AMSI News

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Mathematical sciences and economic stability

Over the past month, world news has been dominated by the US-led economic downturn. We are reassured that Australian banks are not at such risk as those in US and UK, partly because we have a more stringent system of financial regulation and oversight. We at AMSI have some familiarity with this system because we have just completed a major review of the mathematical arrangements in PAIRS (Probability and Impact Rating System), commissioned by the Australian Prudential Regulation Authority. The project team consisted of William Dunsmuir and Scott Sisson (Statistics, University of New South Wales), Harald Scheule (Finance, University of Melbourne), and Dimetre Triadis, Tom Montague and myself (AMSI). Expressing a desire for transparency of their process, and inviting international feedback, APRA will be making the reports public.

Within the PAIRS process, experts of a specified financial sector (e.g. authorised deposit-taking institutions, general insurers, superannuation funds) assign numerical quality assessments on 18 factors such as counter party default risk, access to capital and expertise of senior management. These scores are combined within a quartic function to produce an index for overall risk of failure. Separately, an impact index is calculated, based on the total assets of the entity and a multiplier for extra community costs of failure. These two indices link to the SOARS (Supervisory Oversight and Response System) to determine the supervisory stance and regulations imposed.

Also, we looked over a proposed Benefit Model that estimates the financial benefits of increased regulatory intervention. We are satisfied that the APRA systems are serving us well. However, as mathematicians, we tried to identify weaknesses in its fabric. Contributing to the continuous improvement process, we identified some assumptions that needed more justification and we made a number of recommendations that should improve the mathematical consistency of the rating procedure without compromising its integrity.

The mathematical sciences contribute in many ways, both directly and indirectly, to economic stability. Actuarial calculations give insurers the confidence to protect companies and individuals against the financial consequences of accidents and calamities. Over the past twenty years, mathematicians have become much more involved in the rational pricing of financial derivatives. It could be argued that without the knowledge of pricing formulae, financial markets would have been even less stable. As we learned from last year's short course on electricity supply

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and pricing, against a background of fluctuating supply, energy retailers could not guarantee a future supply of energy at a modest price, were it not possible to hedge against suppliers' price volatility. We are already capable of making quantitative assessments of borrowers' and investors' financial capacities so that the widespread collapse of US-based mortgage schemes and merchant banks need not have occurred. Of course, government budgets cannot be composed without some predictions of macroeconomic variables over the forthcoming year. These predictions are informed by a multidimensional dynamical model. The way that this is done in Australia is reviewed by Hawkins [1].

A review of Nobel prizes in Economics shows that many of the awards are for advances in mathematical modelling. Most mathematicians are aware of the mathematical contributions of prize winners Scholes, Merton, Nash, Arrow and Samuelson. If only we could better model the human factors of greed, stupidity and lust for power or the short-sightedness of self-serving governments!

Economic development cannot be merely a movement of numbers from one account to another, or movement of chips from one square to another on a roulette wheel. Ultimately, national wealth requires value to be added to our resources, products and expertise. Economic stability requires us to have some control in adding value, not relying on externally determined prices of minerals. In this area, mathematical scientists could play an even greater role. We can maintain a competitive position in processing of raw materials and even maintain capability in strategic areas of manufacturing if we take care in creative design, efficient processing with high quality control and near-optimal scheduling, and delivery. All of these attributes require a high general level of mathematics and statistics. Several postgraduate students have now been placed in the AMSI industry internship scheme. We expect to be able to demonstrate the value of employing graduates who are well qualified in mathematics and statistics; demand for these skills is high but not as high as it should be.

References

[1] Hawkins J. (2005). Economic forecasting: history and procedures. *Economic Roundup*, Australian Government Treasury, Autumn 2005.

Director of AMSI since 2005, Phil Broadbridge was previously a professor of applied mathematics for 14 years, including a total of eight years as department chair at University of Wollongong and at University of Delaware.

His PhD was in mathematical physics (University of Adelaide). He has an unusually broad range of research interests, including mathematical physics, applied nonlinear partial differential equations, hydrology, heat and mass transport and population genetics. He has published two books and 100 refereed papers, including one with over 150 ISI citations. He is a member of the editorial boards of four journals and one book series.