40 331 – FINANCE 5

ASSIGNMENT – EQUITY FUTURES

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Questions

(i) Define hedging in this context and explain why an investor might wish to hedge a substantial equity holding.

Futures markets can be used for three differents goals:

- **Speculation**: a speculator takes a position in futures with a view to making gains from markets gains from market movements. The speculator is fully exposed to risk, essentially betting on the future direction of the market.

- **Arbitrage**: if equivalent assets are trading at different prices arbitrageurs buy in the cheaper market and sell in the more expensive. This provides profit without risk. Such opportunities should be rare. The activities of arbitrageurs generally keep prices in line.

- **Hedging:** Futures contracts can be used to neutralise the risk of an asset by fixing the price at which the trader can buy or sell in the future.
  Hedging reduces the risk of buying/selling assets by reducing the uncertainty of futures outcomes. A perfect hedge completely neutralises risk, but it is not always possible to achieve a perfect hedge.

  To achieve a perfect hedge:
  a/ the asset to be hedged and the asset underlying the futures contract are the same

  If there is no futures contract for the asset wanted to be hedged, one may therefore have to take a futures position on a different asset.
  → take a futures position in an asset that most closely resembles the asset to be hedged.

  Ex: Number of contracts =

$$\frac{\text{value of portfolio x beta of the portfolio (against FTSE 100)}}{\text{spot index x £10}}$$

  b/ the hedge period and the life of the futures contract are the same

  If there is no futures contract with a delivery date that matches the required hedge period, you have to choose the contract with delivery date closest to but after end of hedge period. If all futures contracts end before the hedge period, you need to "roll over" contracts.

LONG HEDGE

  If someone wishes to fix the future purchase price of an asset, he takes a LONG position in futures.
  → Change in the price of the asset to be purchased is neutralised by futures position.

SHORT HEDGE

  If someone wishes to fix the future price at which an asset can be sold, he takes a SHORT position in futures.

→ Change in the price of the asset will be offset by the change in the value of the futures position

If someone owns shares (or know that he will own in the future), he may want to protect a long asset position where there is no intention to sell the asset (LONG asset, SHORT futures)

(ii) Explain the hedging strategies using future contracts that you could undertake to protect your equity investment, indicating the advantages and disadvantages. You should outline at least 2 possible strategies and give reasons for your preferred strategy.

My portfolio:

On 14/11/2006				
Portfolio valuation		**200 M£**	**Spot (p)**	**Nber of shares**
British Airways (%)		**50%**	**463.25**	21 586 616.30
Carphone Warehouse (%)		**30%**	**291.75**	20 565 552.70
Royal Bank of Scotland (%)		**20%**	**1 867**	2 142 474.56

To protect my equity investment, I may use two strategies using futures and one more strategy using one different asset which is Tracker.

a/ The first hedging solution is to deal with FTSE 100 contracts.

Thus, I have to take into account the correlation between my own portfolio and the FTSE 100 index – through the Beta – in order to find the right number of contracts I need in order to hedge my position:

Number of contracts =

$$\frac{\text{value of portfolio x beta of the portfolio (against FTSE 100)}}{\text{spot index x £10}}$$

Advantages:

- it is really cheap to cover with futures contract, you only have to give money to your broker for the margin, which is a very less important amount than what you should have had to invest with trackers for example.
- you can track your portfolio evolution – your portfolio being componed by several different assets – investing in only one asset (Index future). Therefore, you can save a lot of money, avoiding the transaction costs.

Desavantages:

- it is very difficult to obtain a perfect hedge, due to the differences between my portfolio reactions and the FTSE 100 evolution, and on the other hand, to the difference between my hedge maturity (February 2007) and the maturity of the contracts I chose (march 2007).
- The dividends schedule is slightly different between the whole index (and therefore its future contract) and the three assets that compone my portfolio.
  As we know the importance of the dividend yield in the futures contract pricing, it could entail some gaps in the hedge, and oblige me to adjust my hedge quite often.

- Is the historic beta reliable? We can wonder if it is reliable because past do not forecast future. Therefore, the hedge efficiency is closely linked to the beta used by the investor.

Weighted Average Beta of the Portfolio (relative to the whole assets)

1.65 x 50% + 1.04 x 30% + 1.26 x 20% = **1.389**

Relative to FTSE 100 (which beta is 0.98)

= 1.389 / 0.98 **= 1.4173**

Contract details – FTSE 100 index futures

Unit of Trading	Contract Valued at £10 per index point
Delivery Months	March, June, September, December (nearest four available for trading)
Quotation	Index points
Minimum Price Movement (Tick Size & Value)	0.5 (£5.00)
Last Trading Day	10:30:30 Third Friday in delivery month[1]
Delivery Day	First business day after the Last Trading Day
Trading Hours	08:00 - 17:30

1 - In the event of the third Friday not being a business day, the Last Trading Day shall normally be the last business day preceding the third Friday.

Contract Standard:

Cash settlement based on the Exchange Delivery Settlement Price.

b/ The second hedging solution is to deal with Individual Stock Futures.

Advantages:

- you can track as precisely as possible the evolution of your portfolio, thanks to individual stock futures.
- No initial investment required except the margin.
- No correlation problem linked to dividend payment or linked to non reliable beta.

Desavantages:

- The market of individual stock futures is less liquid than Index futures.

- As you have to cover each asset of your portfolio, the more assets you have, the more important your transaction costs will be.

- It is more expensive than the index futures hedge – initial margin required.

Contract size	One future normally represents 1,000 shares[1]
Delivery months	Nearest four of March, June, September, December
Quotation	Pence per share
Minimum price movement (tick size and value)	0.5 pence/£5.00 0.25 pence/£2.50[2]
Last trading day	Third Friday of the delivery month. In the event of the third Friday not being a business day, the Last Trading Day shall normally be the last business day preceding the third Friday
Delivery day	First business day following the Last Trading Day
Trading hours	08.00 – 17.30 London time, Last Trading Day 08.00 – 16.30 London time
Related documentation	**Universal Stock Futures Contract (Cash Settlement)**

List of contract details in respect of London Stock Exchange shares (08/09/05)

Last update 07/05/04

c/ The third hedging solution is to deal with FTSE 100 tracker.

In order to hedge my whole portfolio, I have to sell for the same amount of FTSE 100 tracker adjusted by the beta.

Advantages:

- no imperfect hedge due to maturity difference

Desavantages:

- it is very difficult to obtain a perfect hedge, due to the differences between my portfolio reactions and the FTSE 100 evolution.

- The dividends schedule is slightly different between the whole index (and therefore its future contract) and the three assets that compone my portfolio.
  As we know the importance of the dividend yield in the futures contract pricing, it could entail some gaps in the hedge, and oblige me to adjust my hedge quite often.

- Is the historic beta reliable? We can wonder if it is reliable because past do not forecast future. Therefore, the hedge efficiency is closely linked to the beta used by the investor.

- Huge initial investment required compared to futures initial margin.

As far as I am concerned, I think the best strategy to hedge any kind of portfolio is to deal with the closest index futures – here the FTSE 100 futures, because of the low initial margin required, the liquidity of this asset, and the small number of transactions you have to do (limitation of transaction costs).

However, if the portfolio is componed by a few assets, the hedge using individual stock futures should give better results than index futures, even if the transaction costs are higher.

(iii) Take your preferred strategy from above and illustrate how you would set up the futures position, including reference to margin requirements. Use actual data from www.LIFFE.com. The futures contracts you choose should have a few months to delivery.

With FTSE 100 futures:

The maturity of my hedge is February 2007. Therefore, I choose to hedge with the March 2007 contract (maturity 16.03.2007 – third Friday)

On 14/11/2006				
Portfolio valuation		**200 M£**	**Spot (p)**	**Nber of shares**
British Airways (%)		**50%**	**463.25**	21 586 616.30
Carphone Warehouse (%)		**30%**	**291.75**	20 565 552.70
Royal Bank of Scotland (%)		**20%**	**1 867**	2 142 474.56

Weighted Average Beta of the Portfolio (relative to the whole assets)

$$1.65 \times 50\% + 1.04 \times 30\% + 1.26 \times 20\% = \mathbf{1.389}$$

Relative to FTSE 100 (which beta is 0.98)

$$= 1.389 / 0.98 = \mathbf{1.4173}$$

On 14/11/2006, FTSE 100 stands at 6255

Number of contracts =

$$\frac{\text{value of portfolio x beta of the portfolio (against FTSE 100)}}{\text{spot index x £10}}$$

$$= \frac{200\ \text{M£} \times (1.389/0.98)}{6\,255 \times 10} = \mathbf{4\,532\ contracts}$$

Then, I sell 4 532 FTSE 100 futures contracts, maturity March 2007.

I assume initial margin = 2 065£ per contract
Maintenance margin = 75% of initial

My initial margin deposit = 2 065 x 4 532 = **9 358 580 £**

The maintenance margin equals 75% x 9 358 580 **= 7 018 935 £**

We can notice that it only represents less than **5%** of my portfolio value, so it is a very cheap means to hedge.

With Individual stock futures:

The maturity of my hedge is February 2007. Therefore, I choose to hedge with the March 2007 contract (maturity 16.03.2007 – third Friday)

On 14/11/2006				
Portfolio valuation		**200 M£**	**Spot (p)**	**Nber of shares**
British Airways (%)		**50%**	**463.25**	21 586 616.30
Carphone Warehouse (%)		**30%**	**291.75**	20 565 552.70
Royal Bank of Scotland (%)		**20%**	**1 867**	2 142 474.56

As a contract is worth 1 000 shares, I sell (maturity March 2007)

- 21 587 contracts of BA futures
- 20 566 contracts of CW futures
- 2 142 contracts of RBS futures.

Initial margin for BA:

- 0.29 £ per share x 1 000 x 21 587 = **6 260 230 £**

Maintenance margin: 75% x 6 260 230 = **4 695 172.50 £**

Initial margin for CW:

- 0.28 £ per share x 1 000 x 20 566 = **5 758 480 £**

Maintenance margin: 75% x 5 758 480 = **4 318 860 £**

Initial margin for RBS:

- 0.82 £ per share x 1 000 x 2 142 = **1 799 280 £**

Maintenance margin : 75% x 1 799 280 £ = **1 349 460 £**

The whole margin for the three shares equals **13 817 990 £** which is almost half more than the initial margin of the FTSE 100 futures, and represents almost **7%** of my portfolio value.

With Trackers:

FTSE 100 tracker stands at 621.75 p on 14.11.2006.

$$= \frac{200\ \text{M£} \times (1.389/0.98)}{621.75} \times 100 = \textbf{45 592 181 trackers}$$

I sell 45 592 181 FTSE 100 trackers.

My busy money is worth : 45 592 181 x 621.75 / 100 = **283 469 385.37 £**

(iv) Track the price of the futures contract for 10 trading days and illustrate how the process of marking to market and the margin account works. At the end of 10 days you decide to terminate the hedge strategy by closing down your position in futures. Calculate the profit/loss on futures and show how your overall position has been affected. Assume zero dividends in the 10 day period. Comment on the result.

With FTSE 100 futures:

Marking to market table:

	Day	BA spot	CA spot	RBS spot	FTSE 100 H	Dai P&L (Short)	Cum P&L (Short)	Portfolio value	Futures value	Whole portfolio
0	14/11/06	463.25	291.75	1 867	6255					
1	15/11/06	485	291.75	1880	6257	-2	-2	204 973 610.74	- 90 640	204 882 970.74
2	16/11/06	482.75	292.25	1899	6284	-27	-29	204 997 809.80	- 1 314 280	203 683 529.80
3	17/11/06	480.5	291.75	1904	6225.5	58.5	29.5	204 516 406.90	1 336 940	205 853 346.90
4	20/11/06	483.5	291.5	1893	6237	-11.5	18	204 876 919.30	815 760	205 692 679.30
5	21/11/06	481	287.5	1884	6231	6	24	203 321 809.08	1 087 680	204 409 489.08
6	22/11/06	491	283	1883	6197	34	58	204 533 596.09	2 628 560	207 162 156.09
7	23/11/06	486.75	277.5	1871	6180	17	75	202 227 962.55	3 399 000	205 626 962.55
8	24/11/06	493.75	281.75	1863	6158	22	97	204 441 663.72	4 396 040	208 837 703.72
								4 441 663.72	4 396 040	8 837 703.72

I close down my position in futures buying back 4 532 FTSE 100 futures contracts at 6 158 on 24.11.06, after having sold them on 14.11.06 at 6 255.

No Margin call (variation margin)

		Limit Margin	7 018 935
	Day	Futures value	Margin
0	14/11/06		9 358 580
1	15/11/06	- 90 640	9 267 940
2	16/11/06	- 1 314 280	8 044 300
3	17/11/06	1 336 940	10 695 520
4	20/11/06	815 760	10 174 340
5	21/11/06	1 087 680	10 446 260
6	22/11/06	2 628 560	11 987 140
7	23/11/06	3 399 000	12 757 580
8	24/11/06	4 396 040	13 754 620

Total profit to short contract: 97

Total profit on futures contracts: 97x 4 532 x 10 = 4 396 040.00 £
Portfolio value = 204 441 663.72 £

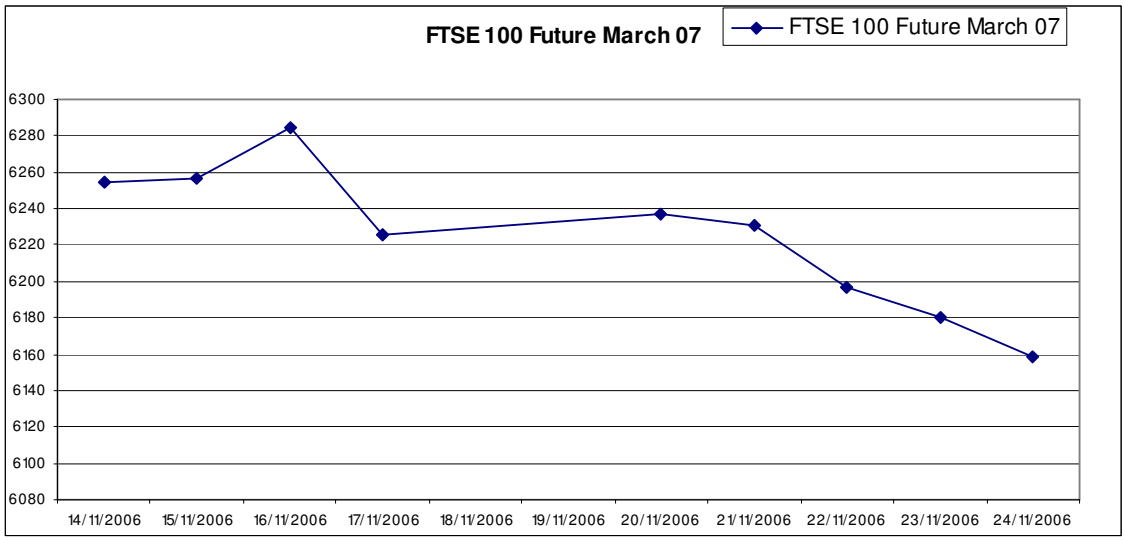
Total gain = 8 837 703.72 £

Return = 4.4189 % on 10 days

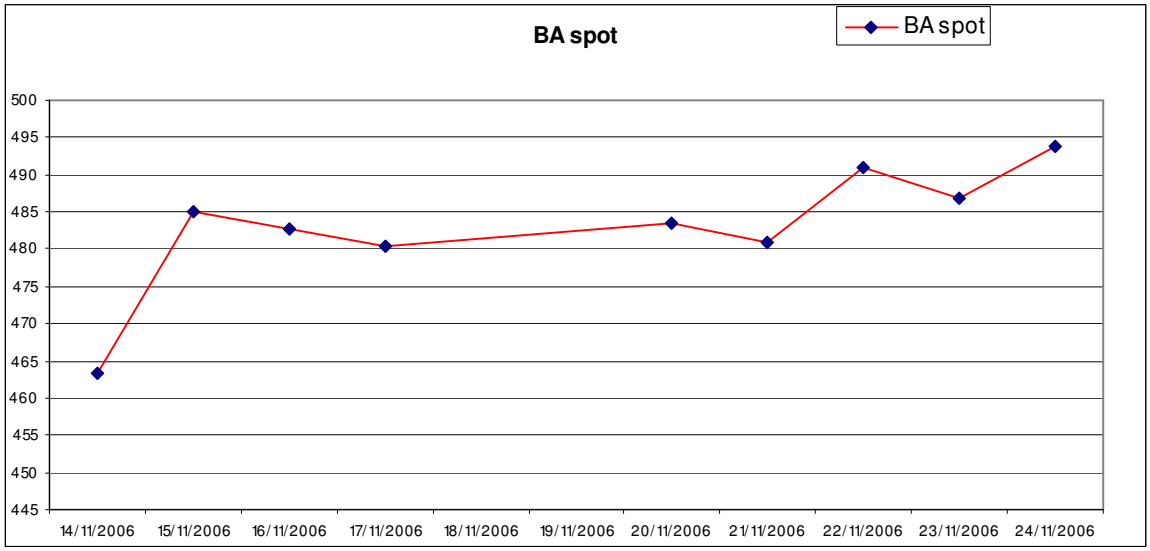
Annualized return = [(1 + 4.4189%) ^ (365/10)] – 1 = **384.65%** **!!!!!**

Comments:

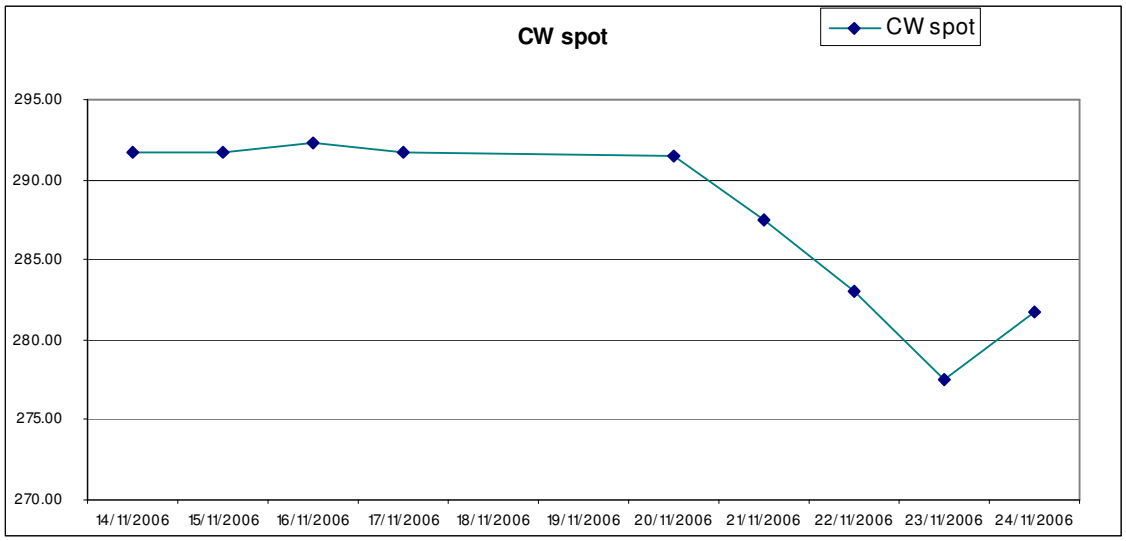
Here, the hedging objective is to protect the long asset position value.
However, we have a annualized return of 384.65%. Why?



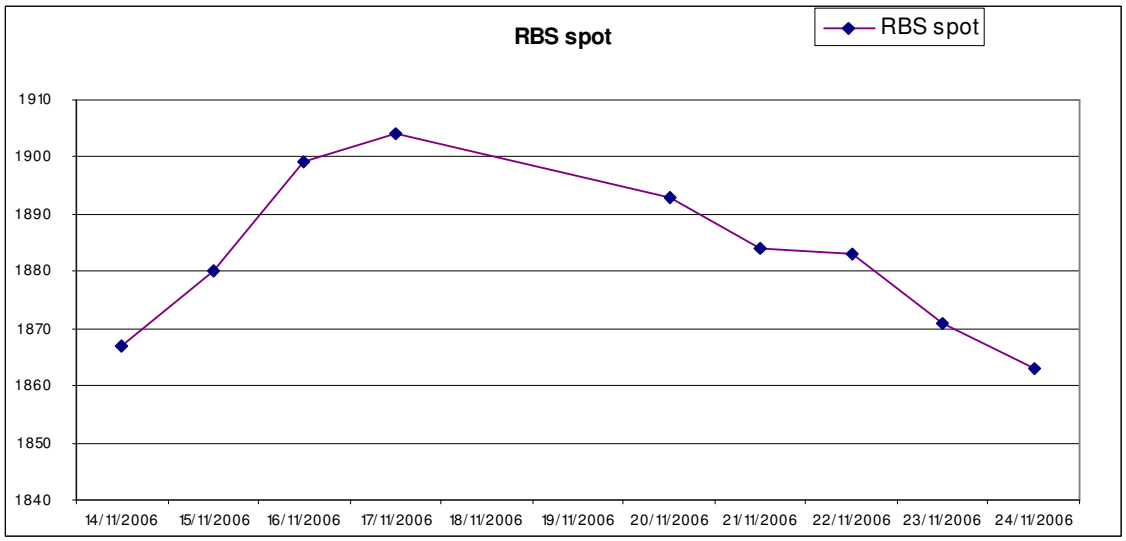
The FTSE 100 contracts dropped by: **1.55%** during the 10 days.
As we are in a short sell future position, we earn money thanks to that.



The British Airways spot increased by **6.58%** during the 10 days.
As we are in a long asset position, we earn money thanks to that.



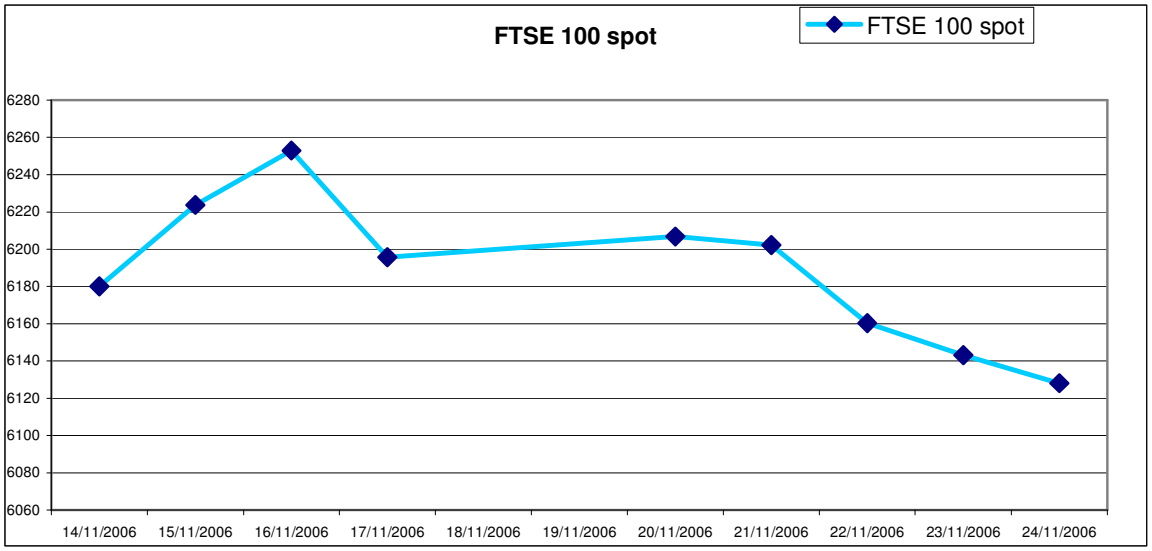
The Carphone Warehouse spot dropped by **3.43%** during the 10 days.
As we are in a long asset position, we lose money because of that.



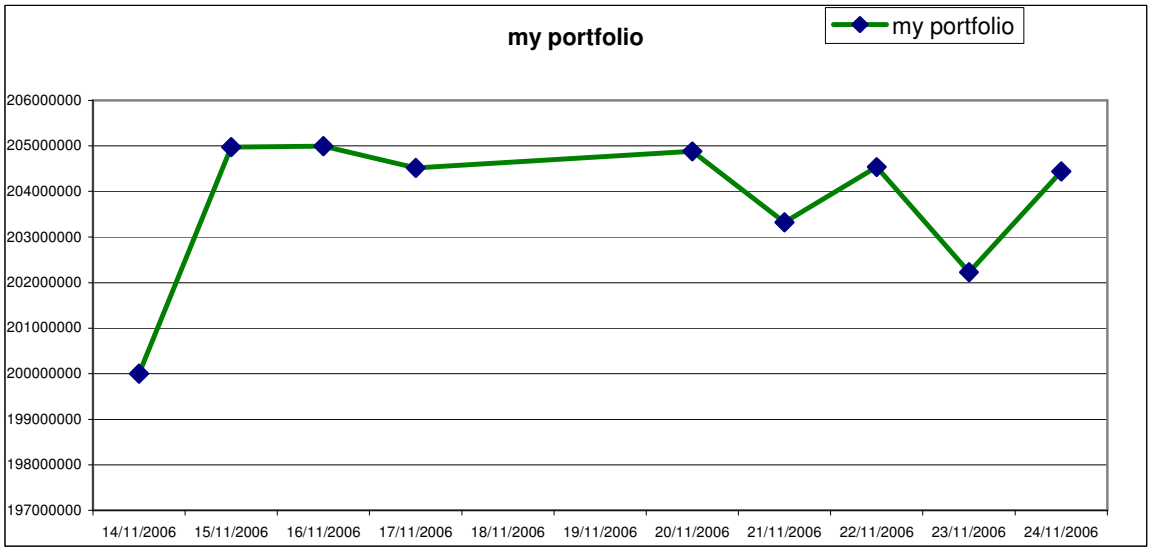
The Royal Bank of Scotland spot dropped by **0.21%** during the 10 days.
As we are in a long asset position, we lose money because of that.

a/ is the historic beta reliable?

FTSE 100 spot evolution



The FTSE 100 spot dropped by **0.84%** during the 10 days.



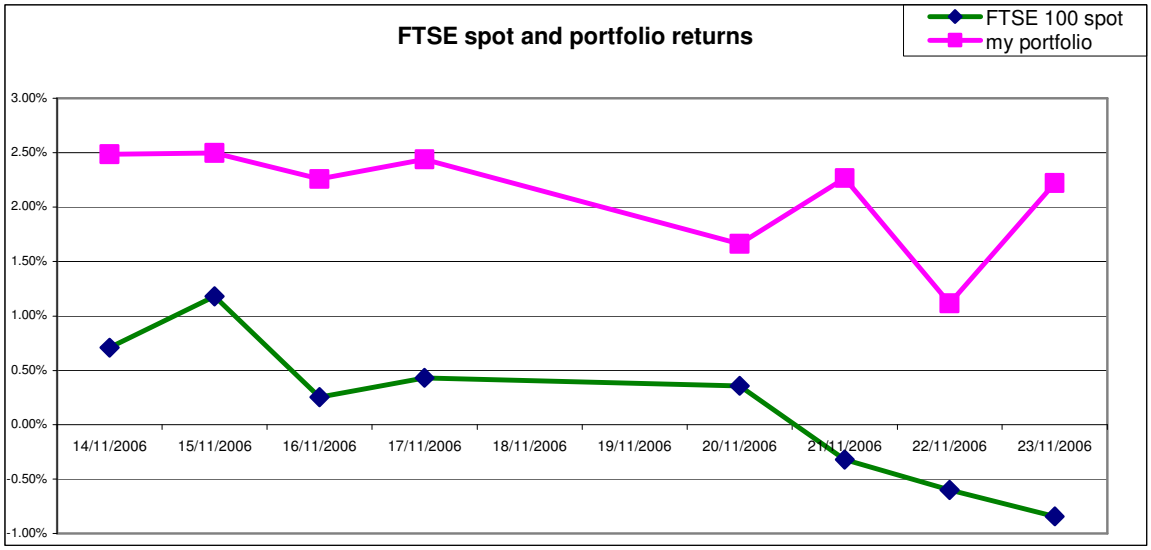
My portfolio increased by **2.22%** during the 10 days.

If the historic beta had been true, my portfolio should have dropped by:

0.84 % x 1.4173 = **1.1973%**

Instead of that, it increased by 2.22%

Then I made profits on my portfolio position and on my short futures position.



In this case, the historic beta was not reliable at all.

With Individual stocks futures:

Marking to market table:

	Day	BA spot	CA spot	RBS spot	BA future	CA future	RBS future
0	14/11/06	463.25	291.75	1 867	470.25	296.25	1840.5
1	15/11/06	485	291.75	1880	492.25	296.25	1853.5
2	16/11/06	482.75	292.25	1899	490	296.25	1872.5
3	17/11/06	480.5	291.75	1904	487.25	296	1877
4	20/11/06	483.5	291.5	1893	490.5	295.25	1865.5
5	21/11/06	481	287.5	1884	488	291.25	1856
6	22/11/06	491	283	1883	498	287	1854.5
7	23/11/06	486.75	277.5	1871	493.5	281.5	1842
8	24/11/06	493.75	281.75	1863	500.75	285.75	1834

Basis (future – spot)

BA : 7 (14.11.06) / 7 (24.11.06)
CW : 5 (14.11.06) / 4 (24.11.06)
RBS : - 26.5 (14.11.06) / - 29 (24.11.06)

		Dai P&L short			Cumul P&L short					
	Day	**BA**	**CA**	**RBS**	**BA**	**CA**	**RBS**	**Portfolio value**	**Futures value**	**Whole portfolio**
0	14/11/06				*21 587 contracts*	*20 566 contracts*	*2142 contracts*			
1	15/11/06	-22	0	-13	-22	0	-13	204 973 610.74	- 5 027 600	199 946 011
2	16/11/06	2.25	0	-19	-19.75	0	-32	204 997 809.80	- 4 948 873	200 048 937
3	17/11/06	2.75	0.25	-4.5	-17	0.25	-36.5	204 516 406.90	- 4 400 205	200 116 202
4	20/11/06	-3.25	0.75	11.5	-20.25	1	-25	204 876 919.30	- 4 701 208	200 175 712
5	21/11/06	2.5	4	9.5	-17.75	5	-15.5	203 321 809.08	- 3 135 403	200 186 407
6	22/11/06	-10	4.25	1.5	-27.75	9.25	-14	204 533 596.09	- 4 387 918	200 145 679
7	23/11/06	4.5	5.5	12.5	-23.25	14.75	-1.5	202 227 962.55	- 2 017 623	200 210 340
8	24/11/06	-7.25	-4.25	8	-30.5	10.5	6.5	204 441 663.72	- 4 285 375	200 156 289

Margin account for British Airways future

		Limit Margin	4 695 172.50		
	Day	**BA**	**Margin**	**Futures value**	**Margin call**
0	14/11/06	*21 587 contracts*	6 260 230		
1	15/11/06	-22	1 511 090.00	- 4 749 140.00	3 184 082.50
2	16/11/06	-19.75	5 180 880.00	- 4 263 432.50	
3	17/11/06	-17	5 774 522.50	- 3 669 790.00	
4	20/11/06	-20.25	5 072 945.00	- 4 371 367.50	
5	21/11/06	-17.75	5 612 620.00	- 3 831 692.50	
6	22/11/06	-27.75	3 453 920.00	- 5 990 392.50	2 806 310.00
7	23/11/06	-23.25	7 231 645.00	- 5 018 977.50	
8	24/11/06	-30.5	5 666 587.50	- 6 584 035.00	
			- 6 584 035.00		

Margin account for Carephone Warehouse future

			Limit Margin	4 318 860.00		
	Day		**CA**	**Margin**	**Futures value**	**Margin call**
0	14/11/06		*20 566 contracts*	5 758 480		
1	15/11/06		0	5 758 480.00	-	
2	16/11/06		0	5 758 480.00	-	
3	17/11/06		0.25	5 809 895.00	51 415.00	
4	20/11/06		1	5 964 140.00	205 660.00	
5	21/11/06		5	6 786 780.00	1 028 300.00	
6	22/11/06		9.25	7 660 835.00	1 902 355.00	
7	23/11/06		14.75	8 791 965.00	3 033 485.00	
8	24/11/06		10.5	7 917 910.00	2 159 430.00	
				2 159 430.00		

Margin account for Royal Bank of Scotland future

			Limit Margin	1 349 460.00		
	Day		**RBS**	**Margin**	**Futures value**	**Margin call**
0	14/11/06		*2142 contracts*	1 799 280		
1	15/11/06		-13	1 520 820.00	- 278 460.00	
2	16/11/06		-32	1 113 840.00	- 685 440.00	685 440.00
3	17/11/06		-36.5	1 702 890.00	- 781 830.00	
4	20/11/06		-25	1 949 220.00	- 535 500.00	
5	21/11/06		-15.5	2 152 710.00	- 332 010.00	
6	22/11/06		-14	2 184 840.00	- 299 880.00	
7	23/11/06		-1.5	2 452 590.00	- 32 130.00	
8	24/11/06		6.5	2 623 950.00	139 230.00	
				139 230.00		

With – 6 584 035 + 2 159 430 + 139 230 = **- 4 285 375 £**

Total loss on futures contracts: 97x 4 532 x 10 = - 4 285 375.00 £
Portfolio value = 204 441 663.72 £

Total gain = 156 288.72 £

Return = 0.078 % on 10 days

Annualized return = [(1 + 0.078%) ^ (365/10)] – 1 = **2.89%**

NB: risk free rate = 5.00%

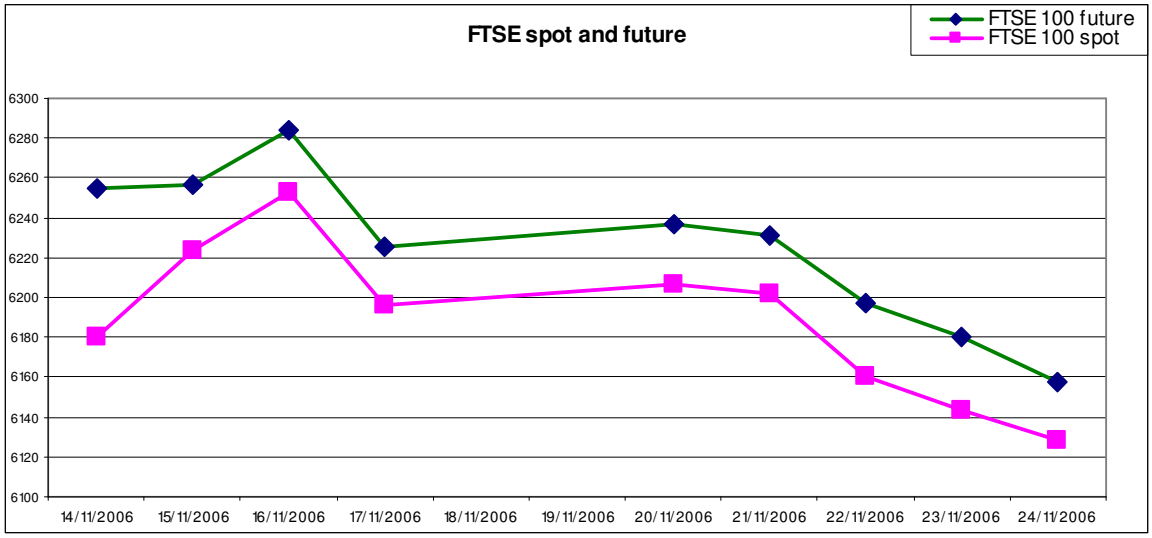
Then dividend yield = 5.00% - 2.89% = 2.11% (if I suppose dividends are paid on 16.03.07)

The difference between my annualized return and the risk free rate is linked to the stock future calculation formula (continuous time), and to the presence of dividend yield

$F = So \times \exp[(r - d)t]$

With r = risk free rate
d = dividend yield
t = maturity

note: as i do not know the dividend payment dates, I cannot give the real dividend yield.
I can only suppose the dividend will be paid on 16.03.07.
There is an exception for RBS.



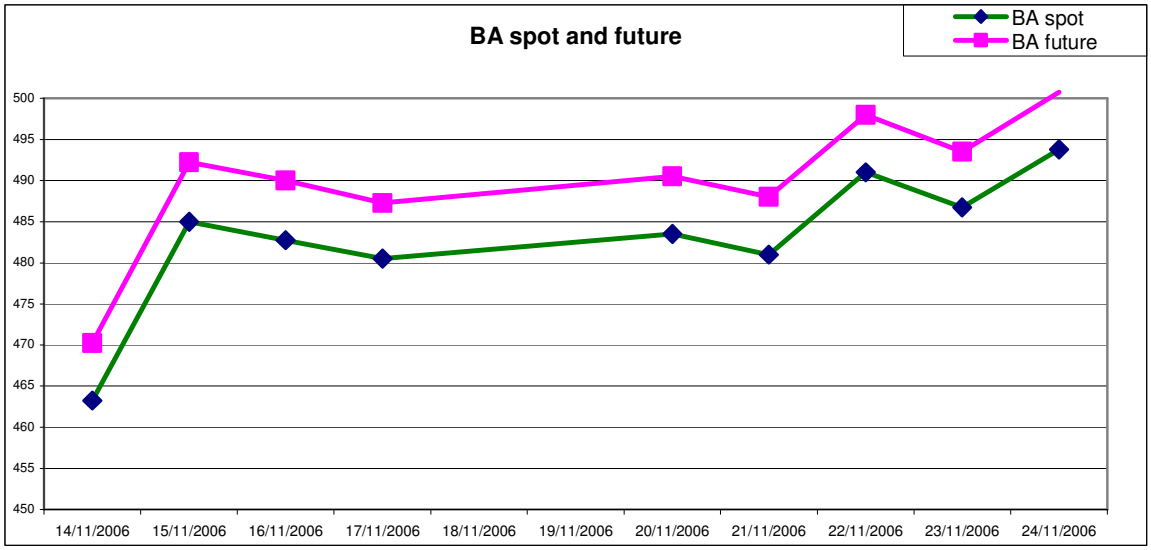
When I take my positions on 14.11.06:

<u>FTSE 100</u>

Spot = 6 180.10
March future = 6255
R = 5%
T = (16/03/2007 – 14/11/2006) / 365 = 122/365 = 0.3342
→ d = 1.78%

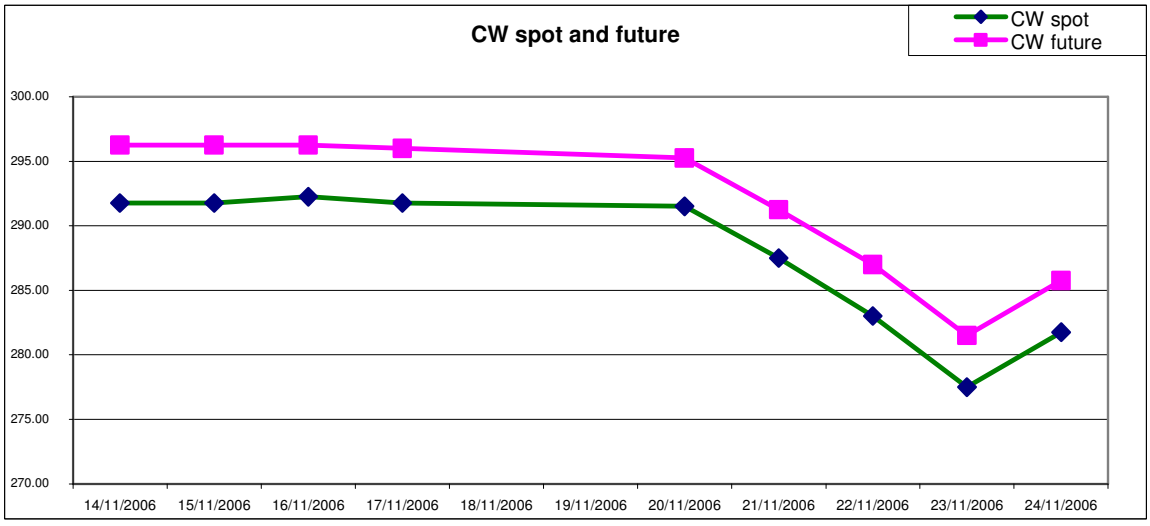
<u>BA</u>

Spot = 463.25
March future = 470.25
R = 5%
T = (16/03/2007 – 14/11/2006) / 365 = 122/365 = 0.3342
→ d = 0.51%



CW

Spot = 291.75
March future = 296.25
R = 5%
T = (16/03/2007 – 14/11/2006) / 365 = 122/365 = 0.3342
→ d = 0.42%



RBS

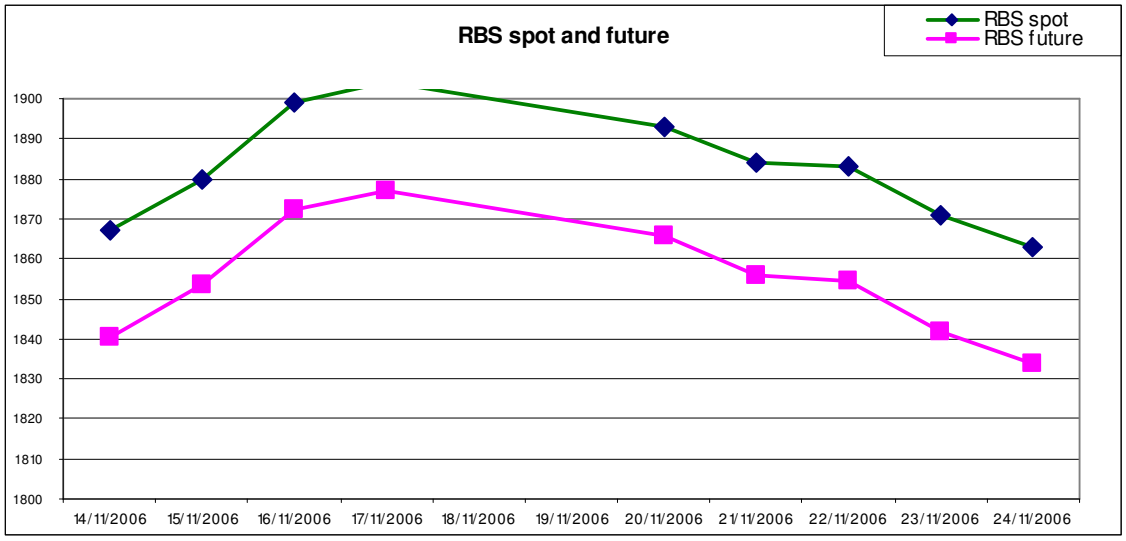
Spot = 1 867
March future = 1 840.5
R = 5%
T = (16/03/2007 – 14/11/2006) / 365 = 122/365 = 0.3342
→ d = 9.28%

note: no company gives such a huge dividend yield, we can suppose that the dividend payment is very close.

In reality, investors are waiting for 56.95p dividends at the beginning of June 2007

We have to discount 56.95 until today at 5% → 55.31p
Then
March future = (1867 – 55.31) *exp (5% * 0.3342) = 1842.22p

The slight difference between the price seen on the market (1840.5) and my theorical price is due to approximations.



With FTSE 100 trackers:

	Day	BA spot	CA spot	RBS spot	FTSE 100	Tracker FTSE 100	Portfolio value	Trackers evolution	Whole portfolio
0	14/11/06	463.25	291.75	1 867	6180.1	621.75	200 000 000.00	- 283 469 385.37	
1	15/11/06	485	291.75	1880	6223.8	626	204 973 610.74	- 1 937 667.69	203 035 943.04
2	16/11/06	482.75	292.25	1899	6252.9	628.25	204 997 809.80	- 2 963 491.77	202 034 318.04
3	17/11/06	480.5	291.75	1904	6195.8	622.25	204 516 406.90	- 227 960.91	204 288 445.99
4	20/11/06	483.5	291.5	1893	6206.8	623.75	204 876 919.30	- 911 843.62	203 965 075.68
5	21/11/06	481	287.5	1884	6202.2	624	203 321 809.08	- 1 025 824.07	202 295 985.01
6	22/11/06	491	283	1883	6160.3	620.75	204 533 596.09	455 921.81	204 989 517.90
7	23/11/06	486.75	277.5	1871	6143.1	618.75	202 227 962.55	1 367 765.43	203 595 727.98
8	24/11/06	493.75	281.75	1863	6128.1	616	204 441 663.72	2 621 550.41	207 063 214.13
							4 441 663.72	2 621 550.41	7 063 214.13

The problem is the same than for FTSE 100 futures, because of the historic beta reliability.

Selling of trackers: 283 469 385.37 £
Risk free rate on trackers selling: 388 580.32 £
Buying back of trackers: - 280 847 834.96 £
Portfolio value = 204 441 663.72 £

Total gain = 7 451 794.44 £

Return = 3.7259 % on 10 days

Annualized return = [(1 + 3.7259%) ^ (365/10)] – 1 = **280.09%** **!!!!!**

The reasons of this gain are close to the reasons exposed in “with FTSE 100 futures”

BIBLIOGRAPHY

Books

John HULL: Options, Futures, and other Derivatives
BODIE, KANE, MARCUS: Investments

Websites

www.londonstockexchange.com
www.ft.com
www.liffe.com
www.euronext.com