Funding Value Adjustment, a practitioner's view

Ignacio Ruiz
Oxford University
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What we are going to cover…

Funding in the big picture
The origin of the controversy
Why FVA makes sense
Conclusions
Quick survey (1)

Do you think that a bank should consider Funding Value Adjustment when valuing its book of derivatives?

1. YES
2. NO
3. Not sure, I don’t know
Quick survey (2)

De value of a financial derivative is

1. What a model says
2. What the market says
3. Not sure, I don’t know
Funding in the big picture
Let’s play a coin-tossing game

Bank A and B decide to enter this agreement:

• Someone will toss a fair coin in 1 year
• If the result is “heads”, A pays $1 to B
• If the result is “tails”, B pays $1 to A

What is the counterparty-risk-free price of this? ➔ $0*

However, both A and B face the possibility that, in 1 year time

1. The trade comes out in my favor
2. The other party has disappeared

(*) Assumes zero risk-free interest rate
Let’s account for counterparty risk in the price

The expected (average) counterparty exposure that each bank has to the other bank is $0.5

The cost of hedging out default (the CDS spread) is

- 100 bps for bank A
- 900 bps for bank B

Both banks agree that the price of counterparty risk is:

\[
CVA = 0.5 \times (900 \text{ bps} - 100 \text{ bps}) = 0.5 \times 800 \text{ bps} = 0.04
\]

So, the price of the trade is

\[
MtM = 0 + 0.04 = 0.04
\]
Now that we have entered the deal, we want to hedge the counterparty risk…

How can each bank hedge the counterparty risk of this trade?

Buying a CDS with notional equal to the “average” I can be owed

How much will that cost?

- Bank A ➔ $0.5 * 900 bps
- Bank B ➔ $0.5 * 100 bps
Let’s sum up all those numbers now…

<table>
<thead>
<tr>
<th></th>
<th>Bank A</th>
<th>Bank B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Price excluding credit risk</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Price of credit risk</td>
<td>$\frac{1}{2} \times 800 \text{ bps}$</td>
<td>$- \frac{1}{2} \times 800 \text{ bps}$</td>
</tr>
<tr>
<td>Spent on credit risk hedge</td>
<td>$- \frac{1}{2} \times 900 \text{ bps}$</td>
<td>$- \frac{1}{2} \times 100 \text{ bps}$</td>
</tr>
<tr>
<td>Trade pay off</td>
<td>$X$</td>
<td>$-X$</td>
</tr>
<tr>
<td>Total</td>
<td>$X - \frac{1}{2} \times 100 \text{ bps}$</td>
<td>$-X - \frac{1}{2} \times 900 \text{ bps}$</td>
</tr>
</tbody>
</table>
Question: What is the cost of funding this trade for each bank?

The cost of funding in a bank is, approximately, the risk-free rate plus its own credit spread*

Each bank will have to pay (hence borrow), in average, $0.5

So the cost of funding this trade for each bank will be**

- Bank A ➞ $0.5 * 100 bps
- Bank B ➞ $0.5 * 900 bps

(*) Let's leave bond-spread basis apart for now
( **) risk free interest rate is zero for now
With CVA in the calculation, the cost to each bank of this trade will be the expected cost of funding

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<td>$ 1/2 \times 800 \text{ bps}$</td>
<td>- $ 1/2 \times 800 \text{ bps}$</td>
</tr>
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<td><strong>Total</strong></td>
<td>$X - 1/2 \times 100 \text{ bps}$</td>
<td>- $X - 1/2 \times 900 \text{ bps}$</td>
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This is, precisely, the cost of funding! 😊
Something a bit more realistic: a non-fair coin

If the coin is not fair, the expected result is not symmetric, what makes this example more realistic

Let’s say the coins has a $\frac{1}{3}$ probability of giving “heads”, and $\frac{2}{3}$ probability of giving “tails”

These are the expected counterparty and funding exposures are…

<table>
<thead>
<tr>
<th></th>
<th>counterparty exposure</th>
<th>funding exposure</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bank A</td>
<td>$\frac{2}{3}$</td>
<td>$\frac{1}{3}$</td>
</tr>
<tr>
<td>Bank B</td>
<td>$\frac{1}{3}$</td>
<td>$\frac{2}{3}$</td>
</tr>
</tbody>
</table>
Again, the cost to each bank of this new trade will be the expected cost of funding

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<tr>
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<th>Bank B</th>
</tr>
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<tbody>
<tr>
<td>Price excluding credit risk</td>
<td>$\frac{1}{3}$</td>
<td>- $\frac{1}{3}$</td>
</tr>
<tr>
<td>Price of credit risk</td>
<td>$\frac{17}{3} \times 100$ bps</td>
<td>- $\frac{17}{3} \times 100$ bps</td>
</tr>
<tr>
<td>Spent on credit risk hedge</td>
<td>- $\frac{2}{3} \times 900$ bps</td>
<td>- $\frac{1}{3} \times 100$ bps</td>
</tr>
<tr>
<td>Trade pay off</td>
<td>$X$</td>
<td>- $X$</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>$\frac{1}{3} + X$</td>
<td>- $\frac{1}{3} - X$</td>
</tr>
<tr>
<td></td>
<td>- $\frac{1}{3} \times 100$ bps</td>
<td>- $\frac{2}{3} \times 900$ bps</td>
</tr>
</tbody>
</table>

CVA = $\frac{2}{3} \times 900$ bps - $\frac{1}{3} \times 100$ bps = $\frac{17}{3} \times 100$ bps
Conclusion, so far…

If we

• Account for counterparty risk in the price of a deal
• Hedge out the counterparty risk

• Account for counterparty risk in the price of a deal
• Don’t hedge out the counterparty risk

• Don’t account for counterparty risk in the price of a deal
• Don’t hedge out the counterparty risk

The P&L of the deal is the risk-free P&L minus the funding cost

The P&L of the deal is the risk-free P&L minus the funding cost + gain of not hedging counterparty risk (as long as there isn’t a default!)

The P&L of the deal is the risk-free, and does not reflect the real funding cost or the real counterparty risk assumed
In practice CVA is calculated at **netting set** level

1. RFE
2. Pricing
3. EPE/ENE
4. RR, PD and YC
5. CVA integration

\[
CVA_{asset} = (1 - RR_{cpty}) \times EPE_{ti} \times DF_{ti} \times PD_{cpty,ti} \times D_{ti}
\]

\[
CVA_{liab} = (1 - RR_{own}) \times ENE_{ti} \times DF_{ti} \times PD_{own,ti} \times D_{ti}
\]
Collateralization: the biggest counterparty risk mitigant.

Everything seen so far assumes that, if a counterparty defaults, the exposure is the value of the portfolio.

To decrease counterparty risk, financial institutions ask for collateral:

- Cash
- Government bonds
- Other (e.g., corporate bonds, equity)

Both counterparties can exchange collateral as the value of the netting set changes.

* Source: ISDA Margin Survey 2011, BIS
The origin of the controversy
The cost of funding in banks has changed since 2008

Until 2008
- Libor was considered a risk-free rate
- Banks funding rate was Libor (or very close)

Since 2008
- Libor is not the “risk-free” rate. Now it is OIS
- Banks fund themselves at IOS + spread
  - This spread can be of many basis points

As a result, when valuing a future cash flow, this extra cost must be considered
- Otherwise, the value of a book will not account for the real cost of creating the book

Source: “A comparison of Libor to other measures of bank borrowing costs”, D. Kuo, D. Skeie, J. Vickery
Banks feel a further adjustment is needed: FVA

The problem is that that price for a derivative carries some idealistic assumptions

There factor influence this

\[ MtM_{true} = MtM_{RiskFree} - CVA - FVA \]

1. Funding cost of collateral
2. Bond/CDS spread, liquidity spread
3. CVA is calculated at netting set level, an institution faces funding cost at corporate level

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However... some people think that this is wrong*

This is because

• Hedging and liquidity should be kept aside from pricing
• A well established principle in corporate finance is that pricing should be kept separate from funding
• DVA (the liability side of CVA) already accounts for funding cost

If pricing uses funding rate instead of the risk-free rate, arbitrage opportunities arise

(*) This slide is a very quick summary of “The FVA debate”, John Hull and Alan White, Risk 25, 2012
Why FVA makes sense
Would anyone be happy if we value a construction project with the wrong price of bricks?

Let’s say we are a small constructor

The price of bricks is

- $1 per brick for me
- $0.7 per brick for a large company

What price do we need to use to value the projects that we are running?
The cost of hedging counterparty risk can be quite different to the cost of borrowing money for a financial institution.

Average 5-yr yield, 15 financial intermediaries most active in the CDS market. Source: "Credit Default Swap and Systemic Financial Risk", Stefano Giglio, Harvard University.
CVA is calculated at netting set level, while funding has cross netting set benefits

CVA is the price of hedging counterparty risk
- Liquidation after a default is done per netting set
- Hence CVA is calculated per netting set

An organization may have funding netting benefits across netting sets
- For example, let’s say that
  - netting set 1 has an *increasing* funding requirement if USD rates increase
  - netting set 2 has an *decreasing* funding requirement if USD rates increase
- CVA calculation per netting set will not account for this.
Conclusions
FVA is a further adjustment done to the price of a derivative because of some idealistic assumptions done when pricing CVA

There factor influence this

$$MtM_{true} = MtM_{Risk\ Free} - CVA - FVA$$

1. Funding cost of collateral
2. Bond/CDS spread, liquidity spread
3. DVA is calculated at netting set level, an institution faces funding cost at corporate level

If these three do not exist, then DVA = FVA, and so FVA is not needed
However, the problem is more fundamental than this…

When we say the say that the value of this portfolio is $X, what do we want to mean by “value”?

- The cost of hedging an instrument?
- The cost of creating it?
- The price at which I could sell it?
- The value of the portfolio to me?

Is correct saying that $\text{Price}_{\text{portfolio}} = \text{Price}_{\text{part}}$?

- Is the price of a car the sum of the price of its parts? → it isn’t!

What we seem to be debating here is the difference between “Price” and “Value”

- In fact, Hull & White say “Assuming the objective is to maximize shareholder value rather than employ some accounting measure of performance, FVA should be ignored”

In fact, I think that everyone is right, but each part of the debate are talking about something different

- Anti-FVA
  Price = “fair value”: value to a theoretical entity that observes the deal from outside:
  - Hedge-able
  - Arbitrage-free

- Pro-FVA
  Price = value to me
This controversy, created by the aftermath of the 2008 market events, has opened a new path for financial theory

1. What is the difference between “Price” and “Value”? 

2. What do we really do when we calculate “risk-free” pricing? 

3. Can we build a framework that reconciles, for a book of derivatives,
   • The value to me, and…
   • The “hedge-able non-arbitrage” price of it?
Thanks!!

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