CVA - The Never Ending Story

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Abstract. During the 2007 economic crisis, credit risk has been recognized as a core issue and a crucial determination of pricing financial instruments. The basic form of credit risk, known as counterparty risk, particularly impacts the valuation of over the counter (OTC) derivatives through an additional term known as the credit valuation adjustment (CVA). To identify the impact of credit risk, a large amount of research has been rapidly developed in the last decades. These amount of attempts confirm the significance of considering CVA and finding suitable methods to do the measurements in a more efficient manner.

In this article, we provide an overview of CVA valuation and intend to give an insight into some of the models of determining counterparty credit risk on market variables. We discuss some recent mathematical methods of valuating CVA and address their potential challenges and outcomes. We then review the regulatory aspects of CVA and question the relation between analytical and regulatory risk models.

Keywords: credit risk, counterparty risk, credit valuation adjustment, analytical and regulatory models

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1 Introduction

After the credit crisis in 2007, the calculation of CVA became of crucial importance, particularly for credit based OTC derivative contracts, since their trades are made between two parties without any supervisions of a third one. Thus, an additional requirement, called credit valuation adjustment (CVA) was introduced in Basel III, issued in 2010, to cover the default risk of a counterparty for OTC derivatives. As a matter of fact, the importance of counterparty credit risk was not considered significant in the pre-crisis models. In the post-crisis models however, the need for an adjustment to the market valuation of the portfolio of transaction with counterparty was recognized to be considerable. In practice, this adjustment reflects the market value of the credit risk of the counterparty to the banks or other financial institutes.

When two counterparties for instance enter into a financial trade, they should take credit risk into account. This is a possible risk due to default of each counterparty on their commitments and has to be considered besides market risk. Therefore, the so-called counterparty default risk needs to be adjusted to the value of a default in order to reflect the risk appropriately. This shows the importance of introducing the concept of credit valuation adjustment as a central role for credit risk measures. In other words, CVA is a market value of counterparty credit risk and depends on the counterparty credit spreads[1]. More precisely, it demonstrates the difference between the risk free value of a portfolio and the real market value with considering the counterparty risk of default.

The following sections outline the historical events that initiated the analytical approaches in mathematical perspective and later followed by the Basel regulations. In section 2, we give a short overview on the motivation of introducing the concepts of credit risk and counterparty valuation adjustment. We recall some background materials and definitions in section 3 and discuss the recent CVA valuation models in detail. After illustrating the currently used models and addressing their potential challenges and outcomes, we proceed in section 4 by reviewing the regulatory aspects of CVA and the recently published consultative document on CVA risk framework by the Basel III Committee. In section 5, we discuss other aspects of CVA in context of accounting. Finally, we conclude with section 6 by questioning the relation between mathematical and regulatory risk methods of assessing CVA and discuss the future works on tunneling from the analytical and numerical models into regulatory risk matters in practice.

2 Historical Background

The initial motivation of applying credit risk valuation comes from the 70s. The first significant step towards building a credit risk model and valuate its effects on bond prices has been done by Black and Scholes in 1973 [1]. Shortly after in 1974,

[1]The dependence applies to the case where the counterparty does have such credit spreads.

Merton put the idea of Black and Scholes into an analytical framework and developed an approach to assess credit risk of a corporate's debt [2, 3]. Thanks to these early attempts, nowadays we have a large amount of research and methods based on either the fundamental approaches or new ideas to follow. The important examples among these approaches are the structural model of Hull and White [4, 5] and the market standard model of Brigo [6]. However, when we talk about "model" we must consider the difference between a value approach and a price approach for understanding the model risk. The value approach by Derman [7] considers a risk that the model is not a plausible description of the factors that affect the derivative's value and yet not realistic. On the other hand, the price approach by Rebonato [8] describes the risk of a significant difference between the mark-to-model value of an instrument and the price at which the same instrument is revealed to have traded in the market.

In the next section, we focus our attention on the currently used model of Brigo [9–11] and follow its mathematical framework.

As we earlier discussed in section 1, a concluding observation is that CVA is a core component of counterparty credit risk, although it is not easy to be measured. One of the reasons why pricing CVA is difficult is that CVA is measured at the counterparty level and generally there exist many assets in a portfolio. Therefore, to obtain the value of CVA, one has to be involved in the high dimensional numerical problem. Another difficulty in measuring CVA arises from the uncertainty of the potential future losses at the event of default without any recovery, which is commonly defined as exposure. Although exposure values are one of the key elements of pricing CVA, they are not easy to implement since they evolve over time in the market. Therefore, an average over the evolving exposure values of contracts must be considered instead.

Regarding these problems, calculating CVA is a drastic work and therefore a relevant tool for assessing the prices and costs is essentially required. In the academic literature, a Monte Carlo approach for computing CVA is a well-known procedure [12–14]. Analytical approaches exist, but they do have their limitations. Under the Monte Carlo simulations, CVA is computed by considering the loss given default and the probability at default at the interval t to T multiplied by

$$\sum \text{expected discounted exposures}\Big]_t^T, \tag{2.1}$$

where the distribution of expected discounted exposures is the average of exposures along simulated paths for the portfolio's underlying variables.

However, one should notice that despite of easy implementation of the simulation procedure, it is a computationally heavy task. For instance, in order to do the computations through 100 number of time-steps with 10,000 scenarios per each, 1 million simulations are required.

3 Mathematical Definitions

CVA is the market value of counterparty credit risk. It shows the difference between the risk free value of a portfolio (P_t) and the real market value with considering the default risk of each counterparties $(\bar{P}_t)$, i.e. $CVA := P_t - \bar{P}_t$.

Basically, there are two approaches to measure the CVA term, unilateral and bilateral. Under the unilateral approach, the bank that does the CVA analysis is assumed to be default-free. In this way, the CVA term is measured as the current market value of future losses due to the potential default of the counterparty. The possible problem with unilateral CVA is that the bank and the counterparty cannot agree on the fair value of the trades in the portfolio, since they both require a credit risk premium. In order to access the correct fair value, besides the counterparty's default risk, we thus must consider the bank's own counterparty credit risk, called debit value adjustment (DVA). Mathematically, bilateral CVA is calculated as the difference between unilateral CVA and DVA.

There are three key elements in pricing CVA in general,

(1) loss given default (LGD), which quantifies the amount of loss at a event of default;

(2) expected exposure at default (EAD), which is the expectation of the potential future; and

(3) probability of the counterparty default (PD).

LGD together with EAD and PD are used to calculate the credit risk capital for banks and other financial institutions. In a more general case of a real financial situation however, these key elements are not independent but highly correlated. We shall indicate this issue by the concept of wrong-way (or right-way) risk later in this article.

3.1 Zero Coupon Bond Pricing

Let us consider the probability space $(\Omega, \mathbb{G}, \mathbb{G}_t, \mathbb{Q})$ where Ω and $\mathbb{G}$ denote the sample space and the sample algebra, respectively. $\mathbb{Q}$ is the risk neutral probability measure and states price densities and $\mathbb{G}_t$ stands for the flow of information of the market, including quantities of credit and defaults. We also consider $E_{\mathbb{Q}}$ as the expectation under $\mathbb{Q}$ and τ as the random time of default. τ is referred as the stopping time and is distinguished from T, the maturity time.

At τ, the net present value (NPV) can be computed. Thus, the CVA term is corresponded to a call option with zero bond on the NPV of a portfolio at the random time of counterparty default.

The following is the bilateral formula of Schönbucher [15] and Brigo [10, 11]. Let us consider a default-free and a defaultable zero coupon bond. We denote the price at time t of the default-free zero coupon bond for all maturities $T > t$ as $P(t, T)$ and the price of the defaultable zero coupon bond for all maturities $T > t$ if $\tau > t$ as $\bar{P}(t, T)$. At any case for $T > t$, this definition holds the condition

$$0 \leq \bar{P}(t, T) < P(t, T). \tag{3.1}$$

Under the martingale measurement, the price of a default-free zero coupon bond is

$$P(t, T) = E_{\mathbb{Q}}[exp(-\int_t^T r_s ds).1], \tag{3.2}$$

where the default free short rate, r_s, discounts the final payoff of 1.

In comparison, a defaultable zero coupon bond can have a payoff of 1, for the case of default after T (i.e. $\tau > T$) or zero, for the case of default before T (i.e. $\tau \leq T$). We denote this payoff as $\mathbb{1}_{\tau>T}$.

Therefore, the price of a defaultable zero coupon bond at $t < \tau$ is

$$\bar{P}(t,T) = E_{\mathbb{Q}}[exp(-\int_t^T r_s ds).\mathbb{1}_{\tau>T}]. \tag{3.3}$$

If r is independent of τ, we thus have

$$\bar{P}(t,T) = E_{\mathbb{Q}}[exp(-\int_t^T r_s ds)]E_{\mathbb{Q}}[\mathbb{1}_{\tau>T}] = P(t,T)\ \mathcal{P}(t,T), \tag{3.4}$$

where $\mathcal{P}(t,T)$ is the probability of the defaultable bond issuer at the time of interval, $\mathcal{P}(t,T) = \bar{P}(t,T)/P(t,T)$.

Likewise, the probability of the defaultable bond issuer after the interval time is denoted by

$$\tilde{\mathcal{P}}(t,T) = 1 - \mathcal{P}(t,T). \tag{3.5}$$

3.2 Bilateral CVA

Bilateral CVA is a situation where both parties in a contract are default risky. One of the most common examples of such contracts is interest rate swap. We define two names of a bilateral contract as the investor, indexed by 1, and the counterparty, indexed by 2.

The loss given default (LGD) by the investor at time t is denoted by L^1_t and is defined as

$$L^1_t := P_t - S_t, \tag{3.6}$$

where P_t and S_t are the replacement cost and the settlement value of the contract at the default time, respectively.

In the case of the counterparty's default and with the assumption of no collateralization[2], S_t is given by the stochastic process

$$S_t := R^2_t\,(P_t)^+\ -\ (P_t)^-, \tag{3.7}$$

where $R^2_t \in [0,1]$ represents the recovery rate of the counterparty. Thus, the investor's LGD, L^1_t, in the absence of collateralization is given by

$$L^1_t := P_t - S_t = P_t - (R^2_t(P_t)^+ - (P_t)^-) = (1 - R^2_t)(P_t)^+. \tag{3.8}$$

Let us define the loss processes as

$$\mathcal{L}^1_t = \mathbb{1}_{(\tau^2>T)}L^1_{\tau^2} \quad \text{and} \quad \mathcal{L}^2_t = \mathbb{1}_{(\tau^1>T)}L^2_{\tau^1}. \tag{3.9}$$

[2]The asset that a borrower promises its lender in the case of failure of payment is referred to collateral.

As mentioned before, the credit valuation adjustment is

$$CVA = P(t,T) - \bar{P}(t,T), \tag{3.10}$$

where for simplicity, we denote $P(t,T)$ as P_t. The value of $\bar{P}_t$ with bilateral counterparty risk is the difference between the risk free value P_t of a contract on the investor's loss $\mathcal{L}^1$ due to the counterparty's default and the investor's loss $\mathcal{L}^2$ due to the investor's default by itself. Thus, CVA can be written as

$$CVA = P_t - P_t(\mathcal{L}^1) + P_t(\mathcal{L}^2). \tag{3.11}$$

If we assume exposure and default as independent variables, from equations 3.2, 3.11 and following [16] we have

$$CVA = Ex(t)\,[1 - \mathbb{1}_{(\tau^2>T)} L^1_{\tau^2} D(t,\tau^2) + \mathbb{1}_{(\tau^1>T)} L^2_{\tau^1} D(t,\tau^1)]\, E_{\mathbb{Q}}, \tag{3.12}$$

where

$$D(u,v) = exp\big(-\int_u^v r(s)ds\big). \tag{3.13}$$

The default probability of the counterparty is

$$\mathbb{Q}(\tau \leq t) = \mathbb{Q}_\tau(t) = 1 - e^{-\lambda t}, \tag{3.14}$$

where λ denotes the default intensity of the counterparty and assumed to be independent from the exposure. Thus, the CVA with LGD of L_t is

$$CVA(t,T,L_t) = L_t \int_t^T E_{\mathbb{Q}}(D(t,u)Ex(u)\,|\tau = u) d\mathbb{Q}_\tau(u). \tag{3.15}$$

3.3 Wrong Way Risk

In order to simplify the Q-expectation of payoffs, one can assume that the expectation operator is a function of independent variables. This simplifying assumption in the perspective of credit risk can be applied to independence of the exposure of a firm from the counterparty credit risk. However, this is not a case for most of the examples in reality. In other words, the exposure of the firm is highly correlated to the credit rating of the counterparty.

It is a negative dependence, when a high exposure is correlated with a decreasing credit risk. This is called wrong way risk, as it is highly undesirable for any firm. Right way risk in comparison, has a positive dependence and it occurs when the exposure decreases with an increase in the credit risk of the counterparty.

In perspective of an analytical view [17], the positive and negative loss process for the investor are

$$\mathcal{L}^{1,\pm}_t := [\mathcal{L}^1_t]^{\pm} = \mathbb{1}_{\tau^2>T}[L^1_{\tau^2}]^{\pm}. \tag{3.16}$$

3.4 Some Current Methods

The framework that we explained so far can be solved numerically with Monte Carlo approach [16]. However, the existing numerical approaches suffer from heavy computational setup.

To minimize the complexity of computing CVA in a Monte Carlo setting, a new framework has been recently introduced by Reghai and others in 2015 [18]. The idea of this framework comes from combining the adjoint algorithmic differentiation (AAD) with the martingale representation theorem. By using hedging sensitivities and linking them to parameter sensitivities, the future prices can be retrieved. These sensitivities are computed with the usage of AAD techniques and prices are reconstructed with applying the martingale representation theorem. Although this approach lessens the Monte Carlo simulations, it suffers from some limitations due to applying many simplifying assumptions in its fundamental framework.

Apart from the Monte Carlo approach, a partial differential equation (PDE) approach has been introduced by Burgard and Kjaer in 2011 [19]. The PDE representation can be linear, if the value at default is given by the counterparty free risk value of the derivative, or nonlinear if this value is given by the counterparty rising value of the derivative. The nonlinearity of the approach in higher dimensions (i.e. dimensions higher than 3) leads us to complexity of implementing a numerical solution at a finite-difference scheme. As we see, the existing approaches confront sever complexities in computing the accurate valuation.

4 Regulatory Aspects of CVA

There exists distinct definitions of the concept of valuation adjustment in different domains of finance. Regulators and financial mathematicians have their own definitions of CVA concept in general which is different from each other. Here we shall distinguish the two different definitions and explain them in the aspects of regulations and the aspect of mathematical calculations.

In the aspect of regulation, CVA is a part of the regulatory capital which is needed to hedge losses due to counterparty credit spreads and default. Recently, The Basel Committee on Banking Supervision (BCBS) published a consultation document proposing changes to the current CVA framework and revised it under Basel III standards [20]. Yet, there are uncertainties in some aspects of regulatory CVA as we see different interpretations in EU and US approaches towards adopting CVA capital charge [21]. This gives the opportunity and room for more research in theory and practice.

In the mathematical perspective as we partly discussed in previous sections, CVA is a measure to adjust the market value to interdependence counterparty credit risk. One crucial issue here is how these two CVA definitions, namely CVA capital charge and CVA measurement, are related.

4.1 Regulatory Methods

The risk of mark-to-market losses on the expected counterparty risk is associated with CVA and it also depends on the probability of default of counterparties. To compute the required capital under the Basel committee framework, one must calculate the risk weight assets (RWA) of counterparties and the credit exposure at default (EAD) arising from bilateral transactions.

According to Basel III, RWA is computed by adjusting each asset class with a certain weight and therefore it contains CVA and other capital requirements. A few different methods to compute CVA are used by regulators such as the standardized approach and the internal rating based (IRB) approach. CVA is thus calculated depending on the banks' approval method for calculating counterparty credit risk and using a VaR method to model credit spreads and default probabilities.

Two different methodologies, the so-called standardized and advanced approaches, exist to calculate CVA for OTC derivatives for banks and financial firms. The advanced method (AM) coupons CVA with simulations of credit spreads through each counterparty. Under the standard approach, regulatory CVA can be computed by using three different methods, namely the standardized method (SM), the current exposure method (CEM) and the internal model method (IMM). The main difference between these three methods lies on the way of computing EAD. One should also notice that with using IMM, one requires an approval from certain supervision for both exposure and VaR calculation (i.e. only banks with approval for internal counterparty credit risk model may use IMM). However, banks with approval for a IMM method as well as simulation of counterparty default probabilities may use the advanced method.

The recently issued revision of regulatory CVA from Basel committee proposes two different frameworks: FRTB-CVA and Basic CVA. On one hand, FRTB-CVA consists of an internal model (IMA-CVA) and standardized (SA-CVA) approach and requires regulatory approval. Basic CVA on the other hand is applicable to those banks that are not using FRTB-CVA. Yet, the majority of banks still use the standardized approach for the calculation of the capital charge. However, adopting various methodologies used by different banks is an indication that the present approaches are not sufficient for accounting CVA.

4.2 Standardized Approach

The standardized approach for calculating CVA risk capital charge in paragraph 104 of BCBS-189 2011, implemented as part of Basel III, is derived from a VaR formalism. The given formula to generate CVA capital is

$$K_{CVA} = 2.33\sqrt{h}\Big[\Big(\sum_i \frac{1}{2}\omega_i\Lambda_i - \sum_{ind}\omega_{ind}M_{ind}B_{ind}\Big)^2 + \sum_i \frac{3}{4}\omega_i^2\Lambda_i^2\Big]^{1/2}, \tag{4.1}$$

where

$$\Lambda_i = M_i EAD_i^{total} - M_i^{hedge} B_i \tag{4.2}$$

and

- h is the one year risk horizon;
- ω_i is the rating based risk weight of counterparty i;
- EAD_i is the exposure at default of counterparty i according to the type of the regulatory method, (i.g. discounted using the discount factor, $DF = 1 - e^{0.05M_i}/0.05M_i$, for non-IMM methods);
- B_i is the notional of purchased single name hedges towards counterparty i;
- B_{ind} is the notional of purchased index hedges;
- ω_{ind} is the risk weight of index hedge using the average index spread;
- M_i is the effective maturity of transactions with counterparty i;
- M_i^{hedge} is the maturity of hedge instrument with notional Bi; and
- M_{ind} is the maturity factor for index hedge.

The standardized CVA charge is calculated across all counterparties. In the absence of hedges, the formula reduces to

$$K_{CVA} = 2.33\sqrt{h}\big[\big(\sum_i \frac{1}{2}\omega_i(M_i EAD_i^{total})\big)^2 + \sum_i \frac{3}{4}\omega_i^2(M_i EAD_i^{total})^2\big]^{1/2}, \tag{4.3}$$

In the limit of a large number of counterparties, it is well approximated as a sum over terms for individual counterparties,

$$K_{CVA}^i \approx 2.33\sqrt{h}\sum_i \omega_i\big(M_i EAD_i^{total}\big). \tag{4.4}$$

Equations (4.1-4.3) are generally used to calculate CVA in all three methods of standardized methods. However, the differences come from inputing the different exposure at default (EAD) and the effective maturity M_i. The details of deriving the mentioned equations can be found in [22].

4.3 Updated Basic Approach

According to the announcement of Basel III committee on July 2015, a new basic approach which is closely related to the former standardized method should be used for calculating CVA. The new formula in its simple form where exposure hedges are excluded from capital charge calculations is

$$K_{spread}^{unhedged} = \big((\rho.\sum_c S_c)^2 + (1-\rho^2).\sum_c S_c^2\big)^{1/2}, \tag{4.5}$$

where

$$S_c = \frac{RW_{b(c)}}{\alpha}\sum_{NS} M_{NS}.EAD_{NS} \tag{4.6}$$

and

- $\rho = 0.5$ is the correlation factor;
- c is the considered counterparty;
- $b(c)$ is the risk bucket of counterparty c;
- $RW_{b(c)}$ is the risk weight for bucket b;
- EAD_{NS} is the regulatory exposure at default of netting set (NS);
- M_{NS} is the effective maturity of NSt; and
- α is the conversion factor for EAD.

The capital charge is the sum of CVA counterparty credit spread and exposure.

4.4 Updated Standardized Approach

The new formula for regulatory capital to calculate CVA as a proper hedging cost of counterparty credit risk based on standardized CVA approach is

$$K_{CVA} = m_{CVA}\big(\sum_b K_b^2 + \sum_b \sum_{c \neq b} \gamma_{bc} K_b K_c\big)^{1/2}, \tag{4.7}$$

where γ_{bc} is the regulatory correction parameter and m_{CVA} is a multiplier of 1.5. The variable K_b is

$$K_b = \Big((1-R)(\sum_k WS_k^2 + \sum_k \sum_l \rho_{kl}.WS_k.WS_l) + R\sum_k ((WS_k^{CVA})^2 + (WS_k^{hdg})^2)\Big)^{1/2}. \tag{4.8}$$

where WS_k is the weighted sensitivity in terms of the risk factor k and can be calculated by multiplying the risk weight with the net sensitivity

$$WS_k^{CVA} = RW_k.s_k^{CVA}, \quad WS_k^{hdg} = RW_k.s_k^{hdg}. \tag{4.9}$$

The net weighted sensitivity is obtained via $WS_k = WS_k^{CVA} + WS_k^{hdg}$. ρ_{kl} and R denote the correlation parameter and the hedging disallowance factor, respectively [20].

5 CVA in Context of Accounting

The importance of CVA does not only arises from a regulatory perspective. The Fair Value Measurement under International Accounting Standards (IAS) before the financial crisis required the inclusion of counterparty credit risk in the fair value of a contract [23, 24]. However, before the crisis the CVA was not taken into account due to its insignificance arising especially from low credit spreads in the CDS market. The International Financial Reporting Standards (IFRS) have defined a single framework containing all requirements for transactions measured at fair value. The so-called IFRS 13 defines the fair value and provides a rule set for the disclosure and determination of fair value. According to IFRS 13 the fair value corresponds to the exit price at the measurement date from the perspective of a market participant that holds the asset or owes the liability[3]. In principle, IFRS 13 distinguishes between mark-to-market and mark-to-model approach for fair value measurement. In case of mark-to-market models the fair value of an asset or liability is derived based on observable market data. In the latter case the fair value is determined using a financial model which is considered as a market best practice and ensures market conformity. The standard explicitly requires to include observable market data as inputs of the applied model as much as possible. In contrast to Basel III there are no compulsory methodology specified. In fact, it is up to the institution to select an appropriate model for measuring the fair value. However, IFRS 13 requires that the utilized financial model should reflect current market practice. Therefore, the accounting fair value not only considers the CVA, but also the DVA of a financial instrument. This symmetric CVA valuation ensures a fair market price of the underlying transaction. Under certain conditions the bilateral CVA can be measured at portfolio level, in case the institution maintains their assets and liabilities on a netting set basis. In such a case, the institution has to distribute the CVA to each financial transaction by applying a specific allocation method.

6 Conclusion

In this article, we attempted to give an insight into some selected aspects of the valuation adjustment of counterparty credit risk. In this content, we reviewed several methods in mathematical literature as well as the recent regulatory and accounting revisions for CVA. A concluding observation is that the concept of CVA from the perspective of mathematicians and regulators and their current methods to approach CVA pricing is distinctly separated from each other. A crucial issue of investigation is thus, how the two CVA definitions, namely CVA capital charge and CVA measurement, can be related.

On one hand, the recent changes in the regulatory regime and the increases in regulatory capital requirements has led many banks to include the cost of capital in derivative pricing. On the other hand, the numerical methods of credit risk valuation analysis renders difficulties on the matter of time and calculations. The present mathematical models try to give us an analysis framework under a number of simplifying assumptions. However, a more precise method of calculation without a limitation of many assumptions is crucially required.

The consequence so far is that there is no specific method for valuating CVA in the literature to quantify what precisely are the impacts of CVA risk on derivative's fair value. Hence, several various methods in accounting and regulatory literature are used to estimate the impacts of the risk on the OTC derivatives' fair value. Although in regulatory and accounting the term CVA is commonly used, the purpose is still different. The accounting requires to include all market information available on a

[3]IFRS 13.9 defines fair value as "the price that would be received to sell an asset or paid to transfer a liability in an orderly transaction between market participants at the measurement date."

reporting date in the fair value measurement to provide a point in time estimate, whereas on regulatory side a more conservative approach is applied to reflect losses through the economic cycle. The research towards finding consistent models which can be applied to compute the risk exposures and meet with the required regulatory standards are still on going.

Moreover, the Basel Committee has launched a project to appropriately consider the double-counting effect between DVA and FVA [25]. The concept of the funding valuation adjustment (FVA) has been used to address the adjustment of the fair value of a derivative to reflect the funding cost of a derivative transaction. Most market practitioner include this adjustment when pricing derivatives. From a regulatory perspective the double-counting between FVA and DVA is more of concern, as the credit quality of a borrower is correlated with its funding spread. The discussion about the double-counting effect has been active for a while. However, there has not been reached any final consensus.

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