G Model
RIBAF-246; No. of Pages 21
ARTICLE IN PRESS

Research in International Business and Finance xxx (2012) xxx–xxx

Contents lists available at SciVerse ScienceDirect

Research in International Business and Finance

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

The forecasting efficiency of the dynamic Nelson Siegel model on credit default swaps

Frances Shaw*, Finbarr Murphy, Fergal O'Brien

Department of Accounting and Finance, Kemmy Business School, University of Limerick, Ireland

ARTICLE INFO

Article history:
Received 27 January 2012
Accepted 6 August 2012
Available online xxx

Keywords:
Term structure of credit default swaps
Nelson Siegel
Forecasting

ABSTRACT

This paper extends the Diebold–Li dynamic Nelson Siegel model to a new asset class, credit default swaps (CDSs). The similarities between the term structure of CDSs and the term structure of interest rates allow CDS curves to be modelled successfully using a parsimonious three factor model as first proposed by Nelson and Siegel (1987). CDSs and yield curves are modelled using the Diebold and Li (2006) dynamic interpretation of the Nelson Siegel model where the three factors are representative of the level, slope and curvature of the curve. Our results show that the CDS curve fits the data well and allows for the various shapes exhibited by the CDS data including steep, inverted and downward sloping curves. In addition to in sample fit of the modelled curve we explore the out of sample forecasting abilities of the model and using a univariate autoregressive model we forecast 1, 5 and 10 days ahead. Our results show that although the one day ahead forecast under performs the random walk, the 5 and 10 day forecast consistently outperforms the random walk for both yields and CDSs. This study reaffirms the ability of the Diebold–Li (2006) methodology to forecast yields and provides new evidence that this methodology is efficacious when applied to CDS spreads.

1. Introduction

Modelling the term structure of interest rates has long been an important aspect of finance. Unsurprisingly, significant effort has been placed on creating an accurate model for the estimation of the

* Corresponding author. Tel.: +353 61 234714.
E-mail address: frances.shaw@ul.ie (F. Shaw).

0275-5319/$ – see front matter © 2012 Elsevier B.V. All rights reserved.
http://dx.doi.org/10.1016/j.ribaf.2012.08.007

Please cite this article in press as: Shaw, F., et al., The forecasting efficiency of the dynamic Nelson Siegel model on credit default swaps. Res. Int. Business Finance (2012), http://dx.doi.org/10.1016/j.ribaf.2012.08.007

yield curve and by extension a model to successfully forecast the term structure of interest rates. One such model that has been successful in yield curve modelling is that of Nelson and Siegel (1987) and its many extensions, the most popular being the Svensson (1994) model. This research does not however, look at the term structure of interest rates. Instead it looks at credit derivatives and proposes a new method of fitting and forecasting the credit default swap (CDS) curve. This is done by applying the Nelson Siegel yield curve model to the term structure of CDSs and forecasting the Nelson Siegel factors as a univariate autoregressive process. We show that we can model the level, slope and curvature of the CDS curve efficiently and accurately using the Nelson Siegel method and our autoregressive forecasting model produces encouraging results, consistently outperforming a random walk approach over longer forecasting horizons.

The Nelson Siegel model is a parametric parsimonious model for the estimation of the yield curve; it is a three factor model that provides the flexibility to represent the typically observed monotonic, humped and S-shaped curves. Originally proposed almost 25 years ago, the Nelson Siegel model continues to be one of the principle models used in finance for the estimation of the yield curve. Since 1996, participating central banks have been reporting their yield curve estimates and estimation methods to the bank for international settlements. A 2005 report,[1] shows that when estimating the term structure of yield curves the majority of central banks adopt a Nelson Siegel model or an extended model as suggested by Svensson (1994) with 8 out of the 13 reporting banks choosing one of these methods of estimation. The remaining central banks choosing to use spline based models such as that developed by Fisher, Nychka and Zervos (1995) that extend more traditional cubic spine techniques (see Vasicek and Fong, 1982 for an example).

In addition to the modelling of the yield curve, there has been an increasing emphasis on producing a model that successfully predicts the zero rate curve (see Fama and Bliss, 1987; Campbell and Shiller, 1991; Cochrane and Piazzesi, 2002; Diebold and Li, 2006). Building on the Nelson Siegel model, Diebold and Li (2006) propose an autoregressive time series forecasting model in which they distil the entire yield curve, period by period, into three dynamically evolving dimensional parameters. They show that these parameters can be interpreted as factors and that their method facilitates precise estimation of these factors which in turn, can be interpreted as the level, slope and curvature of the curve. Through empirical testing of their model, Diebold and Li find that their one-year-ahead forecasts notably outperform standard benchmarks.

Owing to the empirical success of the Nelson Siegel class of models this method of estimation has been applied to bond credit spread curves to estimate the credit spread curve (Van Landshoot, 2004) and (Jankowitsch and Pichler, 2004) and more recently to credit curve forecasting using the Diebold–Li model (Krishnan et al., 2010). It may be seen as a natural progression that these models should be extended to examine credit derivatives, especially credit default swap (CDS) curves, an area which, to our knowledge, has not yet been explored with this method of modelling and forecasting.

Since the introduction of the Black and Scholes (1973) and Merton (1974) structural model, there has been much debate on the valuation of risky corporate debt. Several papers have looked to determine the dynamics of the corporate credit spread, including Longstaff and Schwartz (1995), Collin-Dufresne et al. (2001) and Van Landshoot (2004), however these models are primarily concerned with the pricing of risky bonds and not the pricing of credit derivatives such as CDSs. In addition there is little research in the area of forecasting the credit curve.

Credit derivatives are over-the-counter instruments designed to transfer credit risk from one party to another by way of a bilateral agreement; their value is derived from the credit risk of an underlying reference entity. The-over-the-counter nature of credit derivatives provides the structural flexibility and exposure to credit risk in ways that is not possible with bonds. The most commonly traded credit derivative is the credit default swap (CDS). CDSs have similar characteristics to corporate bonds but have the advantage of being pure credit instruments allowing investors to invest solely in the credit risk of an entity as CDSs are in large part isolated from further risks such as interest rate, currency and tax risk. Daily quoted CDS prices for varying maturities give rise to a curve similar in shape and dynamics to that of an interest rate curve. Credit derivatives arose from demand by financial institutions to

[1] BIS (2005) *Zero-Coupon Yield Curve: Technical Documentation* (Bank for International Settlements, Basle).

Please cite this article in press as: Shaw, F., et al., The forecasting efficiency of the dynamic Nelson Siegel model on credit default swaps. Res. Int. Business Finance (2012), http://dx.doi.org/10.1016/j.ribaf.2012.08.007