Thesis Project Portfolio

Avocado Toast: A Personal Finance Calculator to Provide Advice for Retirement Planning

(Technical Report)

The Impact of Advanced Computing on Theoretical Economics Research

(STS Research Paper)

An Undergraduate Thesis

Presented to the Faculty of the School of Engineering and Applied Science

University of Virginia • Charlottesville, Virginia

In Fulfillment of the Requirements for the Degree

Bachelor of Science, School of Engineering

Aleksander Schultz

Spring, 2024

Department of Computer Science

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Executive Summary

The general topic I'm addressing is how computation and theoretical economics research can be used together to improve financial quality of life for people. I am looking at the way economic and financial models, which are products of research, interact with and mutually shape the development of computing technology. In my technical report, I look at how integrating theoretical economic and financial models into a personal finance application can increase users' confidence in their finances and help them make better decisions. In my research paper, I look at to what extent integrating advanced computing into economic research has changed the development of economic and financial models that are used in decision-making by institutions and individuals. Both projects address the general topic of how technology (specifically computers) and research (specifically theoretical economic models) work together to improve our understanding of the world and make life better. This is a significant topic to address because if we can use technology to improve the validity of our models (my research project), and then use technology to make those theoretical models accessible to everyone (my technical project), we can improve the financial decision making of individuals and improve their financial quality of life outcomes.

My technical project was the creation of a personal finance calculator application that provides specific investment advice to users. The application is open-source and was developed as proof of concept, with room for further development. Many personal finance applications exist, which compare accounts, manage budgets, and more. However, they don't provide specific investment advice to maximize financial quality of life, which is the rationale for this project. Specifically, the app takes information about users' current financial situation (such as investment budget, assets, and liabilities) and future plans (retirement and intermediate financial goals). The output is an investment timeline that shows the recommended investment strategies over time. Primarily, the Capital Asset Pricing Model is the financial theory used, which allows minimization of risk while still reaching the required financial targets. The app was developed initially as a simple text-based Python program that runs in a terminal and was

then converted into a webpage using Flask. The outcome was an effective application that provides value to users and is a good base for developers to expand on in the future. The project fell short in a few ways, like a lack of comprehensive form validation to prevent errors and the use of financial language that might be confusing to users with little experience in financial theories. These are shortcomings that hurt the value of the application but can be remedied with further development. Overall, this project displays the value of integrating theoretical models from esoteric research with computing technology to create applications approachable by many people.

My research project was to analyze the impact of advanced computing on theoretical economic research. The development of computing technology has drastically transformed many fields of research, such as chemistry and biology, but the impact on social science research is not as obvious. This topic is significant because understanding how this technology has been integrated into economics research can inform us as to how to further improve this integration, and these models are used by banks, governments, and institutions at every level to make decisions that have very real effects on the economy. To do this analysis, I picked the top two research papers (by total citations) in theoretical economics for each decade since 1970 and analyzed the impact computing had on the research done. By doing this, I could see both how much computing is being used in research and whether that has changed over time. Ultimately, I found that that use of computers in theoretical economics research is not very common and didn't seem to change much over time. Half of the papers analyzed did not use any significant computation for anything and the other half primarily used computation for non-complex tasks like data processing and simple statistical analysis. Thus, there has not been a significant impact of computing on theoretical economics research over time. There are many possible reasons for this, among them that theoretical research in social sciences is often conceptual and right now, computers are generally better with numbers and simulations. Economics researchers in the future should work with applied economics researchers and computer scientists to validate and verify their theoretical models with real world data, improving the models' accuracy and credibility.

Overall, I'm satisfied with the work I did this year. In my technical project, I was able to produce an application that provided value to users in a way that no other personal finance application does: by providing specific investment advice consistent with theoretical financial models. This demonstrates the significance of my research paper, because it shows one of the many ways in which theoretical research is applied in the real world. My research paper was able to produce value by taking an empirical look at the impact of computing on theoretical economics research. Through this, I was able to find a significant shortcoming of this field. Thus, I was able to successfully create value in both of my projects and advance towards answering the question of how computing and economic research can go together to improve people's lives. To continue my work in my technical project, other personal finance features like budgeting and credit card comparisons can be incorporated to create a more comprehensive suite of tools that allow users to maximize their financial quality of life. For my STS research, future researchers can use tools like AI to summarize more than just two research papers per decade to get a more nuanced understanding of the how computing has changed the field.