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Equity market information and credit risk signaling: A quantile cointegrating regression approach☆,☆☆

Hayette Gatfaoui

IÉSEG School of Management (LEM – CNRS 9221), Finance, Audit & Control Department, Socle de la Grande Arche, 1 Parvis de la Défense, 92044 Paris La Défense Cedex, France
Centre d'Économie de la Sorbonne (CES), Université Paris I – Panthéon-Sorbonne, France

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ABSTRACT

Investigating linkages between credit and equity markets, we consider daily aggregate U.S. CDS spreads as well as well-chosen equity market and implied volatility indexes over ten years. We describe such robust (to spurious correlation) relationship with the quantile cointegrating regression approach. Such approach handles extreme quantiles/CDS values and their behavior with respect to the equity market's influence. Heteroskedastic patterns such as time-varying variance, but also autocorrelation, skewness and leptokurtosis are captured. Thus, the sensitivity of aggregate CDS spreads to equity market price and volatility channels is accurately measured across quantiles and spreads. Such quantile-dependent sensitivity exhibits asymmetric responses to equity market shocks. A sub-period analysis investigates potential regime shifts in estimated quantile cointegrating regressions. Quantile cointegrating coefficients vary over time and quantiles, and exhibit different magnitudes across sub-periods and spreads. Therefore, the relationship is unstable over time. We also propose a scenario analysis and risk signaling application for credit risk management prospects. Under specific risk levels, credit risky situations are described conditional on the equity market's information over time, and related expected aggregate CDS spreads are computed. Estimated conditional quantiles/CDS spreads act as credit alert triggers.

1. Introduction

The recent financial crisis shows the extent to which the credit market can impact the financial market. As a result, investors as well as regulation authorities pay greater attention to the credit market, and more specifically, to credit derivatives. Often, credit default swaps (CDSs) help measure the default risk of corresponding reference entities (Diaz et al., 2013). For example, the aggregate spreads of CDS derivatives indexes offer an aggregate view of the credit market (i.e. broad credit market trend). They illustrate the average aggregate creditworthiness of corporate or government debt issuers across various rating classes. Such indexes provide insightful information to credit portfolio managers, and help them gauge their (over- or under) exposure to a specific rating class (i.e. monitoring portfolios' credit-worthiness, capital structure arbitrage prospects). Therefore, they are useful to both credit risk management and corresponding hedge implementation. However, the credit risk management industry still faces two major challenges among which accurate risk assessment and risk predictability. Such challenges are all the more complicated that credit and financial markets exhibit strong linkages.

This article contributes to recent literature by both characterizing the shifting relationship between credit and market risks, and building a credit risk detection tool. Handling the statistical properties of market data, we apply the quantile cointegrating regression method

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E-mail addresses: h.gatfaoui@ieseg.fr, hgatfaoui@gmail.com.

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to investigate the short-term relationship between aggregate five-year CDS spreads and equity market fundamentals. Such technique allows for describing the evolution of CDS spreads conditional on the equity market information across various quantile values. It captures the dependence structure between CDS spreads and equity market fundamentals as well as the varying nature of their relationship across quantiles. For example, CDS spreads can react more to equity market fundamentals at upper quantiles (e.g. during downward market trends). Moreover, quantile cointegrating regressions allow for computing dynamic conditional quantiles for given quantile levels. Such conditional quantiles are time-varying, and illustrate critical CDS spread thresholds, which are computed at the chosen quantile levels. They serve as CDS spread limits, which signal the occurrence of risk scenarios once they are crossed upward. As a result, they provide a credit risk detection tool. Our study is first motivated by the regulators' needs for risk detection tools and eventually (early) risk warnings. Second, investors react more to bad news than good news so that risk is asymmetric. Indeed, the link between CDS spreads and equity market fundamentals is stronger when downside risk occurs (i.e. widening CDS spreads and deteriorating equity market fundamentals). Finally, such methodology has a wide significance for risk management in terms of risk exposure while computing either Value-at-Risk/VaR (Gaglianone et al., 2011; Gerlach et al., 2011; Manganelli and Engle, 2004) or its improved expected shortfall version (Artzner et al., 1999).

Existing literature first exhibits the link between credit and equity/stock markets (Tarashev and Zhu, 2008; Vassalou and Xing, 2004), and then explores the market fundamentals, which deliver (advanced) informational content about credit risk. Among existing studies, Credit Default Swap (CDS) spreads often serve as a proxy of credit risk while equity market conveys information about credit risk (Arouri et al., 2013; Cao et al., 2010; Narayan et al., 2014; Norden and Weber, 2009; Shahzad et al. 2017). Focusing on the link between credit and market risks, several analyses investigate the correlation between CDS spreads and equity market factors. Such studies often employ linear and nonlinear econometric tools to quantify the correlation risk. The bridge between both types of approaches relies on the fact that a nonlinear relationship can be divided into a set of locally linear relationships. Originally, Merton (1974) exhibits the optional nature of a firm's balance sheet, and expresses a firm's debt as a function of its equity value and volatility. Additionally, Byström (2008), Forte and Pena (2009), and Narayan (2015) exhibit the link between CDS spreads/prices and stock returns while others investigate linkages between CDSs and equity volatility (Benkert, 2004; Cao et al., 2010; Carr and Wu, 2010; Da Fonseca and Gottschalk, 2013; Hui and Chung, 2011; Kim et al., 2013; Naifar, 2012; Wang et al., 2011; Zhang et al., 2009). As an extension, Alexander and Kaeck (2008), Gatfaoui (2010, 2012) as well as Norden and Weber (2009) analyze the evolution of CDS spreads with respect to the two referenced equity market price and volatility channels.

As regards the informational content of equity market fundamentals, Norden and Weber (2009) highlight the joint evolution of credit and equity markets as well as the dependency of the credit market relative to the equity market. According to Wang and Bhar (2014), during disturbed times, the informational content of the equity market drives the investment grade market. In particular, informed traders operate essentially in the equity market. Besides, equity market's influence is gauged with two complementary fundamentals, namely a price and a volatility channel. Stock market indexes or stock returns reflect the equity market trend (i.e. market price channel, directional impact), while the implied volatility index illustrates equity market volatility (i.e. market volatility channel, magnitude effect). The directional impact can contribute to the credit market trend through the widening of CDS spreads (i.e. occurrence of credit risk). Moreover, the magnitude of equity market moves can intensify the credit market trend (i.e. severity of credit risk). Additionally, equity market data represent also systemic/common risk factors due to their close link with the economy (e.g. business cycle, interest rates; Benbouzid and Mallick, 2013). For example, stock prices encompass information about the economic state (Tang and Yan, 2010). Furthermore, the implied volatility index is both a fear gauge of the financial market, or equivalently, an indicator of market sentiment (Dergiades, 2012; Smales, 2013), and a liquidity indicator of the broad financial market (Agrippino and Rey, 2012).

As regards leading markets and advanced informational content, CDS and stock markets lead the corporate bond markets in terms of prices (Blanco et al., 2005; Forte and Pena, 2009; Hilscher et al., 2015; Longstaff et al., 2005; Narayan et al., 2014; Norden and Weber, 2004; Wang and Bhar, 2014; Zhu, 2006). Indeed, CDS spreads and stock prices reflect credit risky information before the corporate bond market does (i.e. informational advantage). However, the question about which of the CDS market or stock market is leading each other remains pending (Longstaff et al., 2005). Investigating lead-lag relationships between CDS spreads and stock prices helps identify causal relationships (e.g. unidirectional or bidirectional relationships). Nonetheless, such lead-lag relationships vary over time so that causality as well as reverse causality is non-stable across time periods (Breitenfellner and Wagner, 2012).

Capturing both the informational content of equity market fundamentals and the instability of the relationship between credit and market risks, our findings are fourfold. First, we extract equity market information to depict the very short-term behavior of CDS spreads, and we account for the regime-dependency of such relationship across equity market phases. A modern structural break test helps detect the various market regimes over which the model is calibrated. Second, we handle the non-stationary property of financial data while accounting for possible cointegration patterns. Third, we handle the asymmetric relationship between CDS spreads and equity market channels. Such asymmetry prevents from using simple mean relationships, and often biases linear studies. Under such distributional asymmetry, we apply the quantile regression approach to CDS spreads (as a dependent variable), and consider the informational content of market price and market volatility channels (as independent variables). Owing to the dynamic quantile regression approach, we are able to describe the whole probability distribution function of CDS spreads conditional on the equity market influence. As a result, we handle the heterogeneity of the relationship and the tail asymmetry in corresponding dependence structures. To our knowledge, we are the first to apply dynamic quantile cointegrating regressions to CDS spreads conditional on short-term equity market information. We find that aggregate CDS spreads are significantly sensitive to equity market price and volatility channels across quantiles. The sensitivity to equity market changes across quantiles, which highlights heteroskedasticity, and therefore risk asymmetry. In particular, the asymmetric responses of CDS spreads to equity market shocks yield a robust quantile-dependent credit risk assessment. Such findings prevail also after splitting the full sample into pre-crisis, crisis and three post-crisis periods. Remarkably, the relationship between CDS spreads and the equity market is regime-dependent. Finally, we set up a scenario analysis under which the conditional exceedance probability of aggregate CDS spreads is successively set to 10%, 5% and 1%. Under each risk scenario, we compute corresponding CDS spreads' critical levels over time. Such critical thresholds act as credit alert triggers. A credit risk signal is triggered as soon as CDS spreads reach or cross such thresholds. We thus provide a very short-term credit risk assessment and detection tool.

Our paper is organized as follows. Section 2 introduces the data and some statistical properties (e.g. robustness to spurious correlation). Data are skewed, exhibit fat tails, and are non-stationary. And, aggregate CDS spreads are cointegrated with equity market indicators. Section 3 introduces the econometric methodology (i.e. quantile regression), and its extension to non-stationary and cointegrated data. Section 4 applies quantile cointegrating regressions to analyze CDS spreads' evolution conditional on the equity market's information. As