

# Case 1: Peter Pan Capital

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## DEADLINE

You are to hand in your assignments by 23:59 on November 11, 2013 (Monday). Late submissions will have grades reduced by 0.5 for each full 30 minutes. Please send your assignments to [m.zamojski.ta@gmail.com](mailto:m.zamojski.ta@gmail.com). You will receive an automated response email if your submission was successful.

## GUIDELINES

- You can work in groups of 3-4 people only. Please email the TA, the names of people in your group by November 3. If you cannot find a group contact the TA before that date. You cannot change groups later on.
- There is a hard limit of 5 pages (including any tables, figures, references, title pages, etc.).
- Include an executive summary of your work on the 1st page (in principle, one line per question).
- Your answers should be concise and self-sufficient.
- You may use any computing environment you wish (incl. Excel, Stata, R, Matlab, Python, C++, etc.).
- You are to send your code/spreadsheets and all additional data files you used.
- In case you use Excel, your answers are not to be hard coded, i.e., if the underlying data is changed the results should update. If you are required to use Solver or Goal Seek for a particular question, this rule does not apply.

## I. Background

Neverland, where you currently reside, is slowly recovering from Captain Hook's dictatorship, in which investing was not allowed. After the tyrant was overthrown, the Neverland's stock ex-

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\*There are no official office hours, but you can contact me at [m.zamojski@vu.nl](mailto:m.zamojski@vu.nl). Please note that you are supposed to send in your answers to [m.zamojski.ta@gmail.com](mailto:m.zamojski.ta@gmail.com)

change re-opened and people slowly started to invest in equities. As the brokerage fees are high, when they do invest, it is through mutual funds. There are currently 9 mutual funds in Neverland and each of them has a distinctive strategy. Unfortunately, there is little transparency in the market—in particular mutual fund managers do not have to disclose a lot of details about their strategy. In fact, the only known facts about these funds are that they invest all holdings domestically and exclusively in equities. Together with the Lost Boys, you intend to open a new mutual fund. You wish to position yourself in a relatively uncontested market space. In order to do this, you need to gain more insight into what your future competition does.

## II. Efficient Frontier

The Lost Boys have compiled some data for you. In the 2013\_Case\_1 file you can find information on **prices** of all funds. Furthermore, you can find both US- and Neverland-specific (denoted without and with  $e$  respectively, e.g.,  $e_{RF}$  is the risk-free rate in Neverland) factors that you may use later. The US factors are from Kenneth French's website. Please note, that the Neverland's statistical office from which the Lost Boys obtained returns on the risk-free asset provides only **annualized** data.

The Lost Boys have also informed you that they believe all Funds invest in efficient portfolios.

- Question 1:** How does this piece of information affect your data needs? Is data in 2013\_Case\_1 enough for you to design an optimal strategy? What data transformations do you need to do?

For simplicity, let's first focus on Fund 1 and Fund 9.

- Question 2:** Provide weights for the minimum variance portfolio (MVP) composed of Fund 1 and Fund 9.
- Question 3:** Draw the efficient frontier spanned by portfolios that include Fund 1 and Fund 9.

Based on experimental data, it is believed that risk aversion parameter is less than 10 for most people.

- Question 4:** What are the weights in optimal portfolios that include Fund 1 and Fund 9 only for the following levels of risk aversion,  $A$ : 1, 2, 7?

Now, consider the whole universe of 9 funds.

- Question 5:** Provide weights for the MVP in this case.
- Question 6:** Draw the efficient frontier in this case.

## TIP

If you do not know an explicit formula for an efficient portfolio, you can approximate the frontier by maximising expected returns on a grid. To do this you may choose  $N$  points in an interval  $[\sigma_{MVA}, X]$  (where  $N$  and  $X$  are sufficiently large) and for each point use Solver to maximise expected returns. Given these results you can use interpolation to obtain approximate shape of the frontier (this can be achieved by a proper choice of figure style).

You are not limited to investments in equities only. The Neverland's government issues bonds which you can include in your portfolio.

**Question 7:** How does the presence of a risk-free asset impact portfolio choice?

**Question 8:** Given your previous (possibly approximate) answers what is the optimal portfolio of risky assets you would want to hold?

**Question 9:** What is the composition of the optimal portfolio (including the risk-free) for the following levels of risk aversion,  $A$ : 1, 2, 7?

## III. CAPM

For now, you may assume the CAPM describes the reality of Neverland well.

**Question 10:** Compute betas for all Funds and plot them against their expected returns.

**Question 11:** Explain how linear regression can be used to test validity of the model and perform these tests using an appropriate econometric model.

## IV. Factor Models

The Lost Boys provided you with the three factors which were created for Neverland using the approach in Fama and French (1993). These factors are:  $e_{Mkt-Rf}$ ,  $e_{HML}$ , and  $e_{SMB}$ . Even though Neverland has trade and political ties with US and is otherwise well established in the world, you suspect that these factors might be better suited to explain returns on Neverland's stock exchange.

**Question 12:** For all funds fit an appropriate linear regression model analogous to Fama and French (1993), but using the Neverland's factors. Briefly report on the results. Given the estimated values of coefficients, what is the investment strategy of each fund?

**Question 13:** When you use a linear regression model, you make certain assumptions about the

underlying data generating process. You can test one of these assumptions by assessing stability of parameters. For this purpose, estimate the Fama and French (1993) model with a moving window (rolling regressions) of 60 months. Describe your findings and for at least one Fund provide figure with results.

- **Question 14:** Using the data from Kenneth French's website, which the Lost Boys have compiled for you as well, run the Fama and French (1993) full-sample regressions again. Compare results with your previous findings and discuss any discrepancies you find.