Personal Statement

[redacted]

982 words

My aim in applying to [redacted]'s PhD in Economics is to prepare for a career as an academic economist. I have worked at [redacted] as a predoctoral researcher for the past two years, which acquainted me with the specifics of [redacted]'s economics department. This period solidified my passion for economic research, and its ability to sharply characterize the invisible rules and incentives of modern life.

I engaged in a diverse mix of activities at [redacted], including coursework, RA work, teaching, and coauthorship of an original manuscript. These experiences have allowed me to form a specific interest in the macro and econometric aspects of heterogeneous-agent models. As I discuss later, I have a few ideas for potential projects, and believe that [redacted] is an exceptional place to do this work.

These models are nontrivial to compute; besides nonlinearity, they require careful decisions about how to keep track of heterogeneity, whether to incude aggregate uncertainty or move to continuous time, and so on.

I have addressed such questions as coauthor of a working paper (recently presented at the [redacted] macro lunch seminar) with [redacted]. The paper demonstrates a new way of computing high-dimensional recursive equilibria. I designed algorithms that reflected the economics, and creatively adapted ideas from the computer science, statistics, and mathematics literature to improve them.

More generally, working with [redacted] has left me well-equipped to do intensive economic research. He has impressed upon me a strong vigilance about suboptimal code. This is crucial, since careless loops or sloppy algorithms can double or triple running times. And my year-long work with him on [redacted] taught me key techniques, like operator discretization and matrix-free methods, for solving ambitious heterogeneous-agent models.

My research background in this area is not only computational, however. A key example is a project I initiated with [redacted], on multidimensional strategic behavior by credit ratings agencies (CRAs.) I also worked as an RA for [redacted]; my projects included extending the shock structure in a model of Treasury bond auctions, and implementing a social network evolution model in Julia. I believe this experience building and extending models will come in handy for future research.

As mentioned earlier, I propose to study heterogeneous settings. I am particularly interested in understanding how heterogeneity can help us understand so-called "systemic" or "endogenous risk." This refers to the tendency of certain economic models to exhibit extreme outcomes (such as "stock market crashes, banking crises, runs on the repo, [etc.]") without a commensurate aggregate shock. (Zigrand, 2014)

Heterogeneity is increasingly held responsible for stylized facts about catastrophe; for example, Anufriev and Tuinstra (2013) credit heterogeneous beliefs with "generating the patterns of bubbles and crashes" in their model. And even two-asset models, like Feldman (2010), indicate that the

type distribution of traders is a crucial risk parameter for financial crises.

One potential project concerns the role of information choice. Learning is a strategic problem for investors, and depends not only on their own portfolios, but on the specialties of other investors. Since learning is costly, and being the second to know something is of little value, investors tend to burrow deeper into their own niches. This creates the "high degree of concentration" observed in van Nieuwerburgh and Veldkamp (2010), and could be a mechanism by which agent heterogeneity exacerbates systemic risk.

Another line of inquiry concerns market fragmentation. As O'Hara (2015) notes, stock exchanges are driven by competitive pressures, and are fracturing into a large variety of platforms. Some studies, such as O'Hara and Ye (2011), suggest that this leads to higher short-term volatility, decreased liquidity, and poorer price discovery. And Menkveld and Yueshen (2019) partly implicate market fragmentation in the 2010 Flash Crash, citing "a breakdown of cross-market arbitrage activity" as a key factor. It could be worth investigating the aggregate risks posed by this self-segregation of traders by type.

On the econometric side, one question I wish to explore is whether the "sufficient statistic" approach made famous in Krusell et al. (1998) can be applied to a wider class of models. In the working paper I mention above, we find that many common economic models exhibit symmetries (such as agent exchangeability) which can be used to sharply reduce the number of parameters required to approximate equilibrium objects.

This question may have some relevance for the more general discussion on how best to estimate heterogeneous agent models. As noted in Parra-Alvarez et al. (2020), a standard technique for estimating Bewley-Aiyagari-Huggett models is to tune structural parameters so the model matches moments in the data. The authors call this the "partial-information" method, as it does not apply "the full set of restrictions implied by a particular economic model." (To do so requires knowing the "complicated endogenous and nonlinear object" which is the model's probability density over states.) But if it were possible to approximate endogenous equilibrium objects as functions of a small number of sufficient statistics, computing that distribution would be far easier.

Altogether, [redacted] is a particularly apt setting for me to do this work. Thanks to my time in the department, I have been able to identify or work with potential faculty mentors (such as [redacted] and [redacted]), who are experts in the models I propose to study. And I have firsthand experience with the advanced computing resources, like the [redacted] cluster, which would enable me to do excellent computational economics.

Additionally, attending the department's seminars with leading researchers (such as the [redacted] Lecture) has broadened my economic thinking considerably. And I have enjoyed working with [redacted] colleagues from other departments, such as the [redacted] and the [redacted] program, who may be able to advise me on aspects of my future research.

I have found the atmosphere at [redacted] to be both collegial and stimulating, with lots of interest in all facets (theory, estimation, macro implications) of heterogeneity. I believe that my research background, combined with my past experience working at the [redacted], puts me in a unique position to thrive in the PhD program.

References

Mikhail Anufriev and Jan Tuinstra. The impact of short-selling constraints on financial market stability in a heterogeneous agents model. *Journal of Economic Dynamics and Control*, 37(8):1523–1543, 2013. URL https://EconPapers.repec.org/RePEc:eee:dyncon:v:37:y:2013:i:8:p:1523-1543.

Todd Feldman. Portfolio manager behavior and global financial crises. *Journal of Economic Behavior and Organization*, 75(2):192–202, 2010. URL https://EconPapers.repec.org/RePEc:eee:jeborg:v:75:y:2010:i:2:p:192-202.

Per Krusell, Anthony A. Smith, and Jr. Income and Wealth Heterogeneity in the Macroeconomy. *Journal of Political Economy*, 106(5):867–896, October 1998. doi: 10.1086/250034. URL https://ideas.repec.org/a/ucp/jpolec/v106y1998i5p867-896.html.

Albert J. Menkveld and Bart Zhou Yueshen. The Flash Crash: A Cautionary Tale About Highly Fragmented Markets. *Management Science*, 65(10):4470–4488, October 2019. doi: 10.1287/mnsc.2018.3040. URL https://ideas.repec.org/a/inm/ormnsc/v65y2019i10p4470-4488.html.

Maureen O'Hara and Mao Ye. Is market fragmentation harming market quality? *Journal of Financial Economics*, 100(3):459–474, 2011. URL https://EconPapers.repec.org/RePEc:eee:jfinec:v:100:y:2011:i:3:p:459-474.

Maureen O'Hara. High frequency market microstructure. *Journal of Financial Economics*, 116 (2):257 – 270, 2015. ISSN 0304-405X. doi: https://doi.org/10.1016/j.jfineco.2015.01.003. URL http://www.sciencedirect.com/science/article/pii/S0304405X15000045.

Juan Carlos Parra-Alvarez, Olaf Posch, and Mu-Chun Wang. Estimation of heterogeneous agent models: A likelihood approach. CREATES Research Papers 2020-05, Department of Economics and Business Economics, Aarhus University, May 2020. URL https://ideas.repec.org/p/aah/create/2020-05.html.

Jesse Perla, Christopher Tonetti, and Michael E. Waugh. Equilibrium technology diffusion, trade, and growth. Working Paper 20881, National Bureau of Economic Research, January 2019. URL http://www.nber.org/papers/w20881.

Stijn van Nieuwerburgh and Laura Veldkamp. Information acquisition and under-diversification. *The Review of Economic Studies*, 77(2):779–805, 2010. ISSN 00346527, 1467937X. URL http://www.jstor.org/stable/40587645.

Jean-Pierre Zigrand. Systems and systemic risk in finance and economics. LSE Research Online Documents on Economics 61220, London School of Economics and Political Science, LSE Library, January 2014. URL https://ideas.repec.org/p/ehl/lserod/61220.html.