



Bachelor of Economics
THAMMASAT UNIVERSITY

FN 211 Financial Markets

Class 7 : Interest Rates and Term Structure

Term Structure of Interest Rates

- One important factor causing interest rates to differ from one another is differences in the *maturity* (or term) of securities and loans.
- The relationship between the rates of return on financial instruments and their maturity at one moment in time is called the *term structure of interest rates*.
- This term structure may be represented visually by drawing a *yield curve* for all securities having the same credit quality.

US Treasury Yield curve

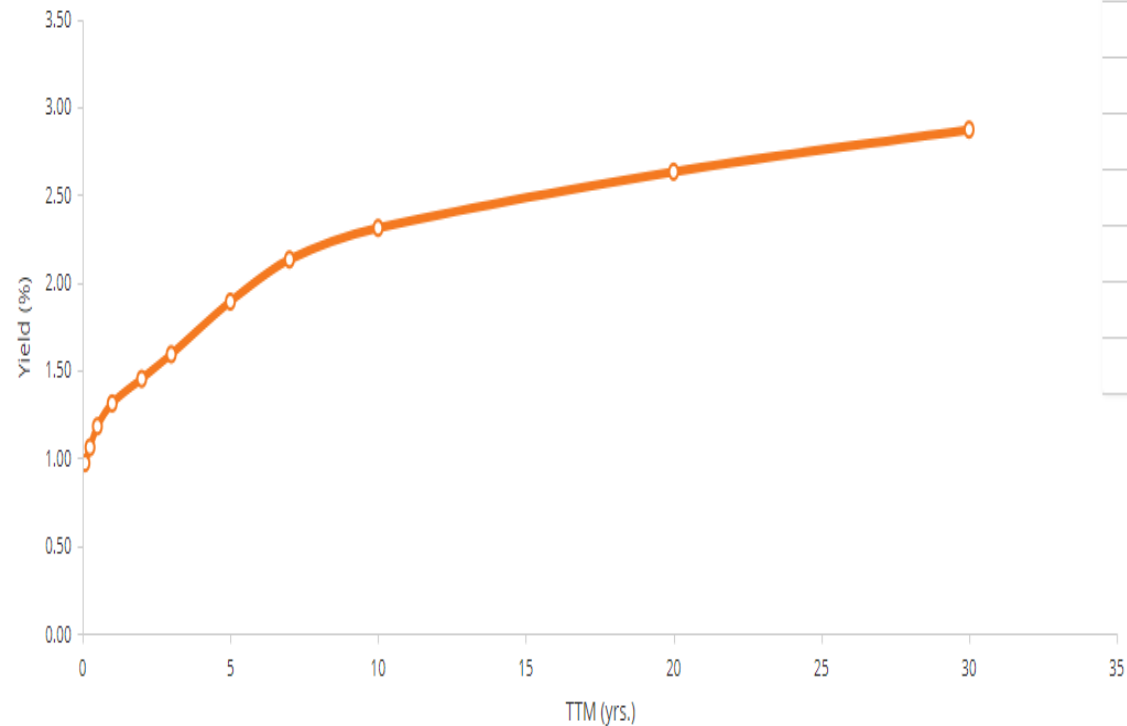
US Treasury Yield Curve

US Treasury Yield Curve

28/09/2017

Zero Coupon Yield Curve vs US Treasury Yield Curve
as of Thursday, September 28, 2017

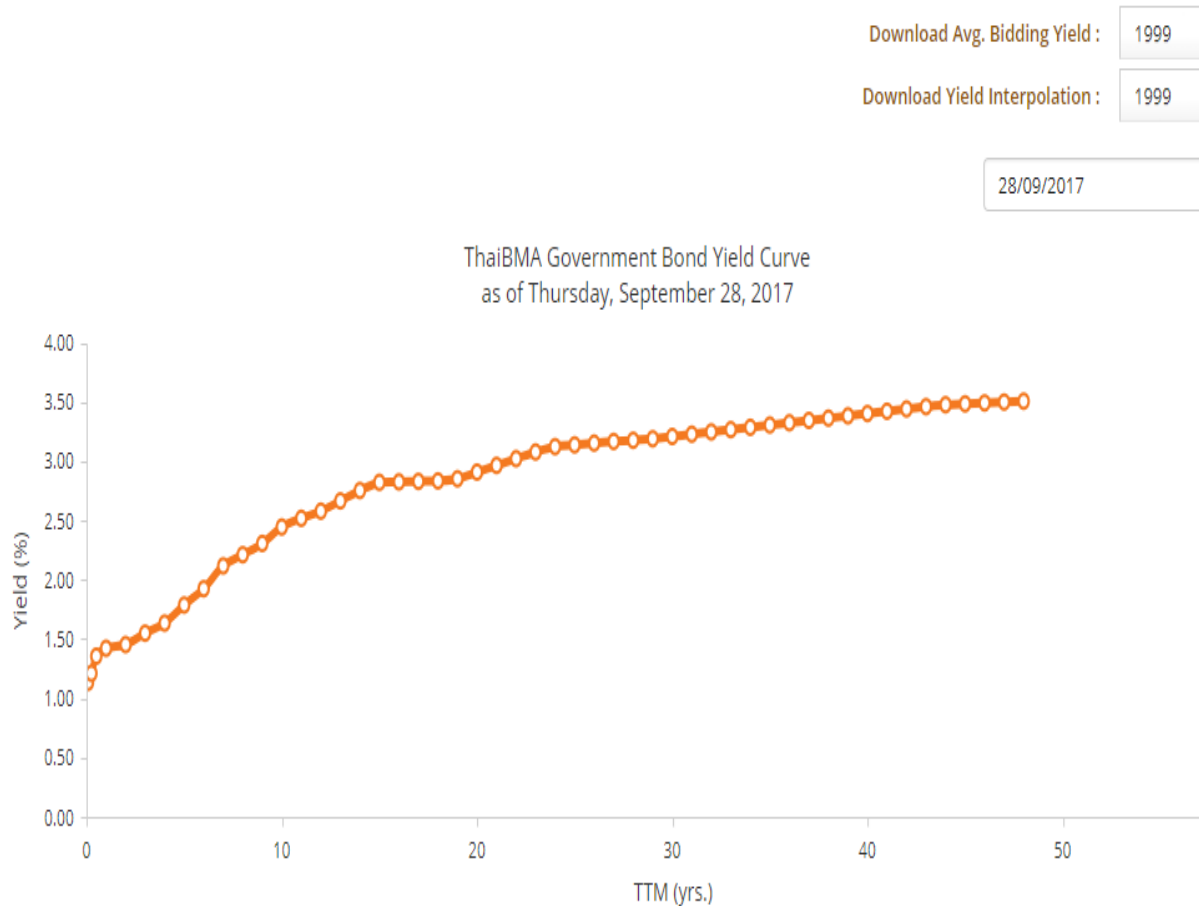
■ US Treasury Yield Curve ■ Zero Coupon Yield Curve



TTM (Yrs.)	Yield (%)	Change (bp)
1 Mth.	0.97	-2.00
3 Mth.	1.06	-1.00
6 Mth.	1.18	-2.00
1 YR.	1.31	-2.00
2 YR.	1.45	-2.00
3 YR.	1.59	-1.00
5 YR.	1.89	-2.00
7 YR.	2.13	-1.00
10 YR.	2.31	0.00
20 YR.	2.63	1.00

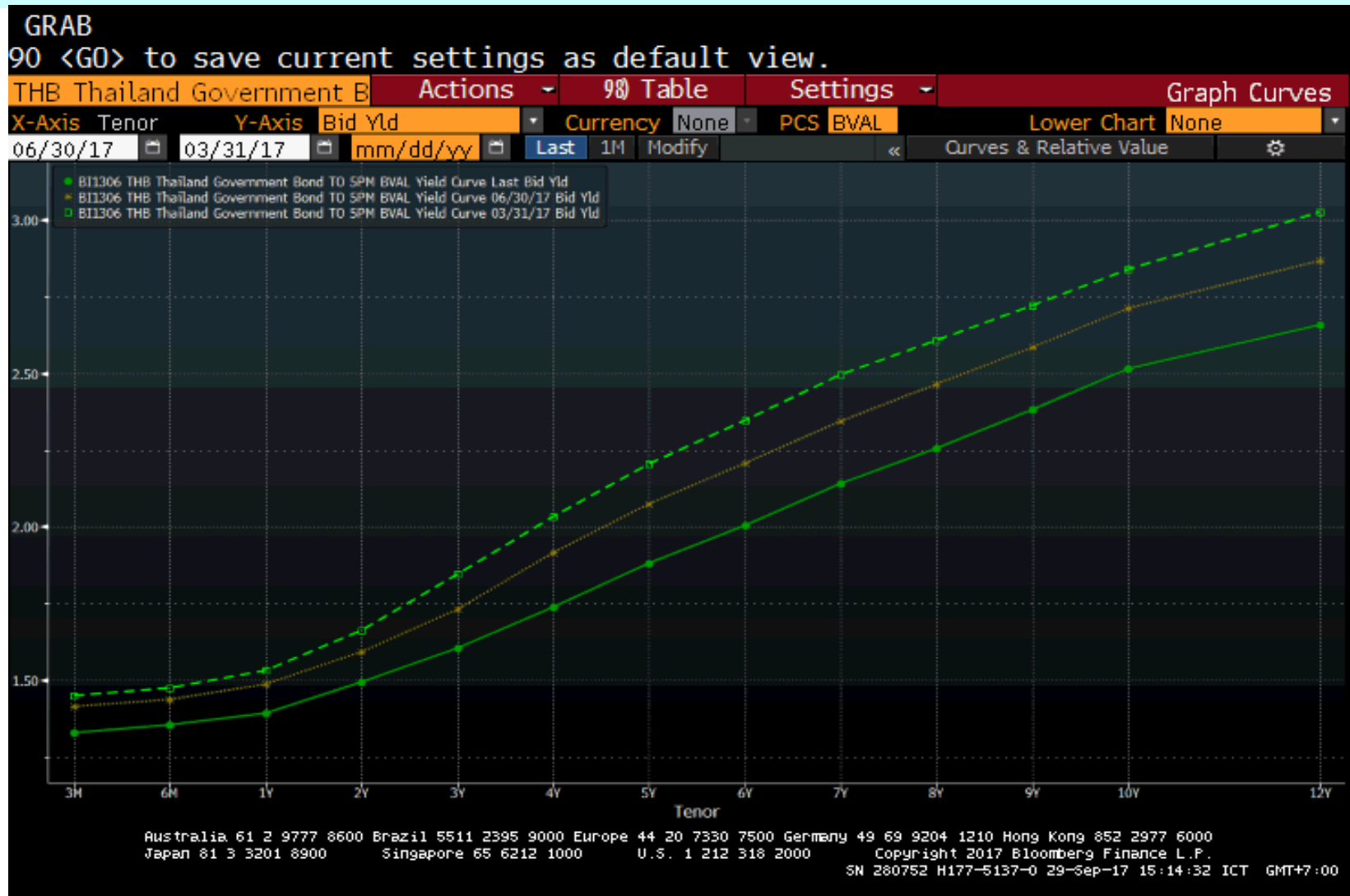
Thai Government Bond yield curve

Government Bond Yield Curve

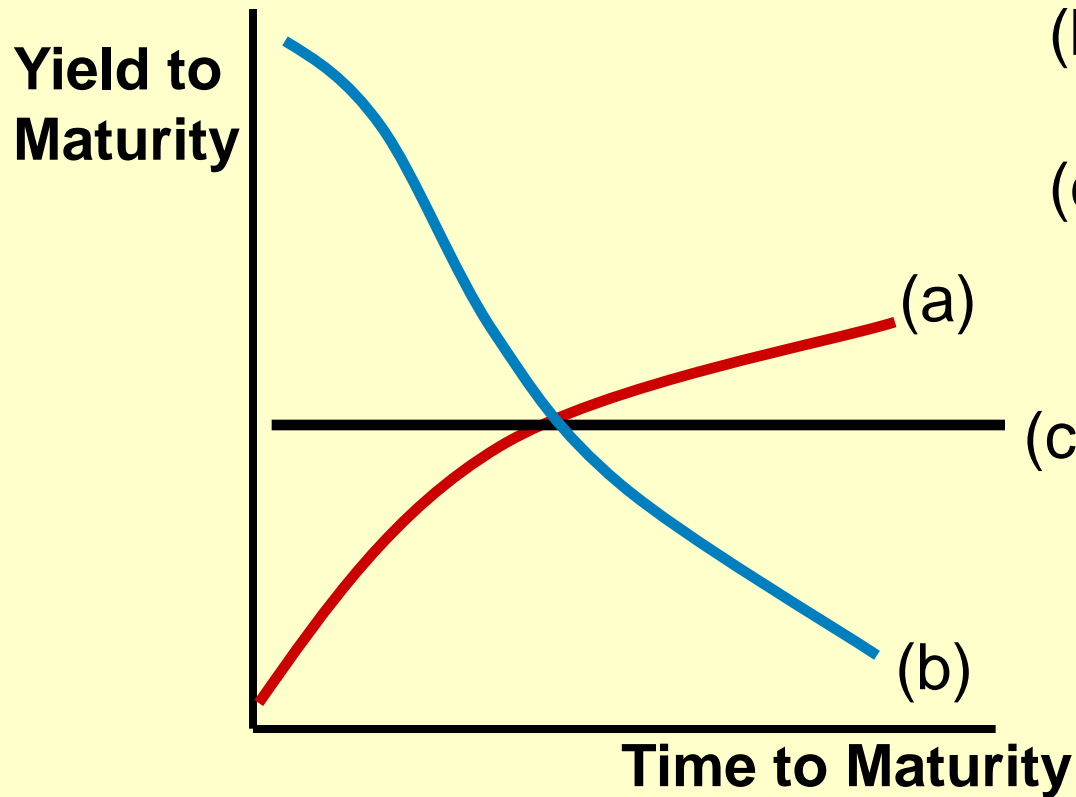


TTM (Yrs.)	Yield (%)	TTM (Yrs.)	Yield (%)
0.08	1.135798	9.00	2.306405
0.25	1.211354	10.00	2.445023
0.50	1.356042	11.00	2.518339
1.00	1.422235	12.00	2.578843
2.00	1.453446	13.00	2.665166
3.00	1.549660	14.00	2.752720
4.00	1.634681	15.00	2.821984
5.00	1.787254	16.00	2.825933
6.00	1.924603	17.00	2.829882
7.00	2.117065	18.00	2.833830
8.00	2.211387	19.00	2.851880
20.00	2.908348	31.00	3.227791
21.00	2.964816	32.00	3.247143
22.00	3.021284	33.00	3.266496
23.00	3.077753	34.00	3.285849
24.00	3.122840	35.00	3.305202
25.00	3.137767	36.00	3.324555
26.00	3.152695	37.00	3.343908
27.00	3.166505	38.00	3.363261
28.00	3.176574	39.00	3.382614
29.00	3.189085	40.00	3.401967
30.00	3.208438	41.00	3.421320

Thailand's Government Bond Yield Curves



Term Structure of Interest Rates



- (a) Upward sloping
- (b) Inverted or downward sloping
- (c) Flat

Term Structure of Interest Rates

Besides explaining the shape of the yield curve, we need theories to explain why:

1. Interest rates for different maturities move together.
2. Yield curves tend to have steep upward slope when short rates are low and downward slope when short rates are high.
3. Yield curve is typically upward sloping.

Interest Rates on Different Maturity Bonds Move Together

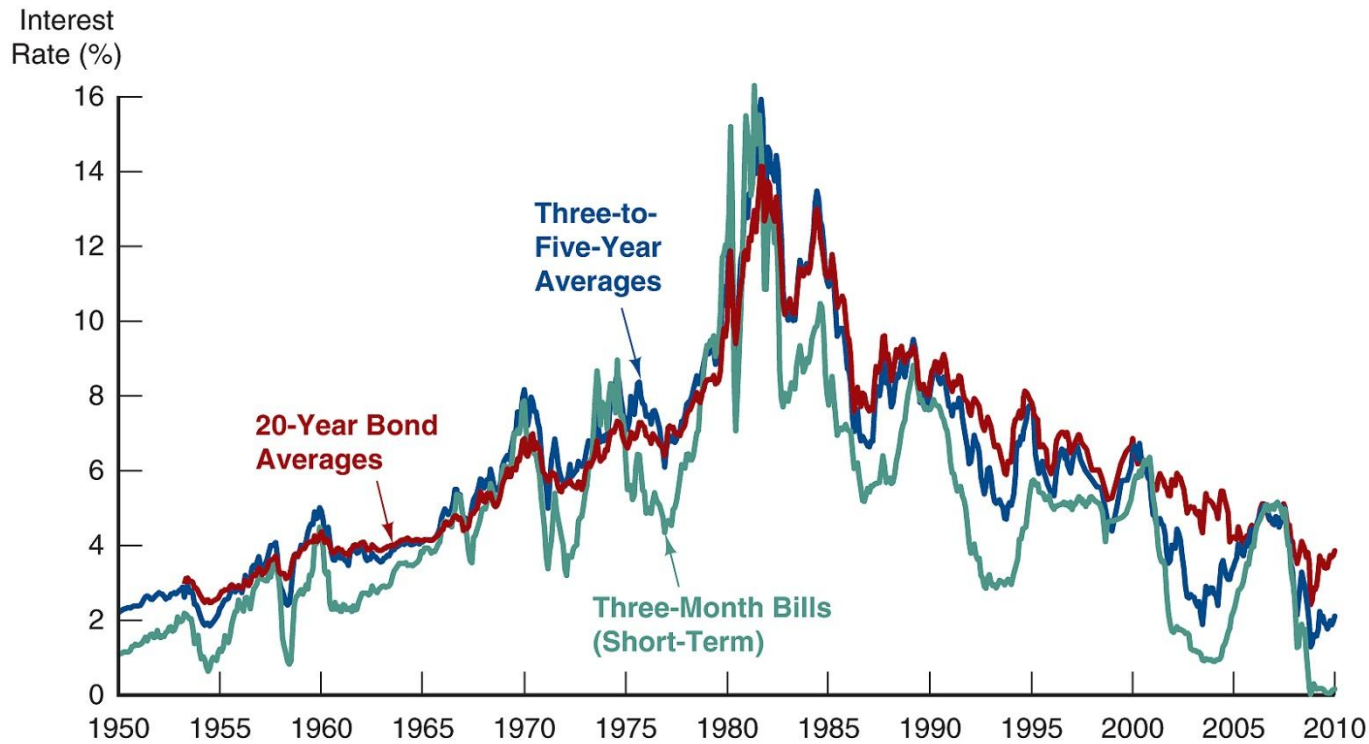


FIGURE 5.4 Movements over Time of Interest Rates on U.S. Government Bonds with Different Maturities

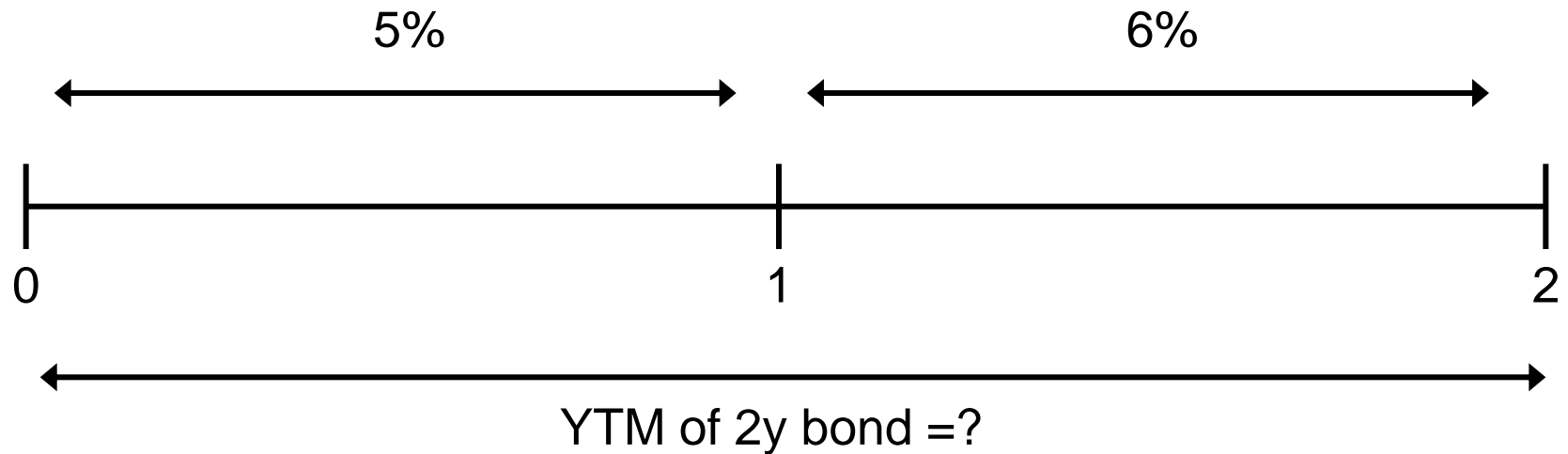
Source: Federal Reserve: www.federalreserve.gov/releases/h15/data.htm.

Expectations Theory

- The *unbiased expectations hypothesis* (*Expectation Theory*) argues that investor expectations regarding future changes in short-term interest rates determine the shape of the curve.
- So, an upward-sloping yield curve indicates that investors expect short-term interest rates to rise above the current rates in the future.
- This hypothesis assumes that long-term interest rate is a **geometric average** of a series of current and future short-term interest rates.

Expectations Theory

- For example, if YTM of a 1-year bond today is 5% and investors believe that YTM of 1-year bond will be 6% one year from now. What should be YTM of a 2-year bond today?



Expectations Theory

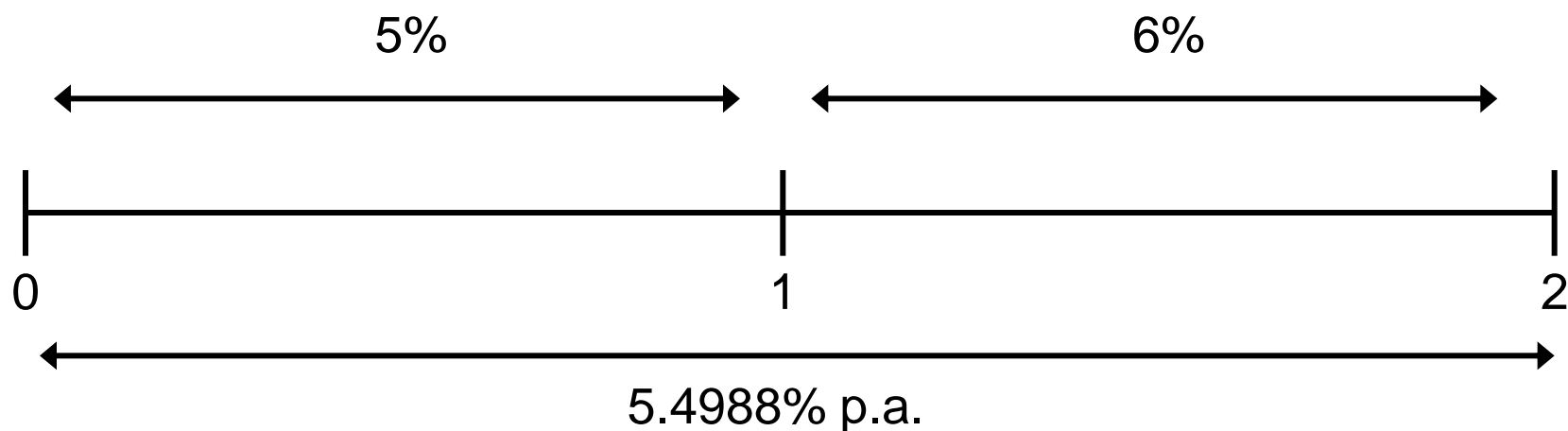
$$(1+x)^2 = (1+0.05)(1+0.06)$$

$$= 1.113$$

$$x = 5.4988\%$$

So, investors should be indifferent b/w two alternatives

- Buy 2-year bond today, or
- Buy 1-year bond today, and when it matures buy another 1-year bond



Expectations Theory

The expected 6% rate, one year from today, is called a **forward rate**. It can be viewed as the market's consensus of future interest rate.

Define ${}_1f_m$ = 1-period forward rate beginning m periods from now, then

${}_1f_1$ indicates 1-year forward rate beginning 1 year from now

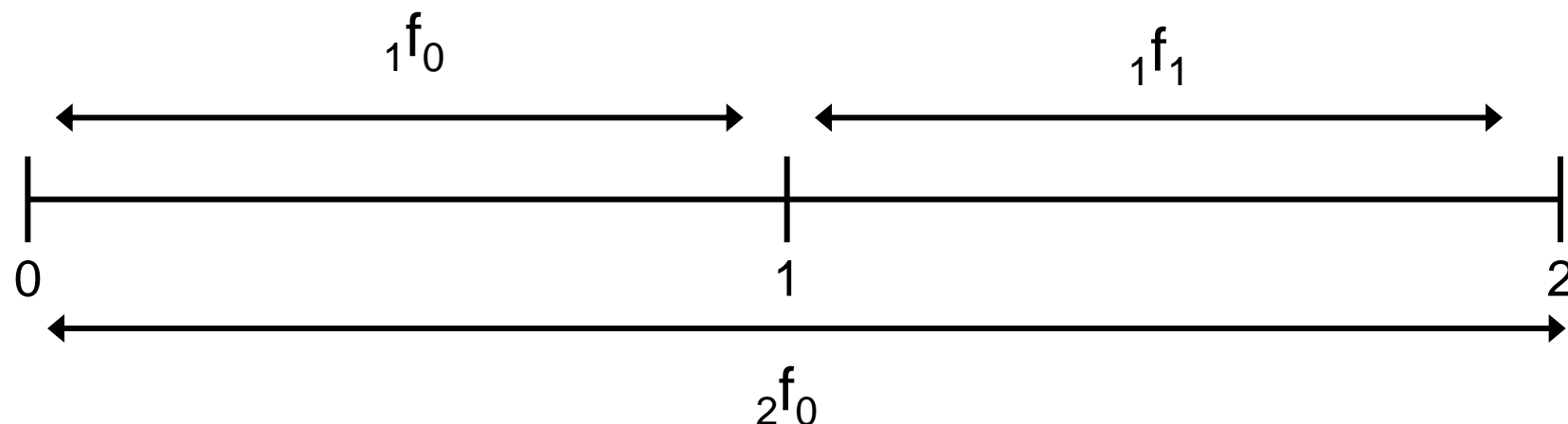
${}_1f_2$ indicates 1-year forward rate beginning 2 years from now

${}_1f_3$ indicates 1-year forward rate beginning 3 years from now

...

${}_1f_0$ indicates 1-year rate today, also called spot rate

${}_2f_0$ indicates 2-year rate today, also called **spot rate**



Expectations Theory and Term Structure Facts

- Explains why yield curve has different slopes
 1. When short rates are expected to rise in future, average of future short rates = i_{nt} is above today's short rate; therefore yield curve is upward sloping.
 2. When short rates expected to stay same in future, average of future short rates same as today's, and yield curve is flat.
 3. Only when short rates expected to fall will yield curve be downward sloping.

Expectations Theory and Term Structure Facts

- Pure expectations theory explains fact 1—that short and long rates move together
 1. Short rate rises are persistent
 2. If $i_t \uparrow$ today, i^e_{t+1} , i^e_{t+2} etc. $\uparrow \Rightarrow$ average of future rates $\uparrow \Rightarrow i_{nt} \uparrow$
 3. Therefore: $i_t \uparrow \Rightarrow i_{nt} \uparrow$
(i.e., short and long rates move together)

Expectations Theory and Term Structure Facts

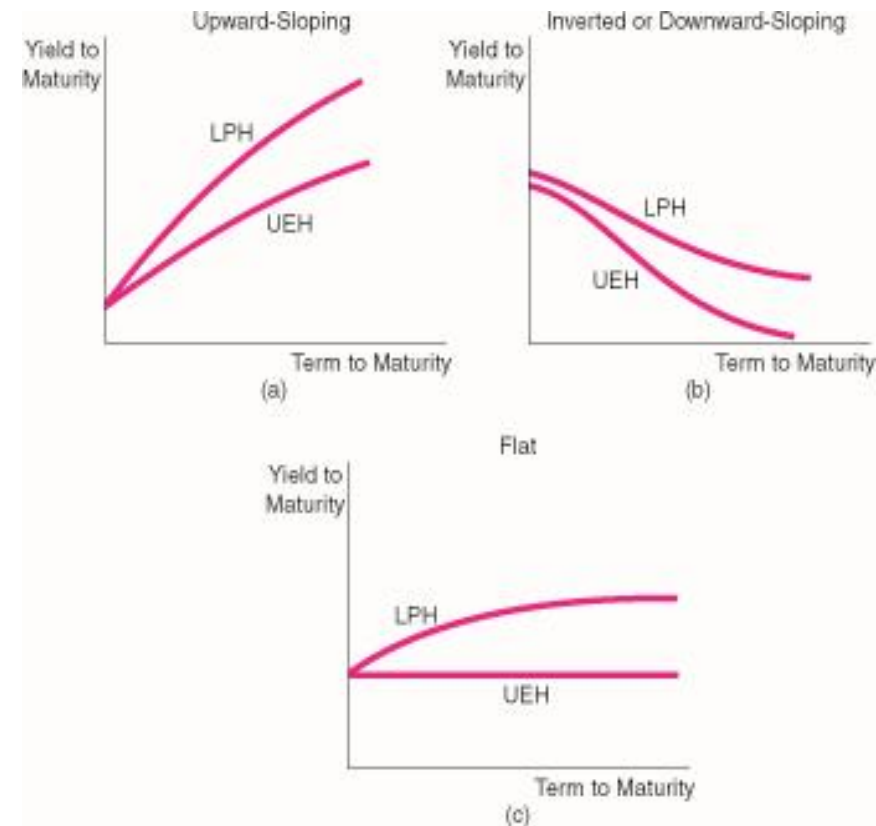
- Explains fact 2—that yield curves tend to have steep slope when short rates are low and downward slope when short rates are high
 1. When short rates are low, they are expected to rise to normal level, and long rate = average of future short rates will be well above today's short rate; yield curve will have steep upward slope.
 2. When short rates are high, they will be expected to fall in future, and long rate will be below current short rate; yield curve will have downward slope.

Expectations Theory and Term Structure Facts

- Doesn't explain fact 3—that yield curve usually has upward slope
 - Short rates are as likely to fall in future as rise, so average of expected future short rates will not usually be higher than current short rate: therefore, yield curve will not usually slope upward.

Liquidity Premium Theory

- The *liquidity premium theory* of the yield curve suggests that there is a **bias** toward positively-sloped yield curves.
- This is because longer-term securities tend to have more volatile market prices and hence, greater risk of capital loss.
- So, investors must be paid an interest rate premium (the **liquidity premium**) to encourage them to purchase long-term securities.



Liquidity Premium Theory

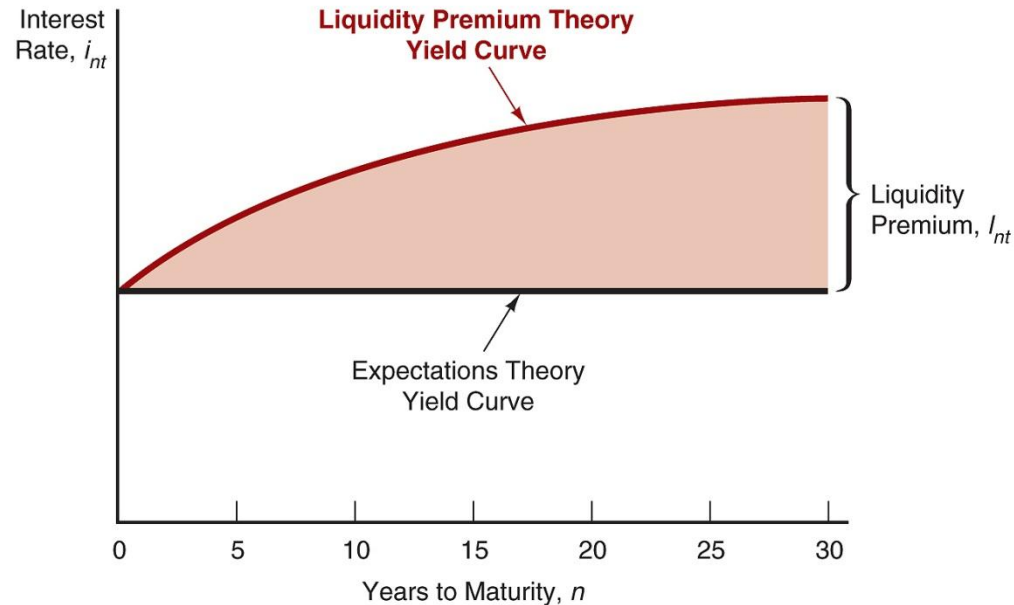


FIGURE 5.5 The Relationship Between the Liquidity Premium and Expectations Theory

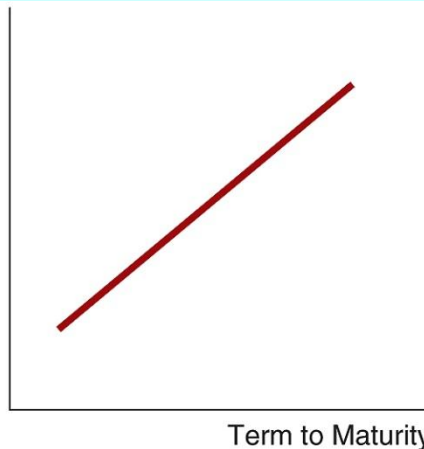
Because the liquidity premium is always positive and grows as the term to maturity increases, the yield curve implied by the liquidity premium theory is always above the yield curve implied by the expectations theory and has a steeper slope. For simplicity, the yield curve implied by the expectations theory is drawn under the scenario of unchanging future one-year interest rates.

Liquidity Premium Theory: Term Structure Facts

- Explains All 3 Facts
 - Explains fact 3—that usual upward sloped yield curve by liquidity premium for long-term bonds
 - Explains fact 1 and fact 2 using same explanations as pure expectations theory because it has average of future short rates as determinant of long rate

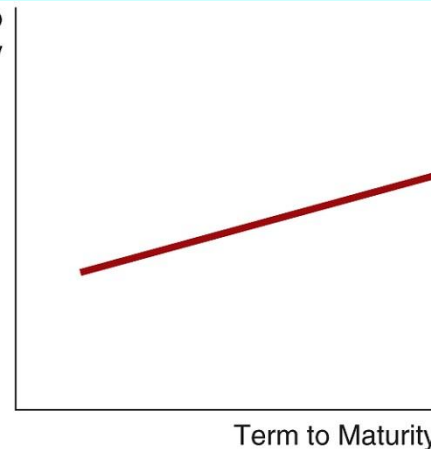
Market Predictions of Future Short Rates

Yield to Maturity



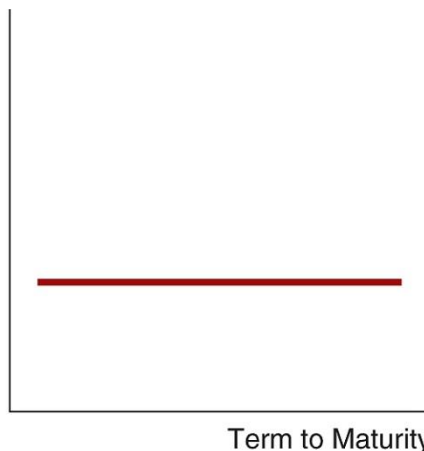
(a) *Future short-term interest rates expected to rise*

Yield to Maturity



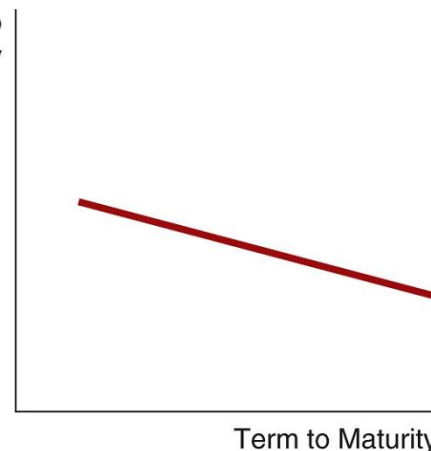
(b) *Future short-term interest rates expected to stay the same*

Yield to Maturity



(c) *Future short-term interest rates expected to fall moderately*

Yield to Maturity



(d) *Future short-term interest rates expected to fall sharply*

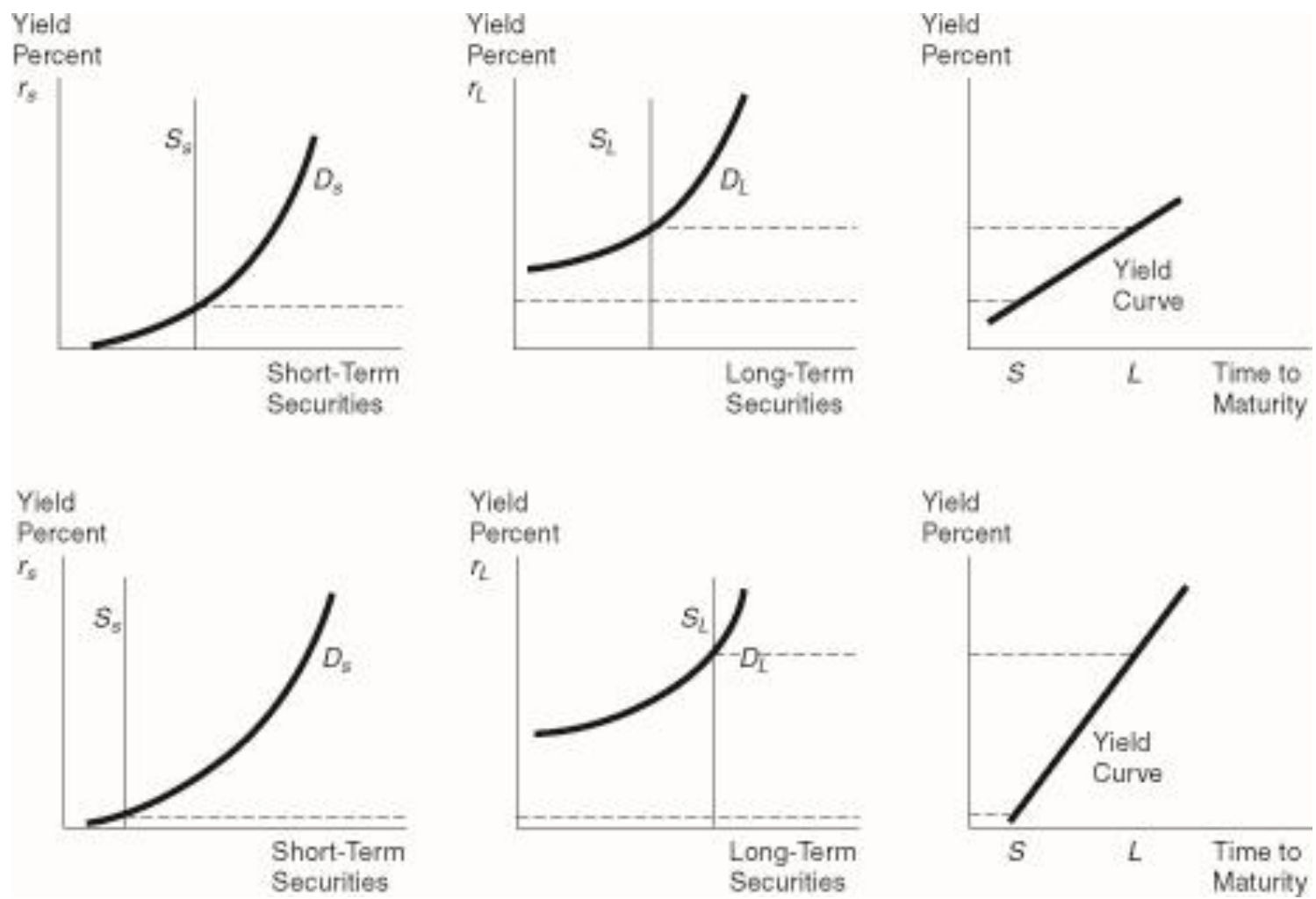
FIGURE 5.6 Yield Curves and the Market's Expectations of Future Short-Term Interest Rates According to the Liquidity Premium Theory

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Market Segmentation Theory

- The **market segmentation argument** of the yield curve separates the financial markets into several distinct markets according to the maturity preferences of the investors.
- It assumes that all financial assets **are not perfect substitutes** in the minds of investors. Maturity preference exist among some investor groups and they will not stray from their desired maturity range unless induced to do so by higher yields or other favorable terms.
 - *For example, pension funds prefer long-term bonds.*
- The implication is that governments can alter the shape of the yield curve by shifting the available supplies of securities relative to the demand for those securities in each distinct market.

Market Segmentation Theory



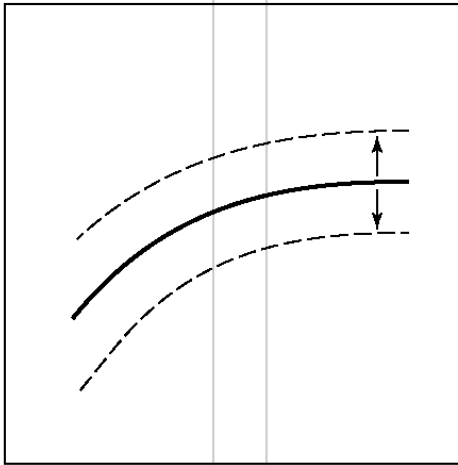
Market Segmentation Theory

- Explains fact 3—that yield curve is usually upward sloping
 - People typically prefer short holding periods and thus have higher demand for short-term bonds, which have higher prices and lower interest rates than long bonds
- Does not explain fact 1 or fact 2 because it assumes long-term and short-term rates are determined independently.

Changes in Yield Curves

A. Shifts in the *level* of the yield curve

Yield to maturity (%)

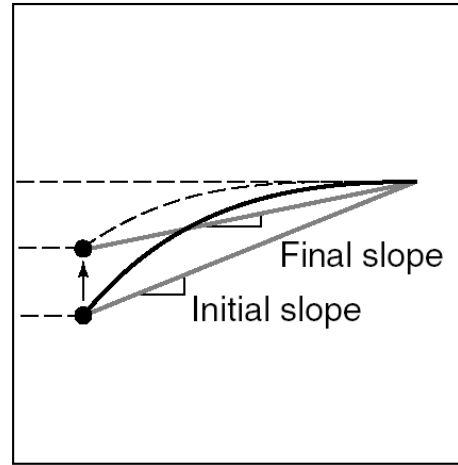


Time to maturity (Months + years)

B. Changes in *slope* of the yield curve

Yield to maturity (%)

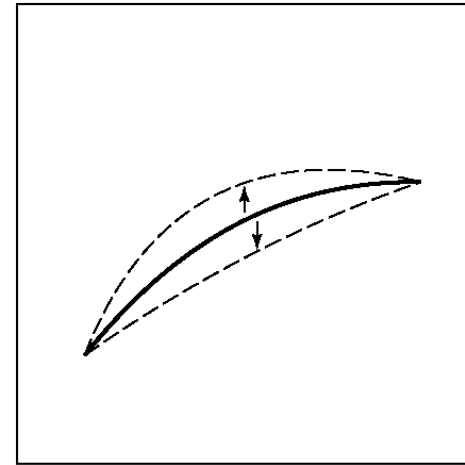
r_e
 r'_s
 r_s



Time to maturity (Months + years)

B. Changes in *yield curve's curvature*

Yield to maturity (%)



Time to maturity (Months + years)

The Uses of Yield Curves

- The yield curve is a useful tool for ...
 - forecasting interest rates – a downward-sloping yield curve suggests near-term declines in short-term interest rates
 - identifying portfolio management strategies – a rising yield curve favors short-term borrowing and long-term lending
 - detecting over- and under-priced financial assets
 - indicating trade-offs between maturity and yield
 - “riding” the yield curve – active investors may gain by timely portfolio switching