**Q2.**In this case study, we undertook an analysis and constructed the CDS curve for Intesa San Paolo (ISP) as of February 15, 2008, utilizing a bootstrapping approach. Notably, the settlement date, marking the starting of curve computation, was set on February 19, 2008.

In addressing point a, we were tasked with constructing a complete set of CDS via spline interpolation of the provided spreads. Given the available data, we derived the spread for the 6-year maturity. It is noteworthy that upon plotting and observing the results, we observed an unexpected behaviour in the curve's shape. Specifically, the spread for the 6-year maturity was found to be lower than that of the 5-year maturity. This anomaly arises from the cubic approximation inherent in spline interpolation, which considers the general concavity of preceding points. As a remedy, we advocate for employing linear interpolation, to rectify the unexpected behaviour observed in the curve's shape, ensuring a more intuitive and consistent representation of credit spreads over time.

\\ doppio grafico LINEAR ADN SPLINE

\\ OUTPUT SPREADS e date

Moving on to point b, we proceeded to construct a piecewise constant function for the intensity λ(t) by leveraging the quoted CDS spreads. This method ensures to capture variations in default risk over discrete time intervals. Throughout the bootstrapping process, we derived the intensity curve both with and without considering the accrual term. As anticipated by theory, the outcomes are closely aligned, affirming that the terms related to accrual can be effectively neglected. This assertion is substantiated by the minute discrepancy, less than 1 basis point, observed upon comparing the values obtained through the two methodologies. Furthermore, we computed survival probabilities, unveiling a declining trend over time, with the survival probability dwindling to 95.27% at the 7-year maturity mark.

\\ grapgh 2

Additionally, we explored the Jarrow-Turnbull (1995) simplified model, wherein payments are made continuously, and λ remains constant (flat). A comparison between the NPV\_fee and NPV\_contingent yielded the well-known rule of thumb provided in the following formula:

FORMULA

Qualitative plotting of the results, inclusive of the cumulative intensity, demonstrated alignment with the flat lambdas derived through J-T rules at each maturity point.

FORMULA MEDIE

GRAPH

Even though the Jarrow-Turnbull is largely used by traders to efficiently compute the intensities, it presents some limitations. For instance, its assumption of constant default intensity may oversimplify the dynamics of credit risk, particularly during periods of economic stress.

**Q3**.In this section, we take into the analysis of the First to Default (FtD) contract involving two distinct companies, namely IntesaSanPaolo (ISP) and Unicredit (UCG). Initially, we embark on computing the complete set of Credit Default Swap (CDS) spreads for UCG, employing spline interpolation, as previously demonstrated. Notably, the spreads curve exhibits a non-traditional pattern, with the 6-year spread surpassing expectations, peaking at a higher value than its subsequent 7-year spread. To facilitate a comparative understanding between the two firms, a visualization of the CDS curves is presented.

FIGURE

Moving on to point b, we proceed to price the FtD contract, set to mature on the 20th of February 2012, involving the obligors. This pricing is executed utilizing the Li model, under the assumption of a Gaussian copula and a correlation coefficient (ρ) set at 20%. Through rigorous simulations, we ascertain a specific FtD spread value, amounting to $$$$. This computed value closely aligns with theoretical expectations.

VALUES

Considering the computations above, it becomes evident that when the correlation coefficient remains relatively modest, the FtD price tends to approximate the sum of the individual CDS spreads of the obligors, resulting in an 85-basis point spread over 4 years. The computation of the FtD price is based on a structured framework, consisting in the fee leg, disbursed annually, and the contingent leg, accounting for loss given default (1-π) paid at default time (τ), if applicable. Furthermore, to enhance the reliability of our findings, simulations are conducted within a 95% confidence interval framework, yielding a definitive range:

INTERVAL

Moreover, to capture the full spectrum of potential outcomes, simulations are iterated across the entire codomain of possible correlation coefficients (-1 to 1). This iterative process yields a revealing plot, elucidating the FtD spread's behaviour in response to varying correlation coefficients. Theoretical underpinnings suggest that the FtD price fluctuates continuously between the maximum spreads of the obligors and the aggregate of their respective spreads. Thus, distinct scenarios emerge:

1)  In instances where obligors exhibit negligible or negative correlation, the price impact remains consistent, as evidenced by the flat curve spanning from -1 to 0, stabilizing around 85 basis points.

2)  Conversely, in scenarios characterized by positive correlation, the FtD price experiences a progressive decrease, eventually converging to the maximum spread between obligors for ρ equal to 1, culminating at 45 basis points.

To complement our analysis, a visual representation in the form of a figure is included, further elucidating the relationship between FtD price and correlation coefficient.

FIGURE

REFERENCES TO BOOK 2003

(!!!!! DA **CONTROLLARE TEORIA** SU LIBRO FARE CIT COSI PO METITMAO REFERENCE !!!!)

It is imperative to note that achieving robust results necessitates a significant number of simulations, albeit incurring substantial computational costs and time investments. **SUGGESTION?!**

**SUGGESTION BY AMICO CHAT:**

**Discussion of Limitations**: Every analytical approach has inherent limitations, and it is essential to acknowledge and address these limitations transparently. In this context, consider discussing potential limitations such as assumptions regarding default probabilities, recovery rates, or market conditions. Additionally, explore how these limitations may affect the robustness and generalizability of the analysis, and propose strategies for mitigating or accounting for these limitations where possible.

POTREMMO COMPLETARE Q3 INSERENDO QUALCHE INFORMAZIONE SU GAUSSIAN COPULA E LI MODEL