## Stock Return Analysis

The following problems use the following information. Assume that you have enough cash to invest (you are not borrowing money to invest). Assume that borrow costs are charged on the entire borrowed amount over the holding period.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Stock | Today’s Share Price | Commission per share | Borrow Cost | Beta |
| IBM | $185.00 | $0.50 | 0.25% | 0.68 |
| APPLE | $515.00 | $0.50 | 0.5% | 1.21 |
| JP Morgan | $39.00 | $0.50 | 2% | 1.32 |
| Citigroup | $34.50 | $0.50 | 3% | 2.60 |

1. If you buy 10,000 shares Citigroup today and in two weeks you sell the shares for $38.50. How much money do you make in dollars – take account of all costs? In percent?

10000x(38.50-34.50-1) = 30,000

1. If you buy 20,000 shares of JP Morgan today and in two weeks you sell the shares for $35.00. How much money do you make in dollars – take account of all costs? In percent?

20000x(35-39-1)=-100,000

1. If you sell short 10,000 shares Citigroup today and in two weeks you buy the shares back for $38.50. How much money do you make in dollars – take account of all costs? In percent?

10000x(34.50-38.50-1-.03\*34.50\*14/365)=-50,396.99

1. If you sell short 20,000 shares of JP Morgan today and in two weeks you buy the shares back for $35.00. How much money do you make in dollars – take account of all costs? In percent?

20000x(39-35-1-.02\*39\*14/365)=59,401.64

1. Construct an equally dollar weighted portfolio consisting of $1m long of apple shares and $1m short of IBM shares. Do not take into account the cost of commissions when constructing this portfolio.
   1. How many shares of each are in the portfolio? Assume you can buy a part of a share.

To compute the shares take 1m/(share price). Thus you are buying 1941.75 shares of APPL and 5405.41 shares of IBM.

* 1. In 1 years time IBM shares are trading at $175.00 and Apple shares are trading at $560. You close out the portfolio. What is the total return in dollars of your portfolio – take account of all costs?

The return on the Apple shares is 1941.75x(560-515-1) = 85,437.00

The return on IBM shares is

5405.41x(185-175-1-.0025x185)=46,148.69

The total return is 131,585.69

* 1. Instead in 1 years time IBM shares are trading at $200.00 and Apple shares are trading at $560. You close out the portfolio. What is the total return in dollars of your portfolio – take account of all costs?

The return on the Apple shares is 1941.75x(560-515-1) = 85,404.00

The return on IBM shares is

5405.41x(185-200-1-.0025x185)=-88,986.56

The total return is -3549.56

* 1. If you are planning on holding the portfolio for 1 year by what percentage does Apple have to outperform IBM in order to break-even (zero profit/loss)? Give an example of Apple and IBM share prices that demonstrate with this level of outperformance your portfolio breaks-even.

If the return on IBM is x% then we can write the return on Apple as a%+b% where b% represents the outperformance of Apple shares.

The return on Apple shares is then 1941.75x((1+a+b)x515-1)

The return on IBM shares is

5405.41x(-(1+a)x185-1-0.0025\*185)

By construction the 1941.75x515 = $1,000,000 and

5405.41x185=$1,000,000

Thus the return on the overall portfolio is

1,000,000x(1+a+b)-1941.75-1,000,000x(1+a)-5405.41-1,000,000x.0025 = 1,000,000xb-9847.16.

To find the break-even return then we set this to zero. The outperformance of apple is thus

b=9847.16/1,000,000 = 0.9847%

One can check this by keeping IBM shares unchanged and having Apple shares increase by 0.9847% or to 520.07.

1. Construct an beta weighted portfolio consisting of $1m long of JP Morgan shares and short of Citigroup shares.
   1. How many shares of each are in the portfolio?

One has 1,000,000/39 = 25,641.03 shares of JP Morgan. We need to use the beta weights to find the number of Citigroup shares. Thus one will want to be short 1,000,000x1.32/2.6/34.50 = 14,715.72 shares of Citigroup.

* 1. If the stock market goes up 1% what are the expected levels of JP Morgan and Citigroup? Confirm that the profit/loss (w/o trading costs) of your portfolio is $0.

If the market moves 1% then we would expect that JP Morgan moves 1.32% or from 39 to 39.507. The expected profit on the JP Morgan shares will be $13,200. We would expect the Citigroup shares to move 2.6% to 35.397. The loss from the Citgroup shares would be 14,715.72x(34.50-35.397) = 13,200. This is what should happen from a beta weighted portfolio.

* 1. In 1 years time JP Morgan shares are trading at $42.00 and Citigroup shares are trading at $35.00. You close out the portfolio. What is the total return in dollars of your portfolio – take account of all costs?

The return on the JP Morgan shares is 25,641.03x(42-39-1) = 51,282.05. The return on the Citigroup shares is

14,715.72x(34.5-35-1-.03x34.5)=-37,304.35. The total return is 13,977.70.

* 1. Instead in one year JP Morgan shares are trading at $42.00 and Citigroup shares are trading at $50.00. You close out the portfolio. What is the total return in dollars of your portfolio – take account of all costs?

The return on the JP Morgan shares is 51,282.05. The return on the Citigroup shares is 14,715.72x(34.5-50-1-.03x34.5)= -258,040.13. The total return -206,758.08.

* 1. If you are planning on holding the portfolio for 1 year by what percentage does JP Morgan’s beta weighted performance have to outperform Citigroup’s beta weighted performance in order to break-even (zero profit/loss) (the beta weighted performance is that which is implied by the beta. If the market moves x% then JPM moves 1.32x% and C moves 2.6x%)? Give an example of JP Morgan and Citigroup share prices that demonstrate with this level of outperformance your portfolio breaks-even.

Here we can consider that Citigroup’s performance is its expected move given a market move – namely if the market moves a then Citigroup is expected to move 2.6xa. We will call the performance of JP Morgan is 1.32xa + b. This then works in the same way that d from problem 5 worked. The return on the JP Morgan shares is

25,641.03x((1.32xa+b)x39-1)= 1,000,000x(1.32xa+b)-25641.03

To compute the return on Citibank remember how the portfolio was set up. 14715.75=1,000,000/34.5/2.6\*1.32 The return on Citibank is

14715.72x(-(2.6xa)x34.5-1-0.03x34.5) = -1,000,000x1.32xa-14715.72-15,230.77

To find the break even we add the returns and set them to be zero or

1,000,0000xb-25,641.03-14,715.72-15,230.77=0

b = 55,587.52/1,000,000

b = 5.56%

To check we assume that the market doesn’t move, Citigroup doesn’t move and JP Morgan rises by 5.56% or 39x1.0556=41.17. The return on JP Morgan is then 25,641.03x(41.17-39-1) = 30,000. The return on Citigroup is 14,715.72x(-1-0.03x34.5)=-29,946.49. We are off by $50 which is due to us rounding everything to two digits.

## Stock Order Book Arbitrage

1. Shown is the Top of two separate order books. Is there arbitrage and if so how do you take advantage of it? How much money will you make?

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  | | --- | --- | --- | --- | | Bid Q | Bid P | Offer Q | Offer P | | 1,000 | 99 | 102 | 2,000 | | |  |  |  |  | | --- | --- | --- | --- | | Bid Q | Bid P | Offer Q | Offer P | | 5,000 | 102 | 104 | 4,000 | |

There is no arbitrage in this market.

1. Shown is the Top of two separate order books. Is there arbitrage and if so how do you take advantage of it? How much money will you make?

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  | | --- | --- | --- | --- | | Bid Q | Bid P | Offer Q | Offer P | | 1,000 | 106 | 107 | 2,000 | | |  |  |  |  | | --- | --- | --- | --- | | Bid Q | Bid P | Offer Q | Offer P | | 5,000 | 102 | 104 | 4,000 | |

In this market you can buy at 104 and sell at 106. Thus you can make $2 per share on 1,000 shares or $2,000 ignoring transaction costs.

1. Shown is the Top of two separate order books. Is there arbitrage and if so how do you take advantage of it? How much money will you make?

|  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  |  |  | | --- | --- | --- | --- | | Bid Q | Bid P | Offer Q | Offer P | | 1,000 | 99 | 100 | 2,000 | | |  |  |  |  | | --- | --- | --- | --- | | Bid Q | Bid P | Offer Q | Offer P | | 5,000 | 102 | 104 | 4,000 | |

In this market you can buy at 100 and sell at 102. You can do this for 2,000 shares so you can make 4,000 dollars ignoring transaction costs.

## Stock Dealer Arbitrage

1. Shown are bid-offer quotes from two dealers. These quotes are for 10,000 shares. Is there arbitrage and if so how do you take advantage of it? How much money will you make?

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  | | --- | --- | | Bid P | Offer Q | | 52 | 53 | | |  |  | | --- | --- | | Bid P | Offer Q | | 54 | 55 | |

In this market you can buy 10,000 shares for 53 and sell them for 54. Thus you make 10,000 dollars.

1. Shown are bid-offer quotes from two dealers. These quotes are for 10,000 shares. Is there arbitrage and if so how do you take advantage of it? How much money will you make?

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  | | --- | --- | | Bid P | Offer Q | | 71 | 75 | | |  |  | | --- | --- | | Bid P | Offer Q | | 68 | 69 | |

In this market you can buy 10,000 shares for 69 and sell them for 71. Thus you ccan make 20,000 dollars.

1. Shown are bid-offer quotes from two dealers. These quotes are for 10,000 shares. Is there arbitrage and if so how do you take advantage of it? How much money will you make?

|  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| |  |  | | --- | --- | | Bid P | Offer Q | | 3.02 | 3.04 | | |  |  | | --- | --- | | Bid P | Offer Q | | 2.97 | 3.1 | |

In this market there is no arbitrage.

## Foreign Exchange Manipulations

1. The exchange rate between USD and ZAR is 7.8 ZAR/USD. The exchange rate between USD and EUR is 1.3 USD/EUR. What is the exchange rate between ZAR and EUR in ZAR/EUR?

It is 7.8x1.3 = 10.14 ZAR/EUR

1. The exchange rate between USD and AUD is 0.9683 AUD/USD. The exchange rate between USD and CHF is 1.0583 USD/CHF. What is the exchange rate between AUD and CHF in CHF/AUD?

It is 1/(0.9683x1.0583)=0.9758 CHF/AUD.

1. A trader is giving you a quote of 7.8-7.9 ZAR/USD. What is his bid price (to buy ZAR) and what is his offer (to sell ZAR)?

He is willing to buy ZAR for 7.9 ZAR/USD and sell ZAR for 7.8 ZAR/USD

1. A trader is giving you a quote of 0.9683-0.9783 AUD/USD. What is his bid price (to buy AUD) and what is his offer price (to sell AUD)?

He is willing to buy AUD at 0.9783 and sell AUD at 0.9683.

1. A trader is giving you a quote of 1.276-1.286 USD/EUR. What is his bid price (to buy EUR) and what is his offer price (to sell EUR)?

He is willing to buy EUR at 1.276 and willing to sell EUR at 1.286.

1. A trader is making markets in ZAR/USD and USD/EUR.

|  |  |  |  |
| --- | --- | --- | --- |
| Trader Buys EUR and sells USD | Trader Sells EUR and buys USD | Units | |
| 1.3 | 1.35 | USD/EUR | |
|  | | | |  | |
| Trader Buys ZAR and sells USD | Trader Sells ZAR and buys USD | Units | |
| 7.8 | 7.7 | ZAR/USD | |

What is his market in ZAR/EUR?

|  |  |  |
| --- | --- | --- |
| Trader Buys ZAR and sells EUR | Trader Sells ZAR and buys EUR | Units |
| 7.8\*1.32=10.2960 | 7.7\*1.3=10.0100 | ZAR/EUR |

1. A trader is making markets in HKD/AUD and JPY/HKD.

|  |  |  |  |
| --- | --- | --- | --- |
| Trader Buys HKD and sells AUD | Trader Sells HKD and buys AUD | Units | |
| 8.0 | 7.8 | HKD/AUD | |
|  | | | |  | |
| Trader Buys JPY and sells HKD | Trader Sells JPY and buys HKD | Units | |
| 10.4 | 10.3 | JPY/HKD | |

What is his market in JPY/AUD?

|  |  |  |
| --- | --- | --- |
| Trader Buys JPY and sells AUD | Trader Sells JPY and buys AUD | Units |
| 10.4x8.0=83.2 | 10.3x7.8= 80.34 | JPY/AUD |

## Foreign Exchange Arbitrage

1. Shown are bid-offer quotes from two dealers. These quotes are for 1,000,000 ZAR. Is there arbitrage and if so how do you take advantage of it? How much money will you make?

|  |  |  |
| --- | --- | --- |
| Trader Buys ZAR and sells USD | Trader Sells ZAR and buys USD | Units |
| 7.8 | 7.7 | ZAR/USD |

|  |  |  |
| --- | --- | --- |
| Trader Buys ZAR and sells USD | Trader Sells ZAR and buys USD | Units |
| 7.6 | 7.5 | ZAR/USD |

In this market you can buy 1,000,000 ZAR at an exchange rate of 7.7 or for $129,870.13 You can then sell them back at an exchange rate of 7.6 or for $131,578.95.

1. Shown are bid-offer quotes from two dealers. These quotes are for 100,000,000 JPY. Is there arbitrage and if so how do you take advantage of it? How much money will you make?

|  |  |  |
| --- | --- | --- |
| 1. Trader Buys JPY and sells USD | Trader Sells JPY and buys USD | Units |
| 82 | 80 | JPY/USD |

|  |  |  |
| --- | --- | --- |
| Trader Buys JPY and sells USD | Trader Sells JPY and buys USD | Units |
| 78 | 80 | JPY/USD |

There is arbitrage in the second trader’s quotes. You should buy 100,000,000 JPY for 80 JPY/USD. This costs 1,250,000 USD. You can then buy them back for 78 JPY/USD so you get 1,282,051.28. Your profit is 32,051.28 dollars.

1. Shown are bid-offer quotes from two dealers. These quotes are for 1,00,000 AUD. Is there arbitrage and if so how do you take advantage of it? How much money will you make?

|  |  |  |
| --- | --- | --- |
| Trader Buys AUD and sells USD | Trader Sells AUD and buys USD | Units |
| 1.02 | 1.03 | USD/AUD |

|  |  |  |
| --- | --- | --- |
| Trader Buys AUD and sells USD | Trader Sells AUD and buys USD | Units |
| 1.04 | 1.05 | USD/AUD |

You can buy AUD for 1.03 and sell it for 1.04. You start with 1,000,000\*1.03=1,030,000 USD. You can then sell the 1,000,000 AUD for 1.04 which returns 1,040,000 USD. Thus you make 10,000 dollars.