

Research impact: making a difference

Helping Barclays meet the new Basel III regulation

Statistics Professor Qiwei Yao helped Barclays Bank devise methods required by international regulators to test its resilience against future

What was the problem?

In the wake of the global financial crisis in 2008/9, entire national economies and the material wellbeing of ordinary people were put at risk by the actions of a small number of large banking institutions mainly located in the US, Switzerland, the UK and some European countries.

Critical in addressing the underlying problems behind this financial crisis was the international financial regulator known as the Basel Committee on Banking Supervision, with a mandate to set standards for the regulation of banks and encourage cooperation around supervision of the banking industry. The Basel Committee is based at the Bank of International Settlements and its members come from the governments of 27 advanced and emerging economies.

To address the underlying problems and return stability to the financial system, the Basel Committee instituted new rules with special attention to the following key variables:

- capital adequacy ratio – a bank’s ability to meet its time-sensitive liabilities and handle other risks by deploying its core capital;
- market liquidity – a bank’s ability to sell assets quickly and without significant financial loss to cover unanticipated demands; and
- stress testing – the bank’s ability to leverage capital to withstand an economic shock.

One of the financial risks of concern to the Basel Committee was counterparty credit risk – the risk of suffering a loss because another party to a contract fails to meet its side of the deal. The Committee insisted that all banks carry out counterparty credit risk model backtesting to check that the risk measures produced by their models compared well against tests using real market prices. However, it left each bank to define its own backtesting methodology. A small event can cause a major financial shock that spills over into the wider economy.

The recent financial crisis began with problems in an obscure part of the US housing market in 2007 but within three years had led to bank failures across the world, a global recession, a surge in unemployment and the near-collapse of the eurozone.

A team of researchers at the LSE has identified how major financial shocks are often caused by small problems within the system itself rather than an outside trigger. This idea that the cause of a crisis can grow almost unnoticed is what the researchers termed “endogenous risk”, which comes from the ancient Greek words for “growing” and “within”.

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An example is the way that complex networks can accelerate and amplify the reverberation of shocks through the financial system, as in the case of high frequency trading in which price changes are transmitted to hundreds of markets within milliseconds.

Policymakers have been working hard at a national, regional and global level to prevent future crises. However the researchers found that regulations drawn up for this specific purpose can, perversely, become a channel for amplifying the problems and have precisely the opposite of the intended effect.

What did we do?

Prior to the crash LSE Professor of Statistics Qiwei Yao was working with researchers from other universities to develop technical forecasting tools and methods to assess the accuracy of the forecasts these tools produced.

His collaborators were two LSE visiting professors, Jianqing Fan, Frederick L. Moore Professor of Finance in the Department of Operations Research and Financial Engineering at Princeton University, and Peter Hall from the Department of Mathematics and Statistics at the University of Melbourne.

One of the technical forecasting tools they analysed was bootstrap calibration, or bootstrapping, which essentially involves combining a random sample of known statistics. With the help of a computer, thousands of bootstrap samples can be constructed in a relatively short time, enabling forecasters to derive a level of accuracy that would not otherwise be possible. They demonstrated that by using bootstrap calibration banks can conduct a substantially larger number of tests and achieve greater accuracy compared with other methods.

More recently Yao and others produced a new measure and statistical test to help select representative portfolios of assets for backtesting counterparty credit risks.

What happened?

Based on these research outputs, Barclays Bank PLC invited Yao to take part in its counterparty credit risk backtesting project, which was initiated in January 2012.

Yao proposed several key statistical methods that were used in the development of Barclays' backtesting methodology. These included an estimation method that looked at the extreme values of conditional distributions of risk against non-conditional distributions. This method could also be easily extended to test the sensitivity to

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risk factors, which was significant given that testing various features of the risk distribution was an important new requirement of Basel III.

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Barclays found that the new methodology substantially improved its counterparty credit risk assessment and management and put its practice in line with the Basel III regulatory capital framework introduced in 2010 and amended in 2013. The resulting improved information about the bank's exposure to risk was expected to minimise potential future losses.

Yao's research also contributed some key steps to the methodology for selecting representative asset portfolios. Basel III allowed banks to construct representative portfolios for each counterparty consisting of, for example, a subset of the trades between two banks. Banks were left to decide the number and trades to be included in the portfolio, but they had to justify their choices to their supervisors.

Barclays used Yao's research to construct a candidate set of datapoints and to adopt a new measure and a test to check how well the distribution of a selected portfolio matched the target risk distribution at all levels simultaneously, as required by Basel III.

Thus, by contributing to methodology for counterparty credit risk backtesting and to methodology for selecting representative asset portfolios, Yao was able to help Barclays better meet the new Basel III regulatory requirements in two critical ways.

Yao received an initial invitation from Barclays to participate in this project for three months (January - March 2012). The invitation was subsequently extended to December 2013.

Professor Qiwei Yao is the senior member of the Time Series group in the Department of Statistics at the London School of Economics and Political Science. His primary research interests are time series analysis, factor modelling and dimension reduction, nonparametric regression, spatial and temporal modelling and financial econometrics. He has led a number of major research projects and is a fellow of the Institute of Mathematical Statisticians and American Statistical Association.

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