UNIVERSITY OF PENNSYLVANIA
The Wharton School

FNCE 7170/2170:
FINANCIAL DERIVATIVES

Prof. Domenico Cuoco Fall 2025

Assignment 2
(Part 1)

Background

On October 1, 1997, WorldCom Inc. (WCOM) announced a stock-only merger offer to acquire all outstanding shares of MCI Communications Corp. (MCIC) in a transaction valued at approximately \$30 billion. At the time, this was the largest corporate bid in US history.

WorldCom's offer followed a cash-and-stock takeover offer by BT Group plc (formerly British Telecom), originally made on November 1, 1996 and then revised downward on August 20, 1997 as a result of unexpected profit warnings issued by MCI.

Here is the description of WorldCom's offer in a letter from Bernard Ebbers, President and CEO of WorldCom, to Bert Roberts, Chairman and CEO of MCI:

> "I am writing to inform you that this morning WorldCom is publicly announcing that it will be commencing an offer to acquire all the outstanding shares of MCI for \$41.50 of WorldCom common stock per MCI share. The actual number of WorldCom common stock to be exchanged for each MCI share in the exchange offer will be determined by dividing \$41.50 by the 20-day average of the high and low sales prices for WorldCom common stock prior to the closing of the exchange offer, but will be no less than 1.0375 shares (if WorldCom's average stock price exceeds \$40) or more than 1.2206 shares (if WorldCom's average stock price is less than \$34).
>
> Our offer represents a 41% premium to MCI's closing stock price on September 30, 1997. The transaction is valued at approximately \$30 billion—a premium of \$9 billion to the market's current valuation of the proposed acquisition of MCI by British Telecom."

The offer, which was subject to regulatory approval, was expected to take 6 to 9 months to complete if approved by MCI shareholders.

The closing price of WorldCom stock on October 1, 1997 (after the announcement) was \$34.375. The closing price of MCI stock was \$29.375 on September 30, 2007 (before the announcement) and rose to \$35.3125 on October 1, 1997.

On October 15, 1997, GTE Corp. (GTE) announced a cash-only offer of \$40 per MCI share.

Working Assumptions

Assume for simplicity that:

- WorldCom's offer, if approved, was going to be completed in exactly 6 months (i.e., on April 1, 1998) and the actual number of WorldCom shares to be exchanged for each MCI share was going to be determined by dividing \$41.50 by the price of WorldCom common stock on that day (rather than by a 20-day average of the high and low prices), in any case this number being no less than 1.0375 (if WorldCom's stock price exceeded \$41.50/1.0375=\$40.0000) and no more than 1.2206 (if WorldCom's stock price was less than \$41.50/1.2206=\$33.9997);
- The overnight risk-free rate on October 1, 1997 was 5.75% (continuously compounded) and expected to remain constant at this level over the next 9 months;
- There are 21 trading days per calendar month.

Questions

Answer the following questions using the binomial model with time step $h = 1/252$ (one trading day) as needed.

(a) Plot the number of WorldCom shares to be exchanged for each MCI share under the terms of the offer versus the (unknown) WorldCom's stock price on July 1, 1998. In addition, plot the value of those shares on July 1, 1998 versus the WorldCom's stock price.

(b) The Excel spreadsheet *WCOM.xlsx* lists the daily closing prices of WorldCom's stock over the period from April 1, 1997 to October 1, 1997. WorldCom did not pay any dividends over this period. Use this data to estimate the volatility of WorldCom stock as of October 1, 1997.

(c) Assuming that WorldCom was not expected to pay any dividends over the next 6 months, what was the value on October 1, 1997 of WorldCom's offer per share of MCI? Was Mr. Ebbers' statement that WorldCom was offering "\$41.50 of WorldCom common stock per MCI share" accurate? Was GTE's offer an improvement over WorldCom's?

(d) How does your answer to part (c) change if WorldCom was expected to pay a \$0.50 dividend on December 1, 1997 and a \$0.55 dividend on March 1, 1998?