Introduction

This thesis seeks to explore the importance of higher-order moments in the consumption Euler equation, both theoretically and empirically. Applying log-linearized versions of Euler equations has been a dominant approach to obtaining sensible analytical solutions, and a popular choice of model specifications for estimation. The literature however by now has been no lack of conflicting empirical results that are attributed to the use of the specific version of Euler equations. Important yet natural questions whether the higher-order moments can be safely ignored, or whether higher-order approximations offer explanations to the stylized facts remain unanswered. Such inquires as in the thesis thus can improve our understanding toward consumer behaviors over prior studies based on the linear approximation.

This thesis consists of three chapters. The first chapter seeks to provide better estimation performance on the structural parameters from estimating the higher-order approximated consumption Euler equation. This idea emerges from the many anomalies found in the Euler equation estimation. Despite the many empirical efforts devoted to estimating these parameters, estimates of these structural parameters seem to vary over a wide range, and even worse, they sometimes contradict each other or are inconsistent with their theoretical values. Carroll (2001b) and Ludvigson and Paxson (2001) provide a compelling explanation for these frustrating results. They argue that those empirical works that estimate preference parameters with a log-linearized or second-order approximated version of the consumption Euler equation are subject to significant approximation bias. Even so, the approximation technique continues to be useful and convenient in estimation of the parameters, because noisy consumption data renders consistent GMM estimation impossible. Motivated by its potential success in reducing the bias, in this

chapter, we investigate the economic significance and empirical relevance of higher-order approximations to the Euler equation with simulation methodology. The higher-order approximations suggest a linear relationship between expected consumption growth and its higher-order moments. Our simulation results clearly reveal that the approximation bias can be significantly reduced when the higher-order moments are introduced into estimation, but at the cost of efficiency loss. It therefore documents a clear tradeoff between approximation bias reduction and efficiency loss in the consumption growth regression when higher-order approximations to the Euler equation is considered.

The second part of our Monte-Carlo studies in chapter one then deals with the selection of the approximation order. The trade-off between bias reduction and the efficiency loss suggests an optimal order that can yield most favorable estimation performance. We judge whether a particular consumption moment to be included in the regression by the criterion of mean squared errors (MSE) that accounts for a trade-off between estimation bias and efficiency loss. The included moments leading to smaller MSE are regarded as ones to be needed in the regression. We also investigate the usefulness of the model and/or moment selection criteria in providing guidance in selecting the approximation order. We find that improvements over the second-order approximated Euler equation can always be achieved simply by allowing for the higher-order moments in the consumption regression, with the approximation order selected by these criteria.

Chapter two in this thesis seeks to further enhance the estimation performance, by utilizing the nonlinear relation between higher-order consumption moments. Our previous attempt to deliver more desirable estimation performance with higher-order approximations to the consumption Euler equation reveals that the approximation bias can be significantly reduced when the higher-order moments are introduced into estimation. This reduction in bias does come at the cost of the efficiency loss. It results from the difficulty in identifying independent variations in the higher-order moments by sets of linear instruments used to identify that in variability in consumption growth, mainly consisting of individual-specific characteristics. Thus, one of major challenges in the study is how to obtain quality instruments that are capable of doing so. With the numerical analysis

technique, we first establish the relation between consumption risk and higher-order consumption moments. This nonlinear relation is then utilized to form quality instruments that can better capture variations in higher-order moments. A novelty of this chapter lies in adopting a set of nonlinear instruments that is to cope with this issue. They are very simple moment transformations of the characteristic-related instruments, thereby easy to obtain in practice. As expected, our simulations demonstrate that for a comparable amount of the bias corrected, applying the nonlinear instruments does entail an inclusion of fewer higher-order moments in estimation. A smaller simulated MSE that reveals the improvement over our previous estimation results can thus be achieved.

Chapter three aims to offer a theoretical underpinning for the importance of the higher-order moments in a simple environment where economic agents have a quadratic-utility preference. The resulting Euler equation gives rise to a linear policy function in essence, or a random-walk consumption rule. The twist in our theory comes from a presence of borrowing constraint facing consumers. The analysis shows that the presence of the constraint induces precautionary motives for saving as responses from consumers to income uncertainties, even there has been no such motives inherent in consumers' preference. The corresponding value function now displays a convexity property that is virtually only associated with more general preferences than a quadratic utility. The analytical framework allows us to be able to characterize saving behaviors that are of precautionary motives, and their responses to changes in different moments of income process. As empirical implications, our analysis shed new light on the causes of excess sensitivity, the consequences of sample splitting between the rich and the poor, as well as the relevance of the higher-order moments to consumption dynamics, specifically skewness and kurtosis.