Moody's ANALYTICS

ARTICLE
06 APRIL, 2022

Clearing the Fog: Proxy Valuations of Russian Firms Using CDS-Implied EDFs

Authors

Lily Francus
Director-Research
lily.francus@moodys.com

Michael Zeng
+1.415.874.6182
michael.zeng@moodys.com

Sohini Chowdhury
Dir-Solutions Specialist
+1.610.235.5191
sohini.chowdhury@moodys.com

Contact Us

Americas
+1.212.553.1653
clientservices@moodys.com

Europe
+44.20.7772.5454
clientservices.emea@moodys.com

Asia (Excluding Japan)
+852.3551.3077
clientservices.asia@moodys.com

Japan
+81.3.5408.4100
clientservices.japan@moodys.com

Days after Russia invaded Ukraine on February 24, the United States, Japan, and the European Union levied economic sanctions on Russia and froze the Central Bank of Russia's foreign assets, preventing it from backstopping the freefall of the ruble. By early March, the currency was down by more than 30% from mid-February and Russia's GDP was predicted to decline by 15% in 2022. As of March 24, the Moscow Exchange had only partially reopened, with substantial restrictions preventing true price discovery.

While we can estimate damages by looking at the few companies that are still trading, albeit in largely illiquid and frenetic markets, this estimate likely presents a poor and potentially biased picture. For now, certain US dollar bonds issued by large companies are still trading, with potentially large windfalls for risk-tolerant investors willing to bear the consequences of total loss if further sanctions are imposed. Even those, however, struggle with massive illiquidity and uncertainty. Investors owning equities or assets without tradable dollar bonds face an even greater bind; how can one value a currently valueless market?

Derivatives may be the answer. Although Russian assets worldwide are in effect frozen, derivatives based on those assets are still traded. Financial derivatives in theory derive their value from an underlying asset, with common variants trading on exchanges, such as vanilla equity options, and over the counter. The most salient for the Russian fixed-income investor now may be the credit default swap, a derivative contract that pays out to a buyer in the event of certain defined credit events.

In theory, the CDS provides a tradeable unit for measuring the default risk premium of an obligation, allowing buyers to redeem their bonds at par value when a previously-defined credit event occurs to sellers in exchange for paying the swap premium. In practice, however, the CDS is also a popular speculative tool. It allows investors a way to speculate on the solvency of a particular obligor, as a proxy for a related obligor, or more exotic swaps involving a group of related obligors. CDS were originally designed as an insurance-like product for bonds, but most estimates on the CDS market show it to be largely driven by speculation, with 80–90% of activity representing "naked" CDS or buying without owning the reference obligation.

In general, we observe a parity between equity-based credit signals, usually based on the Merton (1974) model, and derivative credit signals, like the CDS markets. As equities tend to be more liquid than corporate bonds and represent a call option on firm assets, we can measure a firm's latent solvency risk by changes in market capitalization relative to debt structure. In our analysis of existing Russian firms traded in both equity and CDS markets, we note that in times of credit crisis, the correlation between changes in market capitalization and CDS spread strengthens. In normal times minimal information is encoded in CDS spreads, but in a crisis, the default likelihood becomes a dominant factor in asset pricing, allowing us to use CDS and a derived metric, the CDS-implied EDF, as a proxy method for valuing otherwise illiquid, untradeable assets.

Moody's Analytics CDS-Implied EDF Measures

Assuming it is sufficiently liquid, the CDS market should provide the market's best expectation for the amount recoverable on an underlying asset given a default or other credit event occurs. We can therefore usually use it as a basis for estimating default risk. Interestingly, this estimate directly parallels the commonly-used expected default frequency (EDF): the probability of default derived from the Moody's Analytics Merton-derived model of credit risk. They both react to changes in market expectations of an obligor's credit risk but differ in important ways.

In practice, the most common type of CDS contract associates a payout with the loss given that a credit event occurs by a specific maturity, usually five years. This payout is based on a reference obligation, usually a corporate credit instrument like a bond. There is an important technical distinction: the Moody's Analytics/Merton approach reflects obligor risk, rather than a specific issue or instrument issued, but the CDS reflects obligation risk tied to a specific issue.[1] However, as the CDS contracts trade largely in standard maturities—one-year, two-year, three-year, five-year, seven-year, and ten-year—we can derive a term structure based on observed market prices. Conversely, the standard Merton method reflects the expectation of default for an obligor for a particular time horizon (no maturity date), which has been extended in later versions of the EDF model to create a term structure.

Given this implied relationship, changes in equity prices and CDS spreads tend to correlate strongly. As the CDS market grew, mispricings in the market allowed a form of implicit arbitrage when spreads and equity prices diverged greatly; if equity prices implied a lower risk of default than the CDS, observant arbitrageurs could short the equity and sell the overpriced CDS, largely keeping the two markets in parity. This mechanism becomes predominant as firms get closer to the default point, with their equity value largely remaining as optionality for the firm's survival. Nevertheless, the CDS and equity-implied EDF of firms may disagree in certain notable cases.

For years before being placed into conservatorship, Fannie Mae and Freddie Mac had EDF measures that implied a much higher likelihood of default than their associated CDS spreads. This was due to an implicit guarantee that the US government would backstop the reference obligations that underpinned the CDS, whereas the equity value had no such guarantee.[2] Conversely, changes in capital structure, such as the announcement of a leveraged buyout, may be immediately reflected in CDS spreads, but may not always affect the EDF as quickly. In these scenarios, we can derive extra information about the firm's true default risk by computing a CDS-implied EDF and using it in conjunction with the traditional equity-based EDF. Similar to the EDF, the CDS-implied EDF methodology allows us to convert market CDS spreads into a standardized measure of default risk, permitting direct comparison between the otherwise noisy CDS spread.

[1] A similarity between EDFs based on CDS and EDFs based on equity prices is that they both represent physical expected probabilities of default—that is, the PD calculation is based on real-world historical default events. PDs implied directly from CDS spreads can exaggerate true default risk because they are risk-neutral measures.

[2] As it turns out, both risk measures were correct in the end. Fannie Mae's senior obligations never defaulted, whereas more junior obligations such as preferred stock incurred losses, and both Fannie and Freddie were put into conservatorship by the Federal Housing Finance Agency.

Notably, this comparison implies a method to understand the value of assets with otherwise no direct market price. Much like we use the EDF to imply fair-value spreads for otherwise illiquid debt instruments, could we use the still-trading CDS markets to imply equity prices for the now-illiquid Russian securities?
In normal times, we can view a firm's market capitalization as not only representing the book value of the firm's assets but also factors and broad market performance. Well-performing firms do not usually show a linear relationship between solvency risk and equity price; this relation becomes far stronger when a firm's market capitalization nears its default point, conventionally viewed as a maturity-adjusted sum of the firm's liabilities. Similarly, fluctuations in a CDS spread may not directly reflect in equity prices, given that both have different sensitivities to market and credit factors, capital structure, and the performance of similar CDS.

However, in crises, this behavior changes dramatically. Historically, when true credit crunches occur, we observe a flight to quality and a flight to liquidity, where investor preference changes from riskier, less liquid, higher-returning assets to less risky, more liquid, lower-returning assets, such as US Treasuries. Prior research[3] has demonstrated that portfolios with higher credit risk, measured by EDF values, show pronounced long-term underperformance coupled with higher volatility, with the strongest impact for investments in firms near distress. This result is intuitive; as a firm's solvency risk increases, the Merton-implied option value of equity comprises more and more of the equity's market value. At the default point, the non-option equity value of a firm is essentially zero, with any remaining economic value belonging to debtholders (exceptional circumstances aside).

Owing to political and economic factors, many view the Russian government and many private Russian corporations in a state of technical or even financial default. The Russian economy has come under immense pressure from international responses, as evidenced by the dramatic decline in the price of the ruble and publicly traded Russian bonds and equities. Further, much of Russia's extant debt is denominated in hard currencies, with the Russian government owing $40 billion in euro- or dollar-denominated bonds. As a result of sanctions on foreign reserves and dramatically tightened domestic currency controls, hard currencies are scarce, raising the possibility that even if Russia avoids a true financial default, a default may occur on a technical basis. Whether this constitutes a CDS-specified credit event is unclear, given the extant sanctions. Specifically, the threat of sanctions banning secondary trading may affect the reference obligation's ability to be physically auctioned, making it unclear what the final settlement price for the CDS should be. This uncertainty has led to persistent spreads between dollar-denominated Russian government bonds and their associated CDS.

How CDS-Implied EDFs Help in a Crisis

For our analysis, we primarily rely on datasets from Moody's Analytics CreditEdge, which provides a long-term dataset on corporate credit histories and events for more than 400,000 obligors worldwide. Of the 180 firms domiciled in Russia that have EDF values, nine—Lukoil, Gazprom, Sberbank Russia, Gazprom Neft (a subsidiary of Gazprom), Mobile Telesystems, Severstal, Rosneft Oil, VTB Bank, and Alrosa—trade actively as single names on the CDS markets, allowing us to compute a CDS-implied EDF.

Russian equities are assumed to be valued at levels either near or in default, so we hypothesize that the primary driver of changes to valuation, or market capitalization, should be default risk. In scenarios involving the resolution of the military conflict, we expect that the principal rights on a firm's assets in the case of a true bankruptcy will go to domestic, followed by international, debtholders. This scenario parallels what transpired for Russian bondholders in 1998; however, the geopolitical landscape is significantly less favorable now. Despite uncertainty around settlement and payout, we assume that the CDS reasonably approximates the market's true view of the reference obligations' values, and, as a proxy, can provide some insight into the firm's remaining market capitalization.

From the rolling 60-day correlations between EDF and CDS-implied EDF weekly percentage changes (Fig 1), we observe a substantial strengthening starting in early 2022 for the average and median correlations of the sample firms, exceeding the prior highs during the 2020 coronavirus crash. This correlation is robust for both one- and five-year tenors as well. Notably, this correlation seems rapidly increasing toward unity, although EDF-specific data after February 24, 2022, is missing due to stock exchange closure.

[3] "Navigating Choppy Markets – Safety-First Equity Strategies Based on Credit Risk Signals" (Malone et al., 2018)

Figure 1 – Pearson Correlation Statistic of EDF and CDS-Implied EDF measures for Russian Public Firms, 2018–2022

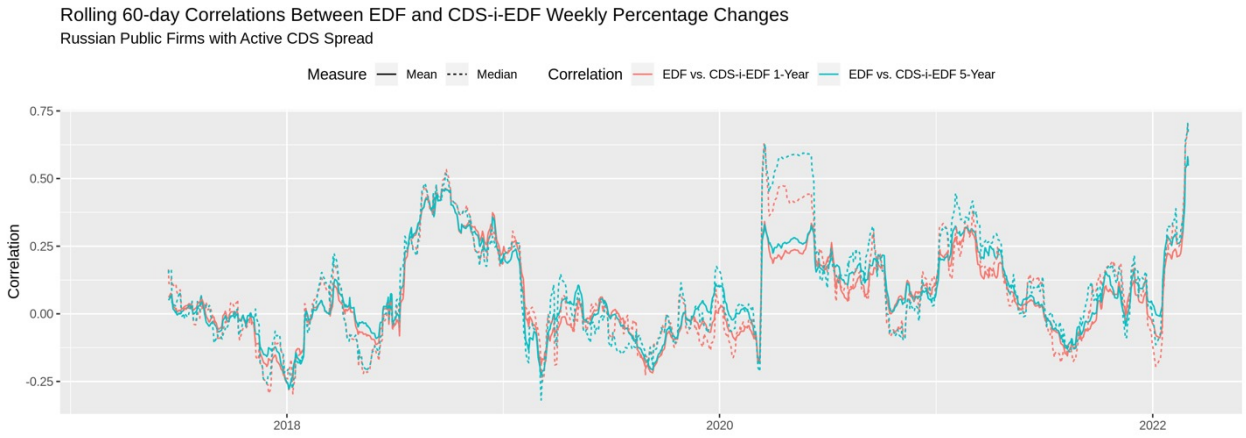
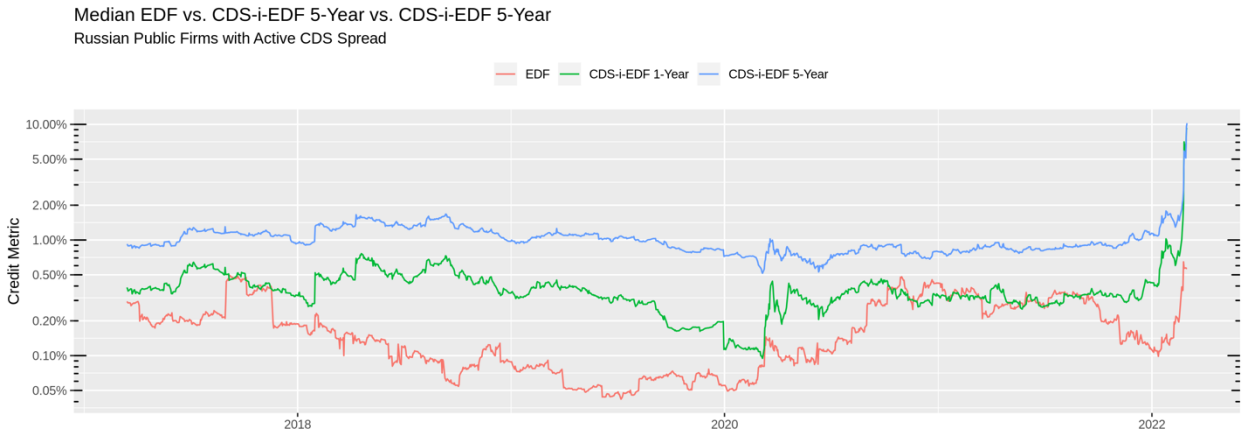
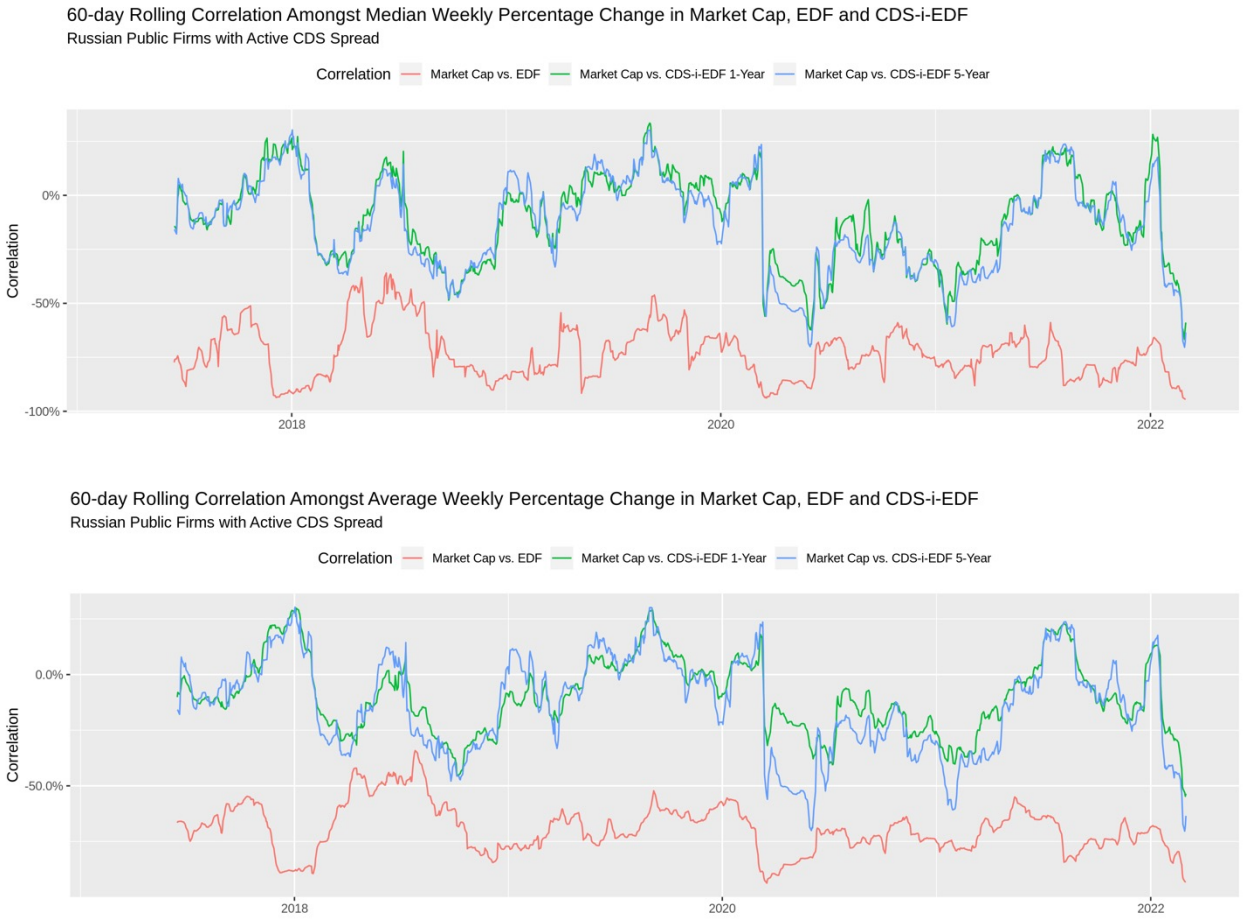


Figure 2 – Median Russian Firm EDFs vs. Median Russian Firm CDS-implied EDFs One- and Five-Year Tenors



Figures 1 and 2 imply a fairly low correlation between credit and equity default signals in normal periods, with higher alignment in times of crisis. This is a well-known and intuitive finding—most changes in equity price (and associated EDF) for non-distressed firms are related to normal market fluctuations rather than solvency risk, which doesn't similarly reflect in the credit-based CDS-implied EDF. We can confirm this by observing that these spikes coincide mainly with periods of elevated median sample EDF (Fig 2).

Figures 3 & 4 – Sixty-Day Rolling Correlation of Median (Fig 3) and Average (Fig 4) Weekly Percentage Change in Market Capitalization, EDF, and One- and Five-Year CDS-implied EDFs



As predicted, we can see in the crisis periods a strong relationship between changes in firm market capitalization and the associated CDS-implied EDF (Figs 3 and 4). While pure EDF data for the Russian firms shows a stronger correlation for the weekly change on a 60-day window than CDS-implied EDF does, both the one-year and five-year CDS-implied EDFs show an increasing correlation to market capitalization in the current credit crisis in Russia (Figs 3 and 4). The median CDS-implied EDFs in this example show a robust negative correlation during 2022 to changes in market capitalization. In all cases, the difference in correlation between equity-based EDFs and CDS-implied EDFs is notable and may result from differences in the liquidity and composition of market participants.

Other than providing an interesting stylized market fact, this increasing correlation potentially gives us a crucially needed method to value otherwise illiquid equities during stressed periods. In crises, not only do we observe a significant correlation between credit-implied and equity-implied default risk signals, but also significant anticorrelation between firm market capitalization and CDS-implied EDF weekly changes. Although stronger anticorrelation exists between market capitalization and EDF changes, the equity EDF itself takes market capitalization as an input, rendering correlation largely redundant. With substantial room for error, this anticorrelation implies a method to proxy changes to firm market capitalization from viewed changes to CDS spreads. In a functional market, this may be unnecessary; however, in cases like this, it gives us a reasonable approach to valuing frozen underlying assets.

Case Study: Sberbank

Out of the nine Russian firms with CDS and EDF history, perhaps the best test case for our approach is Sberbank, which was one of the largest employers in Russia and a notable presence in European banking before the military conflict. From a recent closing high of $20.69 in early October 2021, Sberbank shares on the London Stock Exchange fell to a low of $0.05 in early March before trading was terminated. However, this change doesn't reflect fully in the Moscow Exchange-listed shares, which only fell by 66% during the same period. This

discrepancy is partly due to differences in the trading termination date—the Moscow Exchange ceased trading as of February 28; the London shares traded until March 2—and the risks of American Depository Receipts. Unlike an onshore equity claim, an ADR is a promissory claim by a financial institution representing equity ownership, with a local branch of that institution holding the true equity claim. ADRs are therefore susceptible to geopolitical risk factors that ordinary equity holders do not have, given that the actual equity is held in the foreign nation.

Even in the event of an eventual company restructuring or liquidation, it is possible that foreign owners of Russian assets may not be compensated, or may be compensated in alternative means, such as through ruble payment. The differential between onshore and offshore ownership may be marginal outside crises, but we should rightly expect the spread in prices between ADRs and onshore equities to widen in turbulent geopolitical times.

Analyzing Sberbank's CDS-implied EDF and EDF data from 2017 onward, we observe a strong correlation since the start of the sample period, the strongest among the nine Russian firms. The correlation is robust comparing CDS-implied EDF for both one- and five-year tenors, and implies a strong concordance between Sberbank equity-implied and CDS-implied default risk.

Pearson Correlation of EDF and CDS-Implied EDF Values for Russian Firms

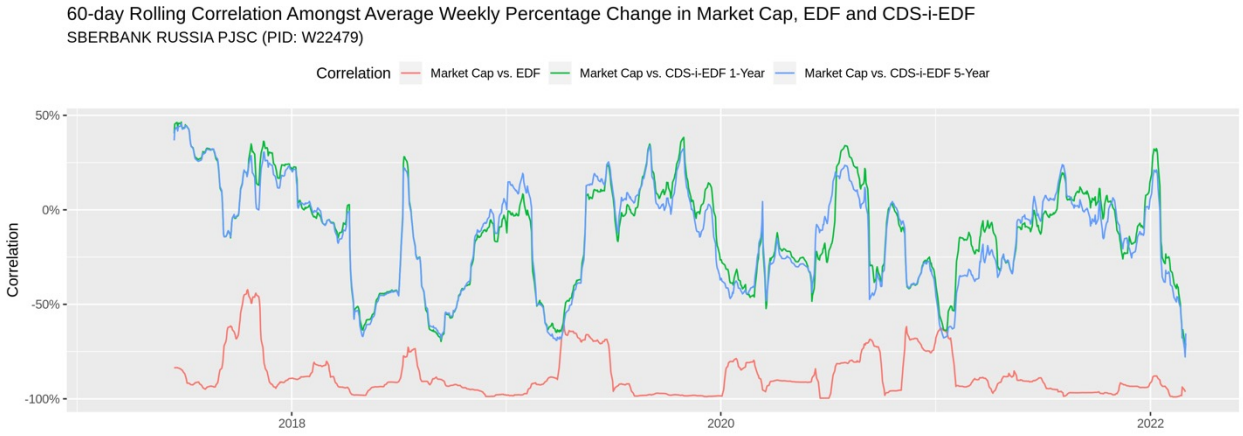
	One-year tenor	Five-year tenor
SBERBANK RUSSIA PJSC	0.54	0.47
ALROSA PJSC	0.49	0.35
VTB BANK PJSC	0.31	0.27
OIL CO. LUKOIL PJSC	0.16	0.05
GAZPROM PJSC	0.16	0.18
GAZPROM NEFT PJSC	0.16	0.03
ROSNEFT OIL CO.	0.10	0.10
SEVERSTAL PAO	0.015	0.07
MOBILE TELESYSTEMS PJSC	-0.32	-0.22

However, the equity-derived EDF diverges notably from the CDS-implied EDF after trading of Russian equities halted globally. Although Sberbank's EDF doubled to around 2.5% in the weeks leading up to the military conflict, it has remained stable since due to stale market capitalization data.[4]

While the EDF shows a strong anticorrelation to Sberbank's changes in market capitalization throughout the sample period, there is a less consistent relationship between Sberbank's weekly changes in its CDS-implied EDF and the weekly changes in its market capitalization. However, as expected, it notably spikes in periods of credit risk, including the current crisis period, for both one- and five-year tenors.

[3] Market capitalization is one of the main inputs into the EDF model and is used to derive the forward-looking asset value of a firm. When a firm's equity stops trading, as in the case of Russian listed companies, we can continue to calculate an EDF for a short period, but must then cease until trading resumes.

Figure 5 – Sixty-Day Rolling Correlation of Average Weekly Percentage Change in Market Capitalization, EDF, and One- and Five-Year CDS-Implied EDFs for Sberbank Russia PJSC

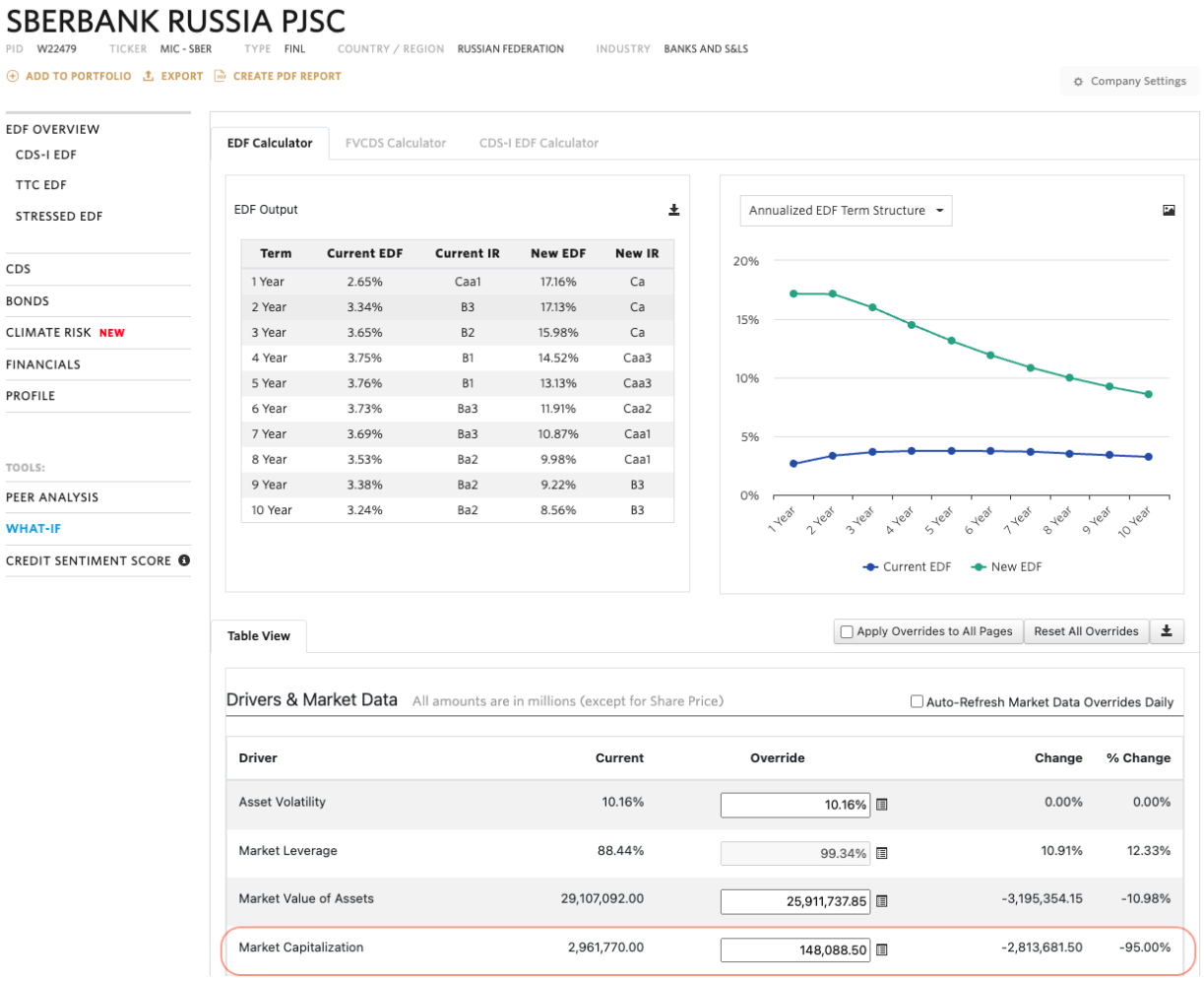


As of March 2, 2022, the Sberbank one- and five-year CDS widened to 1620 and 2260 basis points, considerably wider than pre-crisis spreads of 170 and 273 basis points on February 15, 2022. Converting to the physical probability of default via the CDS-implied EDF, this corresponds to a default risk of 35% for both tenors, the maximum allowed by the model. This is dramatically larger than the equity-implied EDF of 2.5%, which relied on last traded equity prices before the Moscow Exchange closed. Given the stale data, relying on EDF alone likely provides a poor proxy for future market capitalization evolution. However, by relying on the crisis-strengthened anticorrelation between CDS-implied EDF changes and Sberbank's market capitalization changes (Fig 5), we can make informed estimates of what Sberbank's current market capitalization should be.

To do so, we can rely on the "What-If" analysis tool in CreditEdge, which can permit us to estimate Sberbank's "missing" market capitalization information by modifying inputs to the EDF model and viewing changes to EDF and term structure. Specifically, we can rely on our expectation of a strong correlation between EDF and CDS-implied EDF in credit crises, as well as between CDS-implied EDF and market capitalization changes. In the absence of asset volatility changes, the CDS-implied market capitalization can be inferred from the CreditEdge tool as the market capitalization at which the estimated EDF matches the observed CDS-implied EDF.

In Figure 6, we play out a scenario where the market cap of the firm lost 95% of its value as of February 24. This is in line with the reported levels that Russian ADRs listed overseas have traded since the start of military activity. We see elevated EDF levels across all tenors given this change. Specifically, the new one-year EDF is now 17.16%, which would place it in the 99th percentile among the global financials.

Figure 6 – Moody's Analytics CreditEdge What-If Analysis Tool for Sberbank PJSC Using February 24 ADR Market Capitalization



However, there is an obvious discrepancy—as noted, by March 2, 2022 the CDS-implied EDF reached 35% for Sberbank for both tenors, the maximum threshold allowed. Conversely, using last traded ADR prices to imply Sberbank's market capitalization, we estimate an EDF of 17.16%. This implies that even with a 95% haircut to Sberbank's valuation, by March 2, the CDS market was still pricing significantly higher default risk than the last trades in the equity markets. This may reflect a true market capitalization for Sberbank lower than last equity prices, or alternatively can be explained by a substantial and unmeasurable increase in asset volatility. The simplest improvement on the model would likely be to assume dynamic changes to asset volatility; traditionally, asset volatility increases as obligors fall closer (or pass) the default point. Similarly, we could augment this analysis via cross-sectional analysis on similar Russian financial firms, with the assumption that geopolitical risk should impact default drivers between firms fairly equally.

Finally, we cannot rule out that part of this differential may reflect equity market optimism looking ahead to a resolution of the military conflict. While the CDS is explicitly tied to the risk of a reference obligation, in exceptional cases, equity investors may achieve favorable terms and remuneration in bankruptcy or reorganization. However, of all the potential explanations, this seems the most unlikely, especially given currency and related asset performances.

Conclusion

The EDF metric remains the gold standard for measuring obligor default risk, relying on the equity markets to properly and quickly price forward-looking information critical to understanding a firm's health. However, in circumstances like the current military conflict, equity markets may become illiquid, or may not work at all. Derivative markets like the credit default swap provide a secondary method to price in obligor risk, showing an increasing correlation to firm valuation in times of credit crisis. In calmer times, the CDS spread may provide limited extra information on asset valuation for the sample companies studied, with most changes largely uncorrelated with market capitalization

changes. In times of credit stress, however, we observe increased anticorrelation between CDS-implied EDF, equity-implied EDF values, and changes in market capitalization, hinting at a powerful credit signal for equity analysis and valuation in crises.

More importantly, this implies a proxy method to value otherwise illiquid assets with a strong credit risk component. Assuming the above correlations, we can calculate a "CDS-implied market capitalization", backing out the market capitalization level necessary to reach parity between CDS and equity-implied EDF metrics. However, negative shocks to market capitalization implicitly affect asset volatility as well, which complicates simple one-factor approaches. In practice, proxy valuation can likely be improved by accounting for changes to asset volatility, either by dynamic modeling or even simple correlation approaches (to changes in market capitalization or CDS spreads, for example).

In cases where a firm's survival is in question, through geopolitical risk from sanctions or military conflict, the derivative markets may provide a more complete picture of pricing survival odds than stale or otherwise unreliable equity data. While many investors grappling with the current crisis have taken drastic measures to write down Russian-exposed assets, often assuming a zero-recovery likelihood, our approach may present a more optimistic and quantitative alternative.