Journal of Monetary Economics 69 (2015) 70–89

Contents lists available at ScienceDirect

Journal of Monetary Economics

journal homepage: www.elsevier.com/locate/jme

Growth uncertainty, generalized disappointment aversion and production-based asset pricing

Hening Liu [a], Jianjun Miao [b,c,d,*]

[a] Accounting and Finance Group, Manchester Business School, University of Manchester, Booth Street West, Manchester M15 6PB, UK
[b] Department of Economics, Boston University, 270 Bay State Road, Boston MA 02215, USA
[c] CEMA, Central University of Finance and Economics, Beijing, China
[d] AFR, Zhejiang University, Hangzhou, China

ARTICLE INFO

Article history:
Received 22 May 2014
Received in revised form
5 November 2014
Accepted 2 December 2014
Available online 15 December 2014

Keywords:
Equity premium
Asset pricing
Business cycles
Disappointment aversion
Volatility risk
DSGE model
Markov switching

ABSTRACT

We study a production economy with regime switching in the conditional mean and volatility of productivity growth. The representative agent has generalized disappointment aversion (GDA) preferences. We show that volatility risk in productivity growth carries a positive and sizable risk premium in levered equity. Our model can endogenously generate long-run risks in the volatility of consumption growth observed in the data. We show that introducing leverage with a procyclical dividend process consistent with the data is critical for the GDA preferences to have a large impact on equity returns.

1. Introduction

Financial data have provided many stylized facts that are challenging for standard economic models to explain. For example, the mean and volatility of the equity premium are high, the mean and volatility of the riskfree rate are low, and the conditional equity premium is time varying and moves with business cycles countercyclically (Shiller, 1981; Mehra and Prescott, 1985; Campbell, 1999). Using the consumption-based asset pricing approach in the finance literature, one needs to introduce either various sources of risk into the exogenously given aggregate consumption process or nonstandard preferences into the representative agent model. An important source of risk is the long-run risk in the mean and volatility of consumption growth (Bansal and Yaron, 2004; Hansen et al., 2008; Bansal et al., 2014). Nonstandard preferences are crucial for how risks are perceived and priced in the market.[1]

* Corresponding author at: Department of Economics, Boston University, Boston MA 02215, USA. Tel.: +1 617 353 6675.
E-mail addresses: Hening.Liu@mbs.ac.uk (H. Liu), jianjunmiao9@gmail.com, miaoj@bu.edu (J. Miao).

[1] Important nonstandard preferences include Epstein–Zin preferences (Epstein and Zin, 1989), habit formation preferences (Campbell and Cochrane, 1999), disappointment-aversion preferences (Gul, 1991; Routledge and Zin, 2010), and ambiguity-sensitive preferences (Hansen and Sargent, 2010; Ju and Miao, 2012).

http://dx.doi.org/10.1016/j.jmoneco.2014.12.002
0304-3932/

The importance of volatility risk or time-varying macroeconomic uncertainty has also been noticed in the recent macroeconomics literature.[2] This literature typically studies dynamic stochastic general equilibrium (DSGE) models and focuses on the implications for quantities rather than asset prices. While DSGE models are more coherent in that consumption and dividends are endogenous, they typically fail to explain many asset pricing puzzles (e.g., Rouwenhorst, 1995).

The goal of this paper is to provide a production-based asset pricing model with time-varying macroeconomic uncertainty by linking the preceding two strands of the literature. In addition to capital adjustment costs and financial leverage, our model has two key features. First, we assume that aggregate productivity growth follows a Markov-switching process (Hamilton, 1989). In particular, the conditional mean and the volatility of aggregate productivity growth follow two independent two-state Markov chains. The persistent changes in the mean and volatility capture long-run risks in the expected productivity growth and the time-varying macroeconomic uncertainty, respectively. We estimate the Markov-switching model for the historical productivity growth data from 1956:Q1 to 2012:Q4. Our empirical estimates strongly support the presence of shifts in mean and volatility regimes, with volatility regimes being more persistent. We show that an increase in the volatility of productivity growth reduces consumption as in the data and raises marginal utility. Thus the model implied market price of productivity volatility risk is negative. Since aggregate stock returns are negatively exposed to this risk both in the data and in the model, the volatility risk carries a positive risk premium.

Second, we assume that the representative agent has generalized disappointment aversion (GDA) preferences that are recently introduced by Routledge and Zin (2010). As in Routledge and Zin (2010), we embed GDA in the Epstein and Zin (1989) recursive utility framework to further disentangle risk aversion from the elasticity of intertemporal substitution (EIS). Compared with an agent with Epstein–Zin preferences, the agent with GDA preferences puts more weight on disappointing outcomes below a threshold set at a proportion of the certainty equivalent of the continuation value. This causes the pricing kernel to be more countercyclical than that for the Epstein–Zin utility, thereby helping raise the mean and volatility of the equity premium. Unlike the Epstein–Zin utility, GDA preferences imply first-order risk aversion, which has a large quantitative impact on the risk premium in levered equity. Moreover, GDA preferences generate stronger precautionary saving motives and hence help lower the riskfree rate.

The two welfare theorems hold true in our model. We thus solve the social planner's problem to derive the equilibrium allocation. Our calibrated model can generate endogenous long-run risks in the mean and volatility of consumption growth observed in the data. We estimate a Markov-switching model of consumption growth using the US data from 1956:Q1 to 2012:Q4. This model is a nonlinear version of the long-run risks model studied in Bansal and Yaron (2004). Our estimates are broadly consistent with Lettau et al. (2008) and Boguth and Kuehn (2013). Using model simulated consumption data, we can closely replicate persistent volatility regimes estimated using the US data. Thus our production-based model provides a foundation for the consumption process adopted in the long-run risk literature.

We find that preference parameters related to risk attitudes have a very small effect on the volatility of the equilibrium allocation, which is determined mainly by the EIS parameter and the capital adjustment cost parameter. This result is related to the finding of Tallarini (2000) for the Epstein–Zin utility. Our analysis shows that, like the risk aversion parameter, the GDA parameters do not matter much for the volatility of the allocation.

We turn to the asset pricing implications by studying a decentralized competitive equilibrium. We find that preference parameters related to risk attitudes have a large effect on asset returns and the first moments of the allocation. A higher degree of disappointment aversion induces a stronger precautionary saving motive and hence a lower riskfree rate and higher average capital. Analyzing equity returns in the model is less straightforward since firm payouts in the model do not correspond to the observed aggregate public equity dividends in the data. In our model the market value of the firm is equal to Tobin's Q times the capital stock and the return to firm payouts (the unlevered equity return) is equal to the investment return. This return does not correspond to the equity return in the data. We show that unlevered equity premium is very small even though we calibrate the risk aversion parameter and the GDA parameter at high values. The reason is that firm payouts are countercyclical in the model: investment rises too much relative to output in response to a positive productivity shock.

We then follow Jermann (1998) and introduce financial leverage to the model. This modeling raises the (levered) equity premium significantly. But it is still too low, about a half of the mean equity premium in the data. This is because dividend growth is still countercyclical even though its volatility is much higher than that in the data. To overcome this problem, we calibrate dividends as levered claims to consumption so that their moments are consistent with the data. In this case our model can match the historical mean riskfree rate and mean equity premium based on much more reasonable values of the risk aversion and GDA parameters.

In our calibration with GDA, capital adjustment costs are small and the EIS is greater than unity. These parameter choices enable our model to produce smooth consumption growth and volatile investment growth observed in the data. Small adjustment costs imply a small real friction in capital accumulation, causing investment to react strongly to productivity fluctuations. A high EIS implies a large substitution effect and a low desire to smooth consumption. This causes consumption to rise less in response to a permanent shock to productivity growth. Thus a high EIS reduces consumption growth volatility in our model.

The long-run risks literature typically assumes that the EIS is greater than unity. But we recognize that the estimate of the EIS is under debate in the literature (e.g., Hall, 1988; Campbell and Mankiw, 1989, among others). Bonomo et al. (2011)

[2] See, e.g., Justiniano and Primiceri (2008), Bloom (2009), Gilchrist et al. (2013), Born and Pfeifer (2012), Fernandez-Villaverde et al. (2011), Bloom et al. (2013), Basu and Bundick (2012), and Leduc and Liu (2013).