

Foundations of Finance

NYU in London

Pr. Dirk Nitzsche

Yero Niamadio

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Coursework in Finance.

Asset Selection

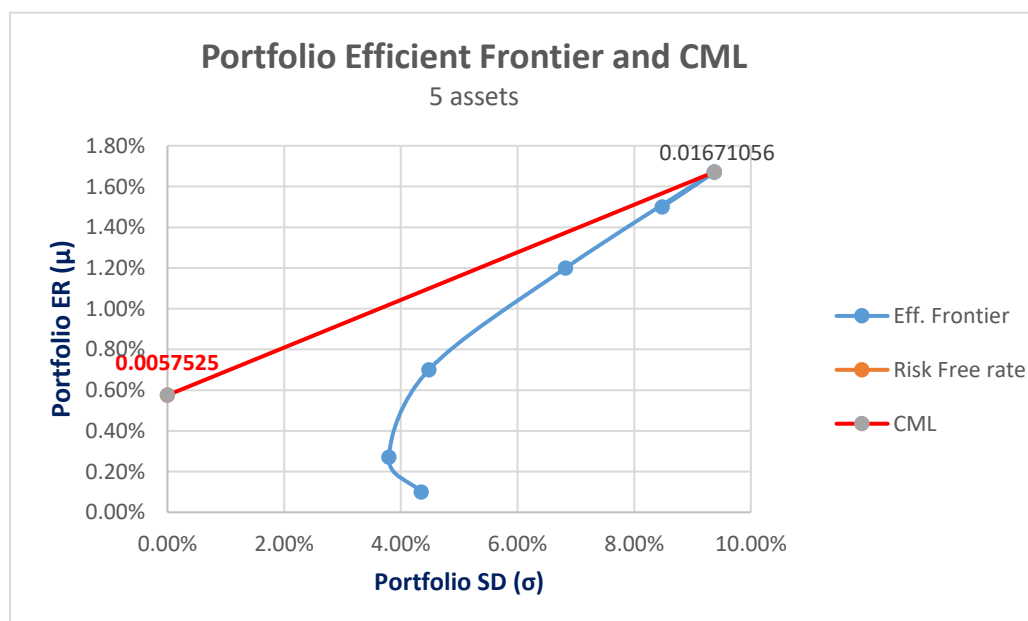
The 5 assets I chose are: Tesco (TSCO), Rolls-Royce Holdings (RR.), BT Group (BT.A), GlaxoSmithKline (GSK) and Unilever UK (ULVR). I believe these assets are diverse enough so as to cover a wide array of the different industries making up the economy notably groceries and retailing, automobile manufacturing and engineering, telecoms, consumer goods and pharmaceuticals. While some sectors that provide commodities are quite stable on the long-run, sectors like automobile sales or pharmaceuticals might experience important swings with respectively spikes in oil price or scientific publications that reveal some unknown negative effects of a pharmaceutical product. For such reasons, I thought that having five different types of assets would make up a diversified portfolio.

Part A: Portfolio Theory

The risk-free rate I'll use in this section will be calculated using data for the period extending from April 2009 to March 2014 (60 months). An average of the LIBOR 1 month rate over this period of time will be a much fairer representation of the current risk-free rate in the market because:

- a) all the LIBOR 1 month rates have stayed below 1% after March 2009 – the post financial crisis --
- b) the LIBOR 1 month rates used to be as high as 6% in 2007 and that wouldn't give a fair picture of today's rates.

We calculated our risk-free rate to be equal to 0.575%. The asset with the highest ER was RR and the one



with the lowest standard deviation was GSK. Following our portfolio optimization, it became clear that the highest Shape ratio was obtained when 100% of our wealth is invested into RR assets.

The minimum variance portfolio is obtained when $\sigma_p = 3.79642\%$.

At that particular point, the portfolio weights are the following:

TSCO	11.6%
RR.	3.7%
BT.	9.5%
GSK	43.9%
ULVR	31.3%

All of these results and the calculations that led to them are available on the “Data” tab of the Excel worksheet. The exact results are reported on the “Calculations” tab of the Excel document. *[For reference]*

Investment Period

We now have £ 1,000 to invest in the stock market on the 1st of April 2014, a 3-year long investment up to March 2017.

1) If I allocate my funds per the optimum portfolio weights, I invest 100% in RR assets which have an ER of **1.671056%**, I shall get in March 2017:

$$FV = £ 1000 (1 + 0.01671)^{36} = £ \mathbf{1815.95}$$

2) If I allocate my funds per the weights in the minimum variance portfolio, I get the following:

$$FV = £ 1000 (1 + 0.00271451)^{36} = £ \mathbf{1102.51}$$

3) If I invest in an equally weighted portfolio at the end of March 2014 without rebalancing for 3 years,

$$FV = £ 1000 (1 + 0.0053861)^{36} = £ \mathbf{1213.34}$$

4) If I rebalance every 12 months into an equally weighted portfolio, I have:

After **12** months, $FV = £ 200 [(1.02395) + (1.22) + (1.03666) + (0.99473) + (1.0703)] = £ \mathbf{1069.128}$, a sum which I rebalance equally into the five assets.

After **24** months, $FV = £ 213.8256 (5.34564) = £ \mathbf{1143.03468}$, which I rebalance equally for the 2nd time.

After **36** months, $FV = £ 228.607(5.34564) = £ \mathbf{1222.05}$

5) If I invested my money in the FTSE all share price index, my terminal wealth would be:

$$FV = £ 1000 (1 + 0.0020871)^{36} = £ \mathbf{1077.95}$$

6) If I invest £ 1,000 at the risk-free rate for three years, I'll be getting:

$$FV = £ 1,000 (1 + 0.0057525)^{36} = £ \mathbf{1229.36}$$

Using data for the investment period between the 1st April 2014 to 31st March 2017, we recalculated the optimum and minimum variance weights as observed in the table below and available for reference in the Excel worksheet. The highest Sharpe Ratio is now obtained when 100% of the investment goes into UNILEVER assets.

	TESCO	ROLLS ROYCE	BT	GSK	UNILEVER	Terminal wealth
Min. Variance Weights	10.39 %	10.31 %	33.51 %	36.68 %	9.11 %	£985.53
Optimum Portfolio weights	0%	0%	0%	0%	100%	£1623.77

Comparing the March 2017 optimum weights to those of March 2014, we can see that there is a complete shift in investment allocation as 100% of our wealth goes from RR assets to now, UNILEVER assets. If I were to advise an investor on where to invest based solely on data up to March 2014, I would advise to avoid wanting to invest 100% in RR assets even though they are the only asset with a predicted positive ER as of March 2014. RR doesn't operate on the commodity market and can thus be volatile at times and as confirmed with the data observed over the investment period, the situation turns out to be quite different 36 months later. Given how high the risk-free relatively is already, I would advise the investor to invest at that rate (which hovers on average around 0.5% since 2009 and thus presents stability).

Part B: Capital Asset Pricing Model

Calculating the betas for different assets

Approach 1 - Beta ratio: $\beta = \frac{Cov(R_i, R_m)}{Var(R_m)}$. [For reference, see "Data Tab", P170:T178]

The Beta Table				
TSCO	RR	BT	GSK	ULVR
0.783097936	1.457503853	0.926711615	1.34229486	1.222572527

Approach 2 - Regression Model 1: $R_{it} = \alpha + \beta R_{mt} + \epsilon_{it}$

In this regression model, we need to plot the FTSE All Share returns against every asset's returns over our 36-month investment period. The betas will be the slope of the best fit line. [For reference, the summary outputs of each regression have been run and the XY scatter diagrams plotted – see tab "Model 1 – Reg Results" in Excel]

TSCO	RR	BT	GSK	ULVR
0.7830979	1.4575039	0.9231935	1.3422949	1.2225725

Approach 3 – Regression Model 2: $(R_i - r_f)_t = \alpha + \beta(R_m - r_f)_t + \epsilon_{it}$

In this model, the theory suggests that α should be equal to 0, which is not the case for any of the five assets. Assets TSCO, RR, BT and GSK all have negative α 's, which means that their risk premium is lower than their market-derived risk premium. These four assets would in this case be considered overpriced. Asset ULVR is the only asset with a positive α of 0.01021, meaning that it is currently underpriced since investors could derive a risk premium higher than the market risk premium by investing in it and thus getting an extra compensation associated with their fair share of risks.

TSCO	RR	BT	GSK	ULVR
0.798081489	1.45096	0.905746	1.32941	1.2151

The three approaches give a convergent estimation of the betas for all assets. Assets RR, GSK and ULVR have beta figures greater than 1, meaning that those assets are theoretically more volatile than the market. TSCO and BT respond by relatively less when changes do occur on the market, positive or negative because their betas are inferior to 1.

In the following table, we'll have a look at how risk is distributed for each of the assets in our portfolio. We easily notice that the firm-specific risk is a much larger component of the assets' total risk than the market-derived risks. than the

	TESCO	ROLLS ROYCE	BT GROUP	GSK	UNILEVER
Total Risk (σ^2_i)	0.7140738 %	0.6318693 %	0.3368428 %	0.2532627 %	0.3166495 %
Market Risk ($\beta^2_i \cdot \sigma^2_m$)	0.0413282%	0.1366038 %	0.0532311 %	0.1146752 %	0.0957981 %
Firm-specific risk ($\text{var}(\epsilon_i)$)	0.6727456 %	0.4952655 %	0.2836117 %	0.1385875 %	0.2208513 %