2.3 Instability, Asymmetry, Non-linear Effects and Volatility Dynamics

So far we discussed papers that study linearlized systems dynamics around a steady state after an unanticipated zero probability adverse aggregate shock. Brunnermeier and Sannikov (2010) build a continuous time model to study full equilibrium dynamics, not just near the steady state. This model shows that the financial system exhibits some inherent instability due to *highly non-linear effects*. Unlike in the log-linearlized models, the effects are asymmetric and only arise in the downturn. Since investors anticipate possible adverse shocks, they endogenously choose a safety cushion – a fact that will be the focus of Section 4. This behavior mitigates moderate shocks and hence amplification effects are much milder near than below the stochastic steady state. However, in response to more significant losses, experts choose to reduce their positions in the light of high volatility, affecting asset prices and triggering amplification loops. Overall, the system is characterized by relative stability, low volatility and reasonable growth around the steady state. However, its behavior away from the steady state is very different and best resembles crises episodes as large losses plunge the system into a regime with high volatility. In short, the system exhibits an interesting endogenous volatility dynamics due to systemic risk and explains the asymmetry (negative skewness) of business cycles. Most interestingly, the stationary distribution is double-humped shaped suggesting that (without government intervention) the dynamical system spends a significant amount of time in the "crises states" once thrown there.

Like KM97, BruSan10 depart from a single aggregate production function. Hence, capital can be redeployed to a different sector and the market illiquidity of physical capital is endogenously determined. More specifically, experts are more productive and produce output at a constant returns to scale rate

$$y_t = a\, k_t,$$

while less productive households produce at a constant returns to scale rate

$$\underline{y}_t = \underline{a}\, \underline{k}_t$$

with $\underline{a} < a$. In addition, capital held in households' hands depreciates at a faster rate $\underline{\delta} \geq \delta$. More specifically, capital managed by the productive experts evolves according