

Financial Risk Management

Spring 2021

Instructor: Wan-Chien Chiu

Individual Assignment 2

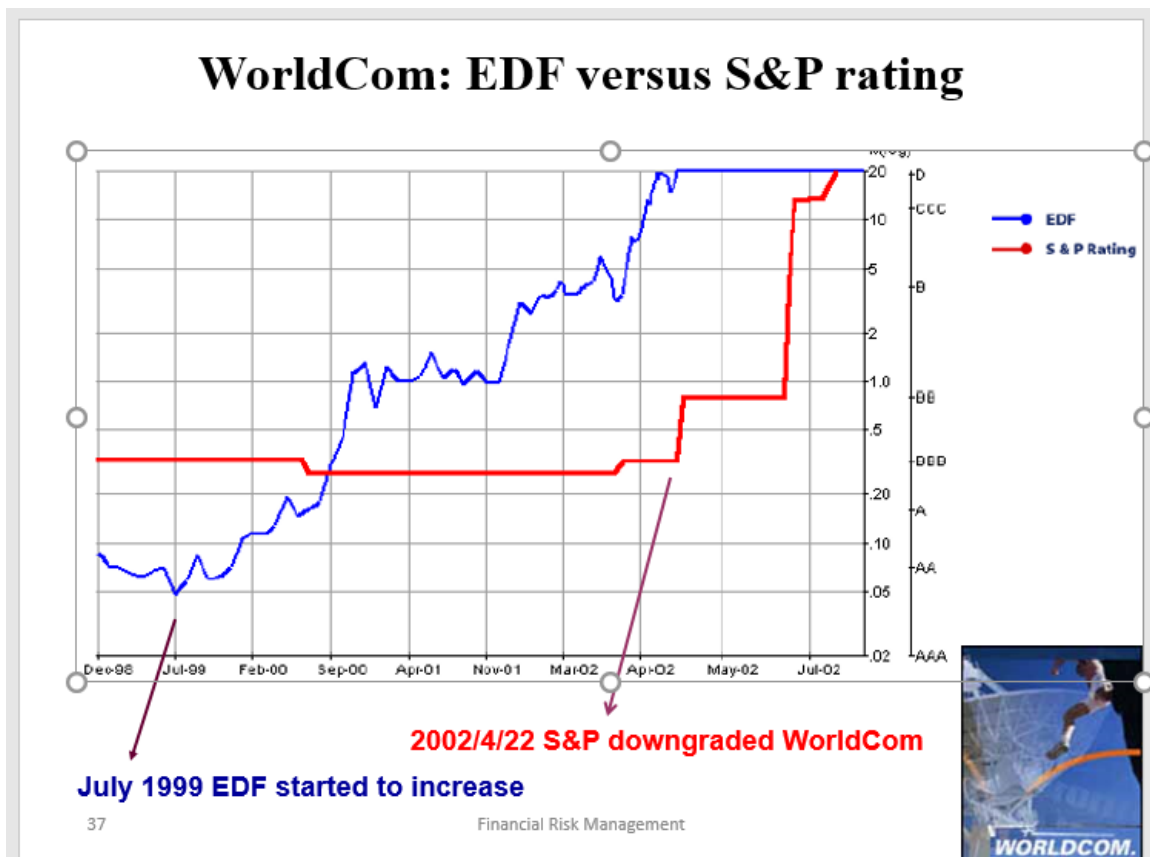
Due on June 15 (Tuesday) 2021 before 11:59 p.m.

Please upload to E-Learning

[Part I: Python for finance]

The literature highlights that: the distance-to-default is a widely used forward-looking default risk indicator, based on the KMV model, to proxy for the likelihood of a corporate borrower's default.

Part I aims to help you practice the “Merton Distance to Default Model.” You are required to use Python to compute the Merton Distance to Default for WorldCom case you see in the lecture slides. EDF (blue line)



Required:

[Note: You need to submit your Python code]

Compute the expected default probability (EDF) for **WorldCom (MCI Inc.)** on two dates based on **KMV-Merton model**.

Date 1: October 1, 2001

Date 2: July 1, 2002

Please use daily data from the past 12 months to obtain an estimate of the volatility of equity, which is then use as an *initial value* for the estimation of the volatility of the firm's asset returns.

Date 1: October 1, 2001 (Please use the data file, named “data_20011001”)

Date 2: July 1, 2002 (Please use the data file, named “data_20020701”)

You will need to read: (1) **Section 2.1 The Merton DD model** in the Bharath and Shumway (2008), and (2) **Section I. Measuring Default Risk** in the Vassalou and Xing (2004), for the knowledge of estimating two unknown variables (i.e., a corporate asset market value and its asset volatility)

[1] Bharath, S. T., & Shumway, T. (2008). Forecasting default with the Merton distance to default model. *The Review of Financial Studies*, 21(3), 1339-1369.

[2] Vassalou, M., & Xing, Y. (2004). Default risk in equity returns. *The journal of finance*, 59(2), 831-868.

[Note: You can choose to do the following bonus question or now. If you do it and do it well, you will get extra points. I definitely encourage you to do it. The reason is that, very often, in finance, we very often use KMV DD as the important default risk indicator, and we will have a time-series of KMV DD to understand time-series variation of a default risk for a company.]

Bonus question: Compute the expected default probability (EDF) for WorldCom (MCI Inc.) from January 1999 to June, 2002, based on KMV-Merton model. (see the figure on the “FRM_Lecture_Week13”, page 38). That is, you will have 42 EDF for every month in this period. (Please use the data file, named “data_bonus”)

[Part II: Academic paper]

Part II aims to help you gain more knowledge about the “Merton Distance to Default Model.” You are required to read the three academic articles (listed in the below) and provide your opinions for the discussion of the advantages and the disadvantages of using Merton Distance to Default Model to measure the default risk. The required word count is about 500 words.

- [1] Bharath, S. T., & Shumway, T. (2008). Forecasting default with the Merton distance to default model. *The Review of Financial Studies*, 21(3), 1339-1369.
- [2] Nagel, S., & Purnanandam, A. (2020). Banks’ risk dynamics and distance to default. *The Review of Financial Studies*, 33(6), 2421-2467.
- [3] Vassalou, M., & Xing, Y. (2004). Default risk in equity returns. *The journal of finance*, 59(2), 831-868.

[Part III: This question is about credit derivatives.]

(1) The bank of HSBC makes a USD 10 million five-year loan and wants to offset the credit exposure to the obligor. A five-year credit default swap (CDS) with the loan as the reference asset trades on the market at a swap premium of 50 basis points (annual rate) paid annually. In order to hedge its credit exposure, what should the bank do? (Detail the payment if the bank uses CDS). And discuss whether using CDS can entirely eliminate credit risk.

(2) Helman Bank has made a loan of USD 100 million at 7% per annum. Helman enters into a **total return swap** under which it will pay the interest on the loan plus the change in the marked-to-market value of the loan, and in exchange Helman will receive LIBOR + 100 basis points. Settlement payments are made *annually*. What is the cash flow for Helman on the first settlement date if the mark-to-market value of the loan falls by 10% and LIBOR is 2%?

(3) Illustrate the framework Collateralized Debt Obligation (CDO) and discuss the extent to which the default correlation affects senior tranche of CDO.