CDS Spreads and Option Volatility during Crises

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1 Extended Abstract

The intrinsic relationship between credit spreads and equity volatility is underlined in the seminal work by Merton (1974). This relation has been studied extensively in the literature, using the yield spread computed from bonds for the credit spread and mean squared returns for the equity volatility, see Campbell and Taksler (2003) and Collin-Dufresne et al. (2001), among many others. More recently, the rapid development of the credit default swap (CDS) market has provided convenient products to extract credit risk, whilst the use of implied volatility has also provided a deeper alternative way to quantify equity volatility. Therefore, over the last years many studies have focused on the interaction between credit default swap spreads and implied volatility. A first set of papers analyzes the relation between the 5-year CDS spread and the at-the-money (ATM) 1-month implied volatility, to name only a few see Benkert (2004), Forte and Pena (2009), and Zhang et al. (2009).

However, the skewness of the smile and the slope of the credit default swap curve contain important information. For example, Cremers et al. (2008) analyze the impact of both implied volatility (ATM) and the implied volatility skew on corporate *bond* credit spreads (long and short maturities) and find that these variables have strong explanatory power. Carr and Wu (2010) find a significant correlation between the smile and the skew and the *average* (along the term structure axis) of the CDS spread on corporate data. Carr and Wu (2007) analyze the interaction between sovereign CDS spreads and currency options. The smile dynamics is synthesized through option strategies (straddles, risk reversals, butterfly spreads) that capture different aspects of the smile, such as the level or the slope, whilst each CDS maturity is studied individually. A strong relation is found between all these variables. Cao et al. (2010) analyze the 5-year CDS spread along with the at-the-money implied volatility and the implied volatility skew. Hui and Chung (2011) study the 10-delta dollar-euro implied volatility in relation to the *5-year* sovereign credit default swap spread. These authors conclude that both level and slope of the smile contain relevant information for the credit market.

The term structure of interest rates is known to convey relevant economic and financial information, see Viceira (2012) and António and Martins (2012), among others. In comparison, the term structure of CDS spreads has attracted less attention, although some recent papers underline its importance. For example, Zhang (2008) studies the default risk premium for Argentine sovereign debt jointly with some macroeconomic variables, whilst Pan and Singleton (2008) apply a similar framework to Mexico, Turkey, and Korea. Han and Zhou (2010) find that the term structure of CDS spreads explains log

stock returns, hence the slope of the CDS curve contains relevant information for the stock dynamics. To sum up, the slope of the CDS curve carries important financial information beyond the level of the CDS curve (usually given by the 5-year CDS spread).

These remarks have lead to the development of a joint analysis of the *entire* implied volatility surface and the *entire* term structure of CDS spreads in Da Fonseca and Gottschalk (2012). For the smile the factor decomposition proposed in Cont and Da Fonseca (2002) is used, whilst for the CDS curve the classical approach presented in Litterman and Scheinkman (1991) is applied. The interaction between the implied volatility and CDS factors is developed for the index pairs S&P500/CDX.NA.IG and EuroStoxx/iTraxx-Europe using a daily sample from January 2007 to December 2011. The results indicate that for the European market a reasonably efficient *cross-market* hedge can be performed, whereas for the US market the relation between the two markets is time-varying and can be weak, thus it is in contradiction with the intrinsic relation that ties these two markets together.

It is well-known that from 2009 onwards the European markets have experienced very different behavior. As both the EuroStoxx and the iTraxx-Europe index aggregate entities from different European countries, it is of interest to understand to which extent market linkages are preserved if the analysis is performed at the country level. Using a sample from April 2007 to September 2012 for major European index options (CAC40, FTSE100, DAX30, IBEX40, MIB40) and the term structure of CDS spreads computed for each country, we analyze the joint evolution of these two markets.

We find that during the US credit crisis the relation between the European credit and volatility markets breaks down although both of them are affected by the crisis. Beyond 2009 for the UK and German markets, which were less affected by the European crisis, the relation between credit risk and volatility remains strong, thus allowing cross-hedging to be performed. For the Ibex, which experienced financial turmoil during that period, we obtain similar results (though slightly weaker). For the French and Italian markets, the inter-market connection breaks down although the volatility and credit markets are highly volatile during the sample period. As a consequence, performing cross-hedging is likely to lead to poor results. This is problematic because, as by construction these two markets are related, during the last years the market practice of using put options to hedge credit risk has experienced tremendous growth (for a theoretical justification see Carr and Wu (2011)).

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