

DEFAULT CASE STUDY

Elpida Memory Inc.

Moody's Capital Markets Research, Inc.

Author

Irina Makarova
+1 (212) 553-4307
irina.makarova@moodys.com

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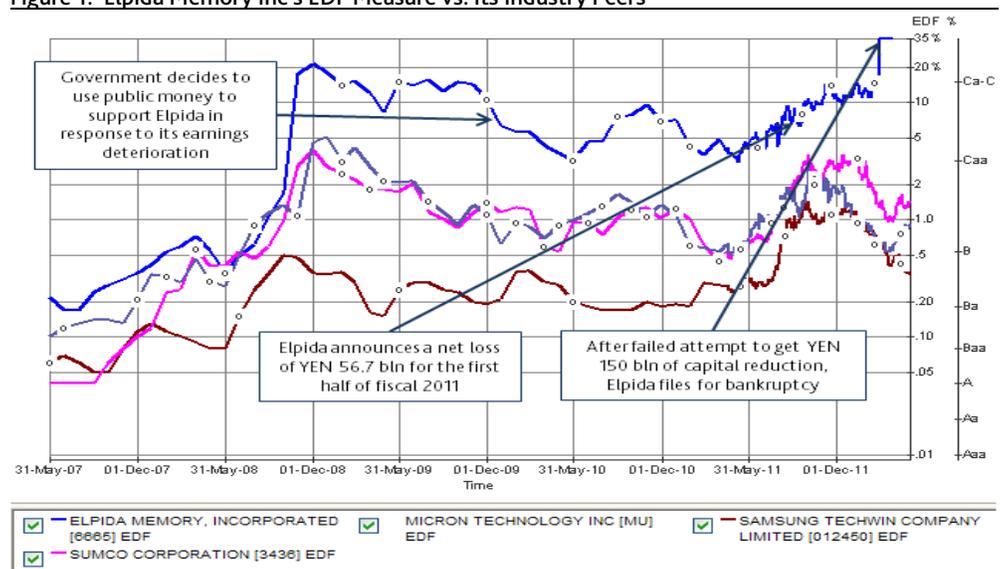
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Summary

- Elpida Memory Inc is a leading Japanese computer chip manufacturer, with production facilities in Japan and Taiwan. The company filed for bankruptcy on February 27, 2012.
- Elpida Memory's one-year EDF™ metric first showed signs of heightened default risk in November 2008, during the global financial crisis. In June 2009, in response to Elpida Memory Inc 's earnings deterioration, the Japanese government decided to support the troubled company. However, Elpida Memory, which employs about 6,000 people, went on to suffer a net loss for five consecutive quarters through December 2011. With liabilities totaling nearly YEN 450 billion, its bankruptcy is the largest corporate default in Japan since World War II.
- The increase in Elpida Memory's EDF measure prior to its bankruptcy can be understood in terms of the changes in its two primary drivers: market leverage and asset volatility. The financial risk of the company, measured by its market leverage, rose from 54.3% in March 2010 to 80.5% a week prior to its February 2012 default, indicating a sharp rise in financial risk. Between 2007 and 2009, its asset volatility – a measure of the company's business risk – increased at the same time that its market leverage was increasing, which resulted in a jump of its EDF level.

Figure 1: Elpida Memory Inc's EDF Measure vs. its Industry Peers



High and Rising Default Risk

The Expected Default Frequency (EDF) measure for Elpida Memory Inc. has signaled a high level of default risk since early 2008, and the pace of deterioration in its EDF metric began to accelerate when the company announced a 30% drop in net profit of YEN 3 billion from March 2010 to March 2011. A year later, on February 27, 2012, the firm announced its bankruptcy filing with debts totaling YEN 448 billion, making it the largest corporate failure in history among Japanese manufacturers since World War II.

Elpida Memory is Japan's sole maker of dynamic random access memory (DRAM) chips, which are used in such products as personal computers and smart phones, and had grown to be the third-largest manufacturer in the global market after Samsung Electronics Co. and Hynix Semiconductor Inc. Because Elpida Memory lacks an agency credit rating and does not have traded bonds or CDS from which to infer credit risk from market spreads, Moody's Analytics' public EDF model provides a unique tool to assess the company's credit risk. And because it uses equity market information, the EDF measure for Elpida Memory provided a timely early warning signal of financial distress.

At the time of its default on February 27 2012, Elpida Memory's EDF metric was 13.57%, compared to 1.02% for the median EDF for the company's industry peer group, Japan Semiconductors. As figure 1 on the cover of this report shows, Elpida Memory remained a high-risk name since the global financial crisis and significantly underperformed its peers, like Micron Technology Inc and Sumco Corporation. Over the last year Elpida Memory struggled to win the battle with its rivals while also facing the headwinds of a strong yen, which tends to make products produced in Japan more expensive in foreign markets. Furthermore, over the last year the EDF measure of the firm has been deteriorating at an increasing rate. Moody's Analytics' research has shown that deteriorating momentum in EDF credit measures signals a relatively higher likelihood of default, while entities with improving momentum show relatively lower levels of default risk.

Figure 2: One-year Default Rates Conditioned on EDF Momentum

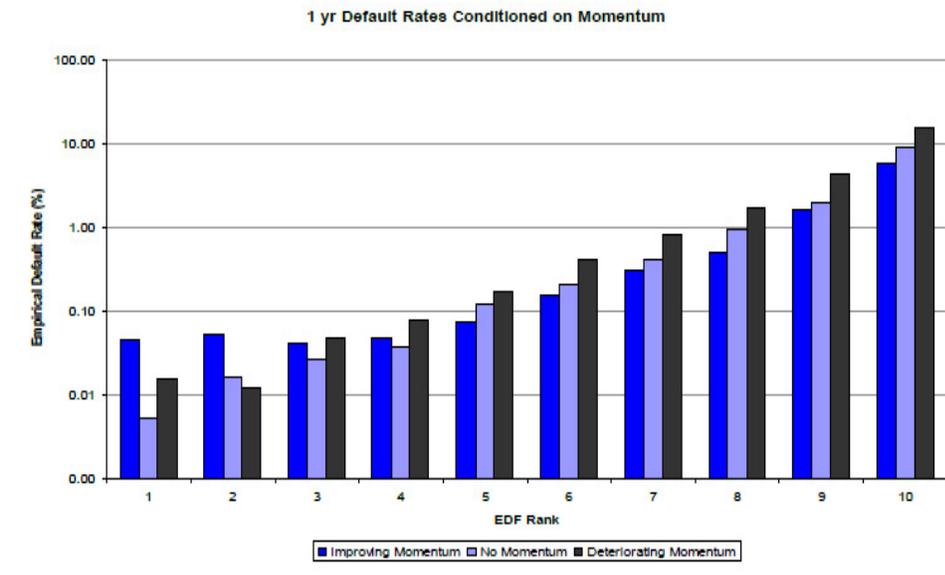


Figure 2 summarizes the EDF momentum research results. EDF levels are placed into ten equally sized buckets on the horizontal axis (deciles). For each bucket we track the direction of momentum (which is measured as change in EDF in the past twelve months). For the highest EDF level group (the 10th decile), the one-year default rate for the firms with deteriorating momentum is 15%, while that for the firms with improving momentum is only 6%. The data shows that analyzing the EDF level of a firm together with the momentum in its EDF measure leads to a better understanding of the risk of default.¹

¹ Complete details of the EDF Momentum research can be found in the methodology document "Using EDF Momentum to Provide Insights into Credit Migration and Default Risk," available on www.moodyanalytics.com.

A Deeper Dive: Understanding the Drivers of the EDF Credit Measure

An analysis of the drivers of the firm's EDF metric sheds additional light on how and why Elpida Memory became financially distressed and ultimately defaulted. In this section we examine the drivers of Moody's Analytics EDF model and discuss their direct connections to basic concepts of fundamental credit analysis.

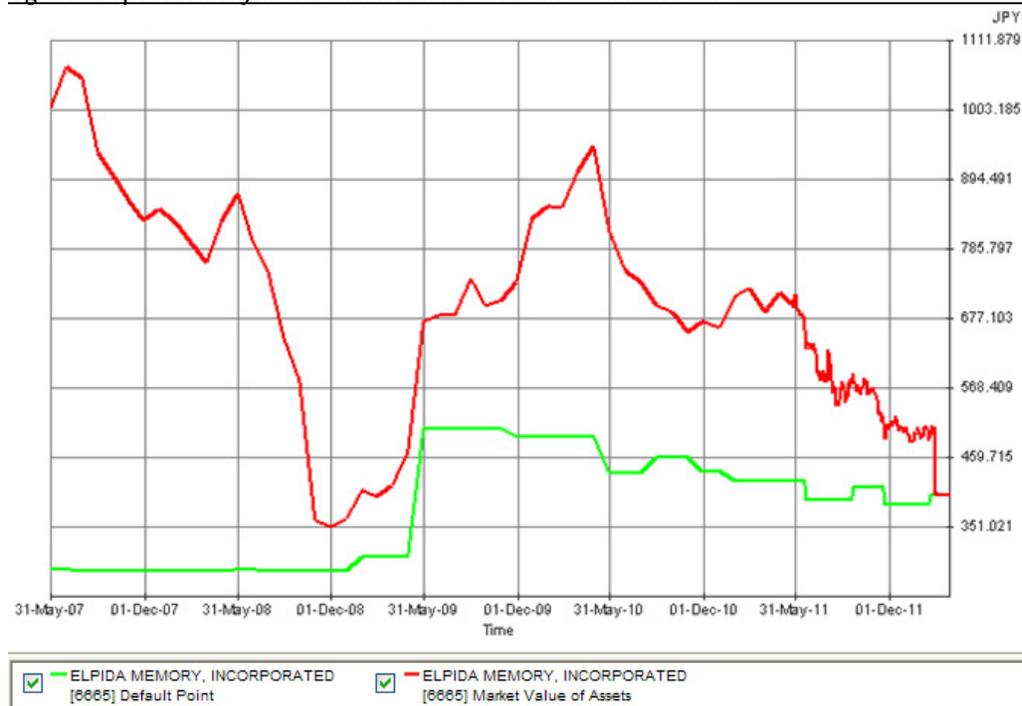
Moody's Analytics' public firm EDF model belongs to a class of credit risk models referred to as structural or asset value models. The basic assumption of asset value models is that there is a causal, economically motivated reason that default occurs. Default is highly likely to occur when the market 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, equity holders can and often will "put" the residual value of the firm to creditors.

The above economic intuition can be translated into three quantifiable variables: the expected 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:

$$DD \approx (\ln(A) - \ln(X)) / \sigma$$

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 represents the firm's 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.

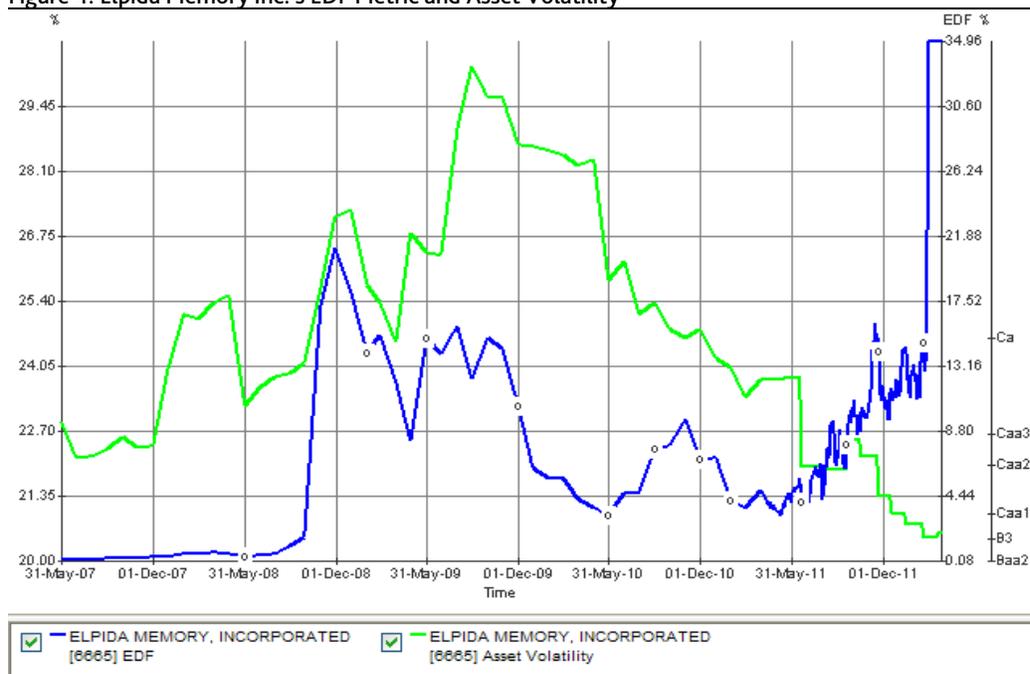
Figure 3: Elpida Memory Inc.'s Default Point and Market Value of Assets



The sharp and sustained increase in Elpida Memory's EDF levels starting in 2008 was primarily the result of rising market leverage (which is measured as the ratio of the default point to the market value of assets). Figure 3 shows the time series of Elpida Memory's market value of assets and its default point. The company received YEN 30 billion in emergency investment via the state-backed Development Bank of Japan in June 2009, which temporarily improved the company's financial position. Less than a year later, in March 2010, Elpida Memory's market leverage began a sharp increase driven by both a jump in its default point (which is derived from the firm's liabilities) and a decline in the market value of the firm's assets. The equity market responded to the company's increasing troubles by bidding the value of its shares lower, leading to a reduction in the market value of its assets, which in turn led to an increase in its market leverage. The financial risk of the company, measured by its market leverage, rose from 54.3% in March 2010 to 80.5% a week prior to its February 2012 default. During the same period of time the market value of Elpida Memory's assets dropped by 45% from YEN 907 billion to YEN 497 billion in February 2012. At that point the asset value of the company had fallen to nearly the same level as its default point of YEN 400 billion. When a firm's market value of assets falls below the default point it is technically insolvent and it is highly likely that the firm will be unable to sell assets or raise additional capital to pay its debt.

Another key driver of Elpida Memory's EDF measure was its asset volatility, which is the standard deviation of the annual change in the market value of assets. Between 2007 and 2009, Elpida Memory's asset volatility increased at the same time that its market leverage was increasing (Figure 4), which resulted in a jump in its EDF level. The prices of the DRAM chips that Elpida was producing had been sinking since the surge in demand for mobile devices like Apple Inc's iPad, which is much less reliant on DRAM chips than conventional PCs. Although Elpida Memory's asset volatility declined from 2010 until the time of its bankruptcy, the pace of increase its market leverage eventually more than compensated for its lower asset volatility, leading to a sharp drop in its distance to default and a material rise in its EDF measure.

Figure 4: Elpida Memory Inc.'s EDF Metric and Asset Volatility



Summary

Elpida Memory Inc. does not have traded bonds or CDS from which to observe credit spreads, and is not rated by Moody's Investors Service. However, Moody's Analytics' public EDF measure effectively captured and quantified changes in the company's risk of default. Over the last three years the company received

government support, but still failed to survive a sharp drop in memory chip prices, strengthening yen, and competition from South Korean and Taiwan rivals. The behavior of Elpida Memory's EDF measure reflects the company's inability to pay its debt of YEN 448 billion, making it Japan's largest manufacturing industry failure since the World War II. One of the key indicators of the firm's demise was the relative deterioration of its EDF measure compared to its peers. At the time of its bankruptcy filing, the firm's EDF measure was 13 times greater than the median EDF for its peer industry group. The movement in the EDF measure is attributable to the increase in its market leverage (financial risk) as well as asset volatility (business risk). On May 7, 2012, US chipmaker Micron Technology Inc., offered more than YEN 200 billion for the exclusive rights to buy Elpida Memory Inc. That purchase will make Micron world's second-biggest maker of the DRAM chip and will keep Elpida Memory's two main factories in Japan open to guarantee the jobs of the company's current employees.

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Author

 Irina Makarova 1.212.553.4307
 irina.makarova@moody.com

Contact Us

 Americas : 1.212.553.4399
 Europe: +44 (0) 20.7772.5588
 Asia: 813.5408.4131

Editor

 Dana Gordon 1.212.553.0398
 dana.gordon@moody.com

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