Homework 2 Report

The Question:
On Aug 3, 2015 you buy a note for $98 that will pay, on Dec 31, 2020, the arithmetic average of an underlying bond's prices observed on Jan 1 of each year 2016–2020.
The underlying is a 10-year bond issued Jan 1, 2010, 5% coupon, semiannual payments, face $100.
Using Bond_Ex3.csv, was buying this note a good investment?

Results:
Underlying bond prices on observation dates

Observation Date	TTM (years)	Price
Jan 1, 2016	5	118.359
Jan 1, 2017	4	113.114
Jan 1, 2018	3	107.355
Jan 1, 2019	2	103.492
Jan 1, 2020	1	102.5

Arithmetic average (2016–2020): 108.964

Discounting the average back to Aug 3, 2015
- Year fraction (ACT/365) from 2015-08-03 to 2020-12-31: 5.41644
- Nearest-neighbor zero rate at T = 5.41644: 0.004419
- Discount factor e^(−rT): 0.976349
- Present value at purchase = 108.964 × 0.976349 = 106.387
- NPV versus purchase price $98: +8.3868

Conclusion:
The present value of the note's expected payoff at the purchase date is $106.387, which exceeds the $98 purchase price. The NPV is positive (+8.39). Therefore, buying the security on Aug 3, 2015 was a good investment under the given curve and assumptions.

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➜  HW2_6767_Vidit_Pokharna git:(main) ✗ g++ -Wall -pedantic -std=c++11 bond.cpp main.cpp -o main
➜  HW2_6767_Vidit_Pokharna git:(main) ✗ ./main

--- Demo ---
Bond (0, 0, 0)
Bond (11/19/2035, 0.5, 0.07)

--- Bond Pricing Unit Tests ---
[PASS] ToString exact
[PASS] Default ctor zeroes
[PASS] Flat-rate monotone
[PASS] Curve equals flat TS
[PASS] First coupon proration

All tests passed

--- Investment Analysis Using Pricing Data ---
Jan 1, 2016  TTM=4  Price=118.359
Jan 1, 2017  TTM=3  Price=113.114
Jan 1, 2018  TTM=2  Price=107.355
Jan 1, 2019  TTM=1  Price=103.492
Jan 1, 2020  TTM=0  Price=102.5
Average price (2016-2020): 108.964
Year fraction 2015-08-03 -> 2020-12-31 (ACT/365): 5.41644
Discount rate (nearest-neighbor at T=5.41644): 0.004419
Discount factor: 0.976349
PV at purchase: 106.387
NPV vs $98: 8.3868  =>  Good investment
```