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**Article**

## Teaching empirical finance courses: A project on portfolio management

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## GENERAL & APPLIED ECONOMICS | RESEARCH ARTICLE

# Teaching empirical finance courses: A project on portfolio management

Bruce Morley<sup>1\*</sup>

**Abstract:** The aim of this article was to assess the use of a group-based project for an empirical finance type of course. It examines the outline of the project, the methodology the students are encouraged to follow and how the course is assessed. This approach enables the students to apply many of the techniques learnt on this course and other courses such as econometrics, to determine an optimal portfolio of assets given their view on the risks in the economy. The emphasis is on risk management through portfolio diversification and the use of a simple hedge strategy. The overall aim was to introduce the students to the basics of portfolio management, as many work in this industry for their industrial placements and when they graduate. The main contribution to the literature is through the analysis of an empirically based portfolio management project. The feedback from the students suggests they felt that they had learnt useful concepts and information, in an enjoyable exercise.

**Subjects:** Econometrics; Finance; Teaching & Learning

**Keywords:** empirical finance; portfolio; risk; econometrics; economic tools for teaching

### 1. Introduction

The aim of the module and the coursework covered in this study was to introduce a more practical and interactive approach to studying a typical Money and Finance undergraduate course. The area of empirical finance covered in this analysis is mainly the project, which forms part of the assessment for this second-year course.<sup>1</sup> In addition, the aim of the project was to make it as realistic and



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### ABOUT THE AUTHOR

Bruce Morley has a PhD from Loughborough University on exchange rate economics and has since published a number of research articles on international macroeconomics as well as housing economics and sports economics (cricket). He has worked as a lecturer in Economics at Aberystwyth University and latterly Bath University, where he has taught mainly macroeconomics- and econometrics-based courses, as well as Money and Finance, which is the course on which the project described in this article is based.

### PUBLIC INTEREST STATEMENT

The aim of this project and the accompanying course was to provide an applied assessment using real market data. This gives the students an insight into portfolio management and the use of many of the empirical techniques acquired on the Money and Finance course as well as related courses, such as data analysis and macroeconomics. The project was marked on the basis of their justification of the assets included in their portfolios and not how well the portfolios performed. Following a number of workshops providing examples of the project, the groups produced their own portfolios, which were limited to UK equities, gold and money. The portfolio is in existence for a couple of months, the one which has the best return wins a small prize. Overall, the students appear to enjoy producing their own portfolios and gained real-world experience of some applications of the course's material.

enjoyable as possible, whilst linking it to the 2008 financial crisis. The course spans two semesters, one semester covers the financial markets and systems assessed mostly by a group project (which is the subject of this study), whilst the other half of the course is more theoretical and concentrates on money, being assessed by the usual exam. There were two main aims of the project, firstly to encourage them to apply some of the techniques they had learnt during this course in a real-world context, secondly to improve their group work and presentation skills. In addition, they would be given the opportunity to apply the knowledge from other relevant first- and second-year courses such as the “data analysis” module, including basic regression analysis.

The approach adopted in this course follows a number of strands in the economics and finance education literature. The emphasis on studying the real world, rather than concentrating on the modelling of the financial sector follows that of Lawson (1997) who believed it better to study the workings of real economies and in a wider sense was based on the “real world economics” movement, although the emphasis in this course differs to that suggested by their approach. It also reflects some of the criticisms of the teaching of economics and finance in general as highlighted by Coyle (2012) in the light of the recent financial crisis, as some argue teaching needs to be more practical and interdisciplinary, whilst preparing students for their possible working lives.

This is only one approach to the teaching of finance and economics through group projects, Helliard, Michaelson, Power, and Sinclair (2000) adopted a different approach using a computer game called *Finesse* (Finance Education in a Scalable Software Environment). The aim of this approach was to enable the students to put into practise many of the finance techniques learnt on their course, using live daily data and allowing a competitive element by ensuring the student teams were aware of the ranking of their portfolio relative to the rest of the class.

The motivation for the approach used in the Money and Finance assessment was initially due to the ending of a specific course on research and presentation skills. However in Economics these skills are often overlooked, but are necessary for most graduate-type jobs. Over recent years, many of the students have gained employment in the financial sector and as highlighted by Lawson (1991) much of the changes in Economics degrees are due to changes in student demands and the labour market. Traditionally, the emphasis of an Economics degree was on the general skills gained from the degree (Economics literacy) which is still the case, although as noted by Lawson (1991) Economics degrees have increasingly attracted students who aim to work in a specific area, such as the finance sector.

In addition the majority of the students at Bath go on placement during their third year, often to finance-based companies. The placement includes a visit by their placement tutor and a discussion between the tutor, student and their supervisor and during these visits, an area the supervisors highlighted for further work was the group work and presentations aspects of their jobs. To cover both the financial aspects that were useful in the placements with the group and presentation skills, this project was introduced and required that students formed groups of four or five, then put together a portfolio of assets, where they had to justify the choice from a quantitative and qualitative perspective. In the project, the teams had to consider both the financial implications of their portfolio and the wider effects of the macroeconomy. Thus, the teams needed to consider the financial and economic implications of their portfolios in tandem.

Money and Finance is an optional course open to all second-year Economics students and also for those doing Economics with a minor subject such as politics. It is also available to students from the politics department; about 20% of the students would be doing the degree in Politics with Economics as the minor. Although it is an optional unit, the overwhelming majority of second-year students choose to do it, so typically there are about 180 students on the course. As part of the project they were required to do some basic regression analysis, although not all the students will be doing the second-year course in econometrics, they will all have done a first-year course on data analysis, which includes basic regression analysis using Excel.

The rest of the paper discusses the learning outcomes of the exercise, course structure and the methodologies used by the groups. This is followed by a discussion of the feedback from the students, then there is a conclusion and suggestions for future changes to the course.

## 2. Review of pedagogical issues

The main learning outcomes for the course as a whole and project in particular, included an understanding of the link between financial markets and economic policy and risks. It was also a test of their ability to use statistical techniques learnt during their first and second years to appropriately assess risk and return and correlation between assets, so that they could become adept at using Excel to analyse the technical aspects of financial assets. In part, this aim reflects the increasingly technical demands of a typical Economics degree. Over the last 50 years, Economics degrees have become increasingly technical across UK Economics departments (Lawson, 1990), and also American economics departments (Allgood, Walstad, & Siegfried, 2015).

Perhaps most importantly they needed to be able to appreciate the importance of risk management in portfolio analysis and the need for a diversified portfolio to control risk. In addition, they were required to develop a number of transferable skills such as presentation and group working skills. This required that their project was clearly and concisely presented and the presentation was clear and captured the interest of the audience. Also by working in a group of four or five, they would benefit from a cooperative learning environment which required the building of a consensus among team members (Ravenscroft, Buckless, & Hassall, 1999).

In addition to the learning outcomes, a main aim of this group project was to encourage the students to interact with other students on the course, this can sometimes be problematic in a group of 180 students. It was also hoped that they would enjoy the exercise overall and be a slightly different learning experience for the students, something highlighted as potentially important in non-Economics disciplines by Becker and Watts (2001). Most of the students go on a placement in their second year and very often this is to a firm which does portfolio or investment management of some sort, so the skills and knowledge that they would learn should help them whilst working during the placement.

### 2.1. The course outline

The project required a number of areas that the groups had to cover in some way during the analysis, although they were also encouraged to use techniques and approaches not stipulated in the coursework outline. These included:

- The level of risk and return the group are aiming for in the current economic climate.
- Some statistical analysis of the assets, this could include a simple regression and correlation matrix.
- Some reference to the key ratios relating to the assets, especially equities, such as the price earnings ratio.
- Some discussion of the macroeconomic climate, such as monetary policy or Eurozone risks and how it has affected the selection.
- Some discussion on international diversification, not forgetting many companies listed on the UK markets do most of their business in other countries.

In addition, the groups were allowed to include any analysis that they felt was relevant to the project. Although all the projects were required to cover these areas, it was up to their own initiative as to how they were covered. For instance, some groups would have simple historic return means and variances or coefficient of variation to assess the risk and return. Others would use Sharpe or Treynor ratios (Sharpe, 1966; Treynor, 1965) or more complicated versions of these risk/return measures.

## 2.2. Teaching

The main content for this part of the module related to the financial markets, the basics of portfolio analysis and the outline of the financial crisis. These topics covered the back ground to the financial system and asset management. The emphasis was on the controlling of risk and the importance of portfolio diversification. The course began with an overview of the financial crisis and its repercussions, based on “This time is Different: Eight Centuries of Financial Folly” (Reinhart & Rogoff, 2009).<sup>2</sup> Additionally, the crisis and the failure of the majority of Economists to predict it was a further justification for the alternative approach to teaching the Money and Finance course. This reflected a wider dissatisfaction with the teaching of macroeconomics-based courses following the crisis, as suggested by Shiller (2010), whereby it was felt that the material was not particularly relevant to the real world and the potential careers of the students that studied Economics at university. As a result, the groups were required to begin the project with an assessment of the economic and financial risks (including the likelihood of another serious crisis) in the economy over the coming months.

To make the Money and Finance course more practical and realistic, we adopted two approaches. Firstly, an emphasis on how the financial crisis had been affected by all parts of the course material and using the more interactive piece of coursework that encouraged the groups to show initiative. In many respects this course complements the CORE approach to teaching economics, which is a question-led technique that emphasises recent developments.

During the course, the following topics on the financial system were then explained in the context of their role in the crisis. For instance, the money markets were explained in terms of how they affected bank liquidity, the stock market was covered in terms of asset pricing and some of the difficulties with this and the importance of the rights issue in bank balance sheets being rebuilt. These topics were again particularly relevant for the section in the project on the macroeconomic risks and how the crisis affected the economy and potentially their assets.

There were also lectures/workshops specifically on the project, based on an example portfolio and use of the approaches they were expected to use as the basic minimum for the analysis. There were also demonstrations on how to access the data and input it into Excel, as well as doing simple regression analysis in the same software. For the presentations, there was a visiting speaker on the art of making presentations and in particular how to grab the audience’s attention using a variety of techniques.

The course required only the standard technology available in most computer rooms and lecture theatres. This included PowerPoint and the overhead projector. The course also involved the use of lecture capture video systems, known as Panopto. The students could then view the lecture in Moodle later if they chose to. Studies such as Toppin (2011) suggest that the use of video lecture capture is beneficial overall from the perspectives of students and lecturers and doesn’t reduce attendance at lectures. However, I have found that the recording of lectures can have both negative as well as positive effects, with some using it as an excuse not to attend the lecture. The software used in the project was mostly Excel, but some also used Eviews and other specialist statistical programs. There was also a specific section on the project including relevant material on the course web page (Moodle).

## 3. Design of the module

The first task for each group was to assess the levels of risk they would allow in their portfolio, based on the macroeconomic climate over the short and long term. The next step was to explain how they would choose the assets and how many would be in the portfolio. For many of the groups, this involves using the required approaches as set out in the coursework outline. So many groups started with a correlation matrix, discarding all those which were highly correlated. The number of assets was then reduced until they had the optimal allocation for their portfolios based on a certain level of risk, which in most cases was measured using a Sharpe ratio or similar measures. After this the groups did individual analysis on the assets, especially ratio analysis, often to determine the weighting of the assets.

In addition to the analysis of risk and return of the assets in the portfolios, one of the main areas involved simple statistical assessment of the assets. This mainly involved the use of correlation matrices and regression analysis using ordinary least squares (OLS). The correlation matrices between the asset returns were important as the portfolio needed to be diversified to control for non-systematic risks. In general most groups set an upper limit on the value of the correlation coefficient between assets, using it as a means to select appropriate assets for the portfolios. This was usually done using Excel, but some groups used Eviews.

The regression analysis usually centred on estimating a simple market model for their assets individually to obtain an estimate of the company beta. The betas, used for assessing the asset riskiness and volatility relative to the market as a whole, were also available from some websites, but estimating them allowed the groups to include t-statistics and also use this model as the basis for the inclusion of other factors that could affect their asset returns. Most groups preferred the beta to be below unity, as they didn't want excessively volatile assets as they wished to reduce risk as much as possible. It was made clear that the level of econometrics required for the project was no more than what they had covered in a first-year course on data analysis, so the regression could be done using standard approaches.

$$R_{it} = \alpha + \beta R_{mt} + u_t$$

$R_{it}$ —return on asset  $i$  (with stock price  $s_{it}$ )

$R_{mt}$ —return on the market (i. e. FTSE 100 index)

where

$$R_{it} = \frac{s_{it} - s_{it-1}}{s_{it-1}} \approx \ln s_{it} - \ln s_{it-1}$$

Although a basic asset return model, it has the advantage of being easy to estimate and having some good econometric properties such as stationarity, so the students didn't need to worry about techniques that they hadn't covered in previous courses. Also the data are easy to access from Yahoo finance or the London stock exchange. This provided an application of the regression analysis they had learnt in other courses and also showed them where the company beta comes from.

A further quantitative requirement was the need to locate and interpret the key financial ratios for their assets, such the price/earnings ratio and gearing ratios. These could be obtained from various web pages such as Morningstar and they didn't need to calculate them themselves. However, they were expected to interpret them against the relevant sector ratios rather than the market as a whole.

The main qualitative input into the coursework is the group's assessment of the macroeconomic outlook and the accompanying risks. This includes not only UK-based macroeconomic performance and relevant indicators, but also a general world outlook covering emerging economies too where required. Although it was mainly a discussion, the views expressed on the economic outlook needed to be supported by recent data or the relevant charts.

The section on international diversification did not require any quantitative analysis but an appreciation of the importance of diversifying through the investment in assets with a large part of their business outside of the UK (Odier & Solnik, 1993). The discussion also needed to cover the extent to which the firm's exported overseas or owned subsidiaries overseas. In many cases nearly all the businesses of the firm would be overseas, especially for the mining companies. Some of the better projects included charts and tables to show the extent of the diversification.



The groups were encouraged to include the other analysis not included in the specific list if they felt it was relevant. In general the better projects did this and mainly it referred to a more complex model of the asset returns. So in the market model mentioned earlier, they included additional factors, mostly macroeconomic that they felt may have affected their returns. This included the exchange rates, especially the Pound against the US Dollar and Euro, various interest rates and oil prices among other factors. They then needed to interpret how this affected their asset, so for instance if the exchange rate was significant it suggested that a depreciation of the exchange rate would increase the asset's price, if the coefficient was positive. As the UK's exchange rate has recently depreciated against the US dollar and given the gradual nature of any effects on profits and therefore prices, the student could conclude that the asset would make a good investment in the short to medium term. Often the factors would not be significant, for instance oil prices in some cases didn't have a significant effect even on oil companies despite a substantial fall of the oil price. The groups then needed to justify this, such as through the use by oil companies of the oil futures markets.

### **3.1. The portfolios**

What assets could be included in the portfolios was fairly restricted, as the portfolios needed to consist of UK equities, from either the main FTSE market or Alternative Investments Market (AIM), along with either money (no return or risk) or gold (simple hedge). No other assets were allowed including no derivative products and no short selling. The groups had a maximum of £10,000 of imaginary money to spend and they were allowed a maximum of 10 assets (although they could have just one). When the groups were unsure about what they were able to include in the portfolio they needed to ask the regulator (lecturer). The aim was to simulate the real financial sector where a regulator sets limits, which financial agents then try to circumvent.

For the purposes of the competition, the portfolio was live for approximately two months, at the end of this time period the change in the portfolio value was calculated. During this time the groups were not able to invest in further equities or other assets, although they could sell them but were not allowed to reinvest the proceeds. This course has been running in this form for about five years, over this time it is not unusual for some groups to outperform the market return by seven or eight per cent over two months, although most of the portfolios tend to follow the market.

The project needed to be a maximum of 3,000 words, so it was essential to be concise. The assessment of the project was based on the group's justification for including the assets that have been selected for the portfolios. The mark does not include how well the portfolio has performed over the time period it is live. This aspect is only for the student's own interest, but there was a small prize for the winning portfolio. In addition to the project, the assessment included a presentation of the portfolio in which the whole group had to contribute and imagine pitching the portfolio to a set of investors. The presentation had to last from five to seven minutes and included questions at the end. Marks were awarded for clarity of speech, maintaining interest, use of charts and tables, timing, working as a group and ability to answer the questions.

Overall, the student feedback on this course was positive, although there have been some specific criticisms of particular aspects of it. Student feedback comes through the module evaluation forms completed by the students at the end of the course electronically. An example of a positive comment is: "By far the most engaging, fun and interesting module I have attended while at university. ... and the coursework is designed to reflect this very well. Making the portfolios live for the coursework is a fun addition to it, making it very fun". A negative comment was: "slightly more guidance in the structure of the project and what we need to include and what we don't". This latter point reflects one of the problems with this type of coursework in that it is difficult to get a balance between the groups needing to use their own initiative and having the required steps for completing it explained in excessive detail. It was emphasised that including their own approaches other than those specified in the outline was to be encouraged. Some of the groups used highly innovative and advanced techniques. For instance, one group overcame the problem of having only historic data to

use as the basis for predicting future returns using Monte Carlo simulations to forecast out of sample. This was also a surprisingly accurate method.

A further potential problem concerned a student worrying that it could be construed as a form of gambling, although not with real money. However, it was explained to them that the main aim of the project was to control for risks by diversification of the portfolio, as was stressed many times it wasn't the group with the highest return that got the highest marks, unless they had the best justification for the portfolio choice.

In the module evaluation forms the students can rank various aspects of a course from one to five, with five being best. Examples of the questions on the form include: "I find the teaching methods used are effective in helping me learn" which received an average of four, whilst the question: "my understanding of this subject is increasing as a result of taking this unit" received a mark of 4.5. In relation to how hard the module was, with one being much too easy and five much too hard and three about right, it received a mark of 3.7, suggesting it was reasonably challenging.<sup>3</sup> Overall, these scores compared favourably with the feedback from the Money and Finance course from previous years when we didn't include the project and it was mainly an exam-based assessment. Similarly, the comments from previous years before the project were mainly about the students not finding the material covered in the module particularly interesting or relevant.

#### 4. Conclusion

The aim of the course and the associated project was to give an insight into practical portfolio and investment management, using quantitative and qualitative techniques from this course as well as other related courses on their Economics degrees. In addition, we aimed to cover some important transferable skills, such as presentation and teamwork skills. We also attempted to account for economic and financial developments as a result of the recent financial crisis, as a number of studies have identified some pedagogical issues relating to the need for the teaching of economics and finance to be more practical and related to the real world.

The evidence from the assessments suggested that on the whole, the teams had managed to assess the macroeconomic risks and produce a portfolio of assets which controlled the risks that had been identified. A further aim was to ensure the groups enjoyed the project and increased their interaction. Overall, the feedback seems to suggest this was the experience of many of the participants, with some groups following their portfolios years after the course ended for them. Although an aim was to encourage the groups to show initiative, some groups expressed the preference for more direct guidance on what was expected in the assessment.

##### 4.1. Possible future changes

The main area that could be developed more in the future is regarding the restrictions on what assets can be included in the portfolios. In particular, the methods and types of hedging in the portfolio, as gold has possibly become less effective as a hedge since the financial crisis in 2008. Some limited short selling could also be included in future, although this could complicate the analysis and possibly make pricing the assets more difficult. Similarly, some form of derivative products could be included, such as options or swaps, although again this may overcomplicate the project. Although it would be more realistic to add in more complex investments, a comment from one of the student representatives suggested that a more straightforward approach was preferred by the students.

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#### Notes

1. The project was originally developed with Dr Ahmad Ahmad who was also responsible for teaching the Money and Finance course. In addition Dr Vito Polito and



- Dr Asgerdur Petursdottir have contributed to it whilst teaching the course with me. The usual disclaimer applies.
- The main text book used to cover this part of the course was "Finance and financial markets" by Pilbeam (2011).
  - Based on 65 responses (38% of total).

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