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Towards an asymmetric long run equilibrium between stock market uncertainty and the yield spread. A threshold vector error correction approach

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ABSTRACT

This paper investigates the interrelationships and the asymmetric co-movements between the yield spread, macroeconomic factors and the stock market volatility across five major world economies. We highlight the non-linear adjusting process of the yield spread to its equilibrium value in response to changes in stock market volatility by using a consistent threshold cointegration error correction model. Our findings differ for different countries and for states of the economy. We find that for the US, the UK, Japan, and France, the adjustment of the yield spread towards its equilibrium value portrays the existence of negative asymmetric market volatility transmission. In addition, differences in the magnitude of the effects denote that yield spread changes in Japan and France appear to significantly adjust more swiftly to equilibrium values compared to the US where a higher degree of persistence is observed. Last, our results suggest evidence of bi-directional time varying Granger causality between the yield spread and stock market volatility for all countries, in both the pre- and post-crisis period.

1. Introduction

Nowadays, all major central banks have set their policy rates either at zero (FED, Bank of England) or even at negative levels (ECB, Bank of Japan) in order to fight very low inflation and support lending and domestic demand. With inflation remaining below target, central banks require maintaining nominal policy rates at or below zero, along with the implementation of unconventional measures which include asset purchase programs, thus resulting in bringing longer term rates further down. In fact, many recent studies have been witnessed that these asset purchase programs were successful at flattening the yield spread, i.e. the difference between long term rates and short term rates (Joyce et al., 2011; Hamilton and Wu, 2012); therefore resulting in dramatically changing the shape of the yield spread in the post-financial crisis period. Furthermore, binding constraints as a result of the crisis amplified financial accelerator effects and have driven asymmetries in the macroeconomic variables (Guerrieri and Iacoviello, 2015). To this end, the impact of macroeconomic dynamics of the yield spread and vice versa, as a result of changes in financial factors has also changed perceptibly (Medeiros and Rodriguez, 2011), while investors

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might also modify their demands for compensation risk, thus resulting in increased stock market volatility (Li, 2016). In light of the above discussion, this paper investigates the interrelationships and the asymmetric co-movements that have been rising between yield spread, macroeconomic factors and stock market volatility across five major world economies.

Addressing this issue is a challenge, because it is not always easy to disentangle the interrelationships that may exist between the yield spread and macroeconomic factors and particularly between the yield spread and stock market uncertainty. The challenge is even bigger when it comes to incorporate non- linear dynamics between these variables. Within our modelling framework and depending on the importance of market uncertainty as expressed by a market volatility index, we investigate and discuss the existence of non-linear short run casual relationships and long run equilibrium mechanisms that characterize the relationship between the yield spread and macroeconomic variables as well as the yield spread and stock market volatility. A large number of studies have highlighted the strong interaction between macroeconomic factors and the yield curve. Since the pioneered study of Estrella and Hardouvelis (1991) and Estrella and Mishkin (1997), who provide arguments for the usefulness of the yield spread as predictor of future economic activity and recessions, there have been an increasing number of papers investigating further this issue. We can refer for instance to Dotsey (1998), Hamilton and Kim, (2002), Kauppi and Saikkonen, (2008), and Evgenidis and Siriopoulos, (2014), who added evidence on the forecasting ability of the yield spread for the US, as well as many others who verify this relationship in the international context (see for example Estrella and Mishkin, 1997; Venetis et al., 2003; Nyberg, 2010).

There are many theoretical rationales which can explain the power of the yield curve to predict changes in future economic activity (Fama, 1984; Harvey, 1988; Mishkin, 1990). The counter cyclical monetary policy is one of the main reasons explaining this relationship. For instance, monetary authorities, in order to moderate the increase in inflation rate, will follow a tightening policy by raising short term rates, thus flattening the yield curve. Another rationale comes from the expectations hypothesis. Accordingly, if market participants anticipate a boost in the economy, then expected future interest rates rise relative to current short rates, thus leading to a steepening of the yield curve. Further, income and productivity shocks also justify the positive relationship between the spread and output growth. In particular, the anticipation of lower income as a result of an expected economic downturn leads agents to buy long term bonds today. This leads to a reduction of long term rates which results in an inverted yield curve.

Building on the significance of the relationship between yield spread and macroeconomic activity, another group of researchers considered, initially, the interaction of term structure models with three latent factors, namely, level, slope and curvature (Diebold et al., 2006) and later they control for the existence of observed macroeconomic variables (Diebold et al., 2006; Ludvigson and Ng, 2009; Favero et al., 2012). The focus of these studies on such approaches is explained by the fact that it relates closely with the vast literature on the power of the yield curve slope (and possibly the curvature) to predict fluctuations in real economic activity and inflation and on the relation of the level with inflation expectations (Ang et al., 2006; Rudebusch and Williams, 2008).

This paper assesses these issues from a different angle, by discussing and investigating the casual time-varying relationships that drive the yield spreads in the short run, uncovering the equilibrium mechanisms that are being developed in the long run and modelling the asymmetric adjusting process towards its long term equilibrium levels. Therefore, out study innovates and contributes in filling some existing gaps in the literature in at least four dimensions.

Firstly, we set up an empirical approach, based on Hansen and Seo (2002) threshold error correction model (T-ECM), to link the dynamics that drive movements in the yield spread and uncover the asymmetric short and long run relationships that lie behind. In particular, our modelling approach can be employed to capture possible non-linearities that arise as a result of the financial constraints that have become more binding in the post-2007 financial crisis period, leading to the presence of asymmetries and regime specific behaviours (see for instance Bianchi, 2010; who introduces binding constraints to macroeconomic models in order to study asymmetries in business cycles). Moreover, according to Tsagkanos and Siriopoulos (2013), the estimations of standard linear cointegrating regressions are biased when the sample period is not smooth; as a result, the short and long run parameters of the model may be subject to structural instability. Threshold cointegration methods have been applied mainly in term structure theory (Enders and Siklos, 2001; Bec et al., 2008; Krishnakumar and Neto, 2009). Other fields include the Fisher effect, financial integration based on comparing local and the US stock markets (Jawadi et al., 2009) and the exchange rate transmission mechanism (Al-Abri and Goodwin, 2009). However to the best of our knowledge, no study has allowed before for employing asymmetric threshold cointegration tests and modelling the adjustment process of the yield spread towards its equilibrium value.

Second, within our modelling framework, we highlight the importance of macroeconomic uncertainty in capturing the long run equilibrium mechanisms of the yield spread. But, except for the predictive impact of macroeconomic variables, there is a growing literature that deals with the impact of stock market uncertainty in various dimensions of the economy, following the last financial crisis (see for example, Arellano et al., 2012; Caggiano et al., 2014). We follow Bloom (2009), by using the VIX, the implied stock market volatility index, which reflects changes in investors' attitudes towards risk and as such it can be considered as a measure of time-varying stock market volatility. There have been some previous efforts to investigate the co-movements between interest rates and stock market volatility. Zhou (1996), find that long-term interest rates explain a major part of the variation in dividend-price ratios and suggests that the high volatility of the stock market relates to the high volatility of long-term bond yields and may be accounted for by changing forecasts of discount rates. Campbell and Taksler (2003) identified important effects of stock market volatility on bond yield volatility while Siddiqui (2003) drew important lessons on the forecasting power of interest rate changes for future stock price volatility in Germany. Our hypothesis about the connection between stock market uncertainty and the yield spread is more closely related to the