SimFinMkts: A Possible Tool for Financial Markets Research

Economic and financial markets outcomes are the result of interactions of many kinds -- risk preferences, liquidity constraints, taxation, beliefs -- all of which are present in different ways due to heterogeneity. The typical model focuses on only one factor and often ignores heterogeneity in that factor. The search for explanations of data is usually a search for that one factor that can suffice. That unicausal approach is unlikely to succeed but is necessary given the limitations of the computational tools typically used.

Other fields have developed community tools that help overcome the resource limitations of individual researchers. One prominent example is Flash -- http://www.flash.uchicago.edu/site/index.shtml. Astrophysics faces many of the same limitations as economics -- they have observations of stars and other astronomical phenomena but are not able to run experiments of full systems. Flash is “a publicly available multiphysics multiscale simulation code. Research projects include high-energy density physics, thermonuclear-powered supernovae, exascale computing co-design, fluid-structure interactions, and development of implicit solvers for ‘stiff’ systems.” If astrophysics can work together to study why stars blow up, perhaps economists can work together to develop a computational simulation tool to study what conditions will lead to economies and financial markets to blow up and determine policies and market structures that could avoid such crises.

SimFinMkts would be a publicly available multi-economics, multiscale simulation code. For example, it would simulate economies where there are heterogeneous preferences, liquidity, taxes, beliefs, and other factors. Some will argue that it is impossible to have a model of everything. That is true, but it is possible to use modern tools from computational science to model far more complex models than is typical. SimFinMkts would recognize this by giving the user the ability to choose which factors they want to focus on and which to ignore.

SimFinMkts could be used to help develop empirical methods. For the next decade or two, it would likely be impossible to incorporate SimFinMkts inside empirical procedures. Therefore, we will be stuck with analyzing low-dimensional projections of data. SimFinMkts could be used to generate synthetic data which would represent the outcomes of a complex model. Since we would know the true data generating process, we could use the synthetic data to test which empirical methods are successful in identifying key empirical issues when confronted
with data from a complex data generating process.

This could not be done using the resources available to the typical researcher on his own. In particular, constructing SimFinMkts would require computational expertise far beyond the knowledge of the typical economist of financial researcher. However, as Flash has shown, the expertise exists.

SimFinMkts could not be run on the computer systems available to the typical economist. However, there are many sources of considerable computational power that are available, are used by not only the physical sciences but also sociology and political science, and that economists could access if they tried. The current state of the art hardware is not the relevant benchmark for us to use in evaluating the value of a SimFinMkts project because the history of computational progress tells us that workstations in 2040 will have the power of today’s supercomputers.

The chaotic collection of computational methods used today in economics and financial research will make many feel that there is no way SimFinMkts could incorporate all of that work into one software tool. However, SimFinMkts is feasible when one uses the proper mathematical concepts. In this case, the underlying equations in financial models are just difference equations in Banach spaces.

My presentation will discuss both the potential value of SimFinMkts for research as well as address the obvious problems that need to be solved as well as the existing algorithms that can be incorporated into this project.