Information Uncertainty and Asset Prices

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Abstract

The main purpose of this dissertation is to examine the relationship between information uncertainty and asset prices. There are many anomalous phenomena in financial markets: the equity premium puzzle, the risk-free rate puzzle, the equity volatility puzzle, and the predictability of equity returns. The standard asset pricing model fails to capture these properties of financial markets. Therefore, I propose alternative asset pricing models that incorporate information uncertainty into the standard model.

If economic agents are uncertain about the current value of fundamentals, they should infer it from observable variables. This information uncertainty is an additional risk for agents, and their behaviors are quite different from what they would be if there is no information uncertainty. Therefore, asset prices that incorporate information uncertainty can also be quite different from those without information uncertainty. In this dissertation, I examine whether the existence of information uncertainty can help to resolve the asset pricing puzzles.

This dissertation is composed of four chapters. Chapter 1 is the introductory chapter. In this chapter, I describe the outline of this dissertation. I also present a brief review of related studies.

In Chapter 2, using a representative economic agent, I analyze the effect of the agent's distorted beliefs on asset prices. I consider the situation where aggregate consumption follows a Markov regime-switching process, and where the agent cannot observe the drift rate of the aggregate consumption process. Under this circumstance, the agent infers the current drift rate from realized values of past consumption growth.

I further assume that the agent's beliefs deviate from beliefs of an expected utility agent. I attribute the distortion of the agent's beliefs to his/her optimal choice among various estimators. I specify the loss function in the agent's estimation problem as a weighted squared error, where weights are state dependent. In this case, the agent's optimal estimator of the drift rate of consumption deviates from its expected value calculated through the Bayesian posterior probability. That is, the agent optimally adopts a biased estimator, while he/she is well aware of its bias. In this sense, the agent in this chapter has distorted but rational beliefs.

If the agent places more weight on higher (lower) growth states, he/she optimally behaves as an optimist (a pessimist). Under power utility assumption, it is shown that the agent's pessimistic beliefs generate a high equity premium with low risk-free rates, unless the agent is highly risk averse. In addition, the fluctuation in the agent's posterior beliefs generates many interesting dynamic properties of asset prices, including the procyclical variation in equity prices and the countercyclical variation in both equity premia and volatilities.

It is also shown that, if the agent is highly risk averse, the agent's pessimistic beliefs increase equity prices. In this case, the covariance between equity returns and consumption growth becomes negative, and the agent's pessimistic beliefs lower the average equity premium.

The results in Chapter 2 suggest that, under power utility assumption, the agent's pessimistic beliefs do not necessarily help to resolve the equity premium puzzle. Under power utility, the agent's intertemporal elasticity of substitution (IES) is the reciprocal of the agent's relative risk aversion (RRA). As a result of this strong restriction of power utility, the effect of the IES and that of the RRA on asset prices is distorted. Therefore, to analyze the effect of information uncertainty on asset prices, it would be more suitable to assume a utility function that allows us to separate the IES from the RRA.

In Chapter 3, using a representative agent, I analyze the effect of information uncertainty about rare economic disasters on asset prices. In particular, I examine whether the possibility of persistent economic disasters generates high volatility of equity returns.

It is well known that the possibility of economic disasters helps to resolve both the equity premium puzzle and the risk-free rate puzzle. However, if the probability of disasters is constant over time, and if the agent knows the true cost of disaster, equity prices should not fluctuate far beyond their fundamentals. That is, the asset pricing model with constant disaster probability cannot explain the equity volatility puzzle.

I then assume that the agent cannot observe the current regime, the normal regime or the disaster regime. The agent estimates the posterior probability of the current regime in each period. In this model, the fluctuations in the agent's posterior probabilities are an additional source of equity volatility.

In this chapter, it is also assumed that the agent's preferences are represented by the stochastic differential utility (SDU). This utility function allows us to disentangle the agent's IES from the agent's RRA. The distinction of these two intrinsically different aspects of the agent's attitude is important, particularly when we analyze the effect of persistent, not instantaneous, disasters on asset prices.

The simulation results show that, when the agent's preferences are represented by SDU, the model in this chapter replicates the historical volatility of equity returns, as well as the historical averages of both equity returns and risk-free rates. Furthermore, in this model, both equity returns and risk-free rates are negative on average during disasters. In particular, large declines in equity prices are accompanied by high volatility of equity returns at the beginnings of disasters, which is consistent with empirical findings.

However, if the agent's preferences are restricted to power utility, the possibility of rare disasters cannot generate high volatility of equity returns nor large equity premia. In particular, when the agent is highly risk averse, equity prices rise during disasters. In this case, the average equity premium is negative, because equity is more favorable asset for the agent than the risk-free asset.

These results suggest that the distinction between the agent's RRA and the agent's IES is essential, when we analyze the effect of persistent disasters on asset prices. It is also shown that the fluctuation in agents' beliefs or sentiments is an essential source of the volatility of equity returns.

In Chapter 4, I analyze the effect of interaction among heterogeneous agents on equity prices. I assume information asymmetry among agents. Informed agents can observe the fundamental value of equity. Although uninformed agents cannot directly observe the fundamental value, they infer it from realized values of equity prices.

I further classify uninformed agents into two different groups according to their beliefs. It is shown that, if uninformed agents believe that the equity price is less volatile than its fundamental value, they will act as trend followers who increase their equity demands when realized past equity returns are relatively high. By contrast, if uninformed agents believe that the equity price is more volatile than its fundamental value, they will act as contrarians that increase their equity demands when past equity returns are relatively low. Then, the equity price is derived through the market clearing condition.

It is shown that the model in this chapter explains many anomalous phenomena in the equity markets, including excess volatility, the momentum effect, and the mean-reverting effect of equity returns. The existence of contrarians makes equity prices respond sluggishly to fluctuations in their fundamental values, which can generate the momentum effect. The existence of trend followers causes equity prices to respond excessively to changes in their fundamental values, which can generate both the excess volatility of equity returns and the mean-reverting effect. Interaction among these agents can simultaneously generate the momentum effect in the short term and the mean-reverting effect in the long term.

The empirical results indicate that the model in this chapter can explain differences in the behavior of the returns of large-cap and small-cap equities in the U.S. market. In particular, the difference in returns behavior between small- and large-cap equities can be explained by differences in the composition of investors.