

Jim Gatheral Travel Scholarship Report

About me

My name is Yihan Zou. I am a Chinese PhD candidate in my final year of study in the Economics at the Adam Smith Business School. I started my doctoral study in October 2016. My research, under supervision of Professor Christian Ewald and Dr Ankush Agarwal, mainly focuses on modeling financial asset prices, pricing derivatives such as salmon futures, European and American options, investigating seasonal risk premium dynamics implied by asset prices, and applying the pricing principles to real life investment projects. In 2019, I was awarded a Jim Gatheral Travel Scholarship of £4000 for a two-month visit to the group of Financial



Mathematics of the School of Mathematics and Statistics of the University of Sydney, Australia.

On the beach of Wollongong

Reasons for applying for the scholarship

My current joint research project with Professor Christian Ewald and Dr Ankush Agarwal is on mathematical modeling of American or Real options' pricing under ambiguity averse belief, with application to real life investment such as natural resource pricing. We study stochastic volatility models in a multiple prior setting and investigate prices of American options from the perspective of an ambiguity averse agent. Using the theory of reflected backward stochastic differential equations, we formalize the problem as to find the essential infimum of the generator of a nonlinear reflected backward stochastic differential equation, and we are planning to solve it numerically by a simulation scheme. We analyze the accuracy of the numerical scheme with single prior models, of which American options could also be efficiently evaluated by the least squares Monte Carlo approach. We also propose another dynamic programming algorithm to price the American option with multiple priors without using the theory of reflected backward stochastic differential equation. By comparing to the single prior case, we highlight the importance of the dynamic structure of the agent's worst-case belief. We are also interested in exploring the applicability of these two algorithms in a setting with multidimensional real option and ambiguity, possibly on topics like natural resource evaluation or portfolio investment.

The scholarship gave me financial support to visit Professor Marek Rutkowski, an expert in nonlinear optimal stopping, no arbitrage pricing theory, credit risk modeling, etc. I got to know him through my supervisor Professor Christian Ewald. Marek's expertise is closely related to our current research project and future

directions. Thus, I was able to discuss our current project with him, and solve potential problems, especially in the mathematical deductions and numerical schemes in solving American real option pricing problems.



Main campus of the University of Sydney



Night view of the University of Sydney and the Victoria Park

Details of the visit

I arrived at Sydney on 15 September and left on 14 November. The welcome I received at my arrival from Professor Marek Rutkowski was just as warm as the sunshine in the beach of Sydney. My main working and research activities were taken place at the main campus located at Camperdown, NSW. The University of Sydney, tracing back to 1850, has an incredibly stunning campus, with the Victoria park next to it. The British Daily Telegraph even ranked it in the top 10 of the world's most beautiful universities. I was living in Sancta Sophia Collage inside the main campus, which is a residential college accommodating casual visitors.



Prof. Marek Rutkowski and me

During the first meeting in the Carlaw building, Professor Marek introduced me to members of the group of Financial Mathematics in the School of Mathematics and Statistics, as well as his doctoral students. After that, we discussed the itinerary of my visit and I explained our current research to Professor Marek in detail. We discussed possible issues with the current project and future potential extensions. Professor Marek also gave me lots of reading materials, suggestions and guidance on other interesting topics such as

credit risk modeling on defaultable options.



Prof. Jan Obloj from Oxford was giving talks

During the stay, I was able to participate weekly talks hosted by the group of Financial Mathematics, which greatly expanded my horizons and gained me enormous new knowledge. Moreover, I had opportunities to meet many young brilliant scholars, and talk with them there. In the last week of visit, I gave a one-hour talk on our current project and received a lot of useful advices from audience.

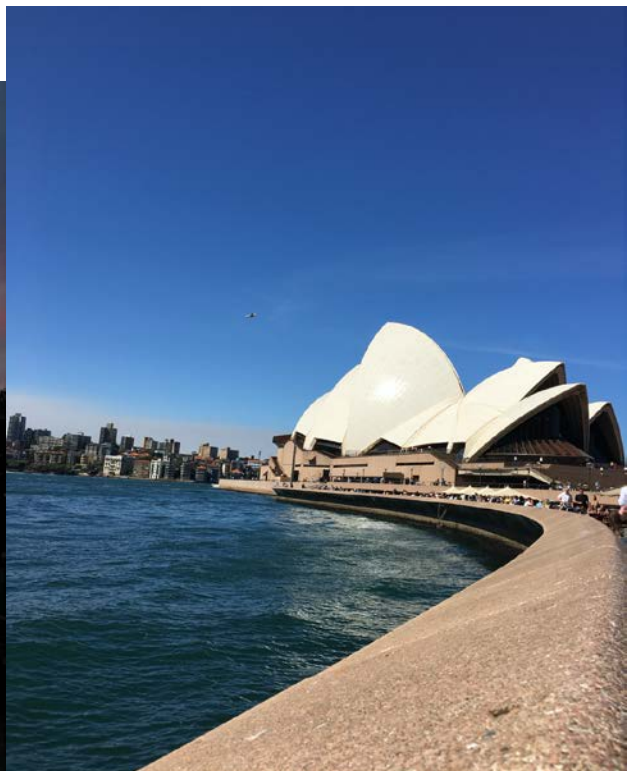
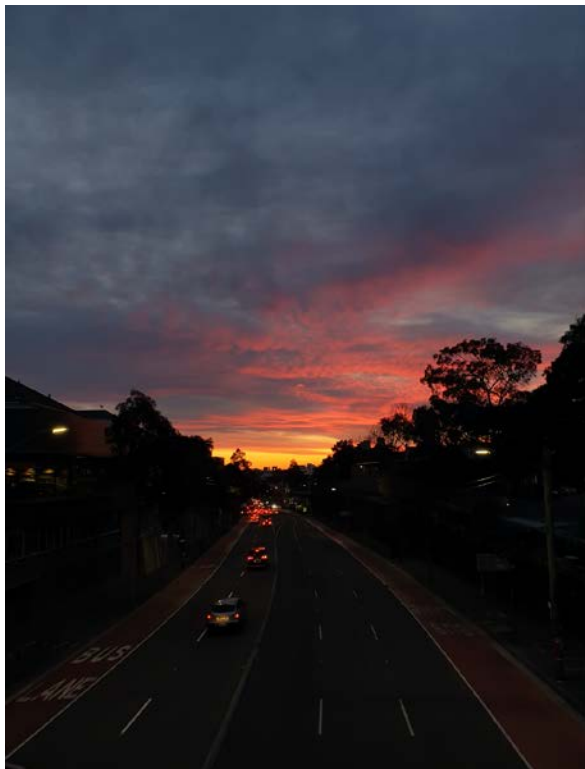
Impact of the scholarship

The Jim Gatheral Travel Scholarship provided me great chances to enrich my research experience and get in touch with one of the world best scholars in the field of mathematical finance. We are still working on fields which Professor Marek has

expertise in, till now to contribute to some collaborative work. The visit was of substantial help, not only in the sense of collaboration but also in my personal academic development. Beyond the academic help, it also enabled me to get to know new unforgettable people, sceneries and customs in Australia.

Acknowledgement

I would like to thank Professor Marek for invitation for me to visit the University of Sydney, his kindness and generous help in my life and research in Sydney. I deeply appreciate Professor Christian's support in my application of Jim Gatheral Travel Scholarship. I should also thank Dr. Ankush for helping me preparing slides for the talk. I am grateful to Rebekah Derrett for the travel arrangement and help in scholarship application, Anamika Astridge and Sonia Morr for help in administration and accommodation in Sydney, and other people helped for my journey to Sydney.



Sceneries in Sydney