Investment Process

CAPM model with stochastic price would be

$$\frac{E[P_{i(t=T_2)}]-P_{i(t=T_1)}}{P_{i(t=T_1)}} = R_f + \beta_i \{\frac{E[P_{M(t=T_2)}]-P_{M(t=T_1)}}{P_{M(t=T_1)}} - R_f\}$$

The factor given below is the **risk adjusted interest rate**

$$1 + R_f + \beta_i \{\frac{E[P_{M(t=T_2)}]-P_{M(t=T_1)}}{P_{M(t=T_1)}} - R_f\}$$

Investment Process

- Linearity of pricing (means no arbitrage)
- Certainty equivalent form

Investment Process

In the CAPM model we have considered the returns are normally distributed. In case they are log-normally distributed then the modified CAPM is $\frac{E(R_i)-R_f}{E(R_i)} = \frac{E(R_M)-R_f}{E(R_M)}\beta_i$

where $\beta_i = \frac{\exp(\rho_{i,M}\sigma_i\sigma_M)-1}{\exp(\sigma_M^2)-1}$

Investment Process

Other portfolio selection models

Generally investors have the following characteristics

- Expected utility maximization, i.e., prefer more to less
- Risk aversion

Even we have other forms of utility function, yet quadratic approximation (i.e., use of mean value theorem) do give us good results, which are more practical.

Investment Process

People have other criteria for portfolio solutions which are:

- Geometric mean return
- Safety first criteria
- Stochastic dominance
- Analysis in terms of characteristics of the return distribution

Investment Process

Geometric mean return

For the selection process we consider the maximum GM has:

- The highest probability of reaching or exceeding any given wealth level in the shortest possible time.
- The highest probability of exceeding any given wealth level over any given period of time

Investment Process

$R_{i,j}$ = i^{th} possible return on the j^{th} portfolio.

$$R_{G,j} = (1+R_{1,j})^{p_{1,j}} \times \ldots\ldots \times (1+R_{n,j})^{p_{n,j}} - 1$$

$p_{i,j}$ = probability of i^{th} outcome for j^{th} portfolio.

Then choose the maximum of the GM values

Investment Process

Consider we have the following combinations of assets A, B and C in the following ratios (weights) to form a portfolio P. The returns are 10, 20, 30 respectively.

	A	B	C
1	0.20	0.20	0.60
2	1/3	1/3	1/3
3	0.25	0.25	0.50

$R_{P,1} = (1+0.10)^{0.20}*(1+0.20)^{0.20}*(1+0.30)^{0.60} - 1 = 0.237$

$R_{P,2} = (1+0.10)^{1/3}*(1+0.20)^{1/3}*(1+0.30)^{1/3} - 1 = 0.197$

$R_{P,3} = (1+0.10)^{0.25}*(1+0.20)^{0.25}*(1+0.30)^{0.50} - 1 = 0.222$

Hence choose scenario # 1

Investment Process

- Maximizing GM return is equivalent to maximizing the expected value of log utility function
- Portfolios that maximize the GM return are also mean-variance efficient if returns are log-normally distributed

Investment Process

Under safety first principle the basic tenet is that the decision maker is unable or unwilling to consider the utility theorem for making his/her decision process. Under this methodology people make their decision placing more importance to bad outcomes

Investment Process

Safety first principles

- Min $P[R_P<R_L]$
- Max R_L
- $Max\ \overline{R}_P$

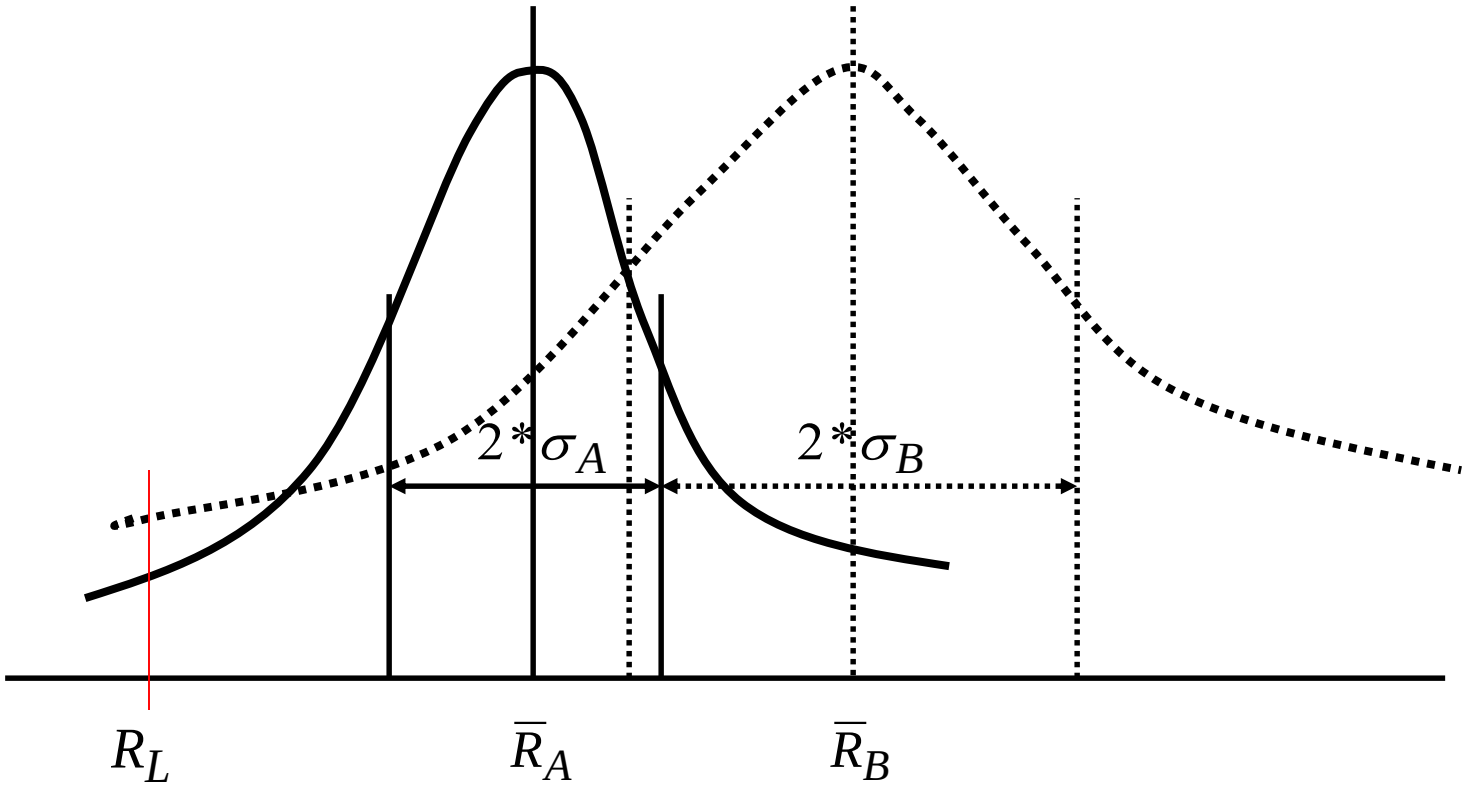
Investment Process

If returns are normally distributed then the optimal portfolio would be the one where R_L was the maximum number of SD away from the mean

Let us consider an example for Min $P[R_p < R_L]$. Remember we consider the returns are normally distributed and the suffix P denotes the portfolio while R_L means a fixed level of return (5).

	A	B	C
R_P	10	14	17
σ_P	5	4	8
Diff from 5%	$-1*\sigma_A$	$-2.25*\sigma_B$	$-1.5*\sigma_C$

Investment Process



Investment Process

In order to determine how many SDs, R_L lies below the mean we calculate R_L minus the mean return divided by the SD. Thus we have

$$\min\left(\frac{R_L - \bar{R}_P}{\sigma_P}\right) = \max\left(\frac{\bar{R}_P - R_L}{\sigma_P}\right)$$

This is equivalent to $\max\left(\frac{\bar{R}_P - R_F}{\sigma_P}\right)$

Investment Process

Even though for our example we have simplified our assumption by considering only normal distribution, but this would hold for any distributions having first and second moments.

Investment Process

According to Tchebychev (Chebyshev) inequality for any random variable X, such that E(X) and V(X) exists, then

$$P\left(\left|\frac{X-E(X)}{\sqrt{V(X)}}\right|>t\right)\leq\frac{1}{t^2}\Leftrightarrow P\left(\left|\frac{R_P-\bar{R}_P}{\sigma_P}\right|>K\right)\leq\frac{1}{K^2}$$

Investment Process

As we are interested in lower limit hence we simply it and have

$$P\left(\frac{R_P - \bar{R}_P}{\sigma_P} > K\right) \leq \frac{1}{K^2}$$

$$P\left(\frac{R_P - \bar{R}_P}{\sigma_P} > \frac{R_L - \bar{R}_P}{\sigma_P}\right) \leq \frac{\sigma_P^2}{\left(R_L - \bar{R}_P\right)^2}$$

Investment Process

The right hand side of the inequality is is exactly equal to the decision process # 1 under safety first principle we have considered previously

$$P\left(\frac{R_P - \bar{R}_P}{\sigma_P} < \frac{R_L - \bar{R}_P}{\sigma_P}\right) \leq \frac{\sigma_P^2}{\left(R_L - \bar{R}_P\right)^2}$$

$$P\left(R_P < R_L\right)$$

Investment Process

For the second criterion we have

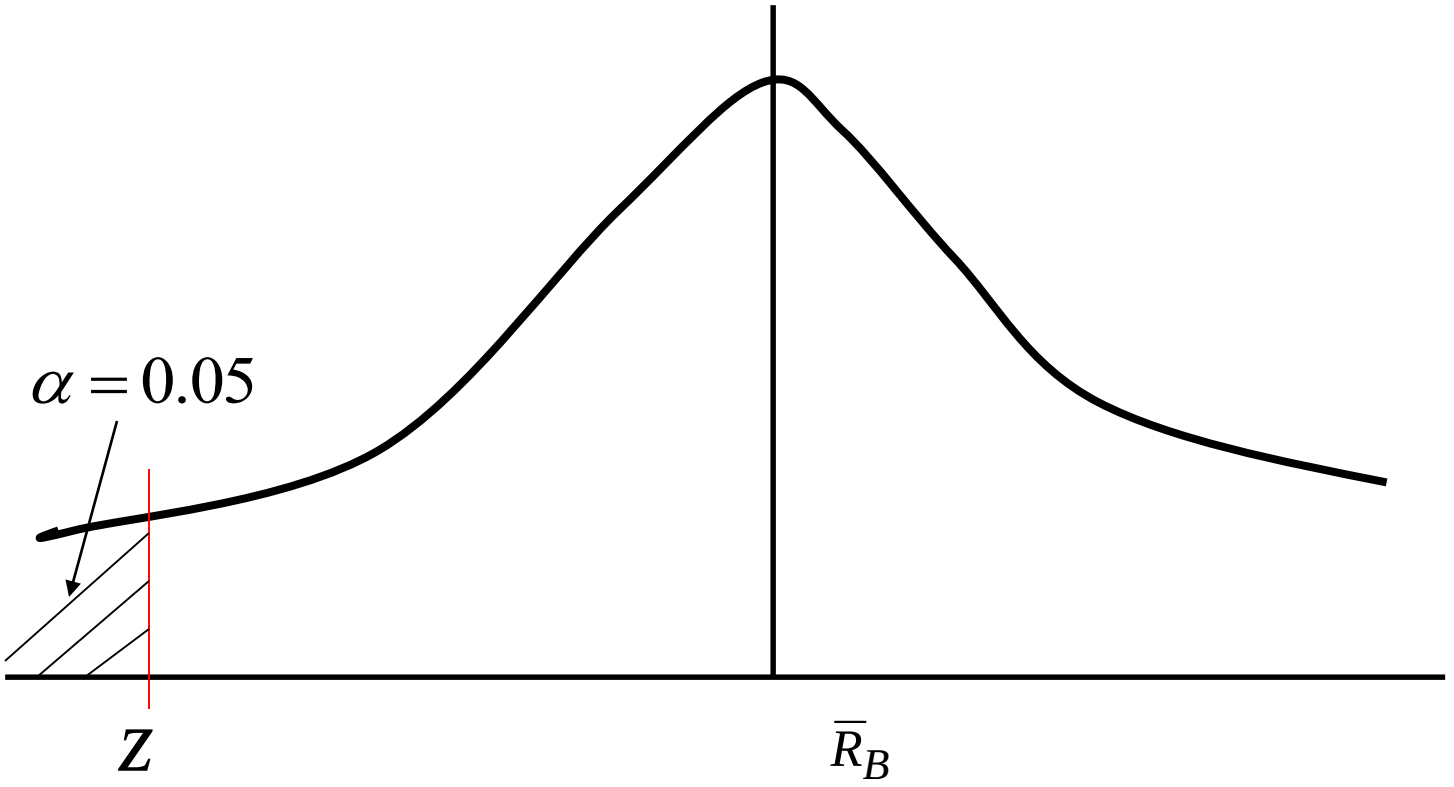
max R_L

such that $P(R_P < R_L) \leq \alpha$

We are given α (say 0.05), then we should have

$$P\left(\frac{R_P - \bar{R}_P}{\sigma_P} < \frac{R_L - \bar{R}_P}{\sigma_P}\right) \leq 0.05$$

Investment Process



Investment Process

This implies we must have

$$\overline{R}_P \geq R_L + 1.65 * \sigma_P$$

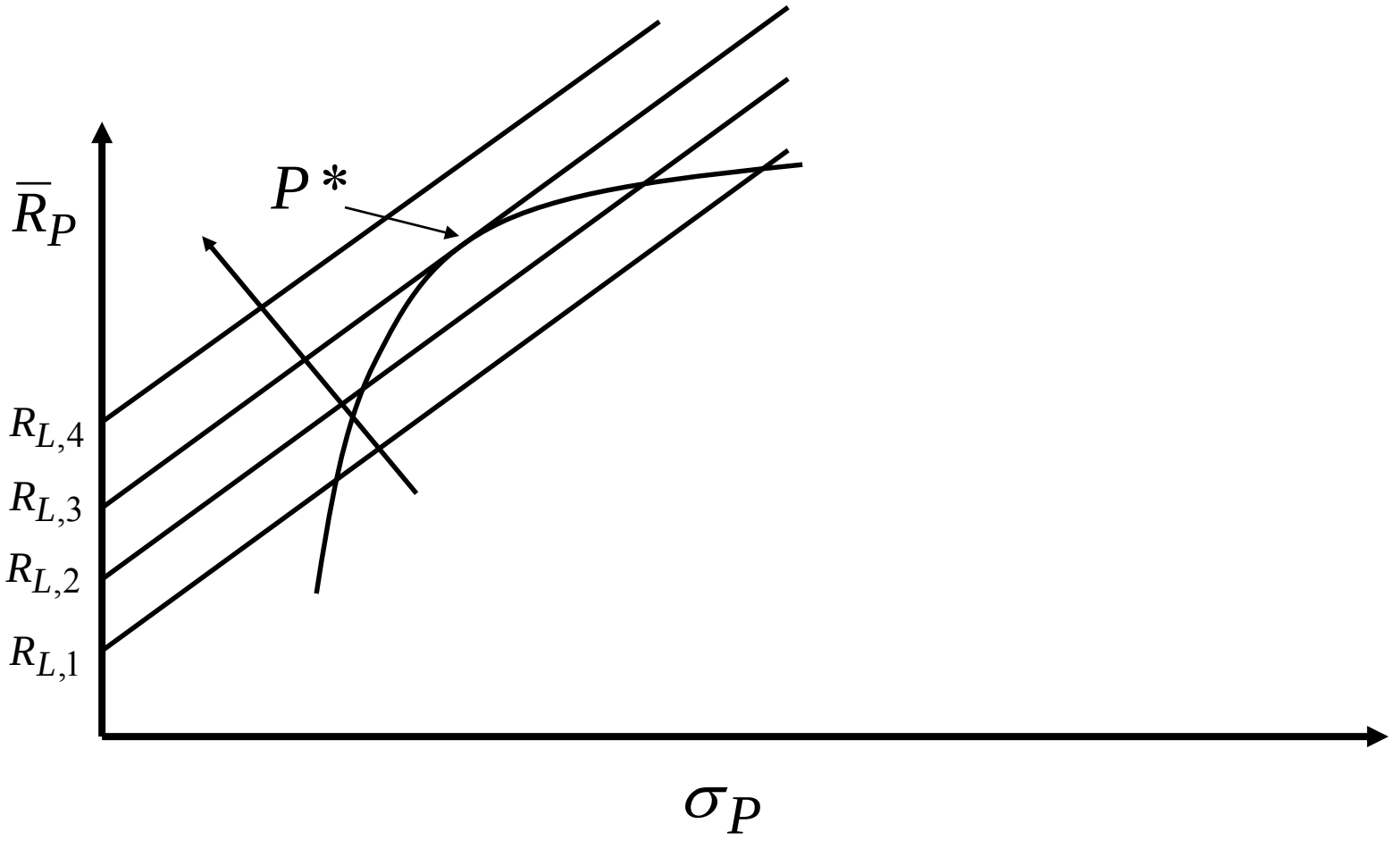
Change the fixed rate of return (R_L) which we want and we have

$$\overline{R}_{P,1} \geq R_{L,1} + 1.65 * \sigma_P$$

....

$$\overline{R}_{P,J} \geq R_{L,J} + 1.65 * \sigma_P$$

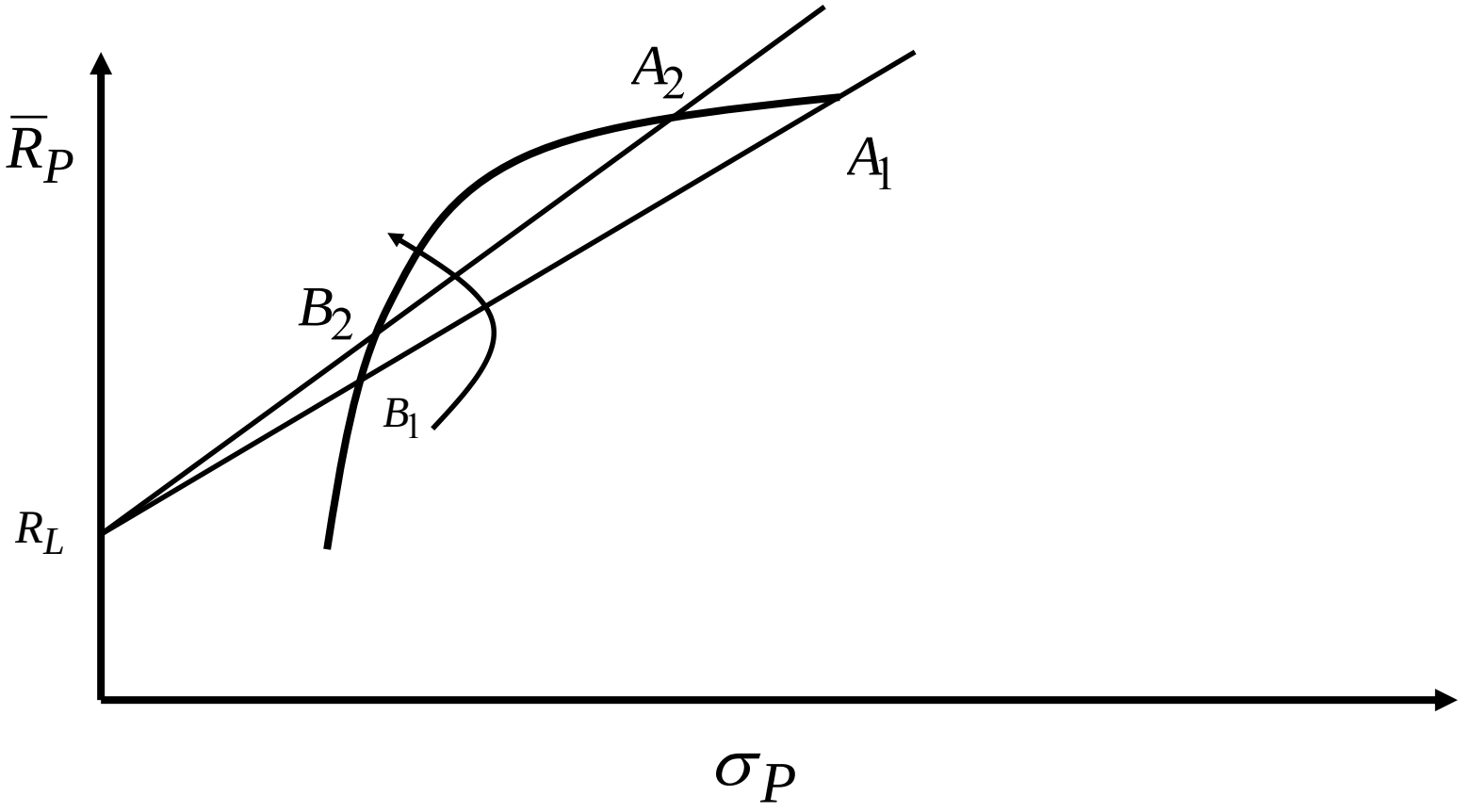
Investment Process



Investment Process

The criterion is $\max \ \overline{R}_P$ such that $P(R_P \leq R_L) = \alpha$, here α is predertermined depending on the investor's own constraints. Thus with the condition we have $\overline{R}_P \geq R_L + z * \sigma_P$

Investment Process

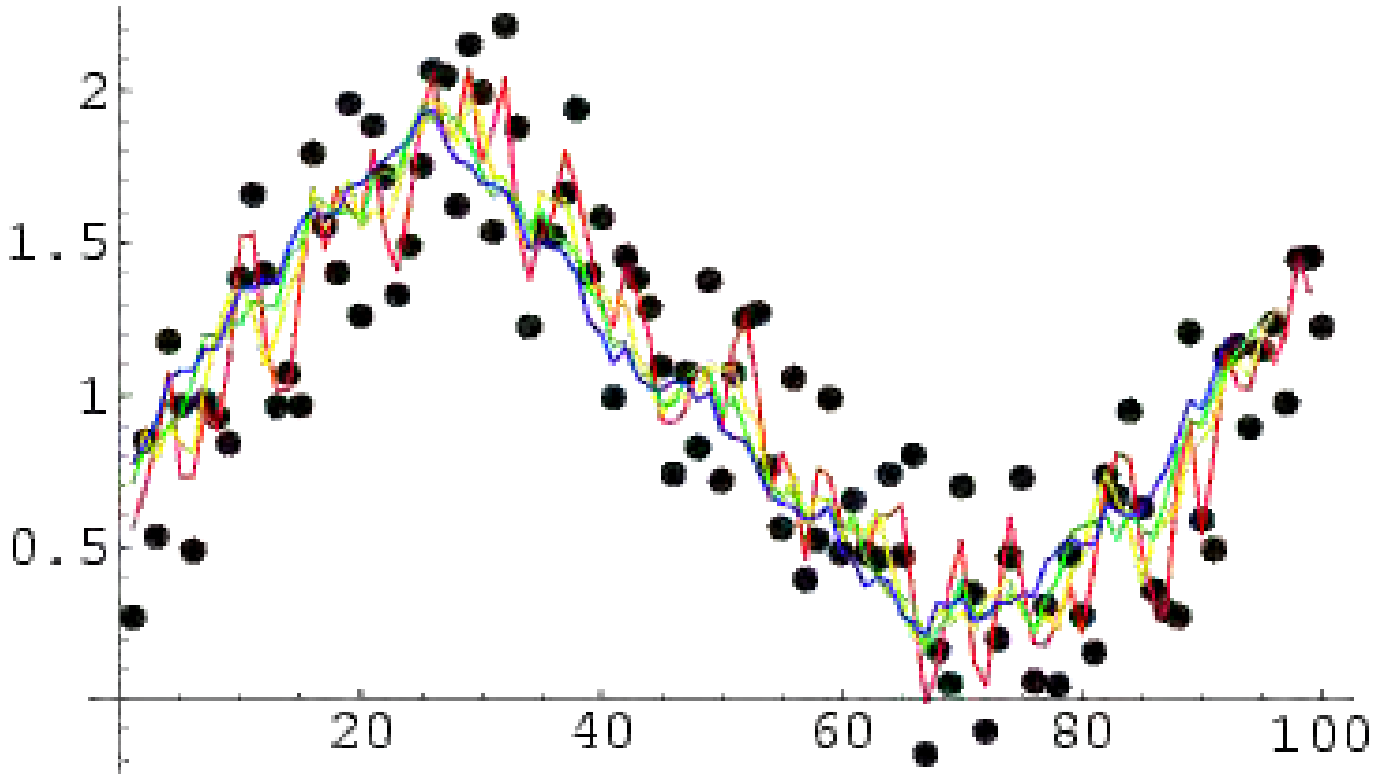


Investment Process

There are three forms of efficient market theory

- Weak form: You cannot predict future stock prices based on past information. Stock prices behave very much like random walk. The basic notion of weak form goes against technical analysis
- Semi-strong form: You cannot utilize published information to predict future prices. The basic notion of semi-strong form goes against fundamental analysis
- Strong form: Nothing, not even unpublished information can be used to predict future prices. The basic notion of strong form goes against fundamental analysis

Investment Process

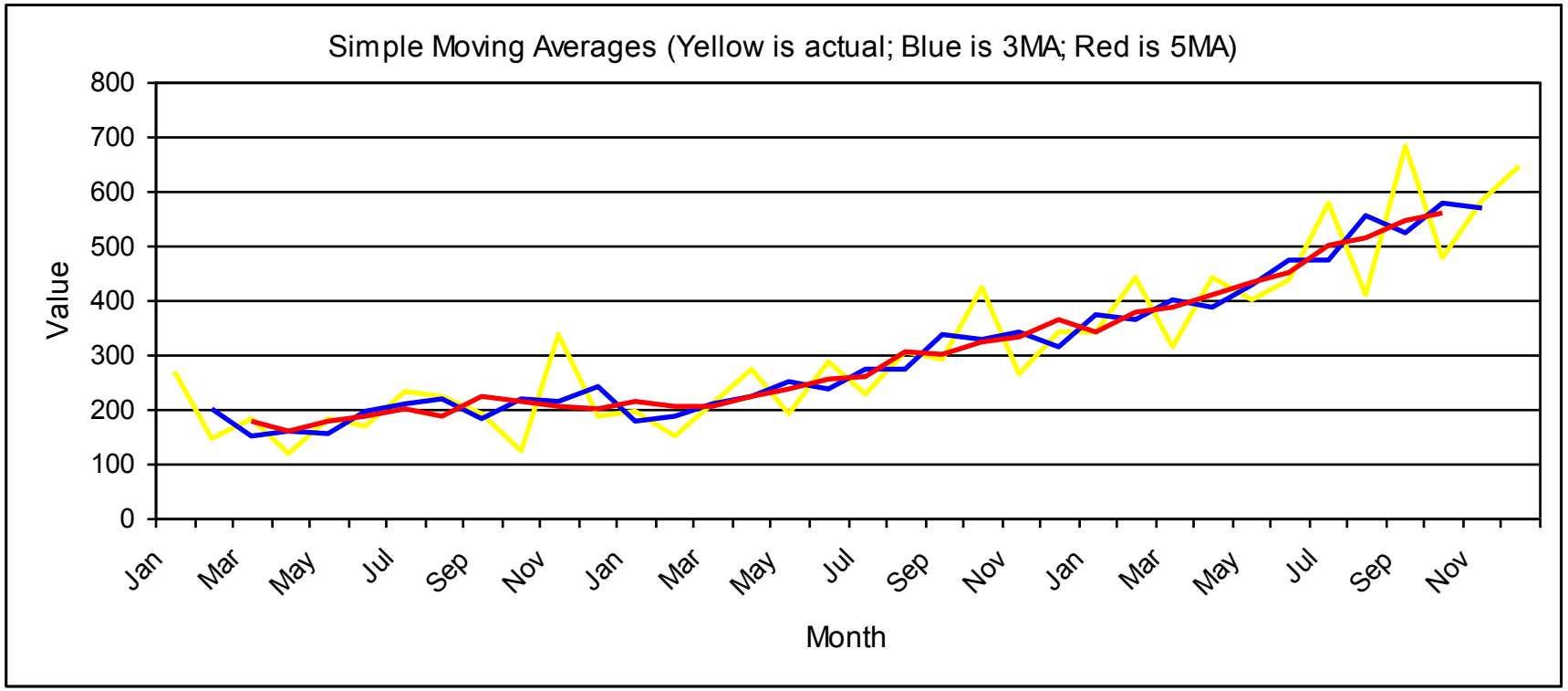


Simple Moving Average
3MA = 3 month Moving Average
5MA = 5 month Moving Average

Month	Actual	3MA	5MA
Jan	266.00		
Feb	145.90	198.33	
Mar	183.10	149.43	178.92
Apr	119.30	160.90	159.42
May	180.30	156.03	176.60
Jun	168.50	193.53	184.88
Jul	231.80	208.27	199.58
Aug	224.50	216.37	188.10
Sep	192.80	180.07	221.70
Oct	122.90	217.40	212.52
Nov	336.50	215.10	206.48
Dec	185.90	238.90	197.82
Jan	194.30	176.57	215.26
Feb	149.50	184.63	202.62
Mar	210.10	210.97	203.72
Apr	273.30	224.93	222.26
May	191.40	250.57	237.56
Jun	287.00	234.80	256.26

Month	Actual	3MA	5MA
Jul	226.00	272.20	259.58
Aug	303.60	273.17	305.62
Sep	289.90	338.37	301.12
Oct	421.60	325.33	324.38
Nov	264.50	342.80	331.60
Dec	342.30	315.50	361.70
Jan	339.7	374.13	340.56
Feb	440.4	365.33	375.52
Mar	315.9	398.53	387.32
Apr	439.3	385.50	406.86
May	401.3	426.00	433.88
Jun	437.4	471.40	452.22
Jul	575.5	473.50	500.76
Aug	407.6	555.03	515.56
Sep	682	521.63	544.34
Oct	475.3	579.53	558.62
Nov	581.3	567.83	
Dec	646.9		

Simple Moving Averages
Actual, 3MA, 5MA



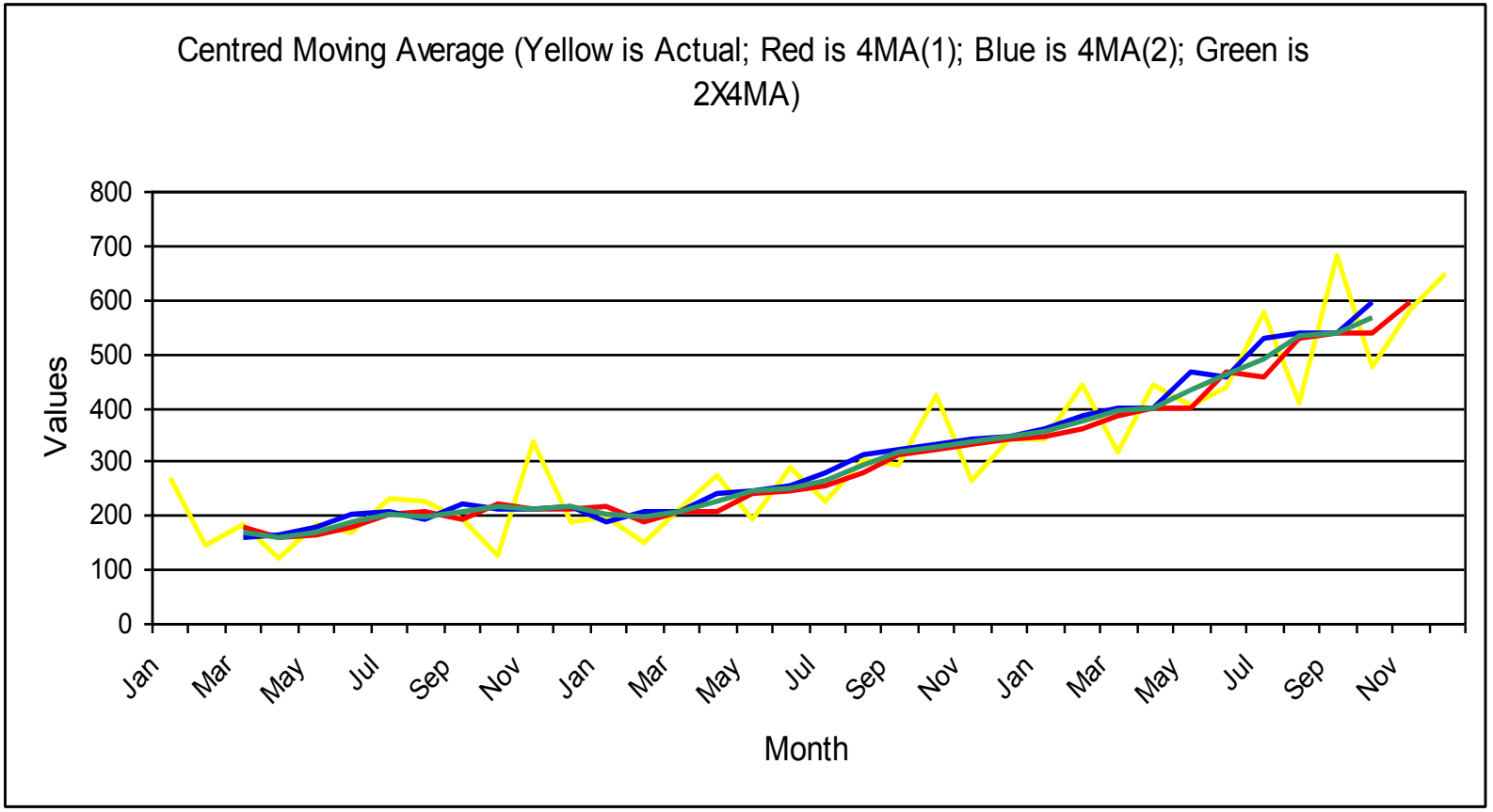
Centred Moving Average

4MA(1) = 4 month Moving Average, 4MA(2) = 4 month Moving Average 2X4MA=Averages of 2MA(1) and 4MA(2)

Mth	Actual	4MA(1)	4MA(2)	2X4MA
Jan	266.00			
Feb	145.90			
Mar	183.10	178.58	157.15	167.86
Apr	119.30	157.15	162.80	159.98
May	180.30	162.80	174.98	168.89
Jun	168.50	174.98	201.28	188.13
Jul	231.80	201.28	204.40	202.84
Aug	224.50	204.40	193.00	198.70
Sep	192.80	193.00	219.18	206.09
Oct	122.90	219.18	209.53	214.35
Nov	336.50	209.53	209.90	209.71
Dec	185.90	209.90	216.55	213.23
Jan	194.30	216.55	184.95	200.75
Feb	149.50	184.95	206.80	195.88
Mar	210.10	206.80	206.08	206.44
Apr	273.30	206.08	240.45	223.26
May	191.40	240.45	244.43	242.44
Jun	287.00	244.43	252.00	248.21

Mth	Actual	4MA(1)	4MA(2)	2X4MA
Jul	226.00	252.00	276.63	264.31
Aug	303.60	276.63	310.28	293.45
Sep	289.90	310.28	319.90	315.09
Oct	421.60	319.90	329.58	324.74
Nov	264.50	329.58	342.03	335.80
Dec	342.30	342.03	346.73	344.38
Jan	339.7	346.73	359.58	353.15
Feb	440.4	359.58	383.83	371.70
Mar	315.9	383.83	399.23	391.53
Apr	439.3	399.23	398.48	398.85
May	401.3	398.48	463.38	430.93
Jun	437.4	463.38	455.45	459.41
Jul	575.5	455.45	525.63	490.54
Aug	407.6	525.63	535.10	530.36
Sep	682	535.10	536.55	535.83
Oct	475.3	536.55	596.38	566.46
Nov	581.3	596.38		
Dec	646.9			

Centred Moving Average
Actual, 4MA(1), 4MA(2), 2X4MA



Centred Moving Average

Note:

- $4MA(1)=(Y_1+Y_2+Y_3+Y_4)/4$
- $4MA(2)=(Y_2+Y_3+Y_4+Y_5)/4$
- $2X4MA=(Y_1+2*Y_2+2*Y_3+2*Y_4+Y_5)/8$

Similarly we can have 2X6MA, 2X8MA, 2X12MA etc.

Centred Moving Average

Note:

- $3MA(1)=(Y_1+Y_2+Y_3)/3$
- $3MA(2)=(Y_2+Y_3+Y_4)/3$
- $3MA(3)=(Y_3+Y_4+Y_5)/3$
- $3X3MA=(Y_1+2*Y_2+3*Y_3+2*Y_4+Y_5)/9$

Weighted Moving Averages

In general a weighted k-point moving average can be written as

$$T_t = \sum_{j=-m}^{m} a_j Y_{t+j}$$

Note:

- The total of the weights is equal to 1
- Weights are symmetric, i.e., $a_j = a_{-j}$

Weighted Moving Averages

Steps are:

1) $4MA(1)=(Y_1+Y_2+Y_3+Y_4)/4$
2) $4MA(2)=(Y_2+Y_3+Y_4+Y_5)/4$
3) $4MA(3)=(Y_3+Y_4+Y_5+Y_6)/4$
4) $4MA(4)=(Y_4+Y_5+Y_6+Y_7)/4$
5) $4X4MA=(Y_1+2*Y_2+3*Y_3+4*Y_4+3*Y_5+2*Y_6+Y_7)/16$
6) $5X4X4MA = a_{-2}*4X4MA(1) + a_{-1}*4X4MA(2) + a_0*4X4MA(3) + a_1*4X4MA(4) + a_2*4X4MA(5)$
   where $a_{-2} = -3/4$, $a_{-1} = 3/4$, $a_0 = 1$, $a_1 = 3/4$, $a_2 = -3/4$

Exponential Smoothing Methods

1) Single Exponential Smoothing (one parameter, adaptive parameter)
2) Holt′s linear method (suitable for trends)
3) Holt-Winter′s method (suitable for trends and seasonality)

Single Exponential Smoothing

The general equation is:

$$F_{t+1} = F_t + \alpha(Y_t - F_t) = \alpha Y_t + (1 - \alpha)F_t,$$

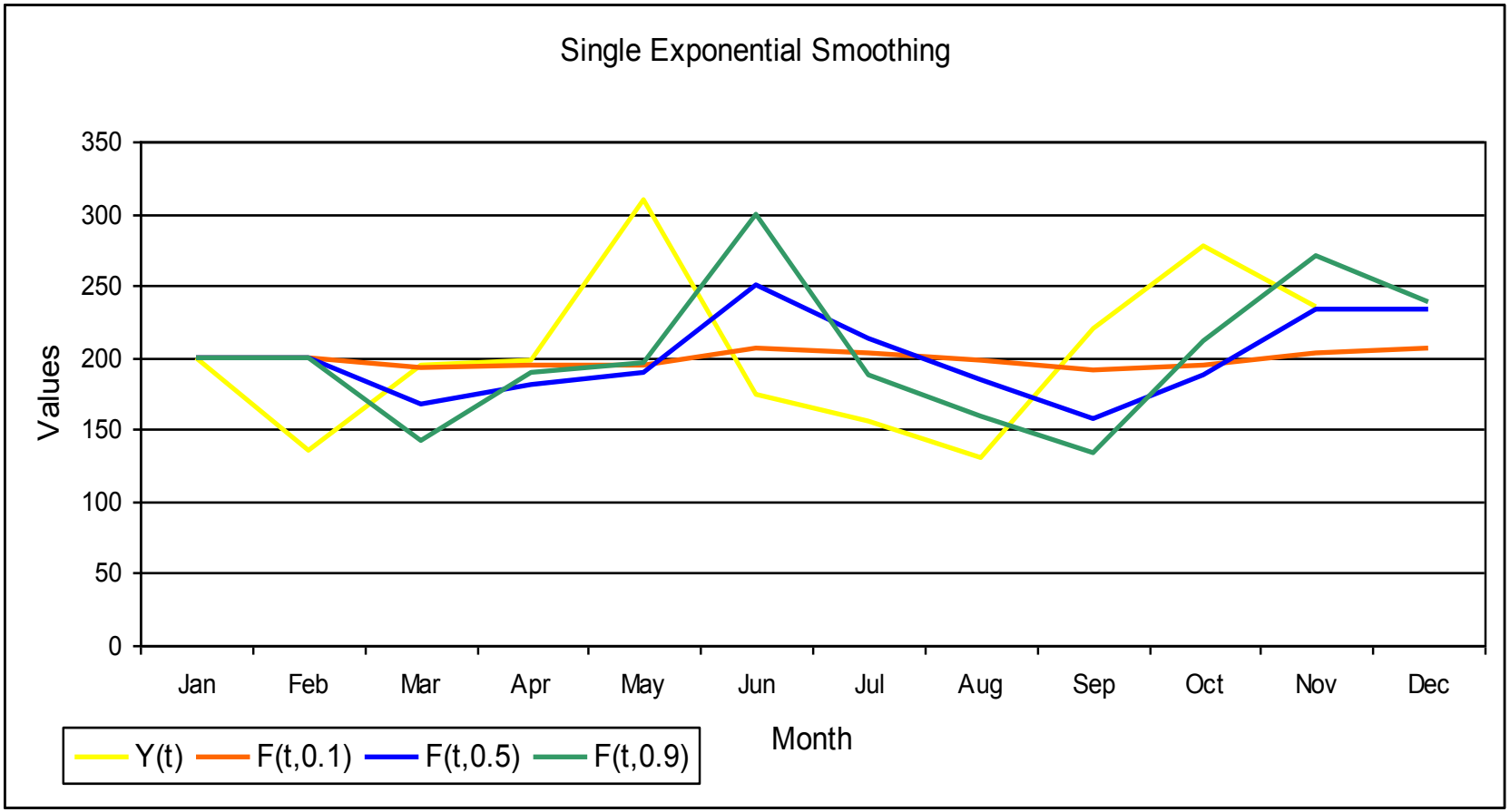
Note:

- Error term: $E_t = Y_t - F_t$
- Forecast value: F_t
- Actual value: Y_t
- Weight: $\alpha \in (0,1)$
- α is such that sum of square of errors is minimized

Single Exponential Smoothing

Month	Y(t)	F(t, 0.1)	F(t.0.5)	F(t,0.9)
Jan	200.0	200.0	200.0	200.0
Feb	135.0	200.0	200.0	200.0
Mar	195.0	193.5	167.5	141.5
Apr	197.5	193.7	181.3	189.7
May	310.0	194.0	189.4	196.7
Jun	175.0	205.6	249.7	298.7
Jul	155.0	202.6	212.3	187.4
Aug	130.0	197.8	183.7	158.2
Sep	220.0	191.0	156.8	132.8
Oct	277.5	193.9	188.4	211.3
Nov	235.0	202.3	233.0	270.9
Dec	-------	205.6	234.0	238.6

Single Exponential Smoothing



Extension of Exponential Smoothing

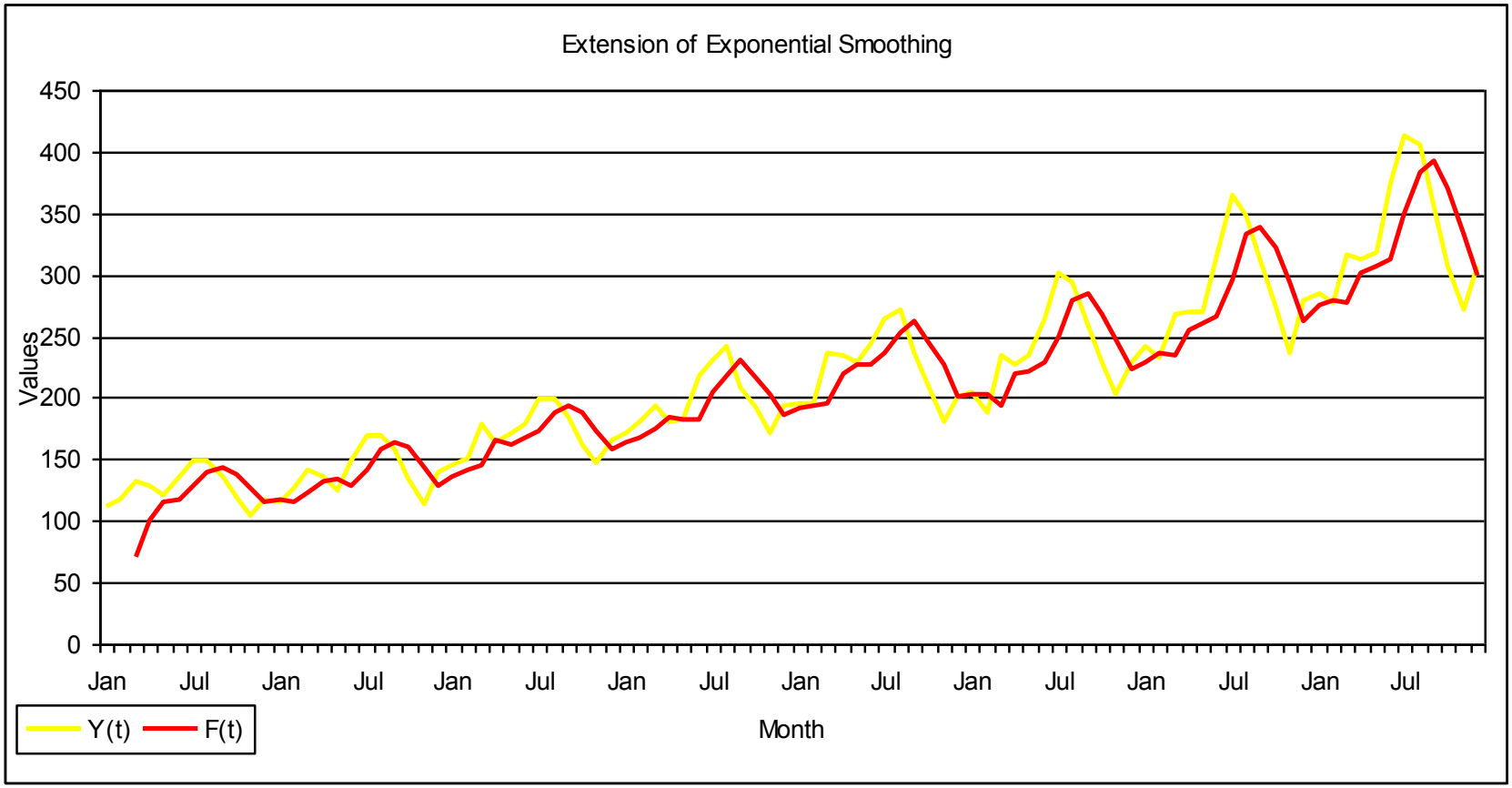
The general equation is:

$F_{t+1} = \alpha_1 Y_t + \alpha_2 F_t + \alpha_3 F_{t-1}$

Note:

- Error term: $E_t = Y_t - F_t$
- Forecast value: F_t
- Actual value: Y_t
- Weights: $\alpha_i \in (0,1) \quad \forall\ i = 1, 2 \text{ and } 3$
- $\alpha_1 + \alpha_2 + \alpha_3 = 1$
- α_i's are such that the sum of square of errors is minimized

Extension of Exponential Smoothing



Adaptive Exponential Smoothing

The general equation is:

$F_{t+1} = \alpha_t Y_t + (1 - \alpha_t)F_t$

Note:

- Error term: $E_t = Y_t - F_t$
- Forecast value: F_t
- Actual value: Y_t
- Smoothed Error: $A_t = \beta E_t + (1 - \beta)A_{t-1}$
- Absolute Smoothed Error: $M_t = \beta|E_t| + (1 - \beta)M_{t-1}$
- Weight: $\alpha_{t+1} = |A_t/M_t|$
- α and β are such that sum of square of errors is minimized

Adaptive Exponential Smoothing

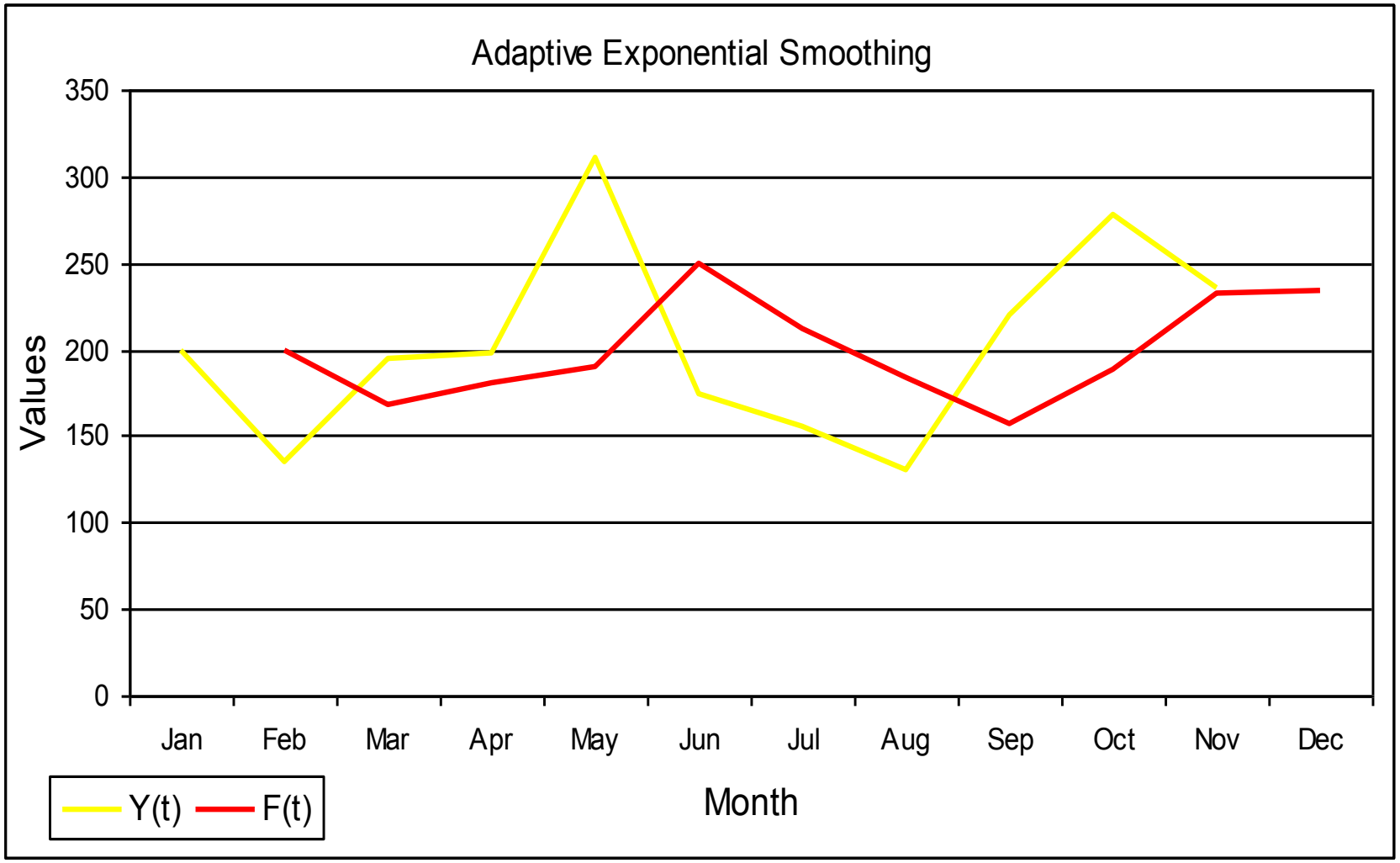
Starting values:

- $F_2 = Y_1$
- $\alpha_2 = \beta = 0.2$
- $A_1 = M_1 = 0$

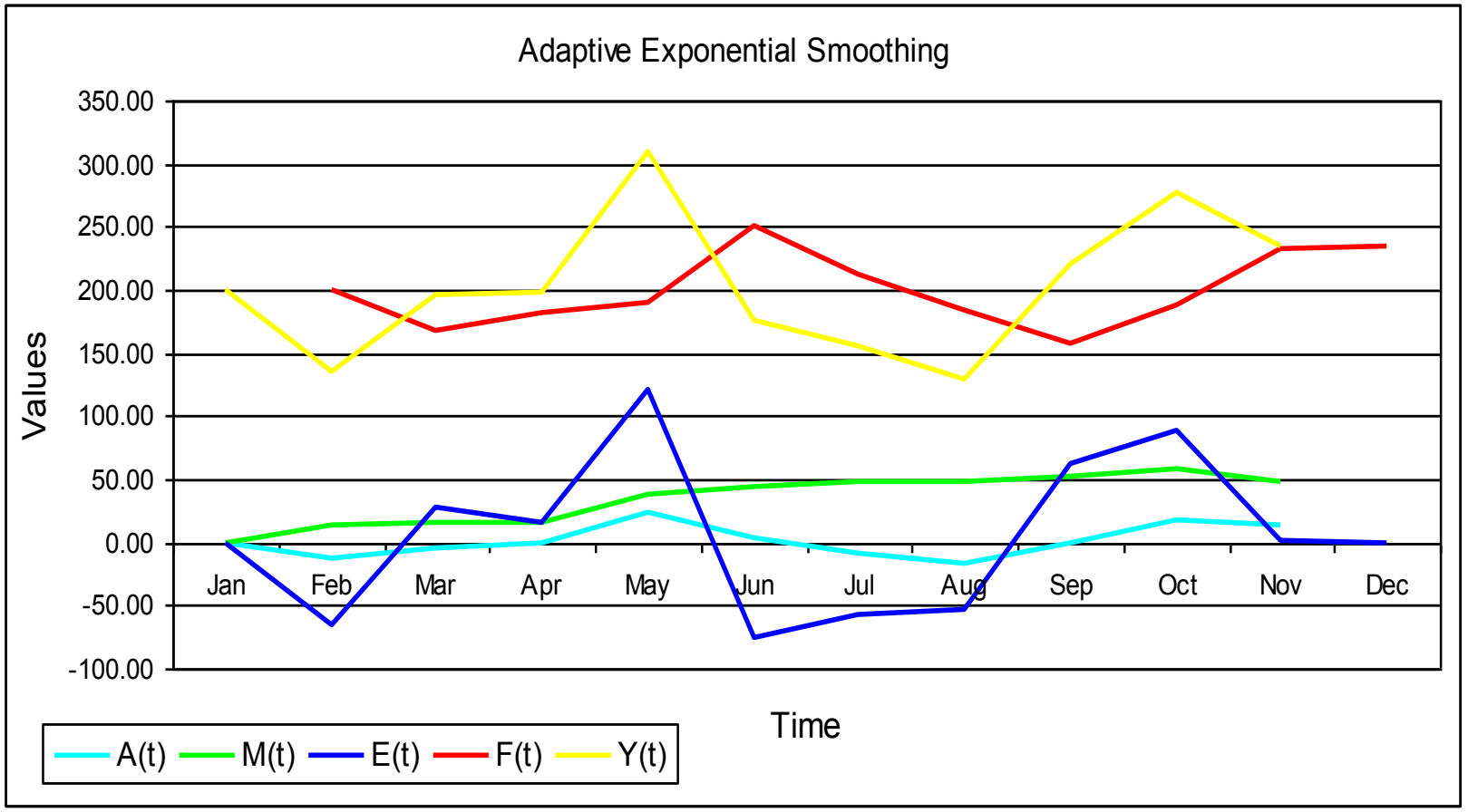
Adaptive Exponential Smoothing

Month	Y(t)	F(t)	E(t)	A(t)	M(t)	α	β
Jan	200.0			**0.0**	**0.0**		**0.2**
Feb	135.0	**200.0**	-65.0	-13.0	13.0	**0.2**	
Mar	195.0	187.0	8.0	-8.8	12.0	1.0	
Apr	197.5	188.6	8.9	-5.3	11.4	0.7	
May	310.0	190.4	119.6	19.7	33.0	0.5	
Jun	175.0	214.3	-39.3	7.9	34.3	0.6	
Jul	155.0	206.4	-51.4	-4.0	37.7	0.2	
Aug	130.0	196.2	-66.2	-16.4	43.4	0.1	
Sep	220.0	182.9	37.1	-5.7	42.1	0.4	
Oct	277.5	190.3	87.2	12.9	51.1	0.1	
Nov	235.0	207.8	27.2	15.7	46.4	0.3	
Dec		213.2				0.3	

Adaptive Exponential Smoothing



Adaptive Exponential Smoothing



Holt's Linear method

The general equations are:

1) $L_t = \alpha Y_t + (1-\alpha)(L_{t-1} + b_{t-1})$
2) $b_t = \beta(L_t - L_{t-1}) + (1 - \beta)b_{t-1}$
3) $F_{t+m} = L_t + b_t m$

Note:

- Error: $Y_t - F_t$
- Forecast value: F_t
- Actual value: Y_t
- Smoothing value: L_t
- Weight: $\alpha \in (0,1)$
- Smoothing constant: $\beta \in (0, 1)$
- Trend/Estimate of the slope of the time series: b_t
- Number of periods ahead to be forecasted: m
- α and β are such that the sum of square of errors is minimized

Holt's Linear method

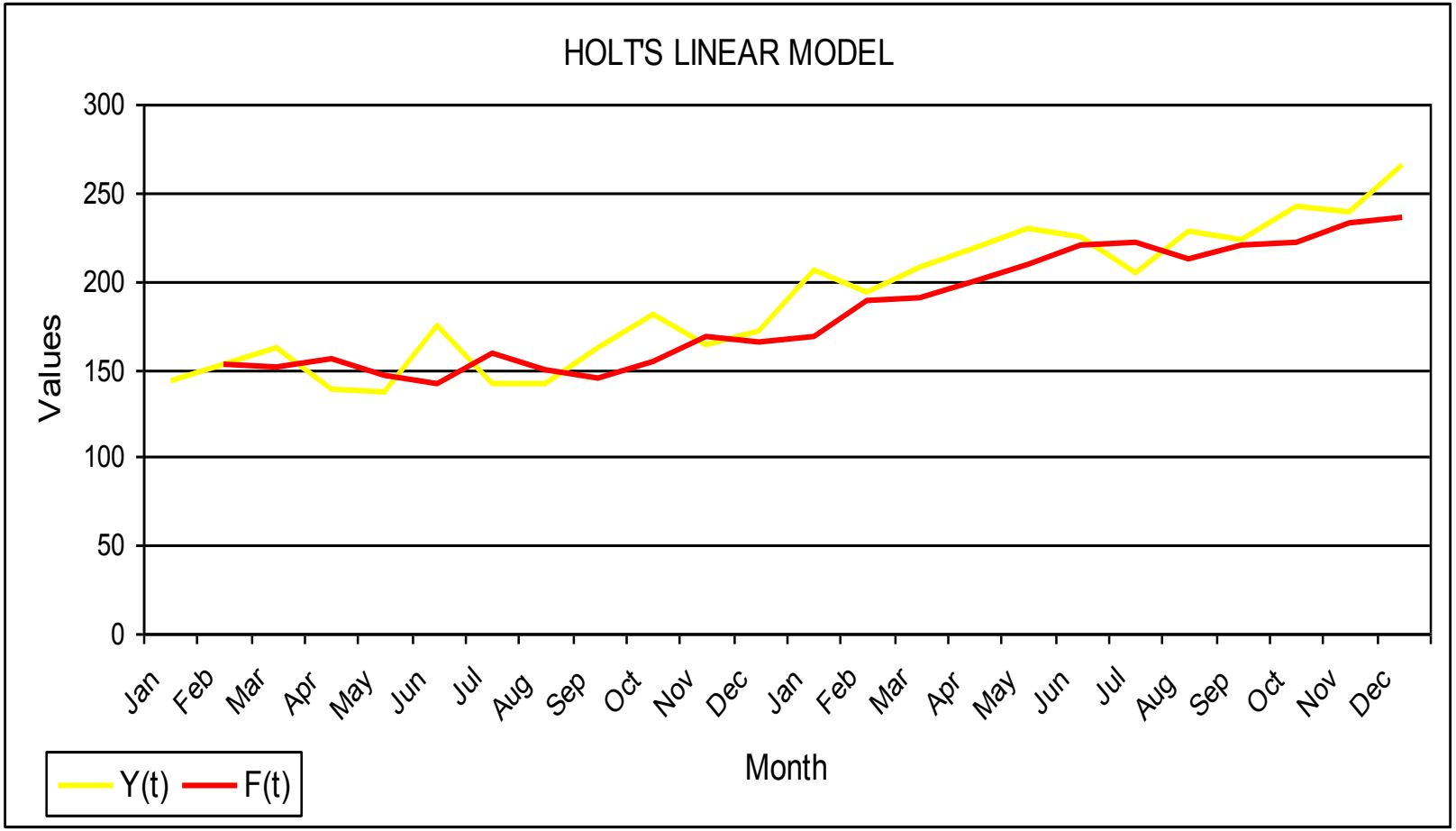
Starting values:

- $L_1 = Y_1$
- $b_1 = Y_2 - Y_1$
- $\alpha = 0.501$
- $\beta = 0.072$
- $m = 1$

Holt's Linear method

Month	Y(t)	L(t)	b(t)	F(t)
Jan	143.0	**143.0**	**9.0**	
Feb	152.0	143.0	8.4	152.0
Mar	161.0	147.9	8.1	151.4
Apr	139.0	139.4	6.9	156.0
May	137.0	134.7	6.1	146.3
Jun	174.0	151.4	6.8	140.8
Jul	142.0	143.3	5.8	158.2
Aug	141.0	139.3	5.1	149.0
Sep	162.0	148.1	5.3	144.3
Oct	180.0	161.4	5.9	153.5
Nov	164.0	159.8	5.4	167.3
Dec	171.0	162.7	5.2	165.1
Jan	206.0	181.8	6.2	167.9
Feb	193.0	184.3	5.9	188.0
Mar	207.0	192.7	6.1	190.3
Apr	218.0	202.3	6.4	198.8
May	229.0	212.5	6.6	208.7
Jun	225.0	215.5	6.4	219.2
Jul	204.0	206.5	5.3	221.8
Aug	227.0	214.2	5.4	211.8
Sep	223.0	215.9	5.2	219.6
Oct	242.0	226.4	5.6	221.0
Nov	239.0	229.9	5.4	231.9
Dec	266.0	245.3	6.1	235.3

Holt's Linear method



Holt-Winter's Method

The general equations are:

1) $L_t = \alpha Y_t/S_{t-s} + (1-\alpha)(L_{t-1} + b_{t-1})$
2) $b_t = \beta(L_t - L_{t-1}) + (1 - \beta)b_{t-1}$
3) $S_t = \gamma Y_t/L_t + (1 - \gamma)S_{t-s}$ for $t > s$
4) $F_{t+m} = (L_t + b_t m)S_{t-s+m}$
5) $S_i = Y_i/L_s$ where $L_s = (Y_1+\ldots+Y_s)/s$ for $i \leq s$

Note:

- Forecast value: F_t
- Actual value: Y_t
- Trend: b_t
- Seasonal component: S_t
- Length of seasonality: s
- α, β and γ are chosen such that the sum of square of errors is minimized

Holt-Winter's Method

Starting values:

- $L_1 = Y_1$
- $b_1 = Y_2 - Y_1$
- $\alpha = 0.822$
- $\beta = 0.055$
- $\gamma = 0$
- $m = 1$

We will cover and discuss about

- Forwards
- Futures
- Options
- Types of Traders

Definition

- A derivative or derivative security is an instrument whose value depends on the values of other more basic underlying variables.
- In many occasions the underlying derivatives are the prices of traded assets or commodities, e.g., stock prices, price of oil, interest rate, etc.

General classification

Derivatives can be classified as

- Exchange traded
- Over-the-counter (OTC)

or

- Forwards
- Futures
- Options
- Swaps

Usage of Derivatives

- To hedge risks
- To speculate (take a view on the future direction of the market)
- To lock in an arbitrage profit
- To change the nature of a liability
- To change the nature of an investment without incurring the costs of selling one portfolio and buying another

Examples of Derivatives

- Forward Contracts
- Futures Contracts
- Options
- Swaps

Forward Contracts

- Is an agreement to buy or sell an asset at a certain time in the future for a certain price.
- It can be contrasted with a spot contract which is an agreement to buy or sell immediately.
- It is traded in the OTC market.

Forward Contracts

- Forward contracts are binding commitments.
- One assumes a LONG POSITION. Agrees to ***buy*** the underlying asset for a specified price and at a specified date.
- Other assumes a SHORT POSITION. Agrees to ***sell*** the underlying asset for the same price at the same date.
- This price is known as the ***delivery price***, chosen such that the value of the contract to both parties is ***zero*** at the time when the contract is signed.

Forward Contracts

- As an example consider a Dubai based company needs to **sell** 50 million dollars (US$) exactly after 6 months from today. In order to hedge this foreign currency risk the company would go into a **short** forward contract such that the rate between dirhams vs dollars is fixed and does not change according to the exchange rate of dollar vs dirhams. This **short** forward contract is between the company and a financial institution, in which the company agrees to **sell** dollars at a fixed pre-determined price, which is the delivery price.
- An opposite example can be when the same company needs to **buy** 65 million dollars (US$), say exactly after 3 months from today. In order to hedge this foreign currency risk the company goes into a **long** forward contract with a financial institution, in which the company agrees to **buy** dollars at a fixed pre-determined price, which is the delivery price.

Forward Price

- The ***forward price*** for a contract is the ***delivery price*** that would be applicable to the contract if it were negotiated today (i.e., it is the delivery price that would make the contract worth exactly zero at the time when then contract is being signed).
- The forward price is usually different for contracts of different maturities.

Forward Price

- ***Forward price*** and ***delivery price*** are two different concepts.
- They are same when the contract is first signed.
- Likely to differ after that.

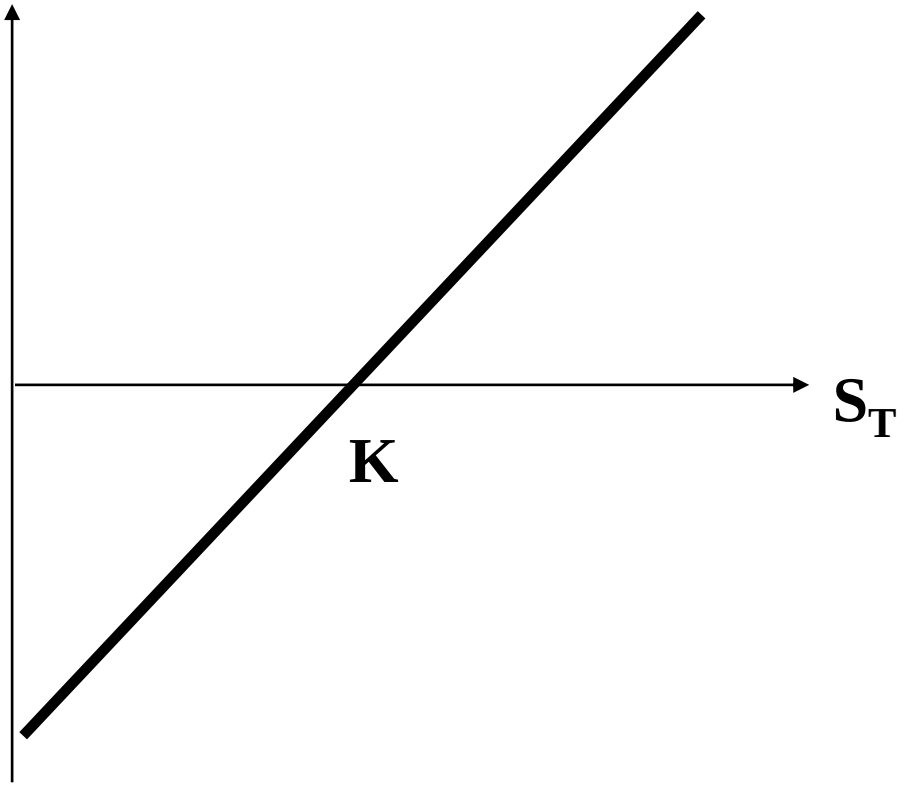
Payoffs from Forward Contracts

K = Delivery Price which has been signed.

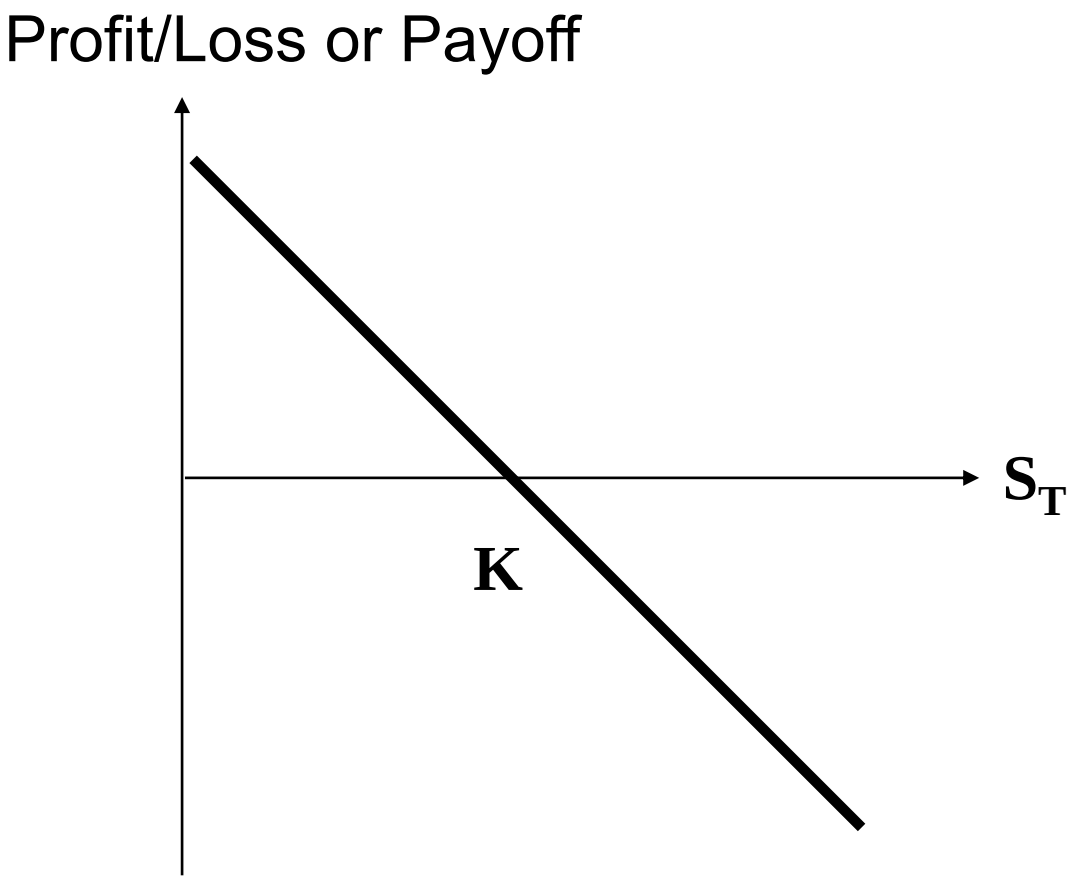
S_T = Asset Price at maturity date (t=T).

Profit from a Long Forward Position

Profit/Loss or Payoff



Profit from a Short Forward Position



Forward Contracts

What should be the value of a forward contract?

Example: Spot price of gold (22K) is 888 (INR) per 1 gm. Also consider the risk free rate of interest as 4.75%.

- CASE I: 3 month gold forward is 895 (INR).
- CASE II: 3 month gold forward is 900 (INR).

Futures Contracts

- Agreement to buy or sell an asset for a certain price at a certain time.
- Similar to a forward contract.
- Whereas a forward contract is traded OTC, a futures contract is traded in an exchange.

Futures Contracts

Exchanges where different types of derivatives are traded

- On 9th July 2007 Chicago Mercantile Exchange (CME) and Chicago Board of Trade (CBOT) merged to form the CME group [http://www.cme.com]
- New York Mercantile Exchange [http://www.nymex.com]
- Multi Commodity Exchange of India Limited [http://www.mcxindia.com/]
- London Bullion Market Association [http://www.lbma.org.uk/]
- Dubai Multi Commodities Centre [http://www.dmcc.ae/]
- Bombay Stock Exchange [http://www.bseindia.com/]
- National Stock Exchange [http://www.nseindia.com/]

Derivative Market in India

NSE commenced trading in index futures on 12th June 2000. The index futures contracts are based on the popular market benchmark S&P CNX Nifty index. S&P CNX Nifty futures contracts have a maximum of 3-month trading cycle - the near month (one), the next month (two) and the far month (three). A new contract is introduced on the trading day following the expiry of the near month contract. The new contract will be introduced for a three month duration. This way, at any point in time, there will be 3 contracts available for trading in the market i.e., one near month, one mid month and one far month duration respectively. S&P CNX Nifty futures contracts expire on the last Thursday of the expiry month. If the last Thursday is a trading holiday, the contracts expire on the previous trading day.

Futures Contracts

In future contracts the exact date of delivery is not specified like forward contract.

It is traded in exchange and if the contract is for delivery of goods, then the quality of the good, each contract amount etc., are specified by the exchange.

Options

- A ***call option*** is an option to ***buy*** a certain asset by a certain date (the ***expiration date or maturity***) for a certain price (the ***exercise or strike price***).
- A ***put option*** is an option to ***sell*** a certain asset by a certain date (the ***expiration date or maturity***) for a certain price (the ***exercise or strike price***).

Options

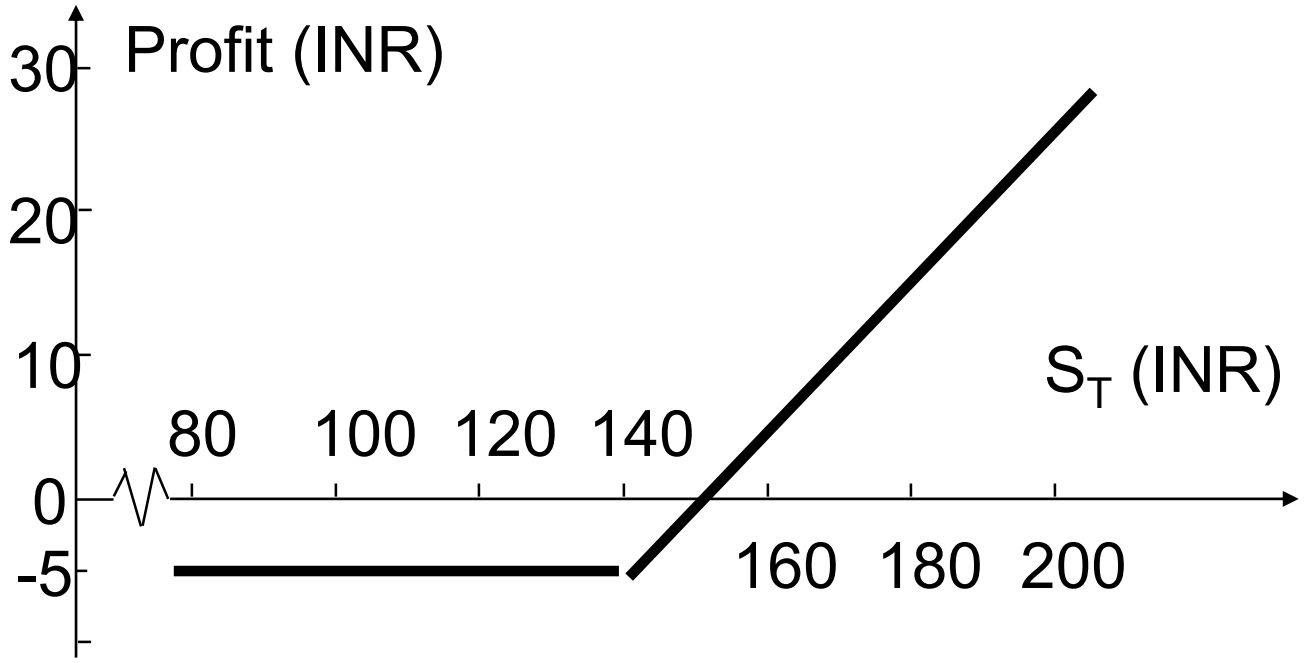
- American Options: Can be exercised any time up to the expiration date.
- European Options: Can be exercised on the expiration date only.
- Other examples: Look back option, Asian option, Bermuda option, Barrier option, etc.

Options

- X = Strike price
- S_T = Underlying asset price at time T
- p = Option price

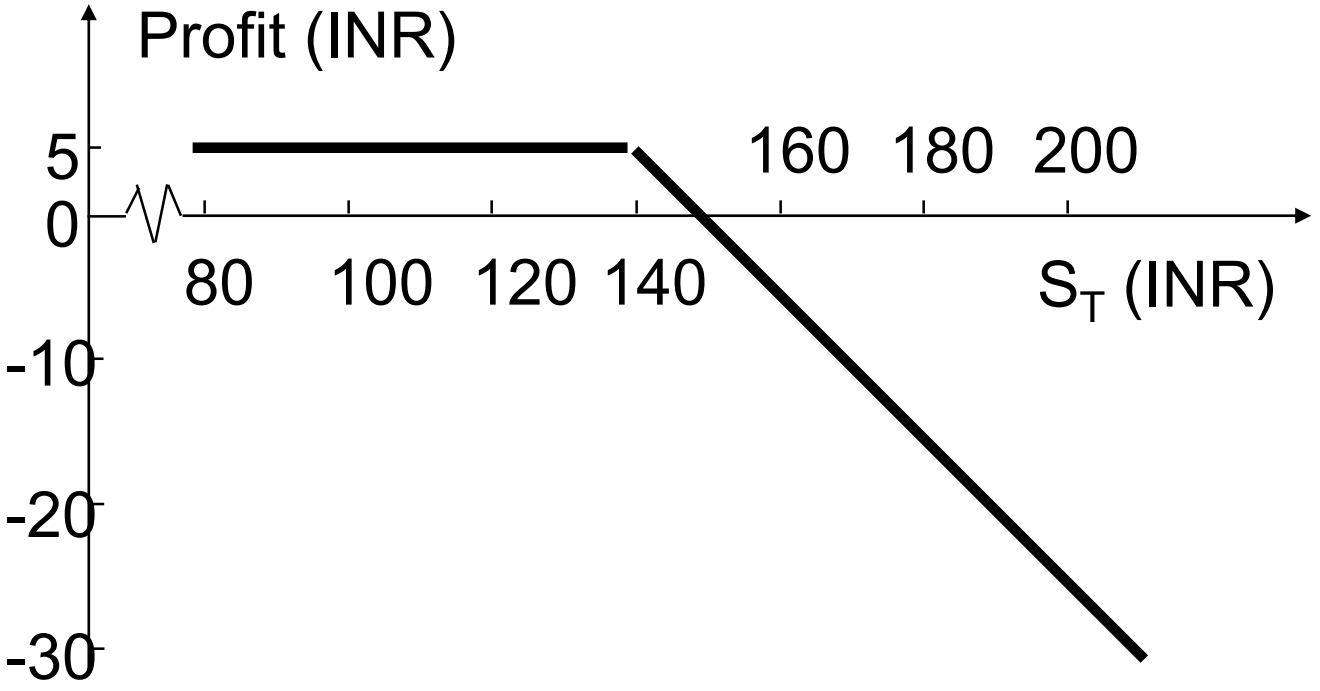
Long Call on ACC

Profit from ***buying*** a European ***call option*** on ACC: option price (p): 5 (INR), strike price (X): 140 (INR)



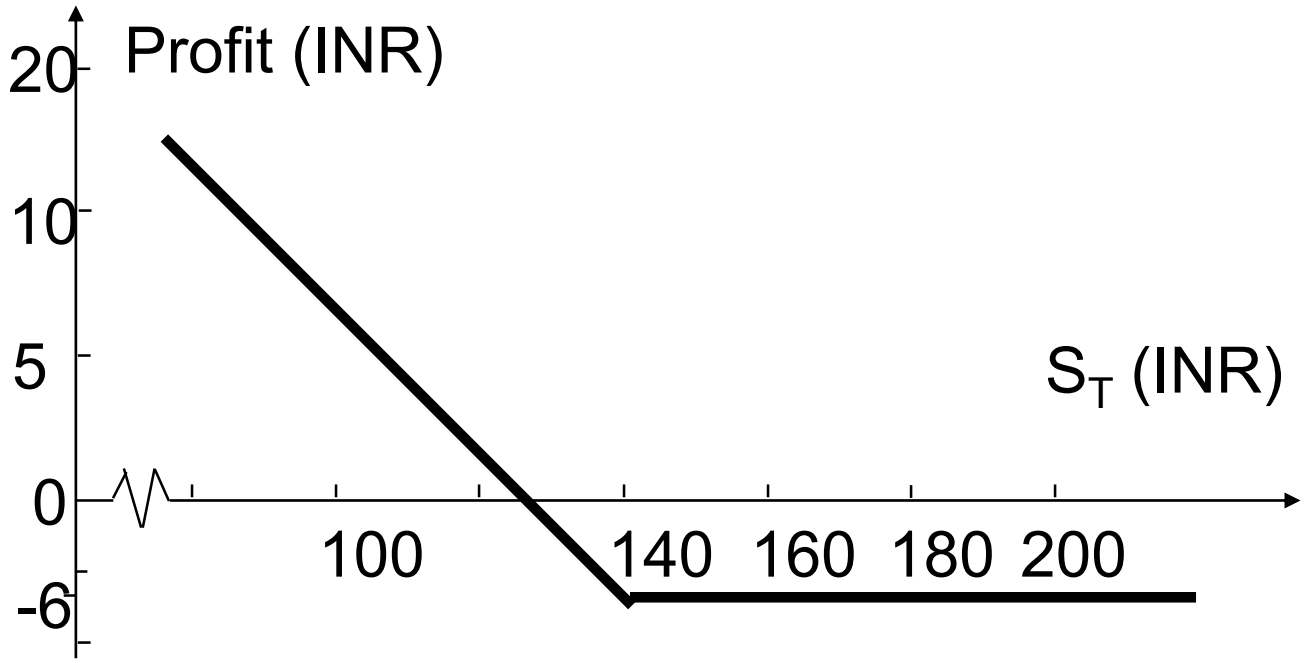
Short Call on ACC

Profit from ***writing*** a European ***call option*** on ACC: option price (p): 5 (INR), strike price (X): 140 (INR)



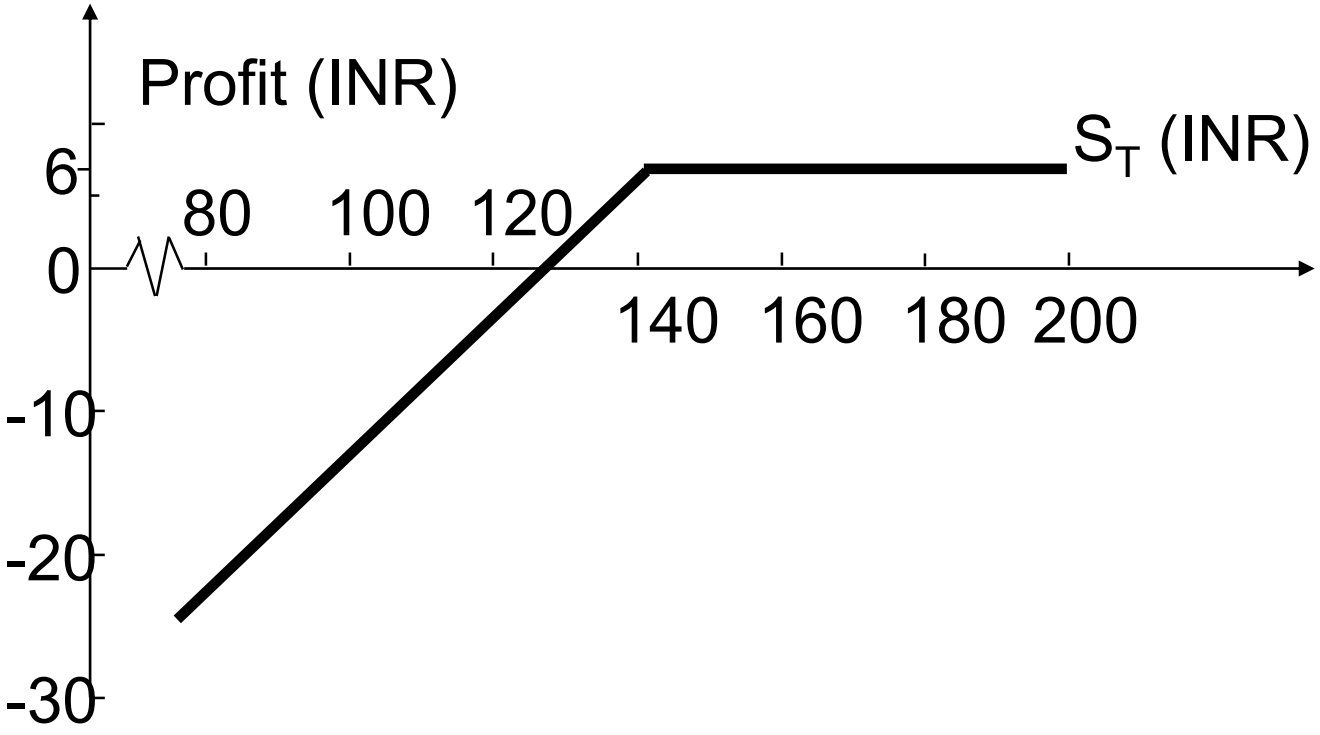
Long Put on ICICI

Profit from ***buying*** a European ***put option*** on ICICI: option price (p): 6 (INR), strike price (X): 140 (INR)



Short Put on ICICI

Profit from ***writing*** a European ***put option*** on ICICI: option price (p): 6, strike price (X): 140 (INR)



Payoffs in Options
(considering price is zero)

- A long position in a call option

  max (S_T – X, 0)
- A long position in a put option.

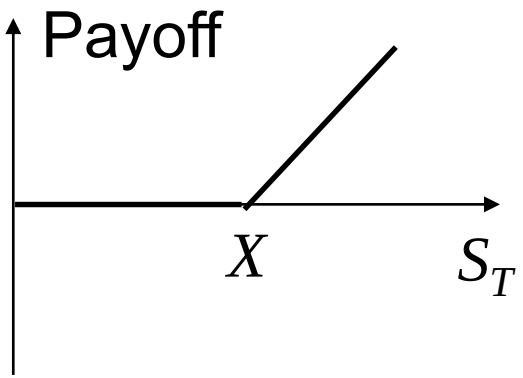
  max (X - S_T, 0)
- A short position in a call option.

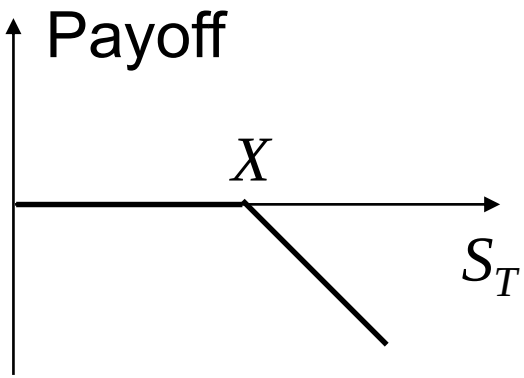
  min (X – S_T, 0)
- A short position in a put option.

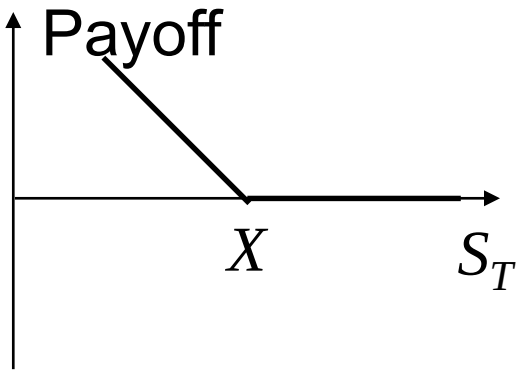
  min (S_T – X, 0)

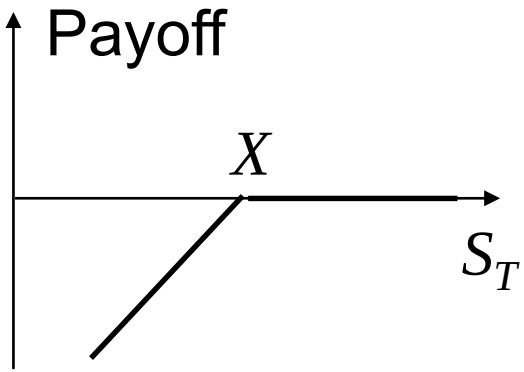
Payoffs from Options

X = Strike price, S_T = Price of asset at maturity









Payoffs in Options
(considering price is not zero)

- A long position in a call option

  max (S_T – X – p, – p)
- A long position in a put option.

  max (X – S_T – p, – p)
- A short position in a call option.

  min (X – S_T + p, + p)
- A short position in a put option.

  min (S_T – X + p, + p)

Types of Traders

- **Hedgers**: Want to avoid exposure to adverse movements in the price of an asset.
- **Speculators**: Wish to take a position in the market. Either they are betting that the price will go up else it will go down. In the process they want to make ***profit***.
- **Arbitrageurs**: Wants to lock in a profit by simultaneously entering into transactions in two or more markets.

Hegders

Example: Consider as on 1st July 2007 Mr.Syed Shabbirul Haque owns 500 IBM share, price $102 per share. Mr.Haque has plans to sell these shares as he needs money to finance his daughter's education, which would be starting in August 2007), in a private college in the state of Wisconsin where Mr.Haque lives with his family. Mr.Haque is concerned that the price of IBM shares will ***decline*** in the coming months, hence he buys Put Options.

a. If price ***falls*** he exercises the option.

b. If price ***remains or increases*** he does not exercise the option.

Examples 1.1

A trader enters into a short forward contract on 100 million yens. The forward exchange rate is $ 0.0080 per yen. How much does the trader gain/lose if the exchange rate at the end of the contract is (a) $ 0.0074 per yen, (b) $ 0.0091 per yen.

Examples 1.2

A trader buys a call option with a strike price of $45 and a put option with a strike price of $40. Both options have the same maturity. The call costs $3 and the put costs $4. Draw a diagram showing the variation of the trader′s profit with asset price (S_T)

Chapter 2: Futures markets and its use for hedging

We will cover and discuss about

- Future contract trading
- Margin accounts and settlement
- Hedging using futures
- Optimal hedge ratio

Futures Contracts

- Available on a wide range of underlying assets
- Exchange traded instruments: One party agrees to buy an asset at a future time for a certain price and the other party agrees to sell the asset at the same time for the same price
- Specifications need to be defined:
  - What can be delivered,
  - Where it can be delivered,
  - When it can be delivered
- Settled daily: Vast majority of the contracts do not lead to delivery as most traders close their positions prior to the delivery period specified in the contract

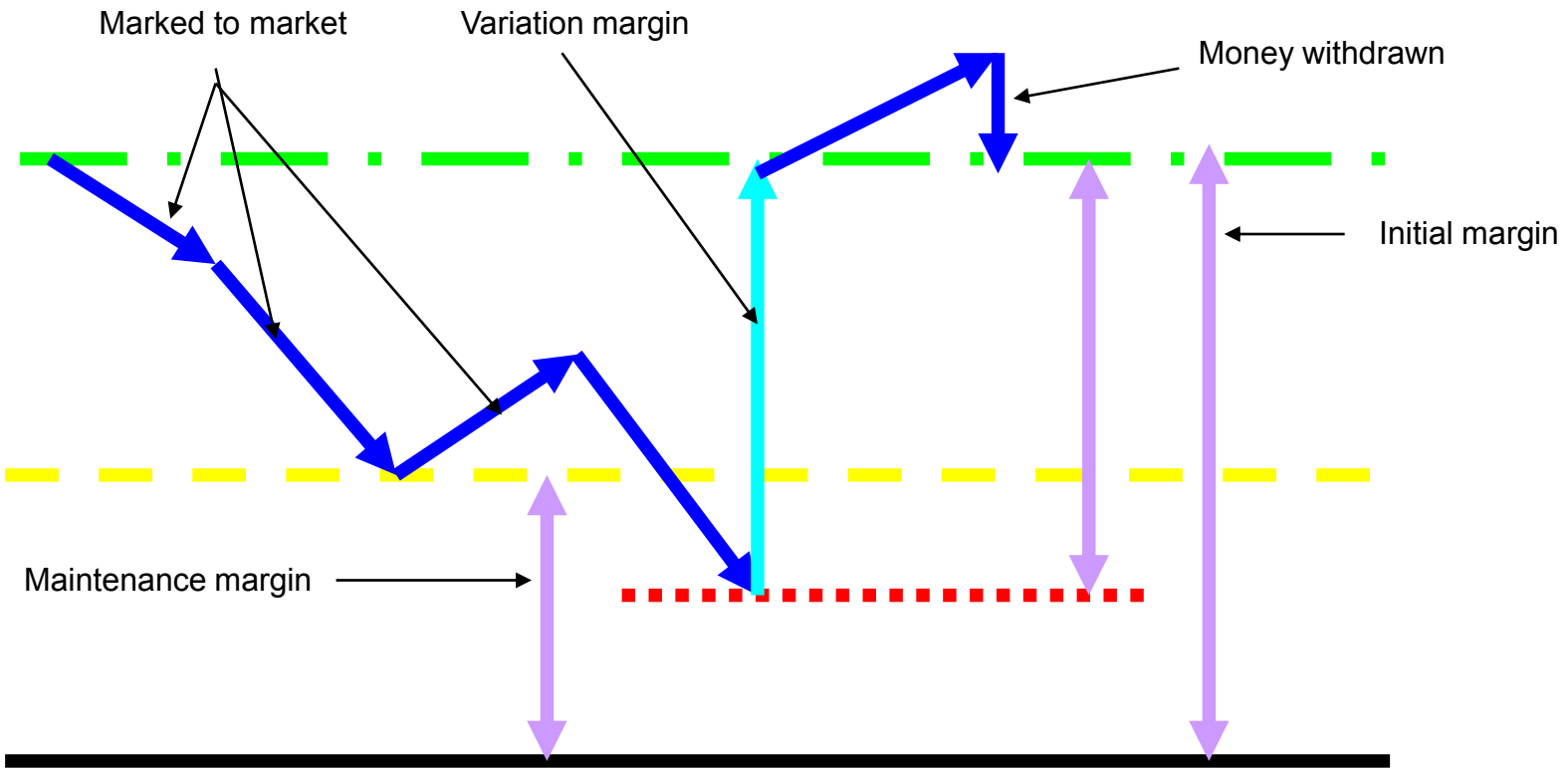
Margins

- A margin is cash or marketable securities deposited by an investor with his or her broker
- The balance in the margin account is adjusted to reflect daily settlement
- Margins minimize the possibility of a loss through a default on a contract

Margins

- Margin account
- Initial margin
- Marking to market: At the end of trading day the margin account is adjusted to reflect trader's gain or loss.
- Maintenance margin: Some percentage of the initial margin
- Variation margin

Margin Account Balance Variation



Margin Account Balance Variation

Future Price	Daily Gain/ Loss	Cumulative Gain/Loss	Margin A/C Balance	Margin Call
400			4000	
397.00	-600(-3.00*200)	-600	3400	None
396.10	-180(-0.90*200)	-780	3220	None
398.20	+420(+2.10*200)	-360	3640	None
397.10	-220(-1.10*200)	-580	3420	None
396.70	-80(-0.40*200)	-660	3340	None
395.40	-260(-1.30*200)	-920	3080	None
393.30	-420(-2.10*200)	-1340	**2660**	**340+1000=1340**
393.60	+60(+0.30*200)	-1280	4060	**60** could have been withdrawn
391.80	-360(-1.80*200)	-1640	3700	None
392.70	+180(+0.90*200)	-1460	3880	None
387.00	-1140(-5.70*200)	-2600	**2740**	**260+1000=1260**

NOTE: Total number of contracts is 200, Initial margin 4000, Maintenance margin 3000

Other definitions

- Day trade
- Spread transaction
- Exchange Clearinghouse
- Clearing Margin
- Normal market: Future prices increases as time to maturity increases.
- Inverted market: Future prices decreases as time to maturity increases.

Future Markets

Settlement Price: Average of the prices at which the contract is traded immediately before the end of the trading for the day. This price is important as it is used for calculating the daily gains/losses and the margin requirements.

Open Interest: Total number of contracts outstanding. It is either the sum of all long positions or the sum of all short positions.

Future Markets

When the delivery period is reached, the future prices equals - or is very close to - the spot price.

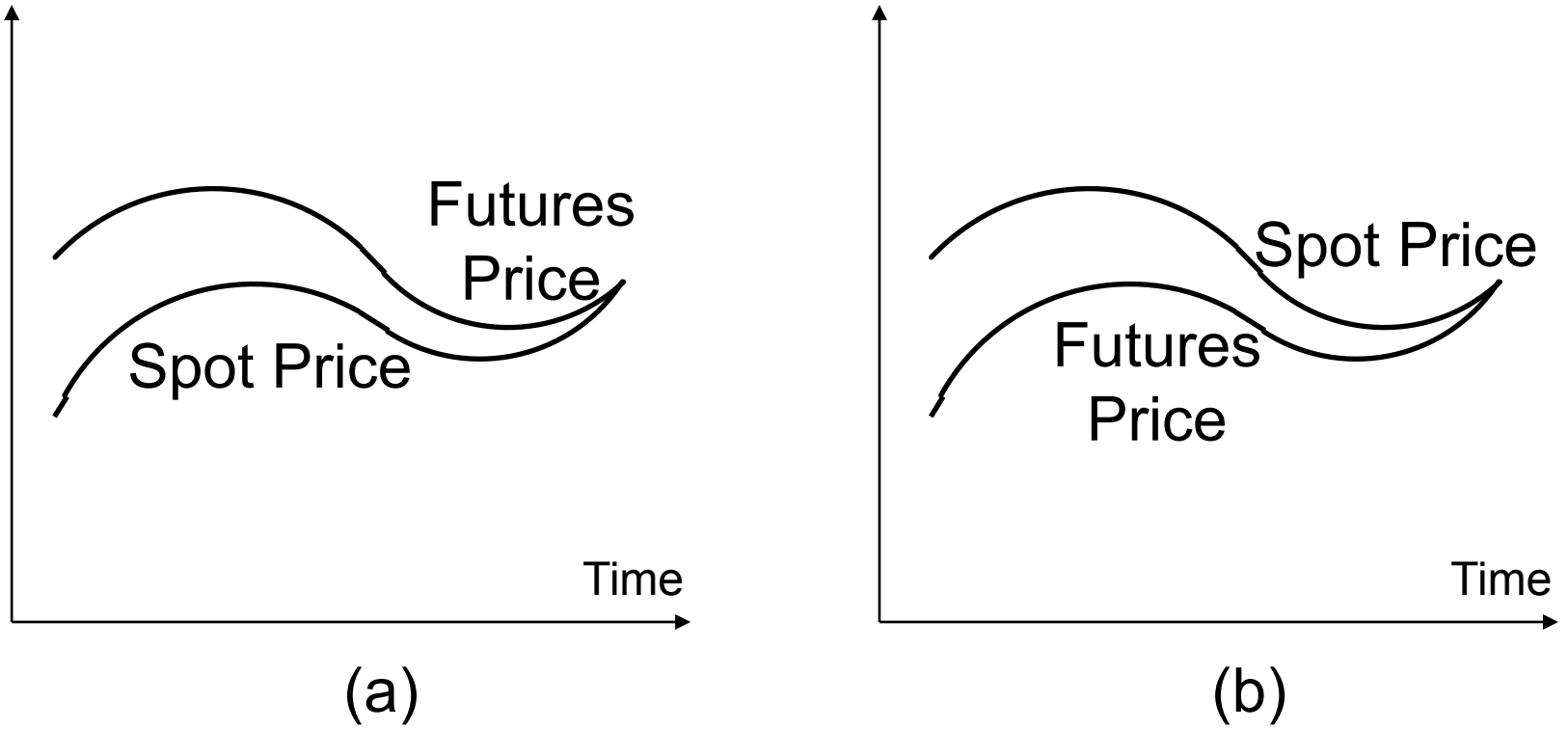
Why?

As arbitrage opportunities will rise it they are different.

How?

- Future price > Spot price: Short Future contracts.
- Future price < Spot price: Long Future contracts.

Convergence of Futures to Spot



Future Markets

Hedging using Futures: Use either ***short hedge*** or ***long hedge***, depending, on whether the company will sell an asset or buy an asset at a particular time in the future.

Long and Short Hedges

- A long futures hedge is appropriate when you know you will purchase an asset in the future and want to lock in the price
- A short futures hedge is appropriate when you know you will sell an asset in the future & want to lock in the price

Arguments in Favour of Hedging

Companies should focus on the main business they are in and take steps to minimize risks arising from interest rates, exchange rates, and other market variables

Future Markets

But in general it is seen that hedging using future contracts is less than perfect, due to the following reasons:

- Asset whose price is being hedged may not be same as the price of the asset underlying the futures contract.
- Future contract is closed before expiration date.
- Uncertainty about the exact date when the asset will be bought or sold.

Basis Risk

- Basis is the difference between spot & futures, i.e. (***spot price of asset to be hedged – future price of contract used for hedging***).
- Basis risk arises because of the uncertainty about the basis when the hedge is closed out

Futures

- ***Strengthening of the basis***: Increase in the spot price is more than the future price.
- ***Weakening of the basis***: Increase in future price is more than the spot price.