INTERNATIONAL JOURNAL OF FORECASTING/SPECIAL ISSUE

EDITORIAL

Predicting Rare Events: Evaluating Systemic and idiosyncratic Risk[1]

The 2008 financial crisis has showed that idiosyncratic and rare events, which initially are perceived as isolated (e.g. Lehman bankruptcy in September 2008), can quickly turn into systemic events that will threaten the stability and functioning of entire economies. Given the enormous consequences of a global financial crisis, it is very important to develop new techniques and approaches to monitor, predict, and eventually prevent financial crises. Rare events, by their very nature, occur very infrequently but when they do their consequences are catastrophic. Natural disasters, e.g. earthquakes, flooding, are rare events that for most part happen in isolation and they are considered "acts of God". On the contrary, when we consider an economic system, these low probability and high magnitude catastrophic events, do not happen spontaneously or in isolation and they are "acts of man". It is precisely because of their lack of spontaneity and human causation that there is hope for forecasting economic rare events.

In the aftermath of the 2008 meltdown, there was an additional crisis of confidence in economic forecasters and their methods. The academic community responded with unusual zest exploring new research ideas, revisiting old methods, and opening to approaches from other disciplines. The 9th Workshop of the International Institute of Forecasters (IIF), sponsored by the Federal Reserve Bank of San Francisco (FRBSF) and organized by Gloria González-Rivera (UC-Riverside and IIF), José López (FRBSF), and Òscar Jordà (UC-Davis and FRBSF), brought together academicians and regulators to discuss the predictability of rare but systemic events as well as the monitoring and propagation of idiosyncratic risks so that a financial crisis may be averted. At the workshop, twelve papers were presented and discussed by the participants (for a summary, see González-Rivera *et al.* 2012), nine of which appeared in this special issue.

As connectedness becomes the key concept to explore, this collection of papers takes a multivariate approach to the modeling of systemic risk. Broadly speaking, the general aim is finding early signals that can detect when a financial crisis is imminent. The public data sets analyzed in these papers are informative and the techniques to tease out such information are diverse and have a multidisciplinary bent. Some papers are rooted in pure econometric methods like multivariate quantile estimation and multivariate volatility models, others borrow statistical techniques like signal extraction and classification methods, and others borrow insights from physics like network theory. The good news is that the 'rare event' is predictable; at the very least it can be measured probabilistically. The econometric and statistical methodologies are sufficiently sophisticated to measure the sources of fragility in the economic system and to detect in advance when the system is at risk. The following papers are classified roughly into three topics: stress testing, early warning signals, and financial networks.

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[1] This special issue contains papers that were presented at the 9th Workshop on Predicting Rare Events jointly organized by the International Institute of Forecasters and the Federal Reserve Bank of San Francisco (FRBSF). The workshop took place in San Francisco in the headquarters of the Federal Reserve Bank on the 28th and 29th of September 2012. We are very grateful for the staff support and sponsorship provided by FRBSF.

Within the stress testing group, we present two papers. The first "Stress-Testing US Bank Holding Companies: A Dynamic Panel Quantile Regression Approach" by Covas, Rump, and Zakrajšek shows how to construct density forecasts of losses associated with different loan portfolios and trading activities, which are generated from quantile autoregressions. Based on these forecasts and under the stress scenarios contemplated in CCAR 2012, the authors simulate capital shortfalls for several U.S. bank holding companies. Those shortfalls are significantly higher than those based on a linear model. Commenting on this paper, Matthew Pristker (Federal Reserve Bank of Boston) underscores the authors' contribution by pointing out that empirically the conditional distribution of losses in stress-scenarios is most relevant and that the autocorrelation of bank losses must vary by quantile in order to capture the heavy left tail of the distribution of P/L during the 2008-09 financial crisis.

The second paper "Stress Testing Banks" by Schuerman argues that the objective of stress testing is converting uncertainty into a risk assessment by mapping a view of the world (macro-scenarios) into micro-outcomes (e.g. higher losses, lower revenues). Upon the definition of stressful macro scenarios, stress testing is purely an exercise in forecasting, that is, dynamic projections of revenues, income/losses, and their effects on the evolution of the institution's balance sheet taking into consideration the regulatory capital and liquidity ratios. The author argues that for stress testing to be successful, there must be first credible bank information, and secondly, upon revelation of the bank's capital needs, credible ability of sovereigns to fill such needs.

The next three papers deal with the construction of early warning signals and all three underscore the role of credit conditions. In "Assessing the Historical Role of Credit: Business Cycles, Financial Crises, and the Legacy of Charles S. Peirce", Jordà discusses a few modern statistical methods (statistical learning, signal processing, and classification methods) to evaluate predictors of rare events, which involves mainly predictions of binary events. In this context, the success of the forecast is measured by the economic consequences of the actions taken as a result of the forecast rather than by the standard metrics of prediction accuracy. On reviewing 140 years of economic history for 14 developed economies, the author argues that, though the accumulation of private credit may not explain recessions, it can explain when a recession will turn into a financial crisis.

Schwaab, Koopman, and Lucas in "Nowcasting and Forecasting Global Financial Sector Stress and Credit Market Dislocation" propose coincident and forward looking indicators of global systemic financial risk as well as an indicator of credit market dislocation, which is defined as a persistent decoupling from macro-financial fundamentals. The authors find that in the past such a decoupling has preceded episodes of financial distress and, because of that, such a measure may serve as an early warning signal for policy makers.

In "Evaluating Early Warning Indicators of Banking Crises: Satisfying Policy Requirements", Drehmann and Juselius argue that an ideal warning indicator of banking crises should be precise, have correct timing, and issue stable signals given an objective function. They evaluate different indicators and find that the credit-to-GDP gap is the best indicator at long horizons and that the debt service ratio is the best at shorter horizons.

The next two papers use a network theory approach to model systemic financial risk. In "Forecasting Systemic Impact in Financial Networks", Hautsch, Schaumburg and Schienle, using only publicly available daily market data (including the 2008/09 financial crisis), determine on a quarterly frequency, the time-varying systemic risk networks and predict the systemic relevance of a given financial institution as the marginal impact of individual downside risks on systemic distress. This network

approach permits dynamically monitoring of a specific firm's role as either a risk transmitter or a risk recipient. The discussant, Galina Hale (Federal Reserve Bank of San Francisco), praises this contribution for providing a measure of a bank's systemic importance that is practical and can be computed in real time. However such a measure produces risk rankings that are highly volatile and further efforts should be made to work on a smoother version.

The next paper by Fushing, Jordà, Beisner, and McCowan has an intriguing title "Computing Systemic Risk using Multiple Behavioral and Keystone Networks: The Emergence of a Crisis in Primate Societies and Banks". Based on social network theory, the authors analyze commonalities between a network of monkeys in captivity and the architecture of a financial system. Though their comparison is somehow unconventional, the foundations underlying "instability" in both systems is quite similar. They consider the banking system as a dynamic and multilayered network in which crisis may be endogenously generated. A system includes a primary or keystone network that summarizes the overall relationship status (hierarchy) across nodes, and a set of subsidiary networks, which are related to the keystone network. A crisis refers to the social collapse of the hierarchy of the group, and it is characterized by a decoupling of the subsidiary networks from the keystone network. The authors use nonparametric methods to study the interconnectedness of the networks and the process of decoupling. Their analysis provides early warning signals before the arrival of the tipping point that brings total collapse.

Finally, a couple of observations related to investing behavior: first, as the world economies become more connected, it seems that the gains of diversification are disappearing; and secondly, during recessions commodity prices seem to be more predictable. In "Correlation Dynamics and International Diversification Benefits", the authors, Christoffersen, Errunza, Jacobs, and Jin, present dynamic patterns and trends in correlations for international equity returns during 1973-2012. They show that correlation across markets has increased mainly in developed markets and, to a lesser extent, in emerging markets. Consequently, the gains of diversification have been drastically reduced in developed markets, though there are still significant benefits in emerging markets especially in severe market downturns. Gargano and Timmermann in "Forecasting Commodity Price Indexes Using Macroeconomic and Financial Predictors" explore the out-of-sample predictability of commodity spot prices over the period 1947-2010 at monthly, quarterly, and annual horizons. The strongest predictability is found at the quarterly horizon for metals and raw industrial indexes and the weakest in fats-oils, foods, and livestock. The predictability of commodity prices is highly state dependent, so that there is more predictive power during recessions than during expansions. The discussant, Jan Groen (Federal Reserve Bank of New York), considers that predictability during recessions is an important contribution and it would be particularly useful when formulating an inflation outlook.

I would like to thank the presenters, discussants, and participants in the workshop for making a lively meeting with so many innovative contributions. My thanks to the many referees who have helped me to evaluate this collection of papers; their insightful and constructive remarks have contributed to an even better special issue.

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Reference

González-Rivera, G., O. Jordá, and J. López (2012), "Ninth IIF Workshop on Predicting Rare Events: Evaluating Systemic and Idiosyncratic Risk", *The Oracle*, 14(2), Institute of International Forecasters. http://forecaters.org/publications/oracle/