PROPOSAL: SOLVING THE AFRIAT INEQUALITIES WITH WAVELETS AND KERNELS

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In 1967, Afriat published his seminal paper on the theory of revealed preference. Given a finite family of price-quantity pairs, Afriat proved that the observations are consistent with maximization of a concave utility subject to a budget constraint if and only if the Afriat inequalities, a finite family of multivariate, polynomial inequalities, are solvable. The parameters in the Afriat inequalities are the market prices and the consumer's demand at these prices. The unknowns are the utility levels and marginal utilities of income in each observation.

The primary methodology for non-parametric analysis of consumer demand data is computing solutions of the Afriat inequalities and extensions of the Afriat inequalities that characterize the maximization of expected utility functions or quasi-linear utility functions subject to a budget constraint.

Unfortunately, solving the Afriat inequalities or extensions of the Afriat inequalities is an ill-posed problem. That is, the inequalities may not have a solution. If a solution exists then it need not be unique. A unique solution may be unstable under small noisy perturbations of the data.

Peter Jones has proposed an algorithm for computing a unique, stable solution of the family of inequalities that characterize maximization of a subjective expected utility function subject to a budget constraint, using the theory of wavelets.

Wavelets are orthogonal bases of function spaces. David Donoho (1992) has shown that wavelets offer the best means of compressing data or approximating functions.

Don Brown has proposed an algorithm for computing a unique, stable solution of the family of inequalities that characterize maximization of a quasi-linear utility function subject to a budget constraint, using the theory of Hilbert spaces with reproducing kernels. This is the class of models used in machine learning.

Our project has two components:
(1) Implementation of Jones's algorithm and an evaluation of its efficiency on individual investment data.
(2) Implementation of Brown's algorithm and an evaluation of its efficiency on a data set, recently reported in *Econometrica* on fitting consumer demand data with a quasi-linear utility function.

Hence we are looking for a student who is interested in data analysis, with a strong background in mathematics and microeconomics .The student must be proficient in one or more of the following programming languages: Matlab, Mathematica or C.