"Wrong-way risk via change of measure : theory, implementation and performance analysis"

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ABSTRACT

A key driver of Credit Value Adjustment (CVA) is the possible dependency between exposure and counterparty credit risk, known as Wrong-Way Risk (WWR). At this time, addressing WWR in a both sound and tractable way remains challenging: arbitrage-free setups have been proposed by academic research through dynamic models but are computationally intensive and hard to use in practice. Tractable alternatives based on resampling techniques have been proposed by the industry, but they lack mathematical foundations (see e.g. Vrins16a for a discussion). This perhaps explains why WWR is not explicitly handled in the Basel III framework in spite of its acknowledged importance. Recently, Brigo & Vrins proposed a new paradigm to deal with WWR, consisting of an appealing compromise. They start with a reduced-form (stochastic intensity) default model and show that WWR can be handled via equivalent measures. In such a framework, it becomes possible to value CVA as if there were no WWR, provided that the drift of the exposure process is adjusted. This approach relies on a continuous set of equivalent measures, so that an infinite number of drift adjustment processes need to be computed. Yet, functional approximations can be derived which rend the method very convenient for practical use. For instance, semi-analytical expressions are obtained for CVA with WWR when the exposure is a Gaussian process. Such processes could nicely approximate the dynamics of forward rate agreements (FRA), equity return swaps (ERS) or interest rate swaps (IRS) using drifted Brownian bridges. Moreover, exp...

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CVA Wrong-Way Risk via change of measure: theory, implementation and performance analysis

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Abstract

A key driver of Credit Value Adjustment (CVA) is the possible dependency between exposure and counterparty credit risk, known as Wrong-Way Risk (WWR). At this time, addressing WWR in a both sound and tractable way remains challenging: arbitrage-free setups have been proposed by academic research through dynamic models but are computationally intensive and hard to use in practice. Tractable alternatives based on resampling techniques have been proposed by the industry, but they lack mathematical foundations (see e.g. [1] for a discussion). This perhaps explains why WWR is not explicitly handled in the Basel III framework in spite of its acknowledged importance.

Recently, Brigo & Vrins proposed a new paradigm to deal with WWR, consisting of an appealing compromise [2]. They start with a reduced-form (stochastic intensity) default model and show that WWR can be handled via equivalent measures. In such a framework, it becomes possible to value CVA as if there were no WWR, provided that the drift of the exposure process is adjusted. This approach relies on a continuous set of equivalent measures, so that an infinite number of drift adjustment processes need to be computed. Yet, functional approximations can be derived which rend the method very convenient for practical use. For instance, semi-analytical expressions are obtained for CVA with WWR when the exposure is a Gaussian process. Such processes could nicely approximate the dynamics of forward rate agreements (FRA), equity return swaps (ERS) or interest rate swaps (IRS) using drifted Brownian bridges. Moreover, explicit expressions of WWR CVA can be found for European call and put options in the Black-Scholes model [3]. Interestingly, for more general exposure processes, the method still yields a dimensionality reduction compared to the standard Monte-Carlo approach, thereby offering a reduction of both computational cost and time.

In this talk, we shall review the concept of WWR CVA, discuss the method proposed in [2] and derive several drift approximations as well as CVA expressions under WWR. The performance of our approach is illustrated through extensive comparisons of Expected Positive Exposure (EPE) profiles and CVA figures produced either by (i) the standard method relying on a full Monte Carlo framework and (ii) the change-of-measure technique combined with the drift-adjustment approximations. We show that these approximations do not impact the level of accuracy typically required for CVA figures.

References


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