My thesis focuses on the theoretical and empirical aspects of the time series modelling during different financial and economic conditions. It consists of three separate chapters in which the properties of Threshold Vector Autoregressive Model (TVAR) models are addressed with subsequent applications to equity and fixed income markets.

In the first chapter, which is a joint work with my supervisor Lars Stentoft, we examine the steady state properties of the TVAR model. Assuming the trigger variable is exogenous and the regime process follows a Bernoulli distribution, we derive the necessary and sufficient conditions for existence of a stationary distribution. The derived stationarity conditions for the TVAR model could help to validate the existing and future empirical studies, which are using these type of framework. We analyze a situation related to so-called "locally explosive models", where the stationary distribution exists though the model is explosive in one regime. Using simulation methods we show that locally explosive models can generate some of the key properties of financial and economic data, usually implied by the literature on bubble formation. Thus, having closed form solution for the stability properties, which describe locally explosive model, could be potentially useful for the studies of bubbles in a multivariate setting. We also demonstrate that assessing the stationarity of threshold models based on simulations might well lead to wrong conclusions, which highlights the caveats of making inference in non-linear threshold models.

In the second chapter, I study the stock market liquidity and volatility relation over the period of 2000 – 2015 in a multivariate regime switching setting. I build a tractable TVAR model for stock volatility and liquidity with two regimes, which are defined endogenously by the past level of stock market liquidity. I find supporting evidence that the link between liquidity and volatility is non-linear and this result is robust for all stocks. My model demonstrates that the relationship between market liquidity and volatility is stronger when market liquidity is low. Interestingly, the model shows that volatility might not affect liquidity of some stocks when liquidity low. This is a new result in the recent literature and will be explored further using a larger sample of stocks in the future work. I demonstrate that a shock to the market liquidity and volatility can lead to vicious cycles when liquidity remains low forever, which is related to the liquidity and volatility spirals observed in the data. On the other hand, I find supporting evidence that a single negative shock to volatility and liquidity is not enough to create the explosive series when the model evolves between regimes. Finally, I show that there is some sign and size asymmetry of the liquidity impact on volatility.

In the third paper, I model the distribution of the interest rates of the Canadian Government Bonds during normal times and Zero Lower Bound (ZLB) period. I examine the properties of the interest rates around ZLB periods and show that its whole distribution changes in this regime. To capture this effect, I propose to use the mixture of t-scaled and Gaussian distributions with time-varying weights. The estimated mixture of distributions model defines two different distributions with the sharp transition between them at around 1.0% level of the short interest rate. I show that the resulting model leads to more accurate empirical performance when compared to the standard (one-regime) models used in the literature. The proposed mixture of distribution model has several appealing applications. First, it could improve the modelling framework in the derivative pricing and risk management in the ZLB environment. In particular, we can price interest rate derivatives with negative value of the underlying rate, which is impossible in standard models. Second, my model could be useful in accessing the effect of unconventional monetary policy during, for example, the recent financial crisis and its aftermath characterized by ZLB regime.