(i) **Teaching objectives.** The main goal of this case is to teach students about TQM in financial services and the importance of operational risk in financial services relative to credit risk and market risk. It provides examples of multi-factor linear and nonlinear regressions. It also illustrates the contrasts between the Central Limit Theorem (and the normal distribution) and the Extreme Value Theorem (and the Generalized Extreme Value distribution) and exposes the differences between thin-tailed distributions and fat tail distributions. Part I (on credit cards) illustrates the importance of the Central Limit Theorem and a normal distribution (a thin-tailed distribution) of Ops Risk losses incurred with credit cards. The students here have to develop a control (Shewhart) chart of the operational losses after cleaning up seasonality and inflation trends that would otherwise skew the data. Part II of the case (on FX trading) illustrates the importance of the Extreme Value Theorem and Extreme Value distributions (examples of fat-tailed distributions) with regard to Ops Risk losses incurred in FX trading. The final discussion of the case will focus on comparing occurrences of thin-tailed distributions (e.g., normal distribution) and occurrences of fat-tailed distributions (e.g., lognormal distribution) and their applications in practice.

Students must read the case prior to class discussion; they may want to watch the first two videos (see links at the bottom of page 3). The instructor may want to assign one or two exercises before the case discussion in class (e.g., Exercises 1 and 7) and assign other exercises later.

(ii) **Lessons from past teaching experience.** Traditional Total Quality Management cases tend to focus more on manufacturing applications (e.g., Toyota) than on services applications. Lately, we have seen in the OM community more TQM cases focused on services (e.g., Ritz-Carlton). However, the financial services industries still has not received much attention from the academic community as far as case writing is concerned. At the Stern School of Business at NYU, with 90% of its graduates going to the services industries and 40% going to the financial services industries, this case has become indispensable. These students are not that interested in how a manufacturing company does its quality control.

From a technical point of view this case also plays a very important role in a business curriculum. Business school students usually become very familiar in their Statistics prerequisites with the Central Limit Theorem (CLT) and the Normal distribution. However, in the finance world this limit theorem is not as important
as the Extreme Value Theorem (EVT) and extreme value distributions (e.g., Pareto), which are fat tail distributions. In the past, students often graduated and went to the finance world without any knowledge regarding Extreme Values and fat tails. This case has opened their eyes with regard to Operational Risk and with regard to the importance of extreme values.

(iii) Evidence of success in the classroom such as course enrollment, extent of usage, and anecdotal student feedback. This case has been used for five years in the Masters of Science in Risk Management program at the Stern Business School at NYU. It was used in the Operational Risk module of this program. Every year this program has a class of approximately 40 students and consistently this case has been a great success. These students typically tend to be finance oriented and before they enter the program they have a reasonable knowledge and expectations with regard to credit risk and market risk. However, typically, the students have not that much knowledge with regard to operational risk. This case drives home the importance of operational risk. It has also been used for over three years now in the Total Quality Management module of the Operations Management core course in Stern’s undergraduate business program as well as in its MBA programs (with hundreds of students). Many students in the classes taught at the Stern School of Business were of the opinion that this case was the most important part of the OM core course.

In addition, this case has been used in the Operations Management course at Gies College of Business, UIUC. At UIUC, students with operations major normally go to the manufacturing, service, or consulting firms after graduation, and they do not have too much exposure to the financial industry at school. Most students who took this course at UIUC have already taken statistics and data analytics courses before, therefore this case serves as a good application of their statistical knowledge together with what they have learnt in the TQM part of the OM course. This case indeed draws their attention and interests towards the financial industry, and some of the students after taking this course start to look into jobs in the financial industry.

Finally, this case has also been used in the Introduction to Business Analytics class of Brad Greenwood at Carlson School of Management, Minnesota.