Stock Option Valuation

Michael A. Paschall, ASA, CFA, JD

Banister Financial, Inc.

Charlotte, NC

**(704) 334-1625**

www.businessvalue.com

Topics Covered in this Presentation

1. Brief Overview of Stock Options.

2. Overview of Black-Scholes Option Pricing Model.

3. Comparison of Black-Scholes with Binomial Model.

4. Regulatory Environment for Option Accounting.

5. Internet Option Pricing Sites.

Topics Not Covered in this Presentation

1. Marketability Discounts for Stock Options.
(see presentations at 4:30 pm today and 10:45 am on Saturday)

2. Stock Option Valuation for Privately-Held Company Stock.

3. Use of Put Options for Blockage and Restricted Stock Valuations.

4. Details of Other Option Valuation Methods.

5. Vested vs. Non-Vested Stock Options.

6. Non-Qualified Stock Options (NQSOs) vs.

Incentive Options (ISOs).
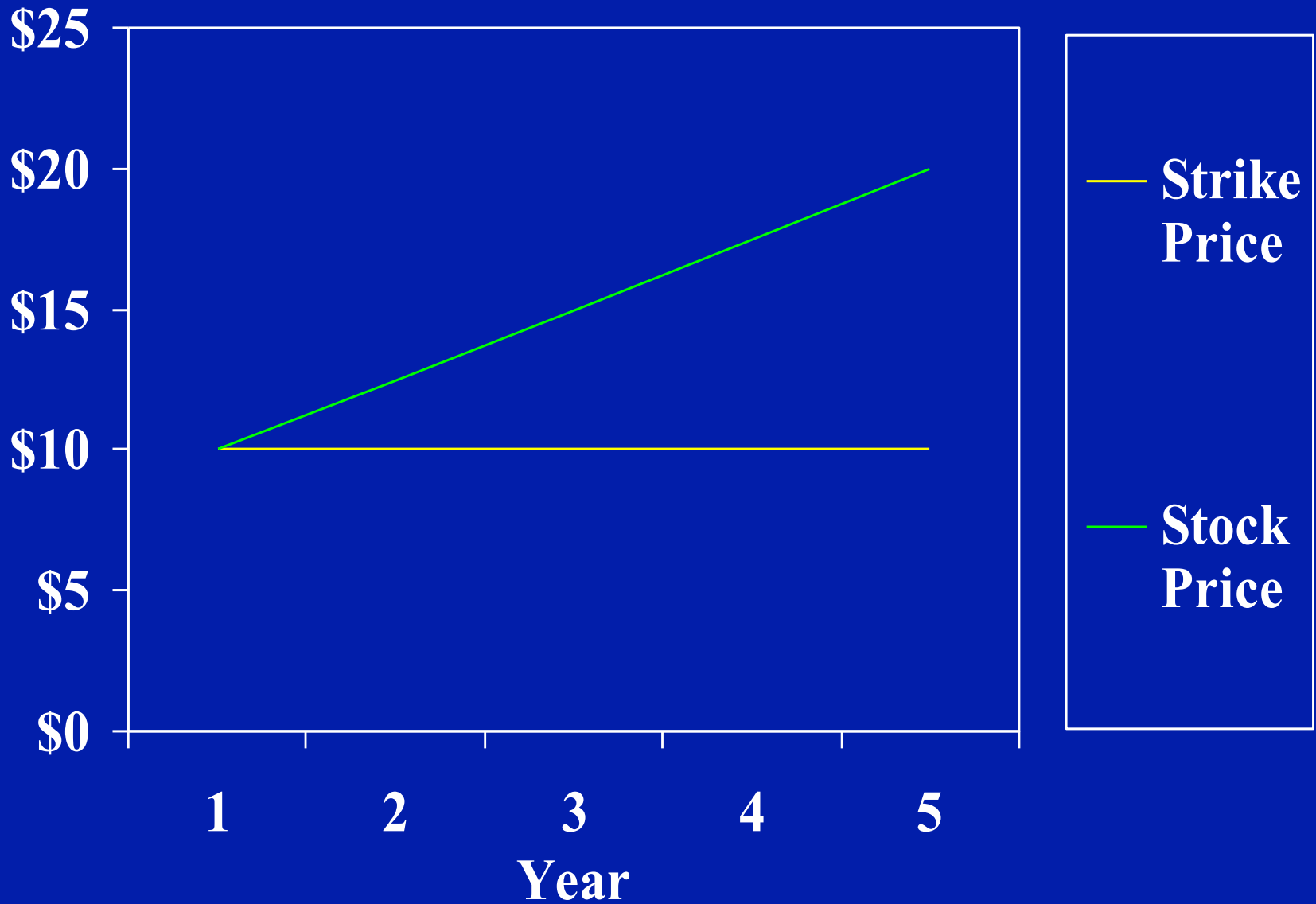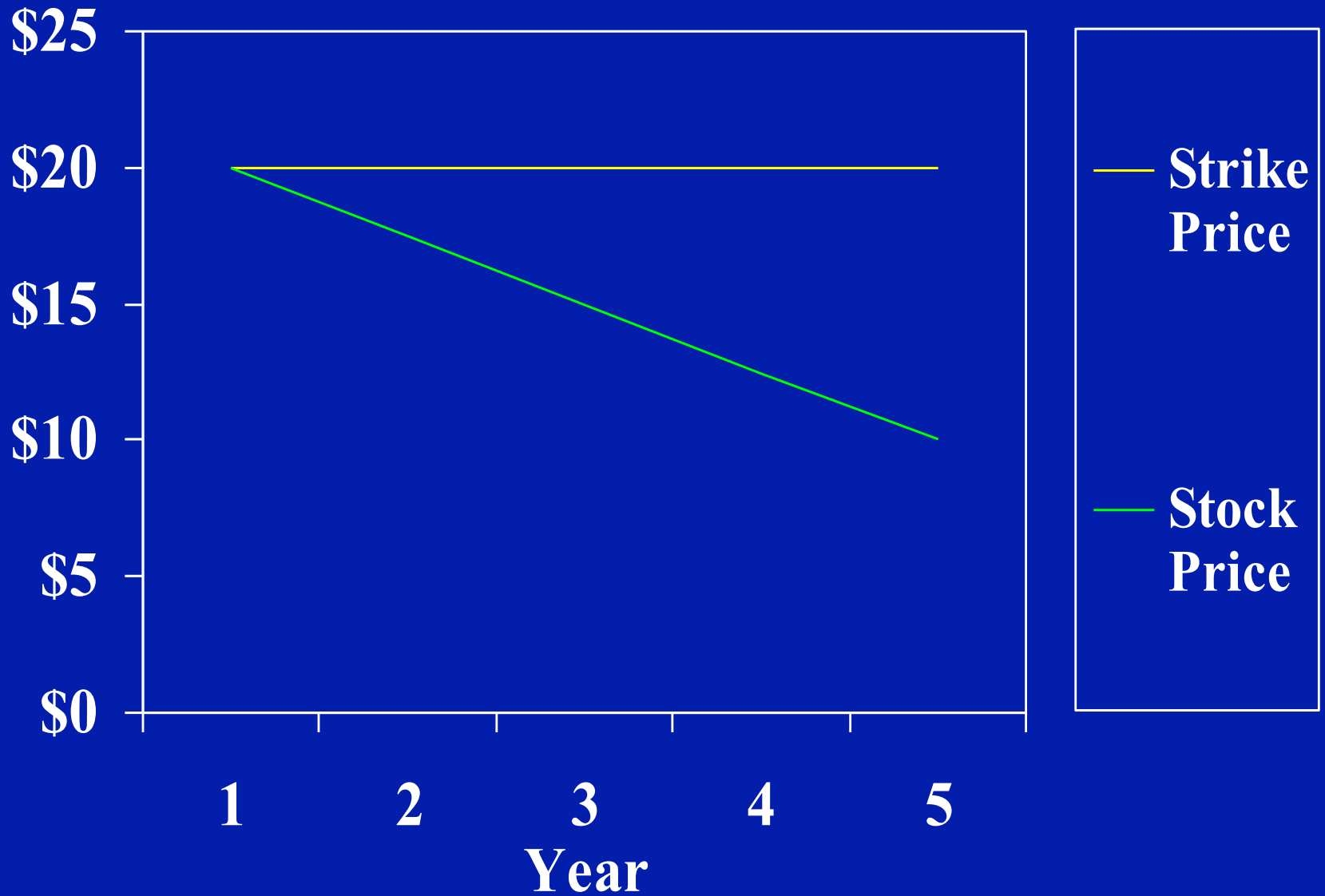
Black-Scholes Options Pricing Model

Proposed in 1973 by Fischer Black and Myron Scholes.

Validated by actual observations in the market.

Widely accepted by the financial industry, the SEC, the FASB, and the AICPA (although other models – such as Binomial, Modified Black-Scholes, etc. – are increasingly popular today).

Black-Scholes Options Pricing Model

Considers two main impacts on value:

1. Intrinsic Value

2. Time Value

Black-Scholes Formula

$$C_o = SN(d_1) - Xe^{-rT}N(d_2)$$

where

$$d_1 = \frac{\ln(S/X) + (r + \sigma^2/2)T}{\sigma\sqrt{T}}$$

$$d_2 = d_1 - \sigma\sqrt{T}$$

Six Inputs to Consider

1. Exercise (Strike) Price

2. Current Stock Price

3. Volatility

4. Option Term

5. Annual Dividend

6. Risk-free Interest Rate

Baseline Option Example

Current Stock Price: $15

Exercise (Strike) Price: $15

Volatility: 40%

Option Term: 2 Years

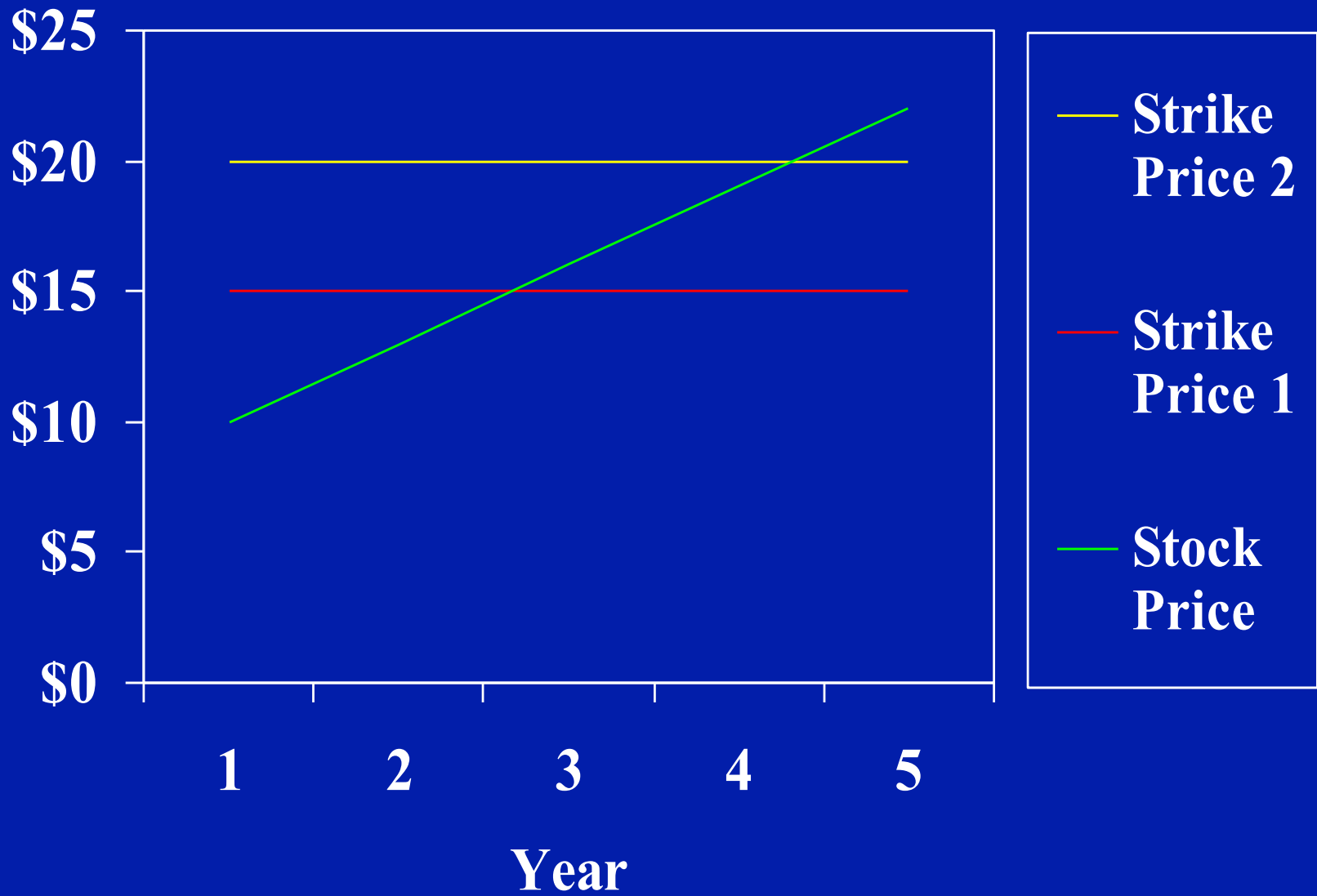Annual Dividend: $1 (paid quarterly)

Risk-free Interest Rate: 3%

Baseline Option Example

Value of Call Option: $2.57

Baseline Option Example

Issue 1

Exercise (Strike) Price

Exercise (Strike) Price

Baseline Model

Exercise (Strike) Price: $15

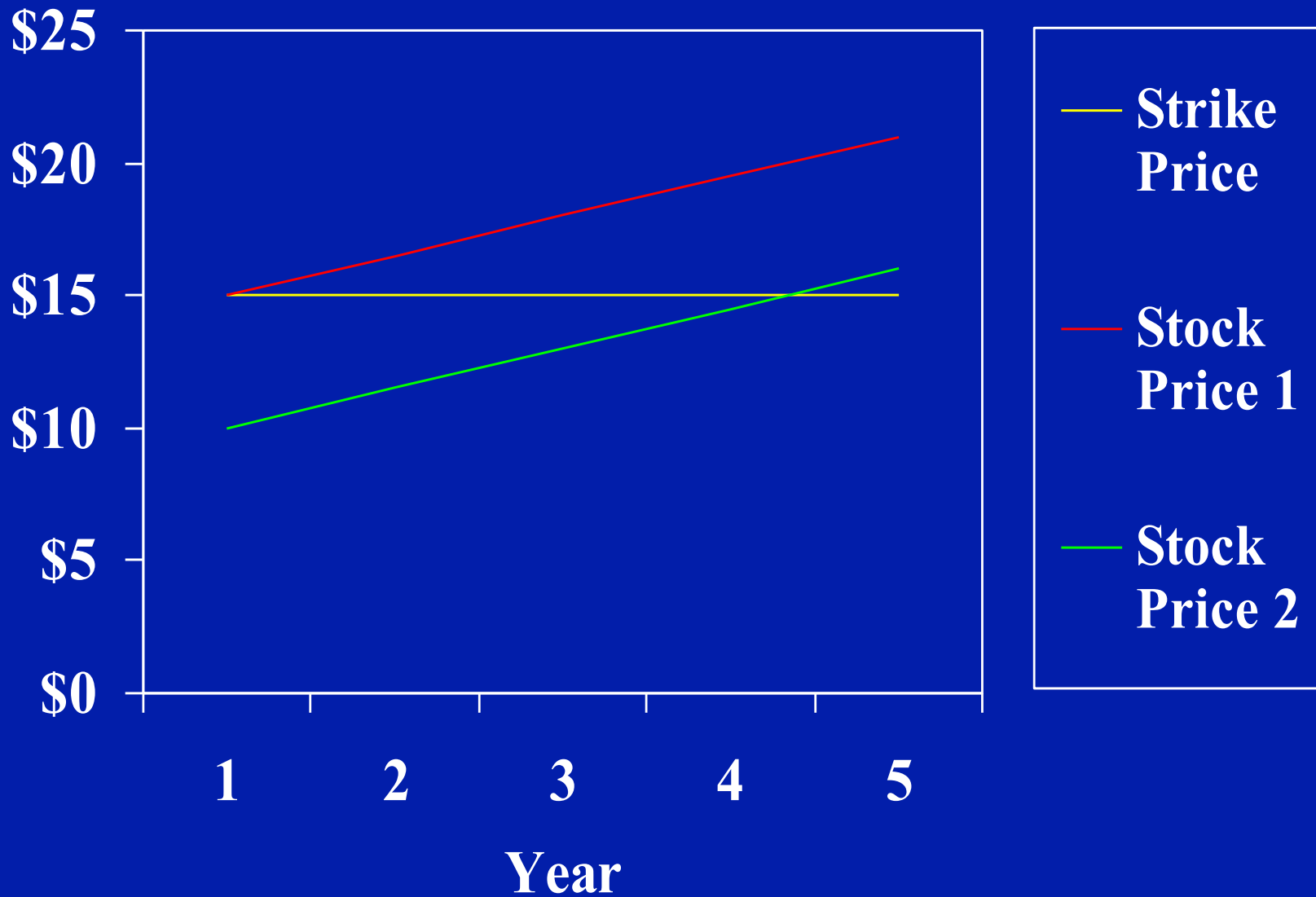Call Option Value: $2.57

New Assumption

Exercise (Strike) Price: $20

Call Option Value: $1.38

Baseline Option Example

Issue 2

Stock Price

Stock Price

Baseline Model

Stock Price: $15

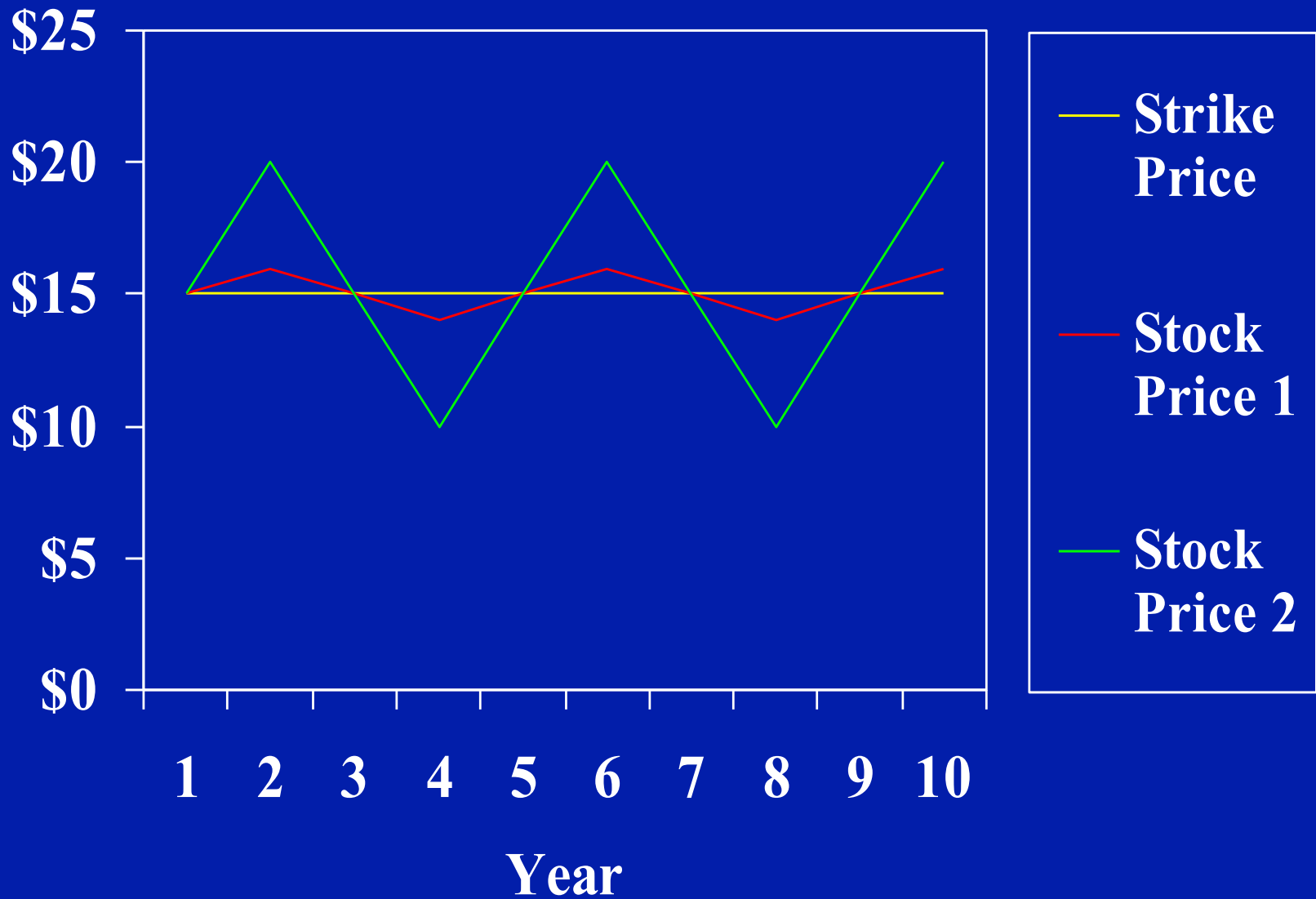Call Option Value: $2.57

New Assumption

Stock Price: $10

Call Option Value: $0.53

Baseline Option Example

Issue 3

Volatility

Volatility

Baseline Model

Volatility: 40%

Call Option Value: $2.57
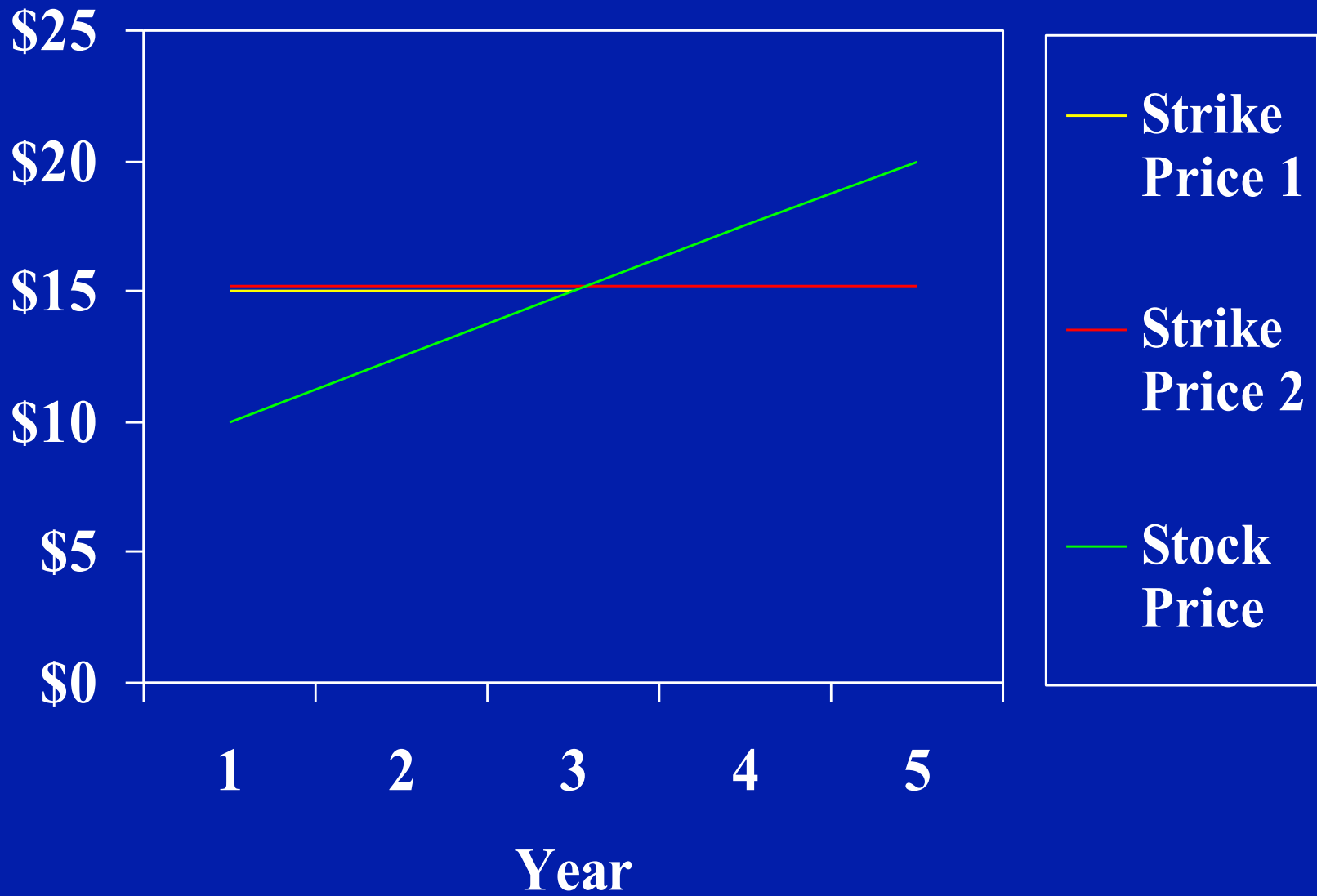
New Assumption

Volatility: 80%

Call Option Value: $5.36

Baseline Option Example

Issue 4

Term to Expiration

Term to Expiration

Baseline Model

Term to Expiration: 2 years

Call Option Value: $2.57

New Assumption

Term to Expiration: 4 years

Call Option Value: $3.02

Baseline Option Example

Issue 5

Dividend Rate

Dividend Rate

Baseline Model

Dividend Rate: $1

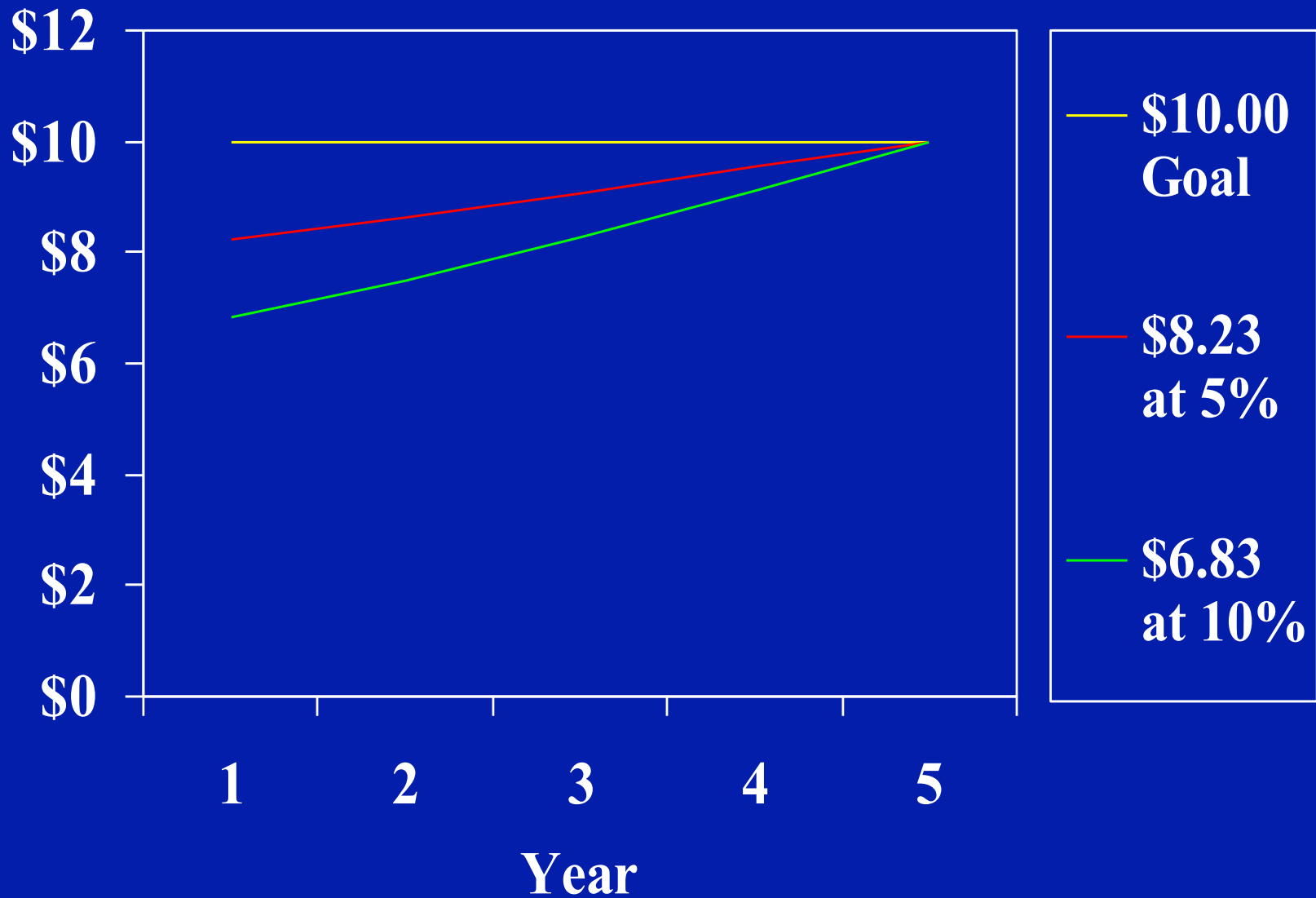Call Option Value: $2.57

New Assumption

Dividend Rate: $2

Call Option Value: $1.74

Baseline Option Example

Issue 6

Risk-free Interest Rate

Legend:
- $10.00 Goal
- $8.23 at 5%
- $6.83 at 10%

Year

© Copyright 2011, Banister Financial, Inc.

Risk-free Interest Rate

Baseline Model

Risk-free Interest Rate: 3%

Call Option Value: $2.57

New Assumption

Risk-free Interest Rate: 6%

Call Option Value: $2.85

Real World Example I

Hugh McColl

Chairman and CEO of Bank of America

Issue Date: July 1, 1999

Stock Price: $74.50

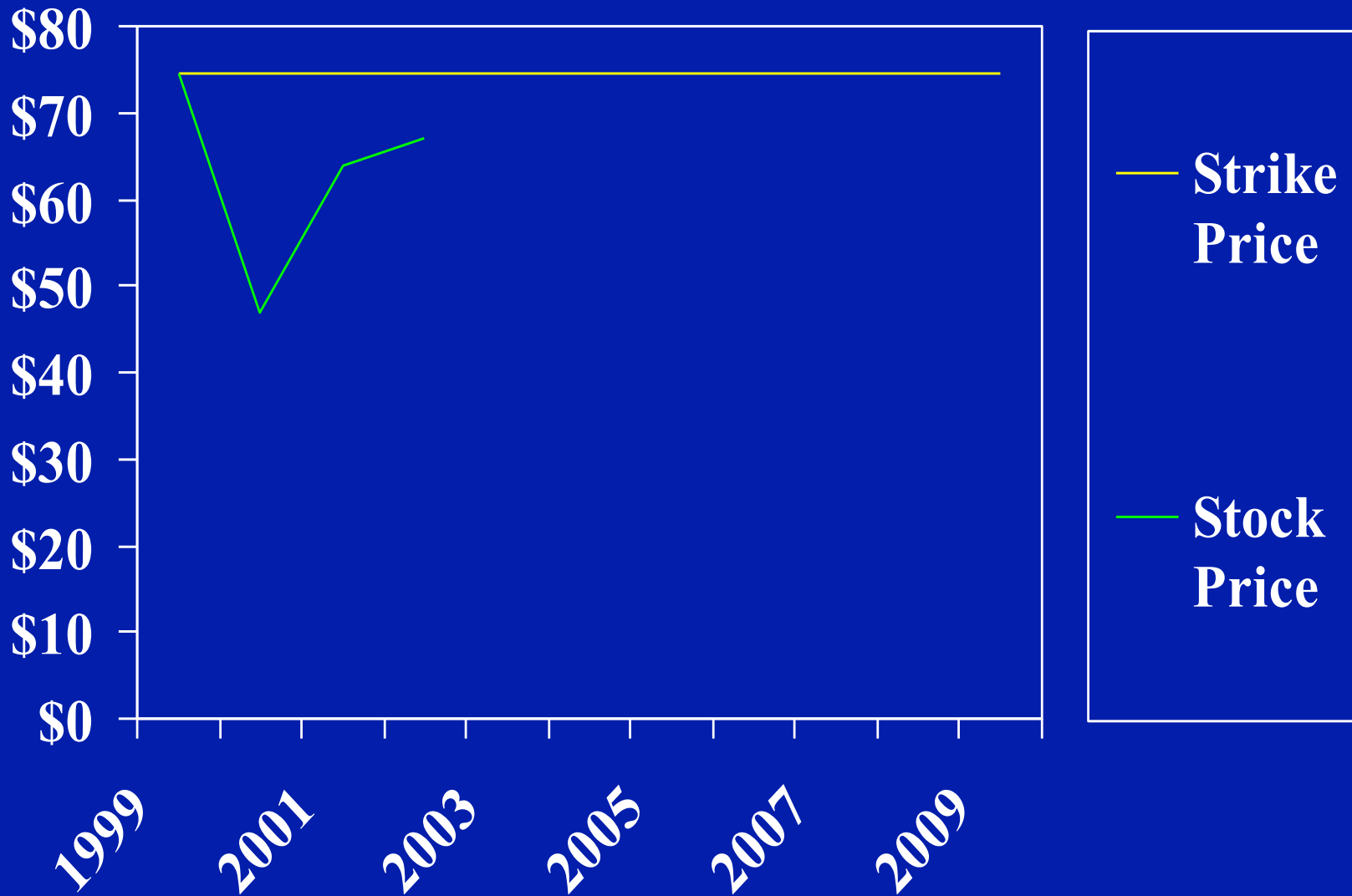Exercise (Strike) Price: $74.50

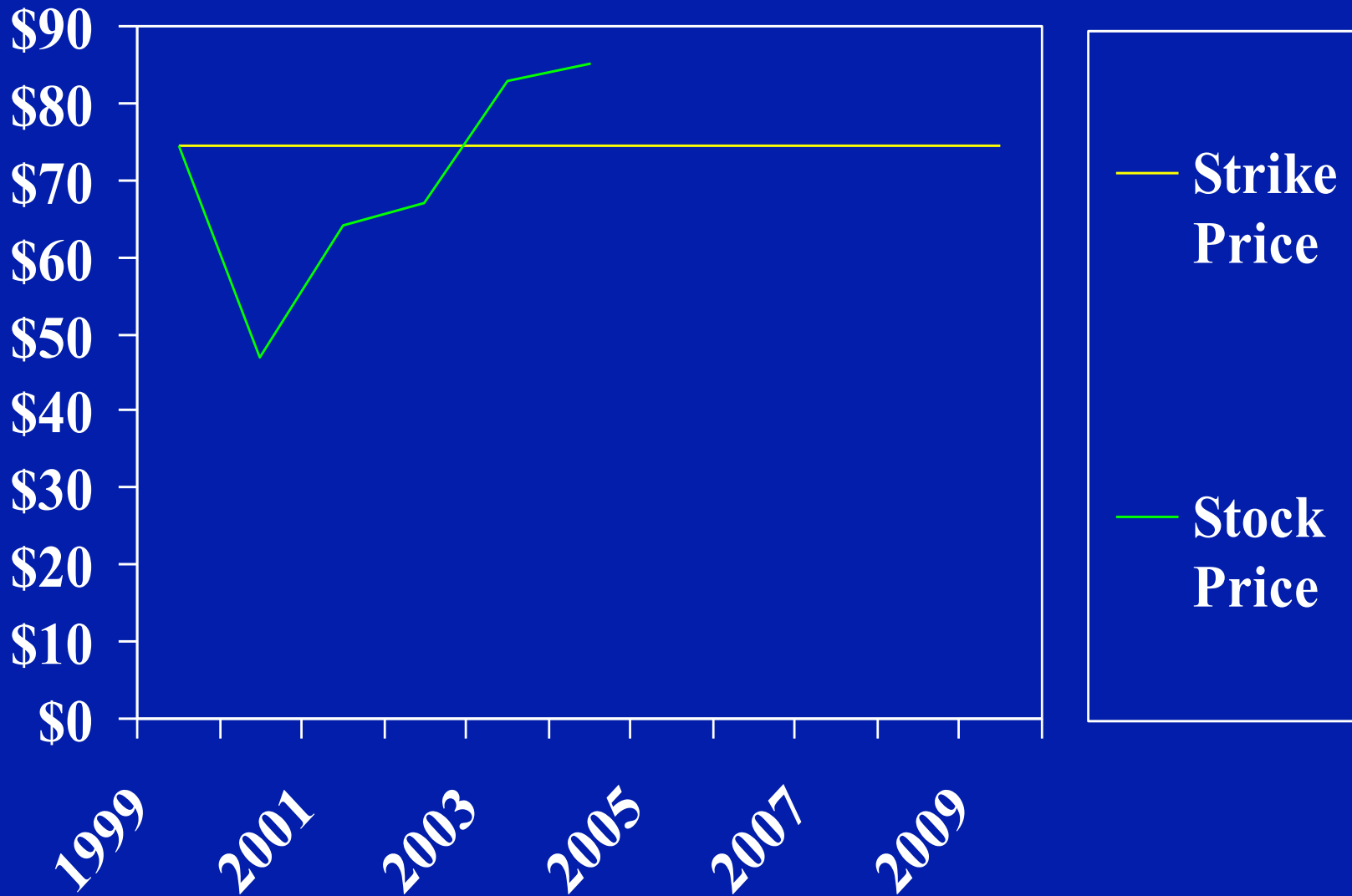Option Term: 10 years

Real World Example I

As of July 1, 1999

Intrinsic Value of Options: $0

Fair Market Value of Options: $19.46

Based on Form Def 14A / proxy statement
filed with the SEC on March 20, 2000

Real World Example II

Imclone

Strike Price: $70.00

Expiration Date: August 31, 2004

Stock Price on July 21, 2004: $65.44

Intrinsic Value: ($4.56)

Traded Option Price: $2.15

Problems/Criticisms of Black-Scholes

1. How to estimate volatility? (practical answer: use the public company's stated volatility measure).

2. Initially based on European option model (can exercise option at end of term only).

3. Initially developed for short-term (i.e. six months or less) options, therefore, the model is less accurate in predicting the value of long-term options.
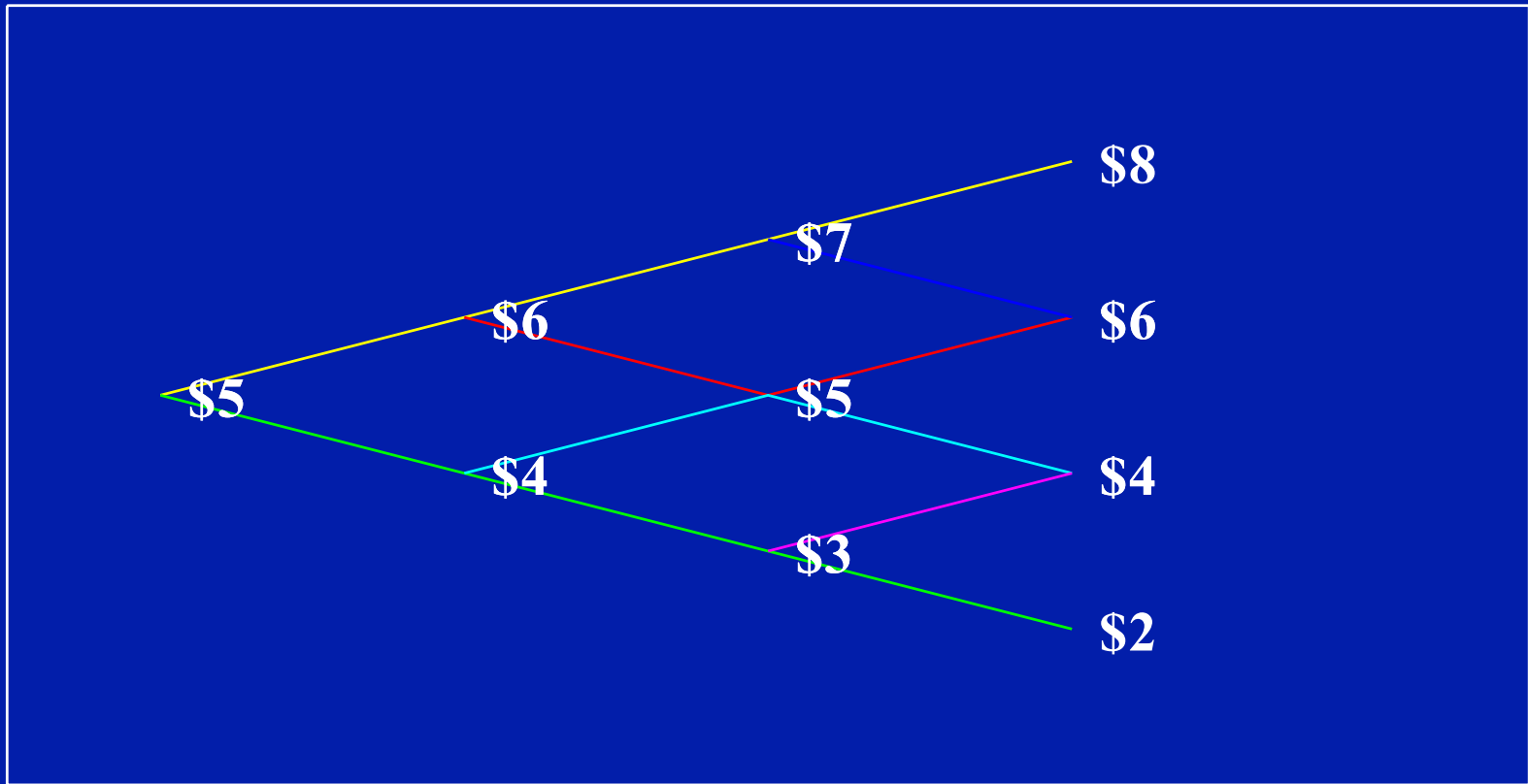
Binomial Option Pricing Model

Developed by Cox, Ross & Rubinstein in 1979.

Used more and more frequently today.

Uses a "lattice" or "decision tree" structure assuming up or down stock price movements at each time interval.

Binomial Option Pricing Model

Binomial Option Pricing Model

Believed to be more accurate than Black-Scholes due to the fact that the Binomial Model takes into account the possibility that changes in the underlying stock price can impact when a stock option is exercised (i.e., when the option is "in the money").

Differences in option value between the Binomial and Black-Scholes models are typically not that great.

Stock Option Regulation

SFAS 123 issued by FASB in October 1995.

Companies can recognize cost of options either as an expense or in a footnote disclosure.

Most companies use the footnote disclosure.

No specific option pricing model required by FASB.

FASB wants options expensed beginning in 2005.

Stock Option Regulation

HR 3574 requires that stock options for only the top 5 executives at the company be expensed.

HR 3574 also allows for a 0% volatility assumption, essentially rendering the value of the options at $0.

HR 3574 passed the U.S. House of Representatives by a 312-111 vote on July 20, 2004, but faces a more difficult fight in the Senate.

Option Pricing Models

See "FASB 123: Putting Together the Pieces," by James R. Mountain, published in the January 1996 *Journal of Accountancy* (included with this presentation and reprinted with permission).

Includes instructions on how to develop an Excel spreadsheet of the Black-Scholes Model.

Calculates both put and call option values.

Internet Option Pricing Sites

Big Applet: www.margrabe.com
Bursa Malaysia: www.mdex.com
CBOE: www.cboe.com
FTS: www.ftsweb.com
HKEX: www.hkex.com
NumaWeb: www.numa.com
OIC: www.freeoptioncalculator.com
Peter Hoadley: www.hoadley.net
Robert's Online: www.intrepid.com
Snowgold: www.snowgold.com

Internet Option Pricing Sites

CAUTION:

With any Internet site, be sure you understand the parameters and assumptions of each option calculation model. Different parameters and assumptions will result in different option values.

Internet Option Pricing Sites

Examples of Differences:

1. Specific model used (B-S, Binomial, other?).

2. European or American option?

3. Risk-free rate compounded annually/continuously?

4. Time period used: 360-day, 365-day year, other?

5. Different number of steps used in various models.

6. Are dividends considered?

7. Calculation errors in models (formulas not shown).

Stock Option Valuation

Michael A. Paschall, ASA, CFA, JD

Banister Financial, Inc.

Charlotte, NC

(704) 334-1625

www.businessvalue.com