

## Research School of Finance, Actuarial Studies and Statistics 2022 Summer Research Camp

### Wednesday, 30<sup>th</sup> November

6.00 pm      **Pre-Dinner Drinks (Monster Kitchen & Bar)**  
6.30 pm      **Dinner (Monster Kitchen & Bar)**

### Thursday, 1<sup>st</sup> December

9.00 am      **Coffee/tea**  
9.20 am      **Welcome to country message** (*Canberra Room*)  
Tyronne Bell

9.30 am      **Keynote Session** (*Canberra Room*)  
[Randall Morck](#) (University of Alberta)  
“How Investor Irrationality Enriches the World?”

Introductions by Bruce Grundy (ANU)

10.30 am      **Morning tea**

11.00 am      **Parallel Session 1**

#### **Finance**

*Canberra Room – Black Mountain*  
Chair: Antje Berndt (ANU)

[Joan Farre-Mensa](#) (University of Illinois, Chicago)  
“Do Startup Patent Acquisitions Affect Inventor Productivity?”  
Discussant: Kun Li (ANU)

#### **Statistics**

*Centenary 2 Room*  
Chair: Andrew Wood (ANU)

[Karthik Bharath](#) (University of Nottingham)  
“Geometry and Modelling of Tree-Structured Covariances”

[Andriy Olenko](#) (La Trobe University)  
“Statistical inference for seasonal long-memory semi-parametric models”

#### **Actuarial Studies**

*Canberra Room – Mt Ainslie*  
Chair: Jananie William (ANU)

[Myles Cover](#) (KPMG)  
“Aged Care consumer contribution - Health Care or Welfare?”

[Lachlan O’Hare](#) (EY)  
“How is reform building the health of private health insurance?”

[Marina Gertsberg](#) (The University of Melbourne)  
“The Unintended Consequences of #MeToo: Evidence from Research Collaborations”  
Discussant: Phong Ngo (ANU)

[Jane Miao](#) (Australian Government Actuary)  
“Military Compensation Schemes: Recent Experience and Modelling Challenges”

12.30 pm **Lunch + Keynote Session** (*Canberra Room*)  
[Steven Marron](#) (University of North Carolina)  
“Object Oriented Data Analysis”  
Introductions by Andrew Wood

2.00 pm **Parallel Session 2**

**Finance (PhD Session)**  
*Canberra Room – Black Mountain*  
Chair: Xianming Zhou (ANU)

[Yue Wang](#) (ANU)  
“More Debt More Leverage? ”  
Discussant: Ben Charoenwong (National University of Singapore)

[Yaodong Zhang](#) (ANU)  
“Overnight and Intraday Return Difference in the ETF Market”  
Discussant: Phil Drummond (Monash University)

[Xiang Dai](#) (ANU)  
“Political Sentiment and CSR Performance: Evidence from Earnings Call”  
Discussant: Isaac Pan (The University of Sydney)

**Statistics**  
*Centenary 2 Room*  
Chair: Yanrong Yang (ANU)

[Jiti Gao](#) (Monash University)  
“A Unified Approach to Estimating Stochastic Trends”

**Actuarial Studies**  
*Canberra Room – Mt Ainslie*  
Chair: Tim Higgins (ANU)

[Hugh Miller](#) (Taylor Fry)  
“Micro-management: Some unsolved problems in microsimulation models”

3.00 pm **Wine tour / hotel rest**  
6.00 pm **Dinner (QT Hotel)**

**Friday, 2<sup>nd</sup> December**

9.00 am **Coffee/tea**

9.30 am **Parallel Session 3**

**Finance**

*Canberra Room*

Chair: Le Zhang (ANU)

[Kelly Liu](#) (ANU)

“Information dissemination and behavioural bias in financial media”

Discussant: Joan Farre-Mensa (University of Illinois, Chicago)

[Terry Zhang](#) (ANU)

“Investor composition and liquidity: An analysis of Japanese stocks”

Discussant: Elvira Sojli (UNSW)

11.00 am **Morning tea**

11.30 am **Parallel Session 4**

**Finance**

*Canberra Room*

Chair: Chao Gao (ANU)

[Alminas Zaldokas](#) (HKUST)

“ESG Shocks in Global Supply Chains”

Discussant: Qiaoqiao Zhu (ANU)

[Elvira Sojli](#) (UNSW)

“Green Innovations and Cluster CEOs.”

Discussant: Le Zhang (ANU)

**Statistics**

*Centenary 2 Room*

Chair: Janice Scealy (ANU)

[Leah South](#) (Queensland University of Technology)

“Unbiased and Consistent Nested Sampling via Sequential Monte Carlo”

[Aurore Delaigle](#) (University of Melbourne)

“Estimating a prevalence in group testing problems with missing values”

**Statistics**

*Centenary 2 Room*

Chair: Yanrong Yang (ANU)

[Zhenhua Lin](#) (National University of Singapore)

“Causal Inference on Distribution Functions”

[Zhao Ren](#) (University of Pittsburgh)

“Heteroskedastic Sparse PCA in High Dimensions”

1.00 pm **Lunch + school-wide thanks**

2.30 pm **Parallel Session 5**

**Finance**

*Canberra Room*

Chair: Takeshi Yamada (ANU)

[Ben Charoenwong](#) (National University of Singapore)

“RegTech”

Discussant: Nhan Le

[Kentaro Asai](#) (ANU)

“Debt-Equity Conflicts and Efficiency of Distressed Firms: Evidence from Banker-Directors in Japan”

Discussant: Alminas Zaldokas (HKUST)

**Statistics**

*Centenary 2 Room*

Chair: Janice Scealy (ANU)

[Boris Beranger](#) (University of New South Wales)

“Logistic Regression Models for Aggregated Data”

[Bin Peng](#) (Monash University)

“Higher-order Expansions and Inference for Panel Data Models”

4.00 pm **End**

## PRESENTATION TITLES AND ABSTRACTS (in order of appearance)

### FINANCE

**Speaker:** Professor Randal Morck

**Title:** How Investor Irrationality Enriches the World?

**Abstract:** The 2008 Global Financial Crisis and China's state-led technological rise have eroded confidence in liberal democracies and rekindled support for dirigisme. The loss of confidence is unwarranted, as is dirigisme. Rather, intermittent crises may be the secret weapon of the Western World by using financial market failures to counter market failures in technological progress to generate prosperity. Kindleberger cycles, irregularly recurring stock market manias, panics, and crashes throughout financial history debunk efficient markets in favor of behavioral finance. From a social perspective, NPV-maximizing firms chronically underinvest in innovation, which has social returns manifold above its IRR. Both market failures are serious and excuse calls for dirigiste countermeasures. However, work in financial history, behavioral finance, and the economics of innovation combine to suggest intermittent manias inundating exciting new technologies with capital counter chronic underinvestment in innovation. Economy-level selection may favor institutions and behavioral norms conducive to manias despite individual agents' losses in panics and crashes. Rather than burdening financial markets and innovators with interventions to correct these market failures, business and public policy decision-makers in liberal democracies might instead accept Kindleberger cycles as an engine of long-term economic growth unavailable to statist autocracies and contemplate reforms to improve their social cost-benefit ratios. Prominent possibilities would constrain state intervention rather than markets.

**Speaker:** Associate Professor Joan Farre-Mensa (joint work with Zack Liu and Jordan Nickerson)

**Title:** Do Startup Patent Acquisitions Affect Inventor Productivity?

**Abstract:** We show that the acquisition of a startup inventor's first patent has a negative effect on the subsequent productivity of the patent's inventor, leading to 6.7 fewer patents being granted to the inventor over five years. This effect is not due to the inventor focusing on high-quality patents—in fact, the opposite appears to be the case. Our novel identification strategy is motivated by two new findings: Incumbent firms are more likely to acquire the patents of startups that patent examiners ask them to cite, and examiners are more likely to cite patents that they have reviewed in the past. When combined with the quasi-random assignment of patent applications to examiners, these two findings give rise to quasi-random linkages between startups and potential acquirers that help identify the causal effect of patent acquisitions on inventor productivity.

**Speaker:** Dr Marina Gertsberg

**Title:** The Unintended Consequences of #MeToo: Evidence from Research Collaborations

**Abstract:** How did #MeToo alter the cost of collaboration between women and men? I study research collaborations involving junior female academic economists and show they start fewer new research projects after #MeToo. The decline is driven largely by fewer collaborations with new male co-authors at the same institution. I show that the drop in collaborations is concentrated in universities where the perceived risk of sexual harassment accusations for men is high – that is, when both sexual harassment policies are more ambiguous exposing men to a larger variety of claims and the number of public sexual harassment incidents is high. The results suggest that the social movement is associated with increased cost of collaboration that disadvantaged the career opportunities of women.

**Speaker:** Yue Wang (joint work with Antje Berndt and Bruce Grundy)

**Title:** More Debt More Leverage?

**Abstract:** If the primary purpose of raising debt levels was to finance growth opportunities, then higher debt levels would signal greater post-payout returns on assets but contain no information about firm risk. Using annual data in real terms for more than 5,500 public US non-financial firms from 1971 to 2021, we reject this hypothesis by showing that the return channel accounts for only 30% of the variation in debt levels, with the risk channel accounting for much of the remainder. The link between greater debt growth and higher firm risk is particularly pronounced during accommodative monetary policy regimes.

**Speaker:** Xiang Dai

**Title:** Political Sentiment and CSR Performance: Evidence from Earnings Call

**Abstract:** This paper documents that firm-level political sentiment influences corporate social responsibility (CSR) performance. Using sentiment expressed in political discussions during earnings call, we find that firms with positive political sentiment have better CSR performance. We find that one standard deviation change in political sentiment leads to a 4.3% increase in CSR performance, which is quite significant given the stickiness of CSR. This performance is complemented by more CSR-related investments and R&D investment. It means political optimism will lead firms to be more willing to invest in longer-term investments, which tend to be investments that are more opaque and returns will not become apparent until the long run. We also find this effect is stronger for firms with more media exposure and weaker for firms with more institutional monitoring. This effect is robust to a range of endogenous test and CSR score produced by different rating agency.

**Speaker:** Yaodong Zhang

**Title:** Overnight and Intraday Return Difference in the ETF Market

**Abstract:** By decomposing close-to-close return into the overnight return and intraday return, we find the overnight return in the ETF market is significantly positive while the intraday return is not significantly different from zero. The different overnight and intraday return patterns are driven by the “tug of war” between retail investors and arbitrageurs. Specifically, the overnight and intraday return difference is positively correlated with the retail investors’ demand and intraday arbitrageurs’ trading. When investigating whether the “tug of war” between retail investors and arbitrageurs has any impact on future returns, we observe that the “tug of war” will not affect the ETFs’ future returns implying that the “tug of war” is a pure cost of investors who buy ETFs near market open and who sell ETFs near market close. On average, the cost exceeds half of the bid-ask spread.

**Speaker:** Dr Xin Liu (joint work with Shuang Chen and Kun Li)

**Title:** Information dissemination and behavioural bias in financial media

**Abstract:** This paper examines how behavioural bias affects the information dissemination role of financial media. By utilizing information from Gallup survey and immigration records, we construct a measure of journalist surname favourability. We find that journalists with more favourable surnames have stronger impacts on the stock price. This effect is more pronounced for firms with smaller firm size, lower institutional ownership, and lower analyst coverage. We further use the U.S.-China trade war as an exogenous shock to the measure of journalist favourability and show that news articles released by journalists with Chinese-origin surnames elicit weaker market reactions during the trade war period. Finally, we find that the stock price show return reversal patterns after controlling for well-known risk factors.

**Speaker:** Dr Terry Zhang (joint work with Hao Jiang, Sheridan Titman, and Takeshi Yamada)

**Title:** Investor composition and liquidity: An analysis of Japanese stocks

**Abstract:** In the late 1990s, several reforms initiated by the Japanese government made the Japanese equity market more attractive for foreign institutions. The resulting increase in foreign institutional holdings provides an opportunity to study how changes in the composition of investors affect market liquidity. Our analysis of a panel of firm-level ownership data indicates that Japanese stocks that are held more by foreign institutions tend to trade more actively but are less liquid as measured by their quoted and effective bid-ask spreads, Amihud illiquidity, and return reversals. To address endogeneity concerns, we use the MSCI index membership and the aggregate foreign investor flows on the Tokyo Stock Exchange as instruments for changes in foreign institutional holdings. We find a causal relationship between increases in foreign institutional holdings and declines in stock liquidity.

**Speaker:** Associate Professor Alminas Zaldokas (joint work with Guoman She and Emilio Bisetti)

**Title:** ESG Shocks in Global Supply Chains

**Abstract:** We show that U.S. importers cut trade relationships when their international suppliers face environmental and social (ES) scandals. The imports from these suppliers reduce by 9.9% and the trade relationship is 3.8% more likely to be terminated following the scandals. These effects are larger when the U.S. importer is publicly-listed and faces high investor-related ES pressure, suggesting that investors' ES preferences can shape global supply chains. On the other hand, the effects are similar across retail-facing industries and intermediate goods producers, suggesting that our results are unlikely to be driven by the increased salience of end customers. We also find evidence of international spillovers: importers switch to suppliers in other countries when an international supplier faces an ES scandal. Our results provide novel evidence that ES shocks can have real transmission effects along the supply chain network and highlight the role of shareholder pressure.

**Speaker:** Associate Professor Elvira Sojli (joint work with Wing Wah Tham and Leo Liu)

**Title:** Green Innovations and Cluster CEOs

**Abstract:** Green technologies are necessary in the pursuit of green growth and the fight for climate change containment. Yet little is known about firms' environmental innovation strategies. "Cluster" CEOs, with more working experience in cities among highly productive scientists, better exploit potential productivity and agglomeration benefits by locating green research labs in regions with more productive inventors. Using firm-CEO fixed effects to address concerns about endogenous CEO turnover events, we identify the impact of Cluster CEOs' time-varying experience in agglomeration economies on the success of locating green research labs, which results in better innovation outcomes. Exploiting exogenous shocks to the mobility of highly productive green inventors surrounding a focal firm's research labs with firm  $\times$  CEO fixed effects, we find that the concentration of cutting edge green inventors plays a substantial role for the green innovation quality of the focal firm. The focal firm benefits from knowledge spillovers and the advantage of scale economies, which facilitates better inventor-firm matching. Our findings suggest corporate insiders are a key driver of strategic location choice of research laboratory and are critical for the success of the firm's green innovation investments.

**Speaker:** Assistant Professor Ben Charoenwong (joint work with Zachary T. Kowaleski, Alan Kwan, and Andrew G. Sutherland)

**Title:** RegTech

**Abstract:** Compliance-driven investments in technology—or “RegTech”—have grown rapidly in recent years. To understand these investments, we study how financial institutions respond to new internal control requirements. First, we show that affected firms make significant investments in enterprise resource planning, data management, and hardware. These investments then allow for complementary expenditures on customer relationship management tools that rely upon information quality. As a result, customer complaints and employee misconduct decline at affected firms. Additionally, market concentration increases. Our results illustrate how regulation can directly and indirectly affect technology adoption, which in turn affects noncompliance functions and market structure.

**Speaker:** Dr Kentaro Asai (joint work with Dong Beom Choi)

**Title:** Debt-Equity Conflicts and Efficiency of Distressed Firms: Evidence from Banker-Directors in Japan

**Abstract:** In Japan, bankers affiliated with a firm's lenders can become directors of the borrower to monitor managerial decisions that may harm the creditors. Exploiting this unique institution, we examine the effect of debt-equity conflicts on firms' investment efficiency and find the following results. First, firms with banker-directors make more debt-friendly decisions, but only when they are financially distressed. Second, banker-directors reduce both underinvestment and overinvestment of distressed firms. Third, the weaker friction also influences lenders' willingness to lend, which further helps resolve the underinvestment problem. Finally, banker-directors of distressed firms may affect their suppliers and customers negatively by paying less to the former and squeezing more cash from the latter. These results suggest that despite the within-firm value creation, the overall welfare implication of the mitigated debt-equity conflict can become ambiguous due to negative spillovers on other stakeholders.

## STATISTICS

**Speaker:** Professor Karthik Bharath

**Title:** Geometry and Modelling of Tree-Structured Covariances

**Abstract:** Generative models for multivariate data with hierarchically related components are typically based on branching or coalescent processes. The hierarchical structure in the data distribution then manifests through a tree-structured covariance matrix. Such matrices constitute a small non-smooth subset of covariance matrices and can be equipped with a stratified geometry that is intimately related to that of the well-known phylogenetic tree space. I will explicate on the geometry and how it influences sampling of and inference for tree-structured covariances, with an application to uncovering the latent hierarchy amongst responses to distinct cancer treatments.

**Speaker:** Professor Andriy Olenko (joint work with A. Ayache and M. Fradon).

**Title:** Statistical inference for seasonal long-memory semi-parametric models

**Abstract:** We consider seasonal long-memory processes with Gegenbauer-type spectral densities. Simultaneous estimates for a singularity location and long-memory parameters based on general filter transforms are proposed. As a particular case, these transformations include wavelet transformations. It is proved that the estimates are almost surely convergent to the true values of parameters. Solutions to the estimation equations are studied and adjusted statistics are proposed. This talk also discusses the central limit theorem for these simultaneous estimators. Asymptotic normality of several functionals of the cyclic long-memory processes is proved. For the case when the values of the functionals are outside the feasible region, we propose new adjusted estimators and investigate their properties. It is shown that they have the same asymptotic distributions as the original ones, but are computationally simpler. Numerical results are presented to confirm the theoretical findings.

**Speaker:** Professor Steve Marron

**Title:** Object Oriented Data Analysis

**Abstract:** The rapid change in computational capabilities has made Big Data a major modern statistical challenge. Less well understood is the rise of Complex Data as a perhaps greater challenge. Object Oriented Data Analysis (OODA) is a framework for addressing this, in particular providing a general approach to the definition, representation, visualization and analysis of Complex Data. The notion of OODA generally guides data analysis, through providing a useful terminology for interdisciplinary discussion of the many choices typically needed in modern complex data analyses. The main ideas are illustrated via several real data examples. Methods for analyzing sets of data objects that combine diverse data types, through understanding both joint and individual variation will be featured.

**Speaker:** Professor Jiti Gao

**Title:** A Unified Approach to Estimating Stochastic Trends

**Abstract:** Time series models often involve stochastic trending components. In many cases, such stochastic trends are not necessarily observable, and should be treated as latent variables. In the econometrics and statistics literature, two different types of stochastic trends have been specified and then estimated by Bayesian methods for stochastically specified time-varying trends, and by nonparametric methods for deterministically specified time-varying trends. This presentation proposes a unified approach to estimating stochastic trends regardless whether they are stochastically specified or deterministically specified. Such an approach is also unified in terms of capable of dealing with stochastically stationary, locally stationary and nonstationary trends. Novel estimation theory is established with finite—sample evaluations. Empirical applications are in climatology, energy, finance and macroeconomics.

**Speaker:** Dr Leah South (joint work with Robert Salomone, Adam Johansen, Christopher Drovandi and Dirk Kroese)

**Title:** Unbiased and Consistent Nested Sampling via Sequential Monte Carlo

**Abstract:** In this talk I will introduce a new class of sequential Monte Carlo methods called Nested Sampling via Sequential Monte Carlo (NS-SMC). NS-SMC reframes the Nested Sampling method of Skilling (2006) in terms of sequential Monte Carlo techniques. This new framework allows one to obtain provably consistent estimates of the marginal likelihood and posterior expectations. An additional benefit is that marginal likelihood estimates are unbiased. This new algorithm is of particular interest in problems where there are so-called phase transitions, which frequently appear in the physics and astronomy literature. To help practitioners use the method, I will give practical advice on how to tune NS-SMC. I will also provide empirical comparisons between NS-SMC and temperature-annealed SMC for several Bayesian inference examples.

**Speaker:** Professor Aurore Delaigle

**Title:** Estimating a prevalence in group testing problems with missing values

**Abstract:** Estimating the prevalence of an infectious disease in a big population typically requires testing individuals for the disease using a specimen test. When a new disease spreads quickly, testing each individual is often not possible because of time constraints and limited resources. The group testing procedure was introduced in the 1940's to handle such situations and has been used extensively during the covid-19 pandemic. Instead of testing all individuals for a disease, it tests the pooled specimens of groups of individuals. This approach permits to estimate fast and accurately a prevalence which is not too high. Often it is the prevalence conditional on important variables which is of interest, and techniques have been developed in the literature for estimating it from group testing data. However, these fail if covariates and/or specimens are missing for some of the individuals, a situation which is often encountered in practice. We construct consistent estimators of conditional prevalence for group testing data, designed for such cases.

**Speaker:** Presidential Young Professor Zhenhua Lin

**Title:** Causal Inference on Distribution Functions

**Abstract:** Understanding causal relationships is one of the most important goals of modern science. So far, the causal inference literature has focused almost exclusively on outcomes coming from the Euclidean space, while in many modern applications, the observed data either naturally emerge or may be summarized as distribution functions. Often in these applications, the interest lies in the causal effect on the distributions themselves, rather than a summary measure such as the mean or the quantiles. We introduce a framework of causal effects for outcomes from the Wasserstein space of distribution functions, which in contrast to the Euclidean space, is non-linear. We develop doubly robust estimators and associated asymptotic theory for these causal effects. As an application, we use the proposed framework to quantify the causal effect of marriage on physical activity patterns using wearable device data collected through the National Health and Nutrition Examination Survey.

**Speaker:** Associate Professor Zhao Ren

**Title:** Heteroskedastic Sparse PCA in High Dimensions

**Abstract:** Principal component analysis (PCA) is one of the most commonly used techniques for dimension reduction and feature extraction. Though it has been well-studied for high-dimensional sparse PCA, little is known when the noise is heteroskedastic, which turns out to be ubiquitous in many scenarios, like biological sequencing data and information network data. We propose an iterative algorithm for sparse PCA in the presence of heteroskedastic noise, which alternatively updates the estimates of the sparse eigenvectors using the power method with adaptive thresholding in one step, and imputes the diagonal values of the sample covariance matrix to reduce the estimation bias due to heteroskedasticity in the other step. Our procedure is computationally fast and provably optimal under the generalized spiked covariance model, assuming the leading eigenvectors are sparse. A comprehensive simulation study demonstrates its robustness and effectiveness in various settings.

**Speaker:** Dr Boris Beranger

**Title:** Logistic Regression Models for Aggregated Data

**Abstract:** Logistic regression models are a popular and effective method to predict the probability of categorical response data. However, inference for these models can become computationally prohibitive for large datasets. Here we adapt ideas from symbolic data analysis to summarize the collection of predictor variables into histogram form and perform inference on this summary dataset. We develop ideas based on composite likelihoods to derive an efficient one-versus-rest approximate composite likelihood model for histogram-based random variables, constructed from low-dimensional marginal histograms obtained from the full histogram. We demonstrate that this procedure can achieve comparable classification rates to the standard full data multinomial analysis and against state-of-the-art subsampling algorithms for logistic regression, but at a substantially lower computational cost. Performance is explored through simulated examples, and analyses of large supersymmetry and satellite crop classification datasets.

**Speaker:** Associate Professor Bin Peng

**Title:** Higher-order Expansions and Inference for Panel Data Models

**Abstract:** In this paper, we propose a simple dependent wild bootstrap procedure for us to establish valid inferences for a wide class of panel data models including those with interactive fixed effects. The proposed method allows for the error components having weak correlation over both dimensions, and heteroskedasticity. The asymptotic properties are established under a set of simple and general conditions, and bridge the literature of bootstrap methods and the literature of HAC approaches for panel data models. The new findings fill some gaps left by the bulk literature of the block bootstrap based panel data studies. Finally, we show the superiority of our approach over several natural competitors using extensive numerical studies.

## ACTUARIAL STUDIES

**Speaker:** Myles Cover

**Title:** Aged Care consumer contribution - Health Care or Welfare?

**Abstract:** The federal government Aged Care portfolio has moved between the Social Services and Health departments over its history. This organisational movement seems to mirror the underlying question of whether Australia considers aged care as healthcare, and thus should broadly be free, or as welfare, and thus should be means tested. This talk takes a look at aged care means testing in order to understand where it lies on this spectrum.

**Speaker:** Lachlan O'Hare

**Title:** How is reform building the health of private health insurance?

**Abstract:** Private health insurance (PHI) in Australia has long formed a significant part of Australia's world-renowned healthcare system but this has not saved it from being beset with much negative attention over recent years. Concerns relating to affordability, perceptions around value for money and complexity are among those which are driving a broad agenda of reform across the industry. This presentation will cover the ways in which this program of reform is seeking to address the challenges of the PHI system, with a deep dive into the area of prostheses reform and the challenges as well as opportunities ahead.

**Speaker:** Jane Miao

**Title:** Military Compensation Schemes: Recent Experience and Modelling Challenges

**Abstract:** The Australian Government Actuary has been valuing the costs of military compensation for the Department of Veterans' Affairs over 20 years. In the last 5 years, we have seen expenditure escalate from total outlays of approximately \$650M in 2017 to \$2 billion in 2022. This talk will cover the unique nature of the schemes, some of the changes that have occurred in the last few years, and the modelling challenges we've experienced and will continue to experience going forward.

**Speaker:** Hugh Miller

**Title:** Micro-management: Some unsolved problems in microsimulation models

**Abstract:** There has been increasing use of detailed microsimulation models, often built by actuaries, in different social sector settings in Australasia. The theoretical underpinnings of these models are generally sound, but the models are not without challenges. This presentation will survey the range of models and their use; explore best practice in updating and evolving models; explore issues and limitations common to many models, with a focus on unsolved technical questions; and discuss opportunities for such models going forward.