NITheCS FOCUS AREA WORKSHOP

NITheCS
National Institute for
Theoretical and Computational Sciences

II Workshop on Quantitative Finance

Theme: Sustainability, Climate-Related Risks, and Innovative Financial Modelling
Dates & Venue: 14–18 July 2025 at Protea Hotel Techno Park, Stellenbosch
Organiser: Prof Mesias Alfeus, Stellenbosch University

Framing the Workshop: Linking Sustainability & Quantitative Finance
From the outset, NITheCS Director Prof Francesco Petruccione's opening remarks underscored NITheCS's five-year vision: to position Africa at the forefront of computational finance research by bridging academic advances with industry needs. This strategic framing set the tone for a workshop that was as much about forging partnerships (e.g., with DSTI and SARB) as about technical innovation. Mr Bheki Hadebe's follow-up DSTI session concretized that vision, highlighting how government-funded research programmes are now structurally embedded within NITheCS—ensuring that projects on climate risk, benchmark reform, and sustainable investment receive both scholarly and policy support.

Key takeaway: Embedding academic research within policy-making structures accelerates the translation of quantitative methods into real-world impact.

The Benchmark Approach: Beyond Risk-Neutral Pricing
Prof Eckhard Platen's mini-school challenged participants to rethink the foundations of asset pricing. Rather than relying on risk-neutral measures, the benchmark approach positions the growth-optimal portfolio (GOP) as the central numéraire, yielding three major insights:

- **Information Efficiency:** Markets can be characterized not by absence of arbitrage, but by minimal informational redundancy across pricing measures.
- **Conservation Laws & Self-Similarity:** Financial assets—when modeled in "activity time"—exhibit scaling properties akin to physical systems, allowing closed-form expressions for key derivatives.
- **Neutral Interest Rate:** A real-world pricing formula emerges, enabling central banks to infer optimal consumption and inflation paths directly from the GOP framework.

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By demonstrating how these principles yield both theoretical elegance and practical pricing formulas, Platen's sessions laid a foundation for workshop discussions on emerging benchmarks like ZARONIA.

JIBAR→ZARONIA Transition: Practical Challenges & Technical Solutions

The SARB mini-school, led by Mr Zakhele Gininda and Mr Naweed Hoosenmia, took a detour of the South Africa's benchmark reform. Participants worked through:

1. **Data Infrastructure:** Migrating from panel-reported JIBAR quotes to transaction-based overnight rates.
2. **Curve Construction:** Building forward curves under ZARONIA—and re-testing old swap valuations using the real-world pricing approach.
3. **Fallback Provisions:** Updating ISDA documentation and bank fallback languages to ensure continuity.

The hands-on exercises underscored that transitioning to a truly risk-free rate is as much an engineering problem (data feeds, system upgrades) as a modeling exercise—a point that sparked lively debate over best practices.

Climate Risk Modelling: From Macro Scenarios to Micro Portfolios

Prof Matheus Grasselli's opening talk introduced machine-learning techniques for global sensitivity analysis of integrated assessment models (IAMs), showing how neural networks can approximate high-dimensional climate–economic linkages more efficiently than traditional Monte Carlo methods. His key insight: ML surrogates can accelerate scenario analysis—critical when testing dozens of policy pathways.

Dr Petri Greeff's ALM case study then brought climate risk home, using NGFS "Net Zero" scenarios to re-optimize a large pension fund's asset allocation. Under severe warming pathways, safe-asset allocations must tilt toward real assets (infrastructure, timberland) to preserve real returns—challenging the conventional 60/40 equity–bond paradigm.

Prof Rüdiger Kiesel culminated the day with a systemic-risk perspective, mapping carbon budgets, net-zero conundrums, and potential "tipping points" into financial stress tests. His probabilistic net-zero framework—built on stochastic differential equations—demonstrated how climate policy uncertainty itself becomes a tradable risk factor, to be priced and hedged.

Overarching insight: Climate risk modelling requires integrating macroeconomic IAM outputs with portfolio-level ALM and stress-testing frameworks—an end-to-end challenge that spans data science, economics, and risk management.

Innovative Asset Classes: Fine Wine & Beyond

The mid-week "mini-school" on fine wine illustrated the workshop's commitment to exploring non-traditional assets:

- **SAFW10 Index (Prof Mesias Alfeus):** A top-10 wine index created via hybrid hedonic–repeat-sales methods demonstrated diversification gains when added to equity–bond portfolios, particularly during equity drawdowns .
- **Bond Wine AMC (Mr Roland Peens):** A Swiss-backed, ISIN-listed vehicle that tracks Liv-ex–priced fine-wine portfolios, offering daily NAV transparency and institutional-grade storage. Peens articulated how fractional-share AMCs can democratize access to this alternative asset class.

The live tasting—featuring vintages from Thelema and Genelly (Lady May)—served not just as a networking event but as a visceral reminder that asset classes carry real-world narratives and sensory dimensions. Prof Platen's quip about never having tasted wine at a finance conference

captured the workshop's interdisciplinary spirit. Thank you, Glenelly and The Stellenbosch Reserve, for generously sponsoring the wines.

Cutting-Edge Research Showcases

Over three days, 30+ short talks spanned:

- **Network-based Tail-Risk Indices:** Dynamic Tail-Risk Connectivity Index (DTCI) for early warning of systemic stress in South African financial networks .
- **Stochastic Games & Environmental Policy:** Nash equilibria under impulse controls, modeling government–industry dynamics in resource extraction.
- **GANs for Volatility Surfaces:** Data-driven inpainting of missing implied-volatility regions, validated against Heston–simulated ground truth.
- **Term-Structure of Default Risk (Verster et al.):** A multistate regression framework under IFRS 9, improving lifetime-loss provisioning via novel Markov and beta-regression diagnostics .

These showcases highlighted a common thread: advanced mathematical techniques (from copulas to GANs) are being rapidly integrated into practical risk-management tools—underscoring the workshop's motto of "innovative financial modelling."

Youth Engagement & Future Directions

Mr Johannes Meyer's "Young & Calculated" presentation capped the workshop by addressing pipeline development: how to demystify quantitative finance for high-school students through gamified challenges and mentorship. His initiative exemplifies NITheCS's long-term vision to cultivate the next generation of African quants.

Conclusions

1. **Interdisciplinary Synergies:** The workshop successfully wove together policy (DSTI, SARB), academia and industry (RisCura, FirstRand, FNB, Autochek), showcasing how each stakeholder group can co-create sustainable-finance solutions.
2. **End-to-End Modelling:** From IAM surrogates to ALM implementations and alternative-asset frameworks, participants gained a blueprint for building holistic risk-modelling pipelines.
3. **Institutional Commitments:** The NITheCS–CQF partnership and the forthcoming IJTAF special issue signal ongoing support for research translation and dissemination.

Next steps:

- **Call for IGPRC2025: InSPiR2eS Global Pitching Research Competition (Stellenbosch Chapter)**
  - As part of our commitment to fostering research communication skills among emerging scholars, delegates were invited to participate in the Stellenbosch-Chapter of the InSPiR2eS Global Pitching Research Competition 2025 (IGPRC2025). Submission link: Home
- Prepare submissions to the IJTAF special issue (deadline 15 Oct 2025)

Acknowledgements: Heartfelt thanks to Mrs Elizna Kruger for flawless administration, all presenters for sharing cutting-edge work, and delegates for vibrant discussions. We look forward to reconvening 22–26 September 2025 at Stellenbosch University.