Outline of Research (Paper Nos. are in Line with the Publications Section of the CV)

My academic focus is Econometric Theory. The anchor of my research is high order asymptotic theory and theoretical time series. Around it, I published in a number of areas, some of which are orthogonal to each other. The spectrum of my research includes:

1. High Order Asymptotic Theory

   Paper Nos. B6, B7, B8, B9, B10, B11, B12, B14, B16, B17, B19, B23, B24, B25, B26, B27, B28, B29, B3, B1, C1, C2.

2. General Time Series Theory

   Paper Nos. B15, D1, E2.

3. Fractional Gaussian Processes

   Paper Nos. B6, B7, B8, B9, B10, B11, B12, B14, B14, B16, B19, B3, B1, C1, E3.

4. GARCH Processes

   Paper Nos. B13, B18, B2, D3.

5. Causality

   Paper No. B18.

6. Bootstrap

   Paper No. B6.

7. Financial Econometrics

   Paper Nos. B18, B20.

8. General Statistics Theory

   Paper Nos. B14, B17, B21, B22, B23, B29, B30, B31.

9. Preliminary Test Estimation

   Paper Nos. B31, B32, B33.

10. Empirical Similarity and Rule-Based vs. Case-Based Reasoning in Housing Prices

    Paper Nos. B4, B5, B36, E34, E35.

11. Panel Data Models

    Paper Nos. B24, C2.

I would like to say a few words on the significance of my contributions. Much of applied and theoretical probability is concerned with finding limiting distributions of statistics of interest. By 'limiting', it is usually meant as the sample size tends to infinity, but other limiting forms are also known. Very often, limiting distributions, when used in finite samples in place of exact and unknown forms, perform very poorly. High order asymptotic expansions are designed with in-built small sample correction mechanisms and generally perform better. The theory has become somewhat of a classic in the statistics literature, with work commencing under the iid assumption, progressing through various forms of weak dependence, and at the forefront, strong dependence (or long memory). Long memory processes are characterized by slowly decaying autocorrelations, hence, the synonym strong dependence. These have been prominent since the early 1950's in a number of disciplines, including mathematical statistics, probability, physics, finance, economics, hydrology and studies of internet traffic. In my work with David Zucker and Judith Rousseau (particularly our *Annals of Statistics* (2003) paper (Paper No. B8), but also Paper No. B16), we were the first to establish valid high order theory for this class of models. I worked on this area with Peter Phillips and with Donald Andrews during my visits to the Cowles Foundation for Research in Economics at Yale (2000-2002, and September 2003), and this resulted in Papers Nos. B6, B7, B8, B10, B11, B3, B1. Paper No. B6 (Topic No. 6) is particularly significant as Andrews and I were the first to justify the parametric bootstrap under long range dependence. This work has implications in a number of disciplines, including finance.

The above continues the research agenda of my Ph.D. thesis (thesis examiners were Tom Rothenberg (Berkeley) and Neil Shephard (Oxford)). In the thesis, I worked on saddlepoint and Laplace approximations. Apart from some work by Peter Phillips, there were practically no econometricians anywhere near this technical area till I published my work in the 1990's.

Preliminary test estimation occupied my pre-Ph.D. years. It is closely related to decision theory and Bayesian statistics. My M.A. thesis developed into my first JASA (1992) article [Paper No. B32]. This topic is perpendicular to all the other topics in the list above.

In Topic No. 4 Fabienne Comte and I worked on multivariate GARCH processes. The GARCH model and its many subsidiaries attempt to describe time varying volatility and are extremely popular in finance (Robert Engle has been awarded the 2003 Nobel prize in Economics for the introduction of this class of models). These models have been applied to a variety of time series, including market indices. Engle's work undoubtedly made an enormous impact, with thousands of applied and theoretical articles. My contribution to the area is in the establishment of first order asymptotic theory for the multivariate GARCH process. Practitioners were using this model without a theoretical justification hitherto. This area of research is perpendicular to the first topic above.

Clive Granger's (who is the other 2003 Nobel prize laureate in Economics) widely accepted definition of causality is for conditional means. For most financial data, causality in variance is of much more interest. In my work with Fabienne Comte (Topic 5) we defined and characterized variance noncausality in a multivariate setting and derived statistical hypotheses tests for it.

Topic No. 10 is based on joint work with Gabi Gayer, Itzhak Gilboa and David Schmeidler. Here, a new formula is devised for real estate pricing, based on the new concept of empirical similarity. The formula is justified axiomatically. My role is in developing the statistical apparatus for the model. It is possible that the formula will be useful in a wide range of applications, including risk analysis in the medical profession and insurance.