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Dear NBER Digital Economics and AI Tutorial,

I am writing to apply for the NBER Digital Economics and AI Tutorial. I am a third-year Ph.D. student in Economics at Northwestern University and a visiting scholar at the Federal Reserve Bank of Chicago interested in finance, labor economics, and macroeconomics. I focused on finance, labor/public/organizational economics, and innovation economics during my coursework. I have two research projects directly related to digital economics and AI: generating economic agents using LLM and examining how alternative credit scoring systems using machine learning algorithms can promote loan access for low-income households. My other works have centered on households' economic decisions and the way they respond to shocks, the expectations of financial market participants, and factors affecting human capital accumulation. I am excited about the opportunity to learn at the program, and my research interests and experience would make me a good fit for the program. During the tutorial, I look forward to developing my current research projects related to digital economics and AI while applying the training to my other research agenda.

In a project with Suhong Moon and Minwoo Kang, we are working on generating virtual economic agents through LLM. As our first step, we created virtual personas through the "Anthology" method (Moon et al., 2024), through which we provide open-ended life narratives to create them and study in/out-group (mis)perceptions. We have shown that the method captures humans' in/out-group (mis)perceptions related to politics, gender, and immigrants better than other method. With the generated virtual agents, we are examining how echo-chambering occurs, by separately estimating the echo and chamber effects and developing the optimal way to decrease the impacts through information injection. In the long run, we want to use virtual economic agents to study the decision-making process of humans and estimate policy effects before implementing them.

In a different project, I am finalizing a data usage agreement with a fintech firm operating in India to analyze how we can use alternative credit scoring systems based on machine learning algorithms to promote loan access for low-income households. The company uses alternative data sources to evaluate credit scores and provide loans to those who do not have access to loans due to limited credit information. In the project, I will first document how the alternative credit score performs better than the original credit scores by reducing the default rates. In the process, I will focus on the (demographic) characteristics of applicants who benefit from the new system. Then, I will analyze how people use the loan to evaluate their welfare improvement and the profit that the firm gains from the new system. Through this project, I hope to shed a new light on the use of machine learning in real-life economic activities and help households that are disadvantaged by the existing credit score system.

In my other research projects, I am especially interested in how people make economic decisions, with a focus on how they respond to shocks. In a project with Younggen Yoo, we focus on the way people "give up" home buying via wages and savings due to dramatically decreased affordability. This trend is present not only in the United States but also in many other countries. We present evidence that households are increasingly giving up on home buying and show how this "giving up" can explain three phenomena prominent in the recent economy: high interest rates coupled with strong consumption, limited labor supply amidst strong demand, and an increase in risky financial investments. We introduce a model of household consumption, saving, investment, employment, and housing decisions to explain the three phenomena through the giving up behavior of households. Finally, we discuss policy implications by performing

counterfactuals and highlight how policymakers should be careful in inferring a strong economy from face numbers, as losing hope of being 'better' leads people to give up when faced with an affordability shock.

In a paper with Scott Baker, Michael Gelman, and Lorenz Kueng, we measure the effect of anticipation on consumption. We leverage exogenous income changes from various state and federal transfer policies to demonstrate that U.S. consumers tend to increase spending in advance of income arrival. However, these anticipatory increases are relatively small compared to the substantial increases observed in the period following income receipt. Our analysis identifies two primary factors that jointly drive this behavior: present bias and salience. These factors explain both the small anticipatory response (excess smoothness) and the large spending response following the arrival of income (excess sensitivity). While liquid assets are associated with excess sensitivity in the post-income period, our findings suggest that this relationship is more likely driven by persistent household characteristics, such as present bias, rather than temporary conditions like binding credit constraints. Notably, individuals who respond strongly following income changes also tend to increase their spending the most in advance of the arrival of income. As most fiscal transfer policies are announced and debated well before their implementation, we conclude that quantifying the entire trajectory of intertemporal marginal propensities to consume, including anticipation effects, is essential for the design of optimal policy and judging of its welfare implications.

Relatedly, I am also interested in measuring economic agents' expectations and how they are related to financial market outcomes. In a paper with Jingoo Kwon and Younggeun Yoo, we propose a novel method of estimating agents' subjective uncertainty and cross-sectional disagreement. Even though subjective uncertainty and disagreement are distinct concepts, they are often used interchangeably in empirical research due to the challenge of observing subjective uncertainty as a separate factor. To measure subjective uncertainty, our research method exploits heterogeneity in how much dispersion in the point estimates decreases shortly after the introduction of a signal, which we call a "common benchmark" and which is perceived to be informative and yields homogeneous interpretation by most agents. Intuitively, such a decrease in dispersion would be greater if agents had higher subjective uncertainty prior to receiving the signal. We apply this approach to equity analysts' forecasts by leveraging their responses to the firms' earnings guidance (the common benchmark in this case) and estimating the analysts' implied beliefs at a firm and fiscal quarter level. Interpreting the analysts' estimated beliefs to be proxies for investors' subjective beliefs, we investigate how investors' subjective uncertainty and disagreement jointly affect returns, trading volume, and volatility in the stock market. For returns and trading volume, subjective uncertainty and disagreement move together, amplifying each other's effects. Regarding return volatility, however, we find that the correlation between subjective uncertainty and return volatility flips depending on the level of disagreement. Our results show that using disagreement and subjective uncertainty without explicit differentiation in empirical research may lead to misleading or even opposite results.

In another project, I am working on measuring the expectations of option market investors by leveraging account transaction data. Traditionally, there have been two ways of measuring expectations in financial markets: analyzing aggregated market-level dynamics and surveying. However, each method has its disadvantages. On the one hand, the market-level approach makes it challenging to incorporate heterogeneity since, for any given transaction, the buyer decides to buy while, simultaneously, the seller chooses to sell at the same price. On the other hand, survey answers do not correlate well with the actual actions of the survey participants. With these disadvantages in mind, I am working on an alternative way of measuring expectations that extracts expectations through transactions and holdings. After extracting and measuring expectations, I aim to examine how agent expectations change in the face of events and varying levels of predictability regarding future shocks.

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In a different early-stage project, I track how households and firms, who are two primary agents of the economy, have different ways of perceiving economic expectations: Households associate higher inflation with a higher unemployment rate and lower economic growth, while firms associate higher inflation with a lower unemployment rate and higher economic growth. The relationship is robust to household and firm characteristics and sample period, and the differences come from the perceived differences in relative changes between price and wage. I hope to examine the consequences of these differences, focusing on how households and firms respond differently to business cycles and how central banks implement monetary policies given the differences.

Lastly, I am interested in human capital, as it is an important source of generating income and economic growth. In a project with Bryan Seegmiller, Yufeng Wu, and Miao Ben Zhang, we investigate what firm characteristics are related to an increase in human capital. We show that firms' investments, especially intangible investments, positively influence workers' human capital growth. In addition, we point out that, since workers tend to move between firms, there is an external spillover of human capital and firms may not be able to retain the human capital that they cultivate. However, we also show how firms are still motivated to invest in human capital as they are able to internalize its benefits through high markup and profitability. Incorporating these ideas, we provide a model to explain the labor market dynamics of firms making hiring and investment decisions, taking into account workers' preferences to work for the "human capital incubator" firms.

In a project in its initial phase, I delve into two observations that I make on large firms: They used to pay higher wages compared to smaller firms and equal wages among their establishments, but both of these trends have been reversed in recent times. I expect to work on what drives these wage-setting changes and how the changes affect the local labor market and aggravate spatial inequality.

I have also been working on human capital from an educational perspective since education determines the accumulation of human capital in early life. In a paper with Christian Buerger and John Singleton, we investigate the effect of school financial reforms on low-income school districts. We find that additional school spending translates into improvements in students' academic performance only in states with test-based accountability measures in place. In another project with Ying Shi and John Singleton, we examine how access to selective education reduces inequality in the long run and identify that social networks serve a crucial role in making selective education more accessible.

NBER Digital Economics and AI Tutorial is an ideal opportunity for me to continue building on my research interests. Lectures from outstanding faculty will help me delve more deeply into my current fields of interest and explore a diverse array of related topics. Interacting with fellow attendees, I will also be able to refine my current research projects and build a foundation for future collaborations. I am eager to learn in the summer institute as a student aspiring to become an academic economist, and to contribute to the intellectual community working on digital economics and AI. I would be happy to provide any additional details that you need. Also, please feel free to contact Scott Baker (s-baker@kellogg.northwestern.edu), Bryan Seegmiller (bryan.seegmiller@kellogg.northwestern.edu), and Hyunseob Kim (hyunseob.kim@chi.frb.org) for references. Thank you for considering my application, and I look forward to hearing from you.

Sincerely,

Seung Hyeong Lee