

## **TEACHING FINANCE IN PERIODS OF UNCERTAINTY**

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### **Abstract**

Universities strive to tailor relevance of the courses they teach to the real world and the application of their material to the current financial environment. The problem facing teachers is the evergreen rules that they are used to applying are being overridden by the volatility of the marketplace and the velocity of the changes. Technology is speeding up the circulation of knowledge to the point that responses to marketplace events are being distorted by sudden volumes of trades that it was not designed to handle in an orderly fashion. The challenge is to use the edge that technology provides to change teaching methods and account for these sudden financial events that do so much to distort the orderly marketplace that previously responded to commonly used financial models. This study looks at the tools that technology provides and poses the question as to whether this will be enough going forward to equip students with the knowledge to handle the volatility issues in the marketplace and their careers in finance.

### **Fundamental Versus Factual in the Learning Process**

Finance teaches the fundamental value of shares that in these times of volatility bear a more distant relationship to the market values as portrayed on television news screens and the relevant computer internet sites every day. For the market to lose or gain a couple of percentage points in value on trading days is not uncommon. Volatility is so high that the VIX volatility index (sometimes called the fear index) is itself is traded as if emotion is a commodity. The issue that faces the teachers of finance is how they teach, with any degree of credibility, the concept that there is a linkage between our models and the marketplace. To then tell students that share values will over a three-year time frame track back from market values to fundamental values is a hard ask in an environment where financial news is instantaneously displayed on television screens as it happens. The task is to use technology in the form of trading tools and information to establish to what degree the market is being driven by emotion and factor that into the valuations in the marketplace versus the fundamental values that financial models calculate we should pay for the securities. Bridging this gap is the challenge.

## **Approaches to Teaching under Uncertainty**

Teaching face to face using the standard lecture format can only entrench the present 'this is the calculated value' approach. Teaching the fundamentals of valuations is now just the initial building block and does not provide the complete picture of what the financial markets are experiencing. An alternative approach is to move lessons from the standard format of presenting information in a lecturing style to case based learning. The value of case based learning is it introduces the concept of examining variations to the norm and why they happen. The value of case-based learning has been recognised and implemented by the Harvard Business School. Their published catalogue includes the analysis of many current financial cases (Harvard Business Review, 2011) and the technology used to provide an analysis of how firms came to the decisions they arrived at. Whether this, again, is enough to explain the vagaries of the financial markets is the subject of conjecture. Do lecturers migrate to the case based learning method to explain the variations in the financial world or should they utilize the tools that technology provide?

Stewart, Ghadim, and Kingwell (1996) say that when teaching students about decision making under uncertainty, they prefer to use simulation games that track the real world as closely as possible. This they find increases the student's awareness and knowledge of the decision-making environment and this is an excellent motivational tool. Coldwell and Rose (2006) say that one of the main challenges facing educators seeking to enhance learning, as well as practitioner and student satisfaction, is to create opportunities for students to apply financial concepts and theory to real world cases.

Shulman (2005) says that professional education is about developing pedagogies to link ideas, practices and values under conditions of inherent uncertainty that necessitates not only judgement in order to act, but also cognizance of the consequences of one's action. In the presence of uncertainty, one is obliged to learn from experience.

Bennis and O'Toole (2005) argue that business education has been preoccupied with imparting theory and concepts rather than practical skills which would enable students to be successful business professionals. Brooks and Oliver (2004) introduced a new course designed to combine management accounting concepts and technology. The technology component emphasized spreadsheet design and communication. The use of cases studies ensured that the curriculum was relevant and simulated 'real life' situations. This enhanced the relevance of the course. It also enabled the educators to change their role to facilitators rather than instructors as the students took on a greater responsibility for their own learning.

Roucan-Kane and Boehlje (2009) discuss the uncertainty that agricultural machinery suppliers face when planning for the future in a notoriously fickle market that always faces uncertainty. They espouse using cases from the recent

past as a tool to design alternative strategies to combat uncertainty. The tools that they recommend are real options, an options portfolio and variable organizational structure. They want the teaching to concentrate on strategic thinking. Their approach was originally laid out by Holt and Anderson (1978) who were teaching farming strategies under uncertainty. They noted that “interactive computer routines and portable terminals make it possible to use farmers own problems as teaching tools.” Decision trees became their core approach to real-life decision making. Even in the 1970s when computers were cumbersome, to say the least, technology was being used to teach methods of making decisions under uncertainty.

According to Albrecht and Sack (2000) educational models focus excessively on content at the expense of skill development. Marriott (2004) argues that if students wish to learn spreadsheets because proficiency in financial modelling will enhance their skills and job opportunities, then educators should facilitate the use of spreadsheets in the classroom.

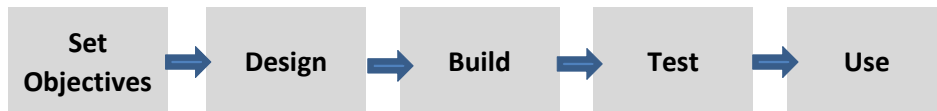
When teaching subjects such as finance, where the marketplace is full of variables such as the recent global financial crisis, then the lessons must use all the pedagogical tools available. The technology component concentrates on the design of the spreadsheet and the variables that are input to quantify all possible uncertainties. The use of cases studies in a currently taught financial decision making unit that examine recent financial issues ensured that the curriculum was relevant and simulated real-life situations. This enhanced the relevance of the course. It also enabled the educators to change their role to facilitators rather than instructors leading to the students taking on a greater responsibility for their own learning (Brooks & Oliver, 2004). This also enhances the maturing of the students in preparation to their entrance into the workforce.

This is known as “constructivism” (Brooks & Oliver, 2004) as students take responsibility for the learning process and become autonomous and independent. The lecturer is no longer the sole authority but acts rather as a facilitator, a guide who supports learners in the process of constructing knowledge (Neo, Neo, & Tai, 2007). Students develop important thinking and problem solving skills and acquire the skills required to work in a team. Experiential learning leads to the enhancement of their knowledge base and the ability to learn how to learn. David Kolb with Roger Fry set out a learning cycle which included four elements: concrete experience, observation and reflection, the formation of abstract concepts and testing in new situations (Kolb & Fry, 1975). Learning involves the use of concrete experience to test ideas. Neo, Neo, and Tai (2007) consider that technology is a critical component of the learning process. Information and communications technologies can be used to support experiential learning environments (Di Challis & Rice, 2005).

## The Use of Spreadsheet Models in Teaching Corporate Finance

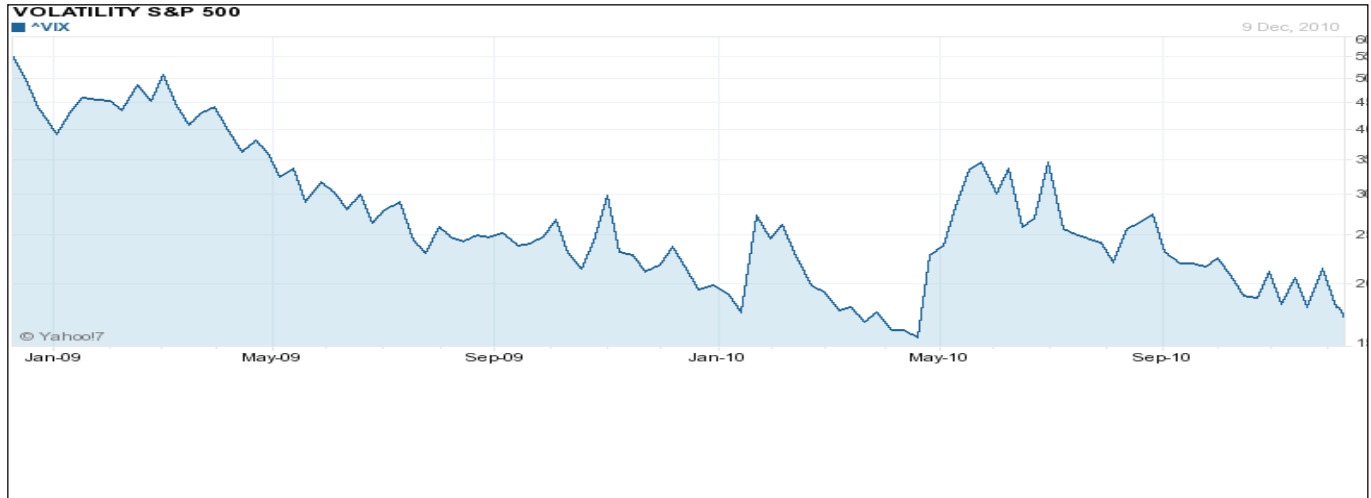
Finance graduates as financial analysts, brokers, treasury operatives and chief financial officers will be employing spreadsheet modeling as a core component of the requirements of the job and spreadsheet models will often be used to support the decision made. It is important that if students are required to use spreadsheet models in corporate finance, then these students should be exposed to the principles of good design and be taught how to avoid the potential for errors. They should also be aware of the variables that cater for uncertainties in the financial world.

The following is a suggested set of guidelines students should be required to go through the following steps in the construction of spreadsheet models in corporate finance:



Following on from this, students should be required to write up the objectives, reports and explain the design criteria. They must understand and be able to explain the vagaries in the market and how these have been allowed for. It is recommended that, as far as possible, financial modelling should be integrated into the corporate finance course and should be tailored to produce a result or report that will stand the scrutiny of reality. Students should be required to undertake a project in Excel which requires them to follow good practice in setting up financial models. Separate sections should be used for inputs, variables, calculations and results. These may be set up in separate spreadsheets but encouraged to use a single worksheet to facilitate the audit of the model using the audit toolbar which cannot easily move from one worksheet to the other. Students should be exposed to the type of errors found in Excel spreadsheets and the tools to minimise errors such as data validation and balancing totals.

Students should also be aware of all the variables in the marketplace and the current level of volatility as shown in the VIX index. This index, sometimes called the fear index, represents the current level (volatility) of movement in share prices and like most things in finance, can be traded as an entity itself. Volatility is measured by the level of change in share prices in any one trading day so a change of say 2.5% in one day would be considered a high volatility for that particular day. This graph is a proxy for market sentiment and as such is a barometer of the variability of trading prices and activity. The S & P 500 is the Standard and Poor index of the prices of the top 500 industrial shares on the New York stock exchange. Risk-averse investors avoid the market when the index goes over 2. An examination of the graph below shows many such occasions.



Further, students should be exposed to the extent of errors found in practice and possible impacts on financial decision making. The importance of testing is paramount, particularly stress testing where we employ extreme values for input variables to ensure that the model works and results in credible results. For example, a model that values a company should calculate a share price that closely reflects the market price or the difference can be attributed to the level of volatility as shown on the graph above.

The use of tools such as the auditing toolbar and named ranges are useful. Students should construct models with view that maintainability and ‘what-if’ analysis is critical. This will promote avoiding the use of hard coded cells and formulae with embedded data values. Students should be exposed to the importance of documentation in setting up a model and students should be required to protect cell formulae as well as use data validation. Spreadsheets are effective at displaying timelines and lecturers should use the spreadsheet format to explain most concepts in finance.

Setting documentation standards and good design practice at an early stage of the course will facilitate the ability of lecturers to grade financial models at a later stage. The reality is that spreadsheet models are easy to prepare and hard to verify.

## The Design and Layout of Financial Models

The flexibility of Excel enables financial analysts, treasury officials, investors and practitioners to create and design applications to solve advanced business problems. Yet, this flexibility and simplicity will often lead users to ignore

important design considerations in setting up their models. This may lead to poor documentation standards and more importantly may lead to significant errors. Setting documentation standards enables users of the model to understand the how the model works. We consider three, often interrelated, issues of *design and layout*, *documentation* and *avoidance of errors* to be crucial in setting up a financial model.

In a corporate finance course that uses spread sheet models, it is important that the lecture emphasises the importance of design and layout principles, inserting appropriate documentation within the model and always being conscious of the potential for errors. The design and layout of the financial model will assist in minimising errors but is not a sufficient condition for avoiding most errors. Examples of poor design, poor documentation and errors in spreadsheets are often very effective in conveying to students the need for adhering to good practice in relation to designing and building financial models. The integrity of a financial model, the ability to maintain a model as circumstances change and the ability to undertake what-if analysis is critical to in setting up any model.

There has been a significant increase in the number of corporate finance textbooks that include Excel spreadsheets. Unfortunately, textbooks often do not adhere to layouts that will enhance the ability for students to undertake sensitivity or what-if analysis.

It is important that even at the undergraduate level, students adhere to good design and layout methods in setting up a financial model. For example, in setting a simple capital budgeting example, students should be exposed to the proper methods of design and layout even if this increases the time required to complete a simple model.

The layout of a spreadsheet model should follow certain principles depending on the application.

**Inputs.** There should be a separate section for inputs. All formulae should refer to this section for data values. Data values should not be included in formulae and input data values should be colour coded.

**Outputs/Results.** The results of the financial model should be placed in a separate section that is close to the Input section, therefore enabling changes to inputs to be analysed immediately in terms of the effect on the results.

**Calculations section.** In a capital budgeting or valuation application, this section depicts the cash flows per section. In capital budgeting applications, tax calculations should form a separate section and in a valuation case, inputs may be related to each period. This section should only consist of formulae linked to values in the input section. Data values should not be embedded in any cells of this part of the section — it should consist only of references to the input section.

**Sensitivity or “what if” analysis section.** The use of data tables in Excel or tornado graphs as well as Scenario Manager Tool can be useful to depict potential changes in results to changes in inputs.

**Workings section.** Workings are an important part of the spreadsheet design. Workings should be referenced and will enable preparers to reduce the complexity of formulae used in the main section of the spreadsheet.

Individual applications will require adjustments to this layout of a financial model, particularly for valuation models which will include projected financial statements as well as free cash flows, financing flows and projected financial ratios. The separation of inputs, calculations and results is useful and is often applied in valuations and capital budgeting applications. It also optimizes the functionality of Excel. However the insertion and particularly the deletion of columns can create risks for maintaining the integrity of the model and this should be balanced against the ease of moving from one section to another section of the spreadsheet.

A cascade approach to spreadsheet design will enable the deletion and insertion of columns without this impacting on other parts of the financial model, but will make it more difficult to move around the spreadsheet model. However, the allocation of range names to sections of the model, which can be set out in a separate reference section, will enable users to move around quickly in within a spreadsheet model. Although, the cascade approach may have advantages, its use is limited in practice as practitioners use separate worksheets within a workbook to manage the different sections of a financial model.

Formulae within a spreadsheet should not include both numbers and cell references within the same formula. A cell formula should only include references to the values in the input section. This will facilitate undertaking “what if” analysis as well as making changes to variables that will apply across the model. For example, the corporate tax rate will be located in the input section and formulae in the spreadsheet requiring the inclusion of the tax rate will refer to a single cell in the input section. If the corporate tax rate changes, this will enable the model to implement the effect of a change to the tax rate throughout the model and will minimise possible errors where there are multiple inputs.

### **Using Technology to Allow for Volatility by Applying What-if Analysis in Excel**

A key objective of a spreadsheet model under uncertainty is to undertake a “what-if” analysis. Students should be exposed to the following Excel functions that will enhance the ability of a financial model to perform what-if analysis.

**Form controls:** The use of combo boxes, scroll bars and spin buttons can assist in quickly analysing the impact of changes in key variables on the result. The use of the Offset function can also be useful to minimise errors when doing what-if analysis on key variables and this may be combined with the dynamic graphical abilities of Excel.

**Data tables** are very useful to depict possible results, like the NPVs of a project, for a range of varying values of a key input variable. Using a Data Table, we can for example display the NPVs for a range of discount rates or we can display the values of a company for a range of WACCs and terminal growth rates.

The **scenario manager** facility in Excel enables setting out a number of possible scenarios — combinations of input variables that may include worst case and best case scenarios. This may require some hard coding of input variables (due to the limitations of Excel) and often is undertaken as a separate exercise within a model.

The use of a **tornado graph** is very effective at displaying the relative impact of a change of in an input variable on the final result. This may be modelled within Excel or it is possible to employ an add-in to Excel.

**Goalseek** is a very effective tool in Excel which works backward from a result to change an input variable. For example, assume you have estimated a future share price and determined based on this price and future dividend flows that the IRR is 10%. Using Goalseek, we can ask the model to work out the future share price so that a target IRR of 25% is achieved.

**Solver** which is an Excel add-in is an optimisation tool which enables input variables to be changed subject to specified constraints so that the target NPV is achieved.

**Monte Carlo simulation** may be set up in Excel by setting up a capital budgeting with simulations. It is, however, preferable to use an add-on program such as Crystal Ball or @RISK to perform detailed Monte Carlo Simulations.

We submit that finance graduates will be using many of these functions in practice as supports to financial decision making once they commence employment and it is possible to integrate the use of these functions within the corporate finance course. Although, corporate finance textbooks are starting to use Excel spreadsheets, the use of these what-if tools is limited.

In relation to the content of a corporate finance course, topics such as Time Value of Money, Risk and Return, Capital Budgeting and Valuations are particularly well suited for the use of spreadsheet modelling. In practice, the use of spreadsheet modelling is pervasive in the areas of capital budgeting, leasing, valuations, financial analysis and option pricing. The teaching of corporate



finance should include spreadsheet modelling particularly in these areas of a corporate finance course. Further, it is submitted that spreadsheet models are highly effective in explaining finance concepts. Understanding portfolio theory and efficient frontiers is facilitated by the use of an Excel model. The use of regression and scatter graphs may explain the use of betas and CAPM. Explaining how IRR and YTM work and the effect of the implied reinvestment assumption when using IRR for decision is facilitated through the use of a simplified model. Our experience in teaching finance, particularly to accounting students, is that they understand the numbers and we use this background to translate numbers into graphs and to improve the understanding of corporate finance concepts. This applies when we depict option pay-off structures. We stress test Excel option pricing models in front of the class in order to explain how option pricing works. When we explain that owning a deep-in-the-money option is like owning a share, understanding this is facilitated by doing the numbers in Excel. We ask students to apply a discrete process but stretch this in order to facilitate the understanding of continuous discounting. Students are required to build a simplified binomial option pricing model so that they understand the process of option pricing models. We then expand this by using a more complex binomial model in Excel. Students are also required to use the Australian Stock Exchange binomial option pricing model.

## Conclusion

The global financial crisis has introduced uncertainty and volatility into financial markets. Volatility becomes self fulfilling by destroying the financial 'norms' and this in turn translates into fear. The marketplace ceases to be rational. This mix does not lend itself to traditional teaching methods. Intrinsic and fundamental values do not exist in an irrational market. Teaching methods and tools must change to cater for this mix. Technology has itself evolved and should be utilized by teachers and students alike to handle teaching under uncertainty.

Spreadsheet modelling represents 'learning by doing' and may empower students to take charge of the learning process. This is particularly relevant when spreadsheet modelling is integrated within the corporate finance course and is used in case studies or business simulations. Spreadsheet modeling often enables the use of case studies in the learning of corporate finance. Case-based learning is one way to bring the current financial world and all its volatility issues into the classroom. Further, financial modelling skills are important for the employment of finance graduates and job advertisements often specify that applicants should have strong Excel skills.

Spreadsheet modelling should be integrated within the corporate finance course and the powerful what-if tools in Excel should form a key component in the teaching of finance. The application of spreadsheet models particularly to such areas as portfolio theory, time value of money, capital budgeting and option

pricing can facilitate the understanding of some complex financial concepts and the factors that have introduced the recent bout of uncertainty. Only by adopting finance courses to utilizing models that allow for uncertainty will we be able to teach courses that are relevant to today's marketplace.

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