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Analysis of PSE Process

Objectives, Methods, and Conclusions

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Executive summary

This document summarizes preliminary findings using Mentys™ to detect and explain daily intra-day fluctuations in credit exposure profiles for one of the top five international banks.

In total, we analyzed and tracked 10,650 unique portfolios containing 270,000 unique transactions (est. 540,000 transaction entries per day) and covering a segmented, five-week period.

First, we transformed the initial, raw PSE log files using a special purpose Mentys “plug-in” to track and cleanse transactional reference data. The idea of tracking plays a key role in the “plug-in” design since Credit Engine uses, in effect, random portfolio ids. Thus, the plug-in must induce portfolios by analyzing the transaction clustering from feed-to-feed.

From the induced portfolios, we created a series of knowledge bases for more than 3,700 non-FX portfolios (est. 147,000 deals). The purpose of these knowledge bases was to help identify and explain anomalous fluctuations in peak exposure, which occurred about half the portfolios.

In a majority of these cases (est. 72%), Mentys correctly encoded the portfolio dynamics and was able to correctly and sufficiently account for peak exposure fluctuations. (We verified these results manually through spot checks.) The remaining cases (28%) indicated causal factors outside the datasets we received.

We pursued an identical process and got similar results on 2,100 FX portfolios (est. 107,000 deals).

We did not analyze a number of FX and non-FX portfolios (est. 4,700 with 16,000 deals) that contained insufficient data.

We did not explain exposure tenors other than the peak exposure. This is not a limitation of Mentys but of the model that we created, which we could modify to explain any tenor as an extrapolation on the peak.

We did also not attempt to optimize the explanations. For instance, we did not use other Mentys functions that classify and/or repair data. We recommend using these functions initially to thoroughly test the data and running them periodically as part of general maintenance.

1. Overview

Mentys™ consists of six products: *Learner*, *Prospector*, *Proactor*, *Refractor*, *Imputor*, and *Mentor*. To analyze the PSE data, we employed *Learner*, *Prospector*, and *Mentor* as well as a new Mentys “plug-in” to track portfolios and transactions and transform the raw data into a Mentys-accessible format.

The approach we pursued throughout this study involved two basic stages, as depicted below.

First, we developed and applied custom data cleansing and normalization tools to transform the client’s raw log data into a rectangular time-series format for each portfolio is directly accessible to Mentys.¹ This cleansing process further suggested a number of special issues in the raw data, which we cover in the Conclusions section.

We then partitioned the cleansed time-series data into two parts for use by Mentys: one to create knowledge bases (i.e., in-sample) and the other to analyze anomalous peak exposure fluctuations (i.e., out-of-sample).

From each out-of-sample time series of portfolio changes, Mentys generated a series of explanations accounting for more than 70% of all significant fluctuations in peak exposure.

¹ We call this rectangular format a “core”.

2. PSE raw data

The raw data provided by the client covered about five weeks of various PSE processing. The data included credit exposure profiles for each portfolio and daily tolerance test entries for individual transactions. Some data was not directly relevant in the context of a portfolio analysis.

The raw data provided daily and intra-day snapshots of each distinct portfolio. However, two *portfolio snapshots* for the same credit line at two different times did not immediately connect with one another because each snapshot possesses a uniquely generated ID number.

In all, the raw data contained information regarding 10,650 portfolios and about 270,000 unique transactions. A single archive, however, typically provided more than 500,000 transaction entries (not unique deals) comprising an average of 6,150 portfolios per day.

3. Mentys™ analysis

As previously indicated, we used Mentys in a twofold capacity: to create knowledge bases for each portfolio time series in-sample and subsequently to analyze out-of-sample data using those knowledge bases.

3.1 Explanation procedures

Mentys employs each knowledge base to detect and account for changes in the peak exposure in out-of-sample test data we call “factoids”. Mentys calculates the circumstantial implications of changes in implicated variables with respect to *dPeak*. Implications and cross-implications are reported as a *confirmation grid* (see Appendices B, C, and D for examples). Then, Mentys prosecutes this grid, determining whether some subset of the implicated variables is “sufficient” to account for the fluctuations. If so, Mentys reports this *implication lineup* to the user along with an estimate of the reliability of the analysis.

We applied these methods systematically to nearly 26,000 out-of-sample test records taken from 5,900 portfolios for which we had adequate data. In 64% of all portfolios considered, Mentys detected positive confirmation for *dPeak*, indicating anomalous variation. Mentys successfully established a sufficient explanation in greater than 70% of such instances.

4. Conclusions

The pilot study confirmed important expectations regarding the performance of Mentys on the data that we analyzed. As we noted above, nearly two-thirds of the portfolios that we analyzed contained instances of anomalous variation, 72% of which Mentys successfully explained.

Furthermore, our analysis has raised constructive questions regarding potential efforts to implement this approach on a production basis. We discuss these considerations below.

5. Swap portfolio example

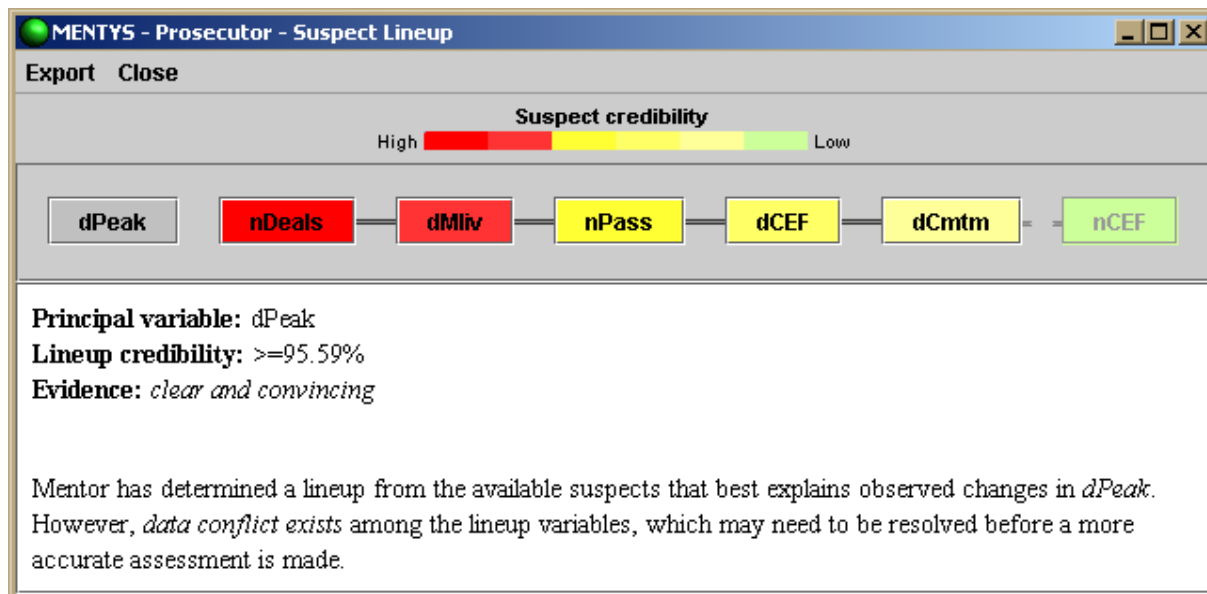
The table below shows an out-of-sample record (bold-face) in the context of the records immediately before and after it in the time series. We notice that one new deal joined the portfolio on January 23. Furthermore, other features exhibit changes possibly reflecting this.

As the accompanying screenshots help to illustrate, Mentys determined that a sufficient explanation of the rise in peak exposure must take into account the features *nDeals*, *dMliv*, *nPass*, *dCEF*, and *dCmtm*. The explanation lists the suspects in order of greatest implication. As anticipated, the number of deals is implicated most strongly.

Time series fragment

<i>Date</i>	<i>nDeals</i>	<i>nPass</i>	<i>dPeak</i>	<i>dCmtm</i>	<i>dMliv</i>	<i>dCEF</i>	<i>nCEF</i>
23-Jan-04 07:02:14	3	3	390101.00	199177.23	142252.12	341429.35	0
23-Jan-04 15:16:20	4	4	520778.00	225076.42	197655.86	422732.28	0
24-Jan-04 06:24:36	4	4	502692.00	225076.42	197655.86	422732.28	0

Sufficient explanation



6. FX portfolio example

The table below shows an out-of-sample record (bold-face) in the context of the records immediately before and after it in the time series. We notice the significant increase (20%) in the peak exposure.

As the accompanying screenshots help to illustrate, notable changes occur also in three other features: *dCmtm*, *dMliv*, and *dCEF*. Indeed, Mentys determined that these three features sufficiently explain the spike observed in *dPeak*.

Time series fragment

<i>Date</i>	<i>nDeals</i>	<i>nPass</i>	<i>dPeak</i>	<i>dCmtm</i>	<i>dMliv</i>	<i>dCEF</i>	<i>nCEF</i>
20-Jan-04 17:43:09	93	93	595454.00	-7461.00	1257085.48	1249624.48	0
21-Jan-04 18:48:59	94	94	716147.00	-16266.00	1342631.57	1326365.57	0
22-Jan-04 17:52:03	93	93	643398.00	-19197.00	1301402.79	1282205.79	0

Sufficient explanation

The screenshot shows the MENTYS interface for a suspect lineup. At the top, there's a title bar "MENTYS - Prosecutor - Suspect Lineup" and buttons for "Export" and "Close". Below that is a "Suspect credibility" scale from High (red) to Low (green). A horizontal bar below the scale shows five variables: dPeak (grey), dCmtm (red), dMliv (red), dCEF (yellow), and Date (green). The main text area contains the following information:

Principal variable: dPeak
Lineup credibility: $\geq 75.06\%$
Evidence: *clear and convincing*

Mentor has determined a lineup from the available suspects that best explains observed changes in *dPeak*.

7. Options portfolio example

The table below shows an out-of-sample record (bold-face) in the context of the records immediately before and after it in the time series. We notice the sudden drop in the peak exposure from greater than \$147M to zero, and then the following day it jumps back up above \$147M.

As the accompanying screenshots illustrate, none of the supporting features display a similar fluctuation, and Mentys determines that no explanation is present in the data available.

Time series fragment

<i>Date</i>	<i>nDeals</i>	<i>nPass</i>	<i>dPeak</i>	<i>dCmtm</i>	<i>dMliv</i>	<i>dCEF</i>	<i>nCEF</i>
22-Jan-04 03:35:32	251	175	147541136.00	-76167789.90	330178875.40	254011085.50	0.30
22-Jan-04 10:35:35	251	178	0.00	-78572228.46	330178875.43	251606646.97	0.29
23-Jan-04 04:41:27	249	183	147579248.00	-73462130.27	334612064.13	261149933.86	0.27

Sufficient explanation

The screenshot shows the MENTYS interface for a suspect lineup. At the top, there's a title bar "MENTYS - Prosecutor - Suspect Lineup" and buttons for "Export" and "Close". Below that is a "Suspect credibility" scale from High (red) to Low (green). A horizontal bar below the scale shows two variables: dPeak (grey) and Date (green). The main text area contains the following information:

Principal variable: dPeak
Lineup credibility: n/a
Evidence: *insufficient*

Mentor has determined that no subset of the known and external variables can sufficiently explain observed changes in *dPeak*.