D I S S E R T A T I O N P R O P O S A L

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"Essays on Applications of Machine Learning to the Macroeconomics of Retirement Savings"

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My dissertation concerns the interaction between macroeconomic policy and retirement financing decisions. In each chapter, I contribute to the literature on unsupervised machine learning applications to macroeconomics and finance with the use of deep neural networks to approximate global policy functions in stochastic dynamic general equilibrium models with very high-dimensional state variables.

In the *first chapter*, I consider the general equilibrium asset pricing ramifications of the Biden Administration's plan to forgive up to $20,000 per borrower in student loan balances. I model student debt forgiveness with education-level heterogeneity in general equilibrium with aggregate uncertainty and endogenous portfolio choice. With the key general equilibrium channels being (1) agents' need to finance retirement and (2) the productivity externality of education, I evaluate the implications of partial loan forgiveness and find decreasing asset returns and mixed welfare results. For continuation work, I propose to use this model as a framework to assess alternate policies that may reduce distortions present in the current policy design.

The *second chapter* is joint work with Zhigang Feng and Eungsik Kim. Motivated by large but low-frequency inflation shocks such as in the 1970s and today, we seek to understand the implications of inflation on asset prices and generational risk. While business cycle shocks affect the realization of contemporary real outcomes, inflation shocks come at a lower frequency and generate an intertemporal wedge by changing interest rates (and therefore asset prices) without affecting all contemporary outcomes. We propose to introduce a social security (SS) system and nominal rigidity to understand the role of SS in insuring against generational *inflation* risk, in contrast to prior work on its role in insuring against generational *business cycle* risk. Comparing the extended model with SS to the baseline model without, we can quantify the extent to which an inflation-indexed SS system can address inflation risk and the corresponding effect on asset prices.

For the *third chapter*, I provide a framework to quantify the general equilibrium asset pricing and welfare effects of enrollment by present-biased households in target-date retirement funds. I start with the fact that households under-enroll in retirement savings plans. Assuming under-saving is the result of present bias, I model one type of agent (under-savers) with quasi-hyperbolic (beta-delta) discounting and constrain these agents to not invest directly in the market. Rather, under-savers may invest in target-date retirement funds. Another type of agent (active savers) directly purchases securities. Assets are priced both by the *direct* holdings of active savers and the *indirect* holdings of under-savers. I propose to study the pricing and welfare effects of incentivizing under-savers to invest in target-date funds, through policies such as automatic enrollment or employer-matched savings. This chapter also contributes to the behavioral finance literature by understanding the interaction between exponential and hyperbolic discounting in general equilibrium.