, such as LinkedIn, Zynga, and Groupon. Among this group, Facebook's probability of default has been very low and stable, while some of its other peers, like Groupon and Zynga, have experienced rather sharp increases in their EDF measures since the first quarter of 2012. Facebook's default risk also looks very favorable relative to the broader set of companies in the Internet Information

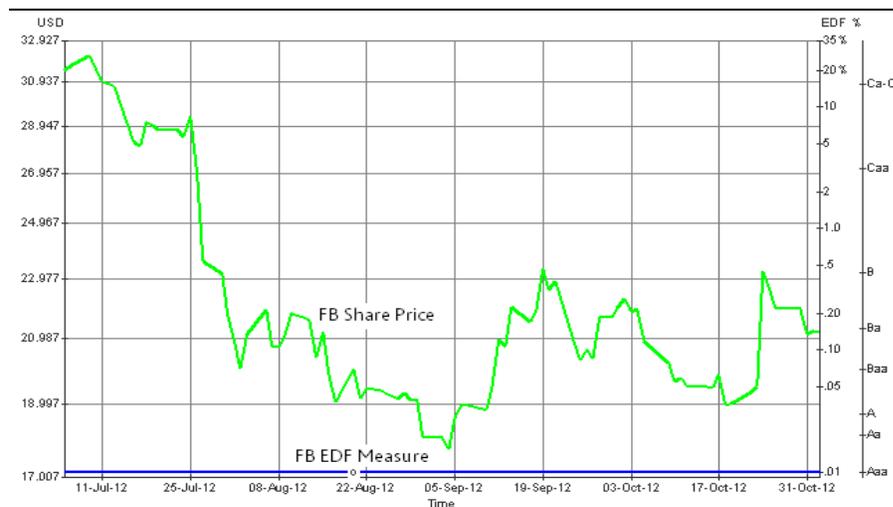
¹ The full public EDF methodology, "Public Firm Expected Default Frequency (EDF) Credit Measures Methodology, Performance, and Model Extensions," is available on moodys.com.

² EDF-implied ratings are calculated by comparing a firm's EDF level to the EDF levels of similarly rated peers. For example, as of September 2012, firms with EDF levels between 0.059% and 0.077% would have received a Baa1 implied rating. The implied rating grid is updated monthly.

Providers industry sector (which consists of 73 companies). Figure 2 shows the median, 25th, and 75th percentiles of EDF for the sector since Facebook's May IPO. The median EDF for companies in the sector as of 6 November is 0.59%, an implied rating level of Ba3.

Figure 3 shows how Facebook's one-year EDF measure and its share price have changed since June. Facebook's EDF measure has been unaffected by the approximately 40% decline in its share price, which has remained unchanged at 1 bp. This graph is a salutary reminder that the link between equity risk and credit risk is, sometimes, quite weak. Equity investors focus on earnings, margin, and profitability, and relative to creditors and credit investors, have a more near-term horizon. As long as a firm's solvency risk is remote, deviations in a firm's operating performance from equity investors' expectations can cause large changes in a firm's equity price. As we discuss in the next section, Facebook's low leverage means that its equity price can move in a relatively wide range without impacting its default risk.

Figure 3: Facebook's 1-Year EDF Measure vs. Share Price



The credit quality and equity performance of some of Facebook's peers has not, however, fared as well. Shares of some notable companies in Facebook's industry sector, such as Zynga and Groupon, now trade well below their issue prices. The default probabilities for these firms have also increased sharply since the start of the year (refer back to Figure 1). As a whole, the sector has experienced healthy equity performance, but also a rise in default risk. The median change in the share price for the 73 firms in the Internet Information Providers industry sector is +8.6% year-to-date 2012. At the same time, the median year-to-date change in the EDF measure for these companies is +12%. So while Facebook's equity performance has trailed its industry peer group, its credit quality can be said to have outperformed its sector by a wide margin.

The foregoing discussion clearly shows that, although equity prices are key ingredient to the EDF model, share price performance and changes in the EDF measure – a key metric of credit risk – are not perfectly correlated. In the next section we analyze the fundamental drivers of Facebook's EDF measure: financial risk and business risk. Facebook's credit quality is characterized by low leverage (low financial risk) and high business risk. Those characteristics make it similar to other firms in its sector (like LinkedIn), but are also features shared by many companies in its industry sector that make it stand apart from other corporates. Its business model means that its operating performance is highly volatile and sensitive to changes in consumer tastes and secular changes in technology.

Analyzing the Drivers of Facebook's EDF Measure

Facebook's EDF measure has been unchanged at 0.01% since its IPO – how did we arrive at that figure? Its business model is highly dependent on advertising revenues. What implication does that have on its credit risk? What impact will the technological shift toward mobile devices potentially have on Facebook's default probability? These are the types of questions that the public EDF model is well suited to answer, and some of which we take up in this section. In contrast to some black-box statistical models of credit risk, the

drivers of Moody's Analytics' EDF model have direct connections to basic concepts of fundamental credit analysis. Studying these drivers in addition to the EDF itself helps further our understanding of a firm's credit risk.

Moody's Analytics' public firm EDF model belongs to a class of credit risk models referred to as structural or asset value models. The basic assumption of asset value models is that there is a causal, economically motivated reason that default occurs. Default is highly likely to occur when the market value of the firm (the sum of the value of its market capitalization and debt) is insufficient to cover its liabilities due at some future date – i.e. firms tend to default when they are insolvent. This follows from the fact that equity holders are residual claimants on the value of the firm. If the market value of the firm is negative, shareholders, who have limited legal liability, will simply walk away from the company, leaving the debt holders to recovery whatever they can from whatever remains of the firm value.

The above economic intuition can be translated into three quantifiable variables: the value of a firm's assets (A), the volatility of its assets (denoted by σ), and its default point, X , which is determined by a firm's liabilities. The interaction of the three variables is encapsulated by the firm's distance-to-default (DD) which, under some largely innocuous assumptions, can be expressed as:

$$DD \approx \frac{\ln(A) - \ln(X)}{\sigma}$$

This simple equation essentially states that a firm's relative credit risk (measured by DD) is a function of its financial risk and its business risk, two factors that are core concepts of fundamental credit analysis. The numerator of the above equation measures market leverage – i.e. financial risk. All else equal, higher leverage decreases DD and hence increases the probability of default. The denominator of the DD equation can be viewed as business risk. Firms in industries with high asset volatility tend to exhibit higher risk of default, all else equal. Once we have calculated a firm's DD , we can derive its probability of default (its EDF measure) by looking at the historical average default rate consistent with each DD level.

Facebook's Default Probability Reflects Low Financial Risk...

Relative to its USD 45 billion market capitalization, Facebook has almost no liabilities to speak of. Its 10-Q released June 2012 listed approximately USD 1 billion of short-term liabilities (partners payable, accrued expenses, deferred revenue, etc.) and USD 585 million of long-term liabilities (the majority associated with capital lease obligations). Figure 4 shows Facebook's short-term, long-term, adjusted total adjusted liabilities, and its default point (the variable X in the DD equation above). For a corporate like Facebook, the default point is calculated as all short-term liabilities plus half of long-term liabilities – about USD 1.3 billion as of October.³ The graph shows that Facebook's default point has been very steady since its May IPO. Total adjusted liabilities have risen slightly by 2% from its August 2012 level of USD 1.5 billion to its current level of USD 1.6 billion.

Total liabilities are calculated and reported using book values. This makes sense as most debt is not marked to market and must be repaid at face value. However, the public EDF model measures leverage on a *market valued* basis. The asset value A in the DD equation above represents more than simply the market capitalization of a firm plus the book value of its debt. It is essentially the enterprise or going-concern value of a company, which includes intangibles such as brand value. This is the quantity relevant for measuring default risk, because if the going concern value of a firm falls below its default point, it is essentially (if not actually) insolvent.

³ The calibration of the default point for corporates was based on large data sample over many years. Setting the default point equal to short-term plus half of long-term liabilities yielded predicted default probabilities that were most consistent with observed default rates. More elaborate calculations did not any better. Intuitively, as a firm enters financial distress some portion of long-term liabilities becomes more immediately due (for example, some long-term debt may accelerate).

Figure 4: Facebook's Default Point, Short-Term, Long-Term, and Total Adjusted Liabilities

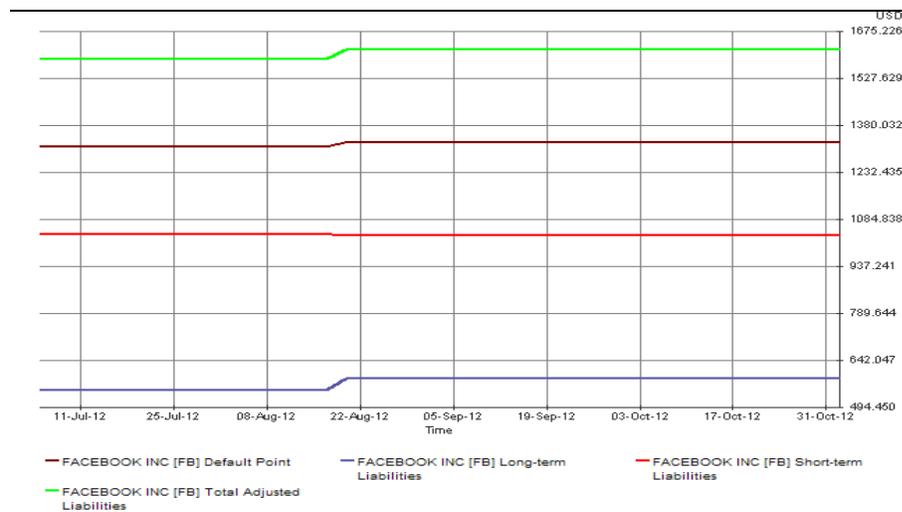
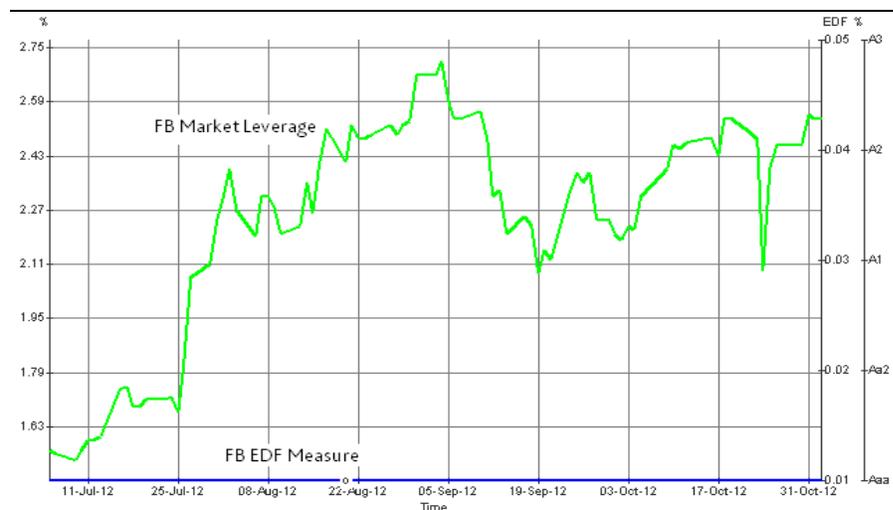


Figure 5 shows the evolution of Facebook's market leverage since June. Market leverage is the numerator of the DD equation, so it includes both the changes in the default point (calculated using book liabilities) as well as changes in the value of the firm that are reflected in its market capitalization. Facebook's market leverage has fluctuated over a relatively wide range, from 1.49% to 2.53%. Since June, Facebook's market leverage has increased by nearly 60%. The rise in its market leverage has been almost entirely driven by the decline in its market value of assets. Since its IPO, Facebook's market value of assets has fallen by 25% to its current level of USD 52.3 billion. Despite the sharp increase, Facebook's market leverage remains very low in both absolute and relative terms. Compared to all corporate firms in North America, its current (as of 6 November) 2.53% market leverage is in the fifth percentile.

Figure 5: Facebook's Market Leverage and EDF Metric



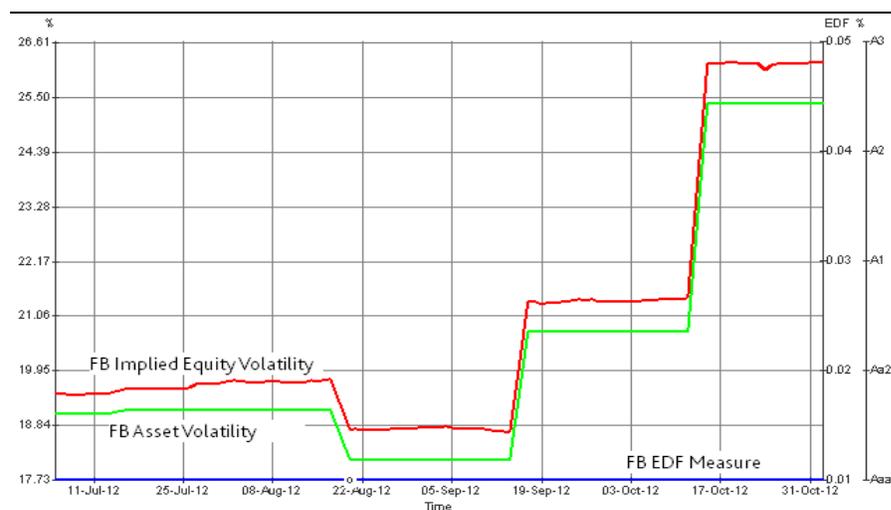
...and High, but Relatively Favorable, Business Risk

A firm's asset volatility is a measure of its business or operating risk. Companies whose cash flows are highly variable or that operate in sectors that are very competitive tend to exhibit higher business risk relative to those that are more stable. The volatility of a company's underlying business has a direct consequence for a firm's asset valuation: it will also show a relatively high level of volatility. As we can infer from Figure 5 above, Facebook is a prime example of a firm operating in a highly competitive industry sector with variable underlying operating characteristics.

Practically, business risk is measured as the standard deviation of the annualized change in the market value of a firm's assets. Figure 6 shows the time series of Facebook's estimated asset volatility against its EDF measure. Like we saw in the graph for market leverage, Facebook's asset volatility has risen sharply since its May IPO, and with no impact on the level of its expected default probability. Since May, its asset volatility has increased by 33% to its current 25.37%. What accounts for the sharp rise in Facebook's measure of business risk?

Advertising is Facebook's largest source of revenue. Of Facebook's USD 1.26 billion third quarter revenues, about 86% was derived from advertising. Analysts and investors have questioned whether the Facebook's business model can successfully adapt to the technological shift toward mobile devices, such as tablets and smartphones, which are less suited to exposing users to advertisements. Approximately 60% of Facebook's members now access its services using a mobile device compared to about 47% a year ago. This growing uncertainty about its business risk, particularly in light of the disappointing performance of its shares, is reflected in the time series of Facebook's asset volatility shown in Figure 6. However, the third quarter results released on 24 October (and not reflected in the data shown in Figure 6⁴) helped allay some of these fears. Advertising revenues from mobile devices increased from USD 10 million in the second quarter to USD 150 million in the third quarter. These results beat analysts' expectations and suggested that Facebook was indeed beginning to successfully adapt its business model.

Figure 6: Facebook's Asset Volatility, Instantaneous Equity Volatility, and EDF Measure



One of the unique features and strengths of Moody's Analytics' EDF model is its ability to calculate default probabilities for firms that do not have traded bonds or CDS, and that may have very short histories. This is often a challenge for securities analysts trying to either value or gauge the risk of new firms. Within the EDF model, one of the key variables one needs to estimate is the firm's asset volatility. We do this by combining a modeled volatility component and an empirical volatility component to calculate total volatility for each firm (as shown in Figure 6). Modeled volatility is the output of a regression model that uses a firm's geography, industry sector, size, and other firm-specific financial variables to estimate volatilities for homogeneous sets of firms. So for a company like Facebook, we can estimate its modeled volatility based on the characteristics that it is an internet company based in the US, with total revenue of USD 1.26 billion, etc. Empirical volatility is calculated from the actual history of a firm's equity returns.

In the EDF model, then, asset volatility is calculated as

$$\sigma = \theta\sigma_M + (1 - \theta)\sigma_E$$

⁴ Asset volatility is estimated monthly.

In other words, (total) asset volatility is a weighted average of modeled volatility and empirical volatility (where the θ are weights that sum to 100%). For a new firm such as Facebook, modeled volatility receives most if not all weight. As firms accumulate more and more history, progressively greater weight is placed on the empirical volatility component, so that asset volatility for a mature company with a long history is primarily determined by its equity return history. This technique not only allows us to estimate default probabilities for a larger set of companies, but it also increases the predictive power of the EDF model.

Testing the Robustness of Facebook's Default Probability

The cause-effect relationship between the EDF model's drivers and the default probabilities generated by the model allows us to test the robustness of Facebook's credit quality. In addition to estimating the level of a firm's default probability, we are also interested in how sensitive its EDF measure is to changes in the underlying risk factors. In this section we perform a sensitivity analysis in which we measure the effect of changing Facebook's EDF drivers – share price (which affects the estimate of its market value of assets), default point, and asset volatility – on its EDF implied rating. We make no assumptions about what the “optimal” implied rating level for Facebook should be. Instead, we find the minimal values for each of Facebook's EDF drivers that would allow it to retain its current Aaa EDF-implied rating. Because a company's EDF drivers evolve interdependently, we perform marginal sensitivity tests – that is, we change one driver while holding the others fixed at their current levels.⁵

Performing a sensitivity test serves at least three purposes. First, it tests how sensitive Facebook's credit quality is to strategic errors that might result in a lower future share price and/or higher asset volatility. Second, as we discussed in the section above, Facebook's asset volatility is currently based on modeled volatility. We can measure the robustness of Facebook's EDF level to any potential mis-estimation of its asset volatility by varying its value. And last, we can test Facebook's financing capacity – i.e. how much it can lever up without substantially affecting its default risk.

Figure 7: Effects of Changing Facebook's EDF Drivers

EDF Driver	Current Value	Hypothetical Value	EDF Level	EDF Implied Rating
Share Price	USD 21.18	USD 8.00	0.03%	Aaa
Asset Volatility	25.37%	33%	0.03%	Aaa
Long-Term Debt (Millions)	USD 394	USD 3,800	0.03%	Aaa

The sensitivity analysis results, presented in Figure 7, show that Facebook's Aaa EDF implied rating is robust to some very large changes in each its drivers. Facebook's share price could fall as low as USD 8, a 61% decline from its current level, without affecting its Aaa implied rating (again, holding the other variables fixed at their current values). The lowest reported equity analysts' estimate for Facebook's shares is USD 15, so even in the worst case assessment of equity analysts Facebook's implied ratings appears solid. Its asset volatility could rise from its current 25.37% to 33% – a 30% increase – without denting its implied rating. The last line of the table in Figure 7 shows that Facebook could issue approximately USD 3.4 billion of additional long-term debt without losing its Aaa EDF implied rating. If Facebook were to raise these funds in the capital markets, it would be a relatively large new corporate bond issue, larger than any US non-financial bond issue in 2012. It would increase Facebook's debt-to-equity ratio⁶ from 2.96% to 28.5%.

It is also interesting to consider what effect such an increase in leverage might have on Facebook's shares. The expected rate of return on equity increases as a firm's debt-to-equity ratio increases.⁷ Facebook's equity

⁵ We performed these calculations use the solver function on CreditEdge Plus.

⁶ Calculation based on shareholders' equity reported in Facebook's June 2012 10-Q divided by long-term debt as reported in Figure 7.

⁷ In a world where interest expense does not receive favorable tax treatment share price will not change (according to the Modigliani-Miller theorem). In reality, shareholders benefit from increased leverage to the extent that the benefits of debt interest deductibility outweigh the expected cost of an increase in default risk.

returns might stand to benefit from increasing leverage as long as the increase in gearing does not materially increase its credit risk. The results of the sensitivity analysis shown in Figure 7 suggest that the possibility exists, considering the fact that the median yield on Aaa-rated debt (as of October) is just 1.7%.⁸ This is, ultimately, a question about whether Facebook has an optimal mix of debt and equity in its capital structure – a difficult question to answer and one clearly beyond the scope of this case study. But given the sharp fall in Facebook's shares since its IPO, and the fact that it has no debt, it is a natural question to contemplate.

Summary

Although the performance of Facebook's shares has received enormous attention from investors and the financial media, its credit quality has received no notice. This is due to the fact that it is an unrated company and has no public bonds or credit default swaps from which to infer its credit risk. Moody's Analytics' public Expected Default Frequency (EDF) model, which uses balance sheet information and equity market data, provides a unique tool to assess the credit risk of the company. Facebook exhibits very strong credit quality, with a one-year EDF measure of 0.01% (1 bp) as of 6 November. That EDF level translates to a Aaa implied rating on Moody's rating scale. Its EDF measure has been unaffected by the approximately 40% decline in its share price since its May IPO.

Analytically, the EDF model considers the same factors important to fundamental analysis of credit risk: business, or operating, risk, and financial risk (leverage). Facebook's 1 bp probability of default is supported by low financial risk and high, but relatively favorable business risk. Its market leverage (financial risk) is just 2.53%, while its asset volatility (business risk), currently at 25.37%, is in the 25th percentile of its industry sector. Its EDF measure is also very robust to some relatively large potential changes in the drivers of its default probability. Facebook's EDF level and implied rating is also robust to a 61% decrease in its share price and an 30% increase in its asset volatility. Facebook could issue up to USD 3.4 billion of long-term debt without affecting its Aaa EDF-implied rating.

⁸ Source: Moody's Capital Markets Research Group.

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