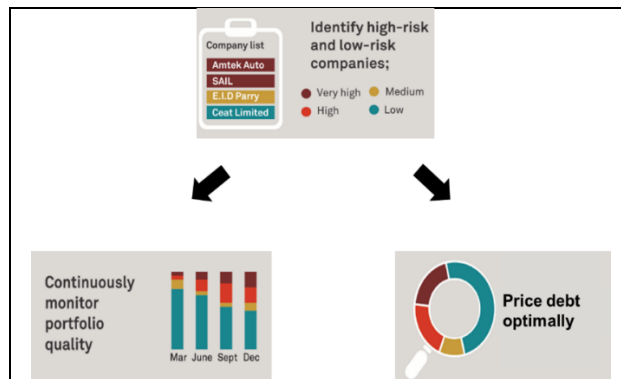## *Financial Sensitivity Model (FSM)*

1. What is FSM?

FSM is CRISIL's proprietary tool developed to **proactively identify companies with deteriorating financial risk profile**. It can help banks, NBFCs, and AMCs identify potential stress points in their lending book well in advance of market – allowing them to monitor their lending book on ongoing basis and take pre-emptive action should the financial health of an exposure deteriorate.

In a study done by CRISIL, between March 2018 and March 2019, there was credit loss upward of Rs. 7,000 crore in debt mutual funds on account of downgrades and defaults. A tool like FSM can prevent such losses by allowing for timely identification of exposures with high financial risk.

2. The wheels behind FSM

FSM tries to segregate companies into heterogeneous groups of varying financial stress – companies with deteriorating financial profile are grouped in *high financial sensitivity* bucket whereas others are grouped in *low sensitivity* bucket. The framework behind developing FSM is depicted below:
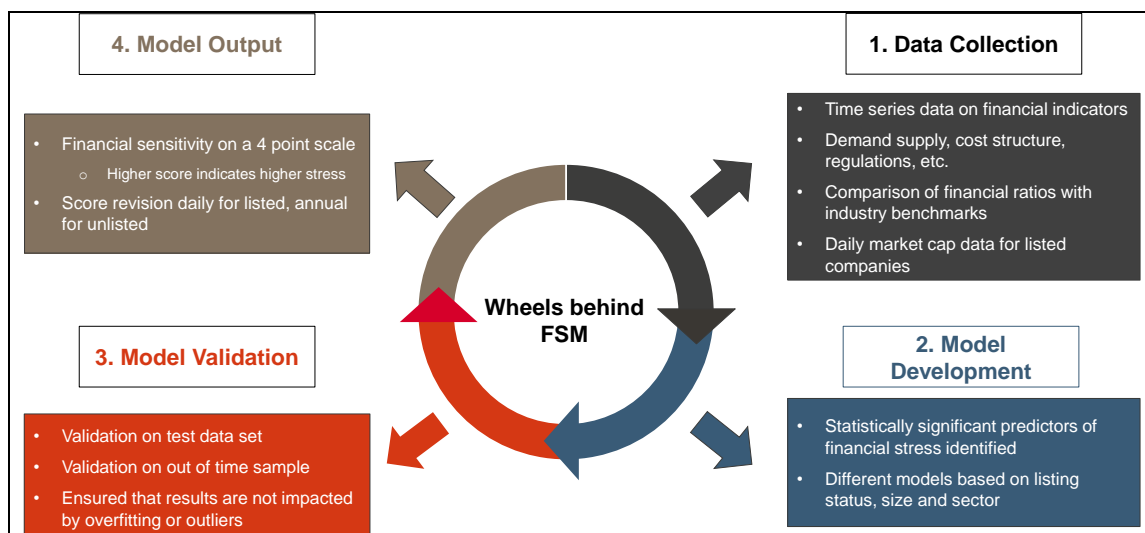
2. 1 Model development

FSM tries to predict signs of financial stress through a range of inputs – quarterly/ annual financials, daily market capitalization data (for listed companies), CRISIL's proprietary Industry Risk Score (IRS), etc. These parameters are described in detail below:
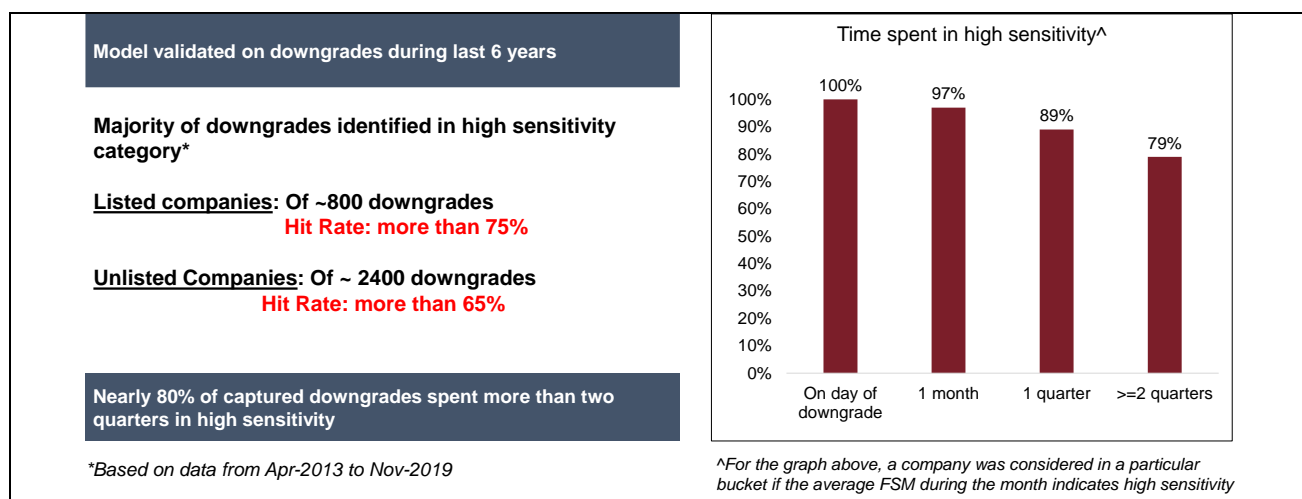
- Time series data on financial indicators: We have used quarterly financials for listed companies and annual financials for unlisted companies. Apart from considering reported quarterly/annual financials, we have taken the trend in various parameters.

- Market capitalization data: Equity prices have a potential to signal credit risk through "Distance to Default (DD)." DD assumes equity value to be a call option on assets of a company. Increasing volatility in equity value, increasing leverage levels translate into lower DD and may indicate deteriorating financial health. FSM takes into account different variants of DD (including trend in DD) that have potential to flag off financial deterioration.

- Industry Risk Score (IRS) is arrived at by aggregating the scores assigned to relevant parameters like demand supply outlook, cost structures, competition and financial parameters. IRS score captures the influence of industry variables and the extent of positive or negative impact on the cash flows and debt repayment ability of companies in an industry.

Using robust statistical modeling techniques, we have developed models that effectively segregate companies on basis of financial risk. These models cover multiple facets of the financial health of the company – e.g. size, profitability, coverage, industry outlook, etc.

2. 2 Model testing

A statistically sound model should be able to perform well on a data set that was not used in its development. To ensure that the strong performance metrics of the model were not result of overfitting, the models were subjected to rigorous testing – both on a validation set (i.e. data that was not used for model development) as well as an out of time sample (i.e. period after the model was developed.)

The high sensitivity companies would ideally be more prone to a downward rating action as compared to low sensitivity companies. As highlighted below, this was indeed the case:

Model validated on downgrades during last 6 years
Majority of downgrades identified in high sensitivity category*
Listed companies: Of ~800 downgrades   **Hit Rate: more than 75%**
Unlisted Companies: Of ~ 2400 downgrades   **Hit Rate: more than 65%**
Nearly 80% of captured downgrades spent more than two quarters in high sensitivity

*Based on data from Apr-2013 to Nov-2019

Time spent in high sensitivity^

On day of downgrade	1 month	1 quarter	>=2 quarters
100%	97%	89%	79%

^For the graph above, a company was considered in a particular bucket if the average FSM during the month indicates high sensitivity

It should be noted that several misses – i.e. instances of downgrades where FSM score is low or medium – were attributable to non-financial reasons such as:

- Downgrade of the parent
- Corporate action – such as acquisition or merger
- Excessive investment in group companies
- Regulatory reasons such as revocation of key permits

Similarly, several false alarms were attributable to companies which didn't get downgraded in the period under consideration but subsequently.

3. How should one interpret the output of FSM?

The figure below highlights a sample FSM output. Two quarters or more of consistent high/ very high sensitivity should be viewed as a red flag.
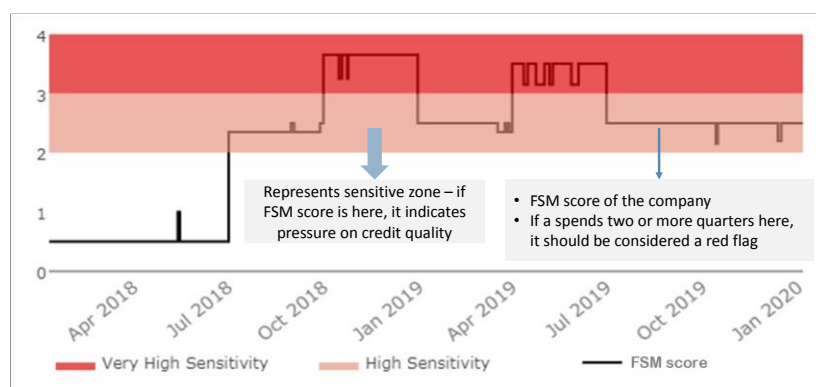
4. Coverage

FSM is applicable on all companies with annual turnover exceeding Rs. 100 crore in listed space and Rs. 50 crore in unlisted space. A study on debt mutual fund universe for fiscal 2019 indicated coverage of ~70% by count and ~90% by assets under management:
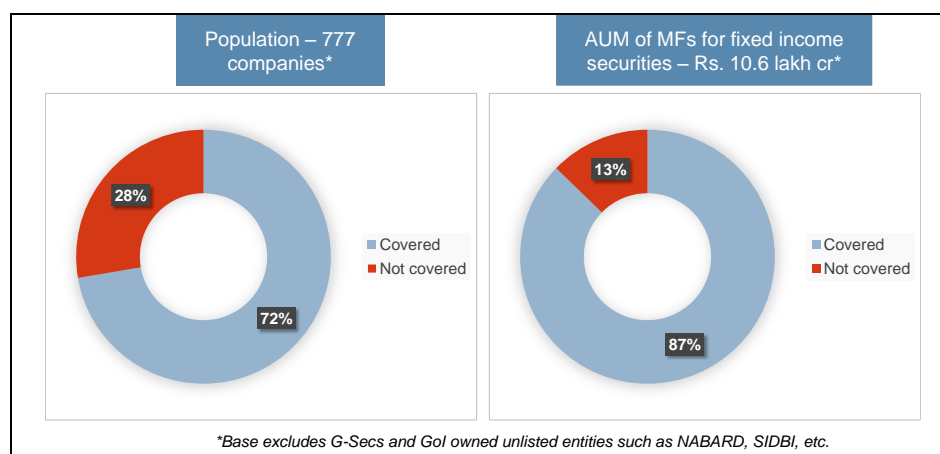
The companies/ sectors that fall outside the coverage are following:

Listed space exceptions	Unlisted space exceptions

• Companies that don't have minimum 12 quarters of financial data
 • Holding companies – these companies don't have their own cash-flows, but depend on dividends up-streamed by subsidiaries
 • Non-lending BFSI segment companies such as Insurance, AMCs, Broking companies etc.
 • Pass through certificates (PTCs) issued against asset backed securities
 • IDFs, REITs, InvITs, etc.
	• Cash-flow based sectors such as:
	    o Real estate
	    o Highway tolling companies
	 • Traders/ distributors/ hold cos.
	 • Sovereign entities with 100% GoI ownership – e.g. SIDBI, NABARD, NHB, etc.
	 • Non-lending BFSI segment companies such as Insurance, AMCs, Broking companies etc.
	 • PTCs against asset backed securities
	 • IDFs, REITs, InvITs, etc.

5. What sets FSM apart from other products available in the market?

FSM is one of its kind tool in Indian market, differentiating itself from other products through:

- CRISIL's rich data: CRISIL is actively tracking financial data for upward of 60,000 companies, and updating it regularly. This rich data helps CRISIL to develop tools that are truly representative of Indian market. Compare this to next closest database that tracks some 30,000 odd companies, and of that updates only 10,000 odd companies regularly
- Keeps in mind nuances of Indian market: Models such as Altman Z, KMV, etc. are based on data from developed markets (e.g. U.S., E.U.) and do not specifically address Indian market. On the other hand FSM has been built and back-tested using data about Indian companies and thus addresses India specific nuances
- Avoids one size fits all trap: We understand that not all segments behave uniformly, and have developed upward of 20 models across revenue buckets and industries that run at back-end of FSM. This ensures that accuracy is uniform across cross sections. Other models such as Altman Z and KMV have limited variants and may not perform uniformly across different turnover and industry segments
- Uses CRISIL's proprietary Industry Risk Score (IRS): FSM factors in IRS, which is CRISIL's proprietary product that aggregates views on factors such as demand supply outlook, cost structure, competition and financial parameters for different industries.

6. Caveats

FSM is a predictive quantitative model that tries to capture deteriorating financial health. **As with any predictive model, the outcome is never 100% accurate** – there will always be false alarms and misses. Our analysis indicates that several misses are on account of non-financial reasons, and several false alarms were actually companies that witnessed downgrades in subsequent periods. While the model tries to minimize such errors, these can't be completely done away with.