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<u>Addendum 6 to the CRI Technical Report, (Version: 2012, Update 2)</u>

This document updates the Technical Report (Version: 2012, Update 2) and details the changes in the treatment of missing values. These changes have been implemented as of the probabilities of default (PD) released on 15 February.

Previous to this change, automated data cleaning was done in a 2-step procedure. In a first step, outliers are floored and capped by winsorizing at the 0.1% and 99.9% levels for each of the ten firm-specific input variables. In the second step, missing values are replaced under certain conditions.

More specifically, if no variables for a firm are missing during a particular month, then the PD can be computed. If six or more of the ten variables are missing, there is deemed to be too many missing observations and no replacements are made. However, if between one and five variables are missing out of the ten, the first step is to trace back for at most twelve months to use previous values of these variables instead. If this does not succeed in replacing all of the variables, a replacement by sector medians is done. The median is for the financial or non-financial firms (as indicated by their Bloomberg industry sector code) within the economy during that month. The intuition behind this treatment is that replacement by the sector median should have a neutral effect on the PD of the firm; the firm is assessed by the other variables that it does have values for. This sector median is always performed in calibration. It should be noted that when reporting historical PD, the sector replacement is not done if it results in a relative change in PD of 10% or more where the initial PD was at or above 100bps, or an absolute change in PD of 10bps or more where the initial PD was below 100bps.

However, this treatment of missing values is not always meaningful and occasionally results in counter intuitive patterns in a company's historical PD. Accordingly, the RMI CRI-team is reconsidering the treatment of missing values in two-stages of development, with a first stage focusing on the replacement of missing values in the initial phase of a company and the second stage of development focusing on later periods in the company's time series. The first stage is explained below.

In the initial phase of a company – up until 6 months after IPO – it can be expected that the company's data availability and quality is relatively low due to, for example, a delay in the issuance of financial statements or illiquid trading. So, many companies require missing value replacements during that period. However, as observed in our data, replacing the missing values during these first six months with a sector median affects a company's PD in an unmeaningful way, sometimes resulting in extreme spikes and falls in the company's PD. Since this occurs at the beginning of a company's history, there are no previous PD values to compare to as can be done at later periods in a company's history.

Hence, in order to avoid this, as of the February calibration, we set a criterion to start the missing value treatment only six months after the beginning of a company's data. Doing so ensures that PDs in the beginning of a company's history are more reflective of the true creditworthiness of that individual company.

The RMI CRI-team is currently developing a method to deal with missing values later in the history of a company in a more meaningful way. This second stage of development for treating missing values will be completed in the coming months.