

## EDF™ CASE STUDY

Moody's Capital Markets Research, Inc.

### Authors

David T. Hamilton, PhD  
+1 (212) 553-1695  
david.hamilton@moody.com

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

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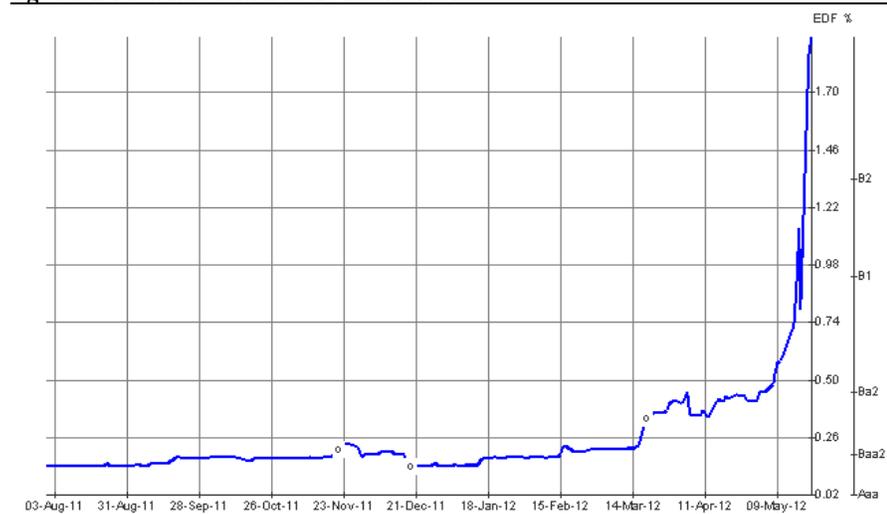
## Bankia S.A.

### Default Risk Jumps Sharply for Troubled Bank

#### Summary

- Bankia SA's one-year probability of default jumped sharply in May, from 0.45% at the start of the month to 2.24% as of May 24. Its EDF™ measure is up from 0.14% in January – an increase of 1,500% over the past five months. Bankia's EDF measure has also underperformed its peers in the Spain banks industry sector. Although Bankia's default probability is still below the 4.4% median EDF for its industry sector, both the deteriorating momentum in its EDF and change relative to its sector highlight Bankia as particularly risky compared to its peers.
- On May 10 the Spanish government partly nationalized the lender by converting a EUR 4 billion loan from the Spanish bailout fund into shares, giving the government a 45% stake. Bankia is Spain's fourth-largest lender with more than 10% of bank deposits. The bank's future is uncertain, with plans varying from reducing its balance sheet significantly to breaking up the institution to liquidation.
- The sharp increase in Bankia's EDF measure can be understood in terms of the two key drivers of EDFs, market leverage (financial risk) and asset volatility (business risk). With a market value of assets of USD 266 million and a default point of USD 242 million, its market leverage is just over 90%, making it one of the riskiest banks in Spain on that metric. Its asset volatility has increased by 19% in the past six months, indicating worsening operating performance.

Figure 1: Bankia SA's One-Year EDF Measure



### Sharp Increase in Default Risk

The probability of default for Bankia SA, Spain's fourth largest lender, jumped sharply in May as the outlook for the troubled bank appeared to worsen. Bankia SA's one-year EDF measure increased from 0.45% at the start of May to 2.24% as of May 24. As Figure 1 on the cover of this report shows, Bankia's EDF measure has deteriorated significantly over the past year. Its EDF measure is up from 0.14% in January – an increase of 1,500% over the past five months.

The rapid decline in Bankia's financial and operating performance led the Spanish government to partially nationalize the bank. On May 10 it converted EUR 4.5 billion of state loans into equity, giving it a majority stake in Bankia. Bankia's ability to survive intact is highly uncertain. Bankia has the most real-estate related loans on its books than any Spanish bank, and needs to come up with EUR 7.5 billion by the end of the year to meet government demands to cushion itself against real estate losses. Moreover, it also needs to raise approximately EUR 1.3 billion by June to meet the European Banking Authority's capital rules. Finance ministers in Spain are currently debating the bank's future, with plans varying from reducing its balance sheet significantly to breaking up the institution to liquidation.

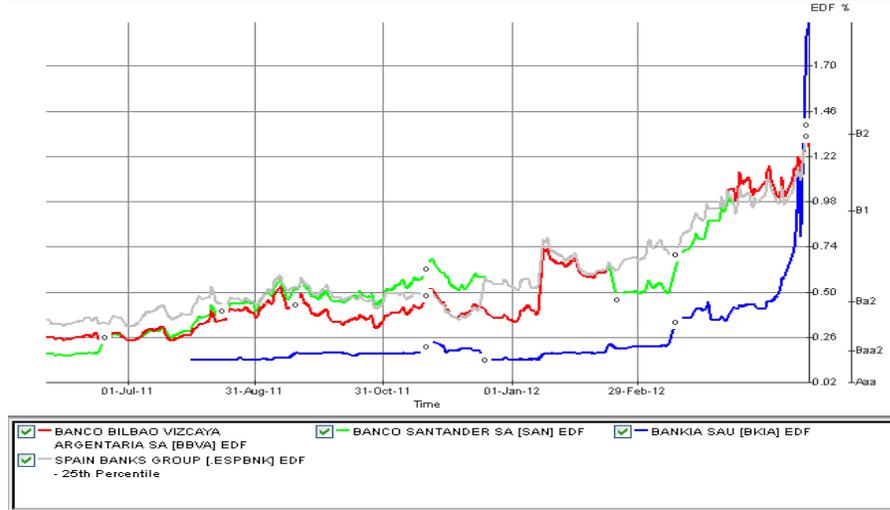
Bankia's problems come amid a worsening in credit risk for the whole Spanish banking sector and the sovereign itself. The median EDF for the Spanish banks sector has more than doubled since the start of the year, from 1.99% in January to 4.4% as of May 24. The annualized probability of default for Spain, derived from its sovereign 5-year CDS spread, has tracked the increase in the median EDF for the Spanish banking sector, as shown in Figure 2. As of May 24 the sovereign EDF for Spain stood at 1.42%. On an implied ratings basis this places both the banking sector and the sovereign firmly within high yield territory.

**Figure 2: Median EDF for Spanish Banks vs. Sovereign EDF of Spain**



In addition to the rising level and deteriorating momentum in its EDF, Bankia has also underperformed its peers in the Spanish banks industry sector. In Figure 3 we show Bankia's EDF measure and those of two other large Spanish banks, Banco Santander and BBVA, over the past year. We also show the 25<sup>th</sup> percentile EDF for the Spanish banks industry sector. Banco Santander and BBVA have tracked the 25<sup>th</sup> percentile EDF level over the past year as the default risk for the entire sector has drifted higher. The overall distribution of EDFs for Spanish banks is affected by the presence of low credit quality savings banks (cajas). The large Spanish banks therefore look relatively strong in comparison. Even until very recently Bankia's default probability appeared to be relatively low among its peers in the Spanish banks sector. However, the data in Figure 3 shows that Bankia's EDF measure is significantly underperforming its large bank peers as well as its peer industry as a whole. Although Bankia's default probability is still below the 4.4% median EDF for its industry sector, both the deteriorating momentum in its EDF and change relative to its sector highlight Bankia as particularly risky compared to its peers.

Figure 3: Bankia SA's EDF Measures vs. Peers and Spanish Bank Sector 25th Percentile EDF



Moody's Analytics' research has shown that firms that underperform their industry sectors, regardless of the level of their EDF measure, experience higher default rates. Based on data from 1992 to 2011, we calculated one-year default rates conditioned on a firm's EDF level and on the relative EDF change versus its sector. Relative performance is measured by the difference in the change in a firm's EDF measure and the change in its industry median EDF measure. Figure 4 shows the results. For ease of presentation, we bucketed EDF levels and change versus sector into ten equally sized categories (deciles). Between January 2012 and May 2012, Bankia's EDF measure worsened by 1,500%, while the trend of Bankia's EDF metric versus its industry group shows relatively heightened default in both absolute and relative terms.

Figure 4: Average Realized Default Rates by EDF Level and Relative Performance vs. Industry Sector

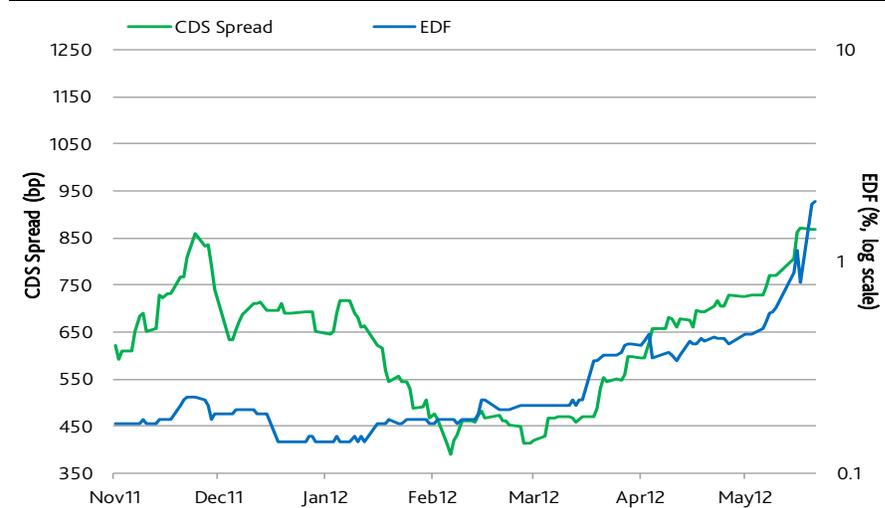
Firm EDF Level	EDF Change Relative to Industry Peer Group Change										ALL
	1	2	3	4	5	6	7	8	9	10	
1	0.05%	0.03%	0.02%	0.00%	0.00%	0.01%	0.03%	0.00%	0.00%	0.00%	0.02%
2	0.10%	0.05%	0.06%	0.06%	0.00%	0.00%	0.02%	0.07%	0.11%	0.27%	0.05%
3	0.10%	0.06%	0.01%	0.03%	0.01%	0.03%	0.07%	0.06%	0.03%	0.18%	0.05%
4	0.28%	0.12%	0.17%	0.15%	0.09%	0.10%	0.08%	0.09%	0.17%	0.30%	0.15%
5	0.32%	0.23%	0.24%	0.32%	0.22%	0.24%	0.21%	0.27%	0.22%	0.46%	0.27%
6	0.62%	0.44%	0.45%	0.34%	0.44%	0.56%	0.44%	0.72%	0.51%	0.97%	0.55%
7	0.71%	0.56%	0.66%	0.80%	0.64%	0.72%	0.73%	1.06%	1.18%	1.63%	0.89%
8	1.01%	1.01%	1.19%	1.25%	1.27%	1.44%	1.58%	1.65%	2.05%	3.10%	1.68%
9	3.14%	2.22%	4.83%	5.16%	5.25%	4.34%	4.87%	5.75%	6.37%	8.39%	5.60%
10	6.43%	4.68%	5.76%	7.70%	7.70%	6.96%	7.67%	9.31%	9.99%	13.70%	8.94%
All	0.66%	0.63%	1.08%	1.73%	1.73%	1.83%	2.24%	2.92%	3.13%	5.96%	2.16%

A Note on Interpreting EDF Measures for Banks

The public EDF model assesses default risk across a firm's entire capital structure. Because of this feature, EDF measures tend to reflect default risk for obligations on the lowest rung of a firm's liability structure. This is of little significance for corporations, where most debt is at the senior level, but the implication for banks is important. Bank liabilities range from senior obligations to hybrid capital, such as preferred shares, that rank just above equity. As a result, a bank's EDF signal reflects the risk of its most junior obligation. For most investors and risk managers, the bulk of their exposures to banks are at the senior level. Other types of credit risk signals, such as CDS spreads or agency ratings, are often quoted at the senior level of exposure. Hence, EDF metrics for banks can tend to appear relatively high relative to measures of credit risk from the CDS market or the rating agencies. During the global financial crisis, as governments began to explicitly state that they would support banks' senior creditors but nobody else, the differences widened even further. Although EDF metrics, CDS spread-based measures, and agency ratings may appear to be sending different or even conflicting signals about the risk of default for a firm, they may actually all be correct. It just

depends on whose perspective on credit risk – the senior lender or everybody else's – is the focus. Figure 5 shows that as its EDF measure started to increase, Bankia's CDS Spread began to increase as well. While the rate of deterioration in Bankia's 5-year CDS spread over the last three months is not as significant as the deterioration of its EDF measure, the spread has more than doubled to its current level of 867 bp.

**Figure 5: Bankia S.A.'s EDF Measure vs. its 5-Year CDS Spread**



Source: Moody's Analytics and Markit

### Analyzing the Drivers of Bankia's EDF Measure

In this section we look into the drivers of Bankia's EDF measure in more detail. 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 identify why a firm's default risk is changing.

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  $\sigma$ ), 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 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.

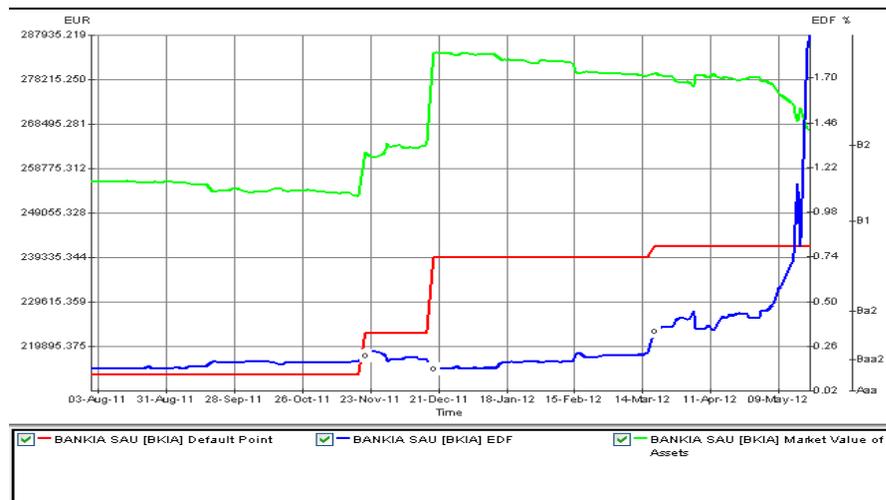
### Rising Leverage and Deteriorating Operating Performance Boost Default Risk

The two fundamental drivers of EDFs, market leverage and asset volatility, have both worked to drive Bankia's EDF higher in the past year. Figure 6 shows the time series of Bankia's market value of assets and

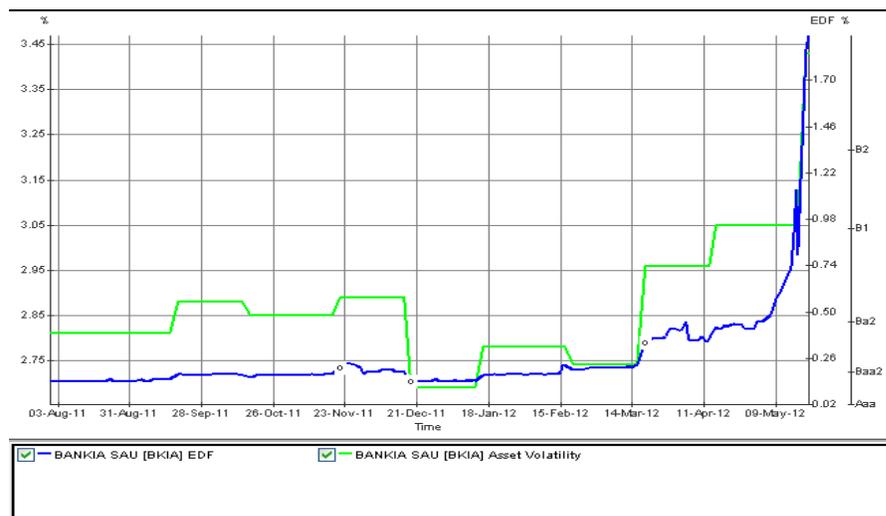
its default point. Beginning in January 2012 Bankia's market leverage (the ratio of the default point to the market value of assets) began to increase, first through a fall in its market value of assets, then in March also driven by a jump in its default point (which comes from the firm's liabilities). Compared to other firms in its industry sector, Bankia's market leverage is in the 90th percentile, making it one of the riskiest banks in Spain on that metric. If the market value of assets falls below the given default point, it is assumed that the firm will be unable to sell assets or raise additional capital to pay its debt – it would be technically if not actually insolvent. Since January 2012, Bankia's market value of assets has dropped by 6% from USD 284 million to its current level of USD 266 million. Bankia's default point has increased by 13% from its July 2011 value of USD 239 million to its current value of USD 242 million. These data show that Bankia's financial risk has increased sharply in the past year and especially so in the past month.

At the same time that Bankia's financial risk has increased, its operating performance has also deteriorated. An increase in the firm's asset volatility, which is the standard deviation of the annual change in the market value of assets has helped boost Bankia's EDF measure. Figure 7 shows the evolution of Bankia's asset volatility and its effect on its EDF measure. Over the last six months the firm's asset volatility increased by 19%. The jump in its asset volatility in March 2012 occurred just as the rise in its market leverage began to accelerate. The combination of higher market leverage and higher asset volatility led to a material rise in its EDF measure starting in March, and a sudden jump in default risk in May.

**Figure 6: Bankia SA's EDF Measure, Market Value of Assets and Default Point**



**Figure 7: Bankia SA's EDF Measure and Asset Volatility**



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**Author**

 David T. Hamilton 1.212.553.1695  
 david.hamilton@moodys.com

 Irina Makarova 1.212.553.4307  
 irina.makarova@moodys.com

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**Editor**

 Dana Gordon 1.212.553.0398  
 dana.gordon@moodys.com

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**Contact Us**

Americas : 1.212.553.4399

Europe: +44 (0) 20.7772.5588

Asia: 813.5408.4131

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