WHAT IS THIS THING CALLED RISK?

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INTRODUCTION

I have been introducing the ideas contained in this paper to my Masters by Coursework students for many years now. What prompted me to write up a more formal paper was the recent discovery of a paper written by Jay Ritter in 2001 entitled 'The biggest mistakes we teach'. Ritter, a Finance Professor at the University of Florida and a Chicago PhD, attacked the continued inclusion in Finance textbooks of a number of "conceptual mistakes that dominate the received body of wisdom in the academic finance profession".

Among the treatments he criticised were –

- The relative risks of stocks and bonds
- The size of the equity risk premium (1% he argues)
- Limits to arbitrage and market efficiency
- Dividend policy
- The failure to deal with inflation
- Ignoring the option value embedded in lease financing.

As a former CFO I particularly empathised with his view of the actual efficiency of finance and currency markets, which he points out can overshoot a long way and only slowly readjust.

Where we part company, I suspect, is that he expressed no concern about the textbooks conceptual treatment of risk and risky decision making, and is presumably, therefore, quite happy with the way these things are handled. On the other hand, I have long been concerned about the concepts, assumptions, and mechanics of how risk is treated in virtually all Finance textbooks. My concerns stem from both my managerial background and real world experiences, and the strong focus in my Finance subjects on corporate financial management rather than what I call Capital Markets finance.

I think it needs to be made clear from the outset that I am concerned in this paper with what is usually referred to as Capital Budgeting or Capital Expenditure evaluation, a process widely used by the managers of profit-seeking organisations to decide which real physical business projects they will invest their capital in. These business projects are quite different from investing in financial securities and instruments. For example investing in a manufacturing plant to produce new silicon sliver solar cells. Standard finance textbooks devote considerable space to capital budgeting, focusing mainly on DCF methodologies. DCF calculations require a discount rate which reflects the riskiness of each project being considered. In other words, DCF techniques require an assessment of the riskiness of specific projects, and an assessment of how high the discount rate needs to be, given the perceived level of risk embodied in the project.

Financial textbooks have, almost universally, attempted to transfer risk concepts developed for valuing financial securities such as shares or bonds, to the field of capital budgeting and the evaluation of real physical business projects. My contention is that these concepts of risk are not very helpful, and may be quite misleading, when we are considering project evaluation in a corporate setting and made by managers subject to performance measurement processes.

HOW THE TEXTBOOKS DEFINE RISK

Brigham, Brealey and Myers, and Ross are the best selling financial textbook authors. All of them define risk in the same way (as variability of outcomes), as do all the other dozen or so textbooks I checked.

The following quotations from Brigham, and from Brealey and Myers, are a fair representation of how risk is conceptually treated in finance textbooks.

> "when we think of investment risk, along with the chance of actually receiving less than expected, we should consider the chance of actually receiving more than expected. If we consider investment risk from this perspective, we can define **risk** as the chance of receiving an actual return other than expected, which simply means there is *variability in the returns*, or outcomes, from the investment. Therefore, investment risk can be measured by the variability of the investment's returns.
>
> Investment risk, then, is related to the possibility of actually earning a return other than expected – the greater the variability of the possible outcomes, the riskier the investment. And as we will soon discover, *the return expected from an investment is positively related to the investment's risk – a higher expected return represents an investor's compensation for taking on greater risk*". *(Brigham)*
>
> "The stock market is risky because there is a spread of possible outcomes. The usual measure of this spread is the standard deviation or variance." (Brealey and Myers)

Statements such as –

- Risk can be measured by the variability of returns
- The stock market is risky because there is a spread of possible outcomes
- The usual measure of this spread is the standard deviation or variance
- The greater the variability of the possible outcomes, the riskier the investment

- all clearly indicate that the authors view risk as variability or volatility – upwards as well as downwards.

This view of risk comes out of the massive amount of capital markets research which has been undertaken in the last 50 or 60 years, made possible by the considerable amount of good quality historical share market data. The perspective taken with this view of risk is clearly that of the Investor/Shareholder, not the manager/decision maker. Finance textbooks back the correctness of this view by insisting, over and over, that shareholders are paramount and that managers should make investment decisions solely from the viewpoint of the Shareholders. A cynic might also suggest that this view of risk is very convenient because along with a few key assumptions it makes the mathematics tractable, plausible and understandable.

The first issue I have with the textbooks, therefore, is that this singular focus on risk from the perspective of the Investor/Shareholder has resulted in a serious disconnect with the real world outside the share market, particularly in terms of how managerial decision makers think of risk and how they use it in making risky physical project decisions.

DOWNSIDE RISK

We have known for a long time now that managerial decision makers (and in fact most people) do not think of risk in terms of volatility. Mao (1970) found executives characterised risk in terms of failure to meet a target rather than in terms of variance. March and Shapira (1987) reported that 80% of the executives they surveyed considered only negative outcomes when thinking about risk. Hoskisson, Hitt and Hill (1991) asserted loss aversion, rather than variance aversion, characterises decision makers risk preferences. Shapira (1995) concluded from his study that "managers are quite insensitive to estimates of the probabilities of possible outcomes … outcome values appear to have a more central role than probabilities". Another important insight was discovered by Tversky and Kahneman (1992) who demonstrated that most people weight losses twice as heavily as possible gains.

Miller and Lieblin (1996) summarised much of this literature and concluded that "downside concepts of risk – those specified in terms of failure to perform at an aspired-to level – are much more relevant to practicing managers than performance variability, which includes both upside and downside outcomes".

Financial textbook authors have either steadfastly ignored this literature, or they are unaware of it, or they have rejected it. Unfortunately their influence has extended beyond finance to other fields of studies such as strategy. Miller and Lieblin chastise their strategy and managerial research colleagues for continuing to employ operational measures of risk reflecting variability in accounting or stock returns. They claim that this failure to differentiate upside and downside outcomes raises many questions about the validity of conclusions obtained from strategy and managerial research using variance risk measures.

To be fair, many textbook authors do concede that variance is not how most decision makers think about risk. For example Brealey and Myers concede that

> "We have defined risk, from the investor's viewpoint, as the standard deviation of portfolio return or the beta of a common stock or other security. But in everyday usage *risk* simply equals "bad outcomes". People think of the risks of a project as a list of things that can go wrong. For example,
>
> - A geologist looking for oil worries about the risk of a dry hole.
> - A pharmaceutical manufacturer worries about the risk that a new drug which cures baldness may not be approved by the Food and Drug Administration".

But then these authors immediately defend their position by criticising this way of thinking.

> > "Managers often add fudge factors to discount rates to offset worries such as these. This sort of adjustment makes us nervous. First, the bad outcomes we cited appear to reflect unique (ie diversifiable) risks which would not affect the expected rate of return demanded by investors. Second, the need for a discount rate adjustment usually arises because managers fail to give bad outcomes their due weight in cash-flow forecasts. The managers then try to offset that mistake by adding a fudge factor to the discount rate."

There is plenty to criticise about real world decision making processes, such as the reckless addition of large risk premiums (fudge factors) to base discount rates. The fact that managers do this, however, does not constitute a convincing argument that variance thinking is a superior risk concept to downside risk.

WHY TOTAL RISK MATTERS

The above quotation leads me to the second issue I have with the textbooks, namely that they have split total risk/variability into unique risk and market risk and then they argue that only market risk is important because unique risk can be diversified away. As Brealey and Myers put it

> > "The risk of any stock can be broken down into two parts. There is the *unique* risk that is peculiar to that stock, and there is the *market risk* that is associated with marketwide variations. Investors can eliminate unique risk by holding a well-diversified portfolio, but they cannot eliminate market risk. *All* the risk of a fully diversified portfolio is market risk. A stock's contribution to the risk of a fully diversified portfolio depends on its sensitivity to market changes. This sensitivity is generally known as *beta*"

Consequently they maintain that reducing risks at the corporate level which are diversifiable at the portfolio level does not benefit shareholders. They argue that most company specific risks can be managed more efficiently by shareholders. The net effect is that financial economists have concerned themselves almost exclusively with the expected impact of risk on market discount rates, for the most part ignoring its effect on expected cash flow.

Shapiro and Titman (1985) identified the expected cash flow issue and argued that although total risk may not affect investors' required returns, large unsystematic (unique) risks, if unmanaged, can substantially reduce the value of the firm. In terms of the DCF model of firm value, diversifiable risks may not raise investors' discount rates, but they can significantly lower the level of the firm's expected cash flows. If this is the case, then reducing total risk can increase expected cash flows, thereby increasing the value of the firm.

They argued that firms with higher total risk are more likely to find themselves in financial distress, and that the possibility of this can affect sales and future cash flows as potential customers will worry about whether the firm will be around in the future to honour its explicit warranties and other implicit claims.

Cornell and Shapiro (1987) added the notion of implicit claims to help explain the importance of total risk. Implicit claims are tacit promises issued by businesses to customers, suppliers, employees, and managers, and include such things as continuing supply and support, quality control, product enhancement, timely delivery, and job security and development. The risk associated with holding such claims is difficult to diversify because they are too nebulous to be reduced to writing, have little or no legal status, and hence cannot be unbundled and traded independently from the goods and services the firm buys and sells.

Total risk is therefore important to implicit claim holders because they will recognise that as the total risk of the firm increases, the probability of default on their implicit claims increases. This can lead to a drop in revenue through lost sales, or an increase in costs through losing suppliers or through declining morale and performance internally. Businesses which sell implicit claims with their products and services must be concerned with managing total risk. Cornell and Sharpiro claim that a large proportion of businesses are in this category. They go on to offer several important suggestions as to how such companies might manage total risk. Consequently, total risk is also important to managers whose performance may be measured by the ex-post success or otherwise of significant projects. Students definitely need to know about this but it is not covered in any of the major texts.

EXPECTED VALUE AND PROBABILITIES

A third major concern I have with the textbooks is the assertion (often unstated, just implied) that wise decision makers should make their choices in risky situations on the basis of expected value. The following example from Brealey and Myers is typical.

> Project cash flows are supposed to be *unbiased* forecasts, which give due weight to all possible outcomes, favourable and unfavourable. Managers making unbiased forecasts are correct on average. Sometimes their forecasts will turn out high, other times low, but their errors will average out over many projects. If you forecast a cash flow of $1 million (the most likely) for projects like Z, you will

overestimate the average cash flow, because every now and then you will hit a zero. Those zeros should be "averaged in" to your forecasts.

Project Z			
Possible cash flow	Probability	Probability-weighted cash flow	"Unbiased" forecast
1,200	.25	300	
1,000	.333	333	
800	.25	200	$833,000
0	.167	0	

The present value of this amount at a 10% discount rate = $757,000. If the project required an investment of $730,000, then the expected NPV = $27,000, and the rate of return is greater than the 10% hurdle rate. The textbooks would say this is a go sign.

However, if the decision makers responsible for project Z looked at the distribution of the possible outcomes, and restructured the table, they may quite sensibly not want to proceed because of the relatively high chance of a negative NPV (42%) and a 17% chance of a complete disaster. This is not irrational nor is it unwise.

Project Z			
Possible cash flow $000	Present Value @ 10%	Net Present Value $000	Expected NPV $000
1,200	$1,090	360	
1,000	909	179	270
800	727	(3)	(positive)
0	0	(730)	

As Higgins (1990) pointed out "It is well documented that when significant sums are involved, the great majority of private investors and executives is risk averse". He went on to describe an example involving 2 investments, one which offered a guaranteed $100,000 outcome, and the other which offered a 50:50 chance of a $1m outcome or an $800,000 loss. Both investments have the same expected cash flow and they both cost the same so they both have the same expected NPVs. In theory we should be indifferent between these 2 investments, but as Higgins points out "it is impossible for most individuals or businessmen to be quite so sanguine about the possible loss of $800,000; first, because it might precipitate bankruptcy, and second, even in the absence of bankruptcy, a stable, predictable income stream it is usually preferred to a volatile, unpredictable one".

In many uncertain situations possible project outcomes may be such that the expected value number is highly unlikely to occur, or may not be possible. If some of the outcomes are losses, or what would be seen as unsatisfactory performance, then using

just the expected value can obscure outcomes which for some decision makers would be bad enough to induce them not to go ahead.

The example is also typical in that there is no discussion of how the probabilities attached to each of the scenario outcomes were obtained, and no guidance is offered anywhere on how students might develop this skill. The evidence is very strong that humans are not very good at assessing probabilities in one-off situations. In any event it seems that real life "managers are quite insensitive to estimated of probabilities of possible outcomes … outcome values appear to have a more central role than probabilities" (Shapira 1995).

Brehmer (1987) and many other critics of expected value decision-making have spoken out over time but they have not seemingly had any impact on financial economists. My favourite example is Daniel Bernoulli who demonstrated a major weakness of the expected value criterion way back in 1738. He showed that if the structure of a gamble is complex then the expected value number can give quite nonsensical guidance. I am referring, of course, to his famous St Petersburg paradox.

The decision-making and behavioural literature is full of examples where, in experiments, people have rejected a choice with the same or higher expected value in favour of something for certain, and where they decline to play a game with a high expected value but containing the possibility of a significant loss. Personally, I am often sceptical of the validity and usefulness of those experiments when we move on to real life situations where someone's real money is at stake. Nevertheless I believe very strongly that we need to incorporate much more from the behavioural literature into financial management studies.

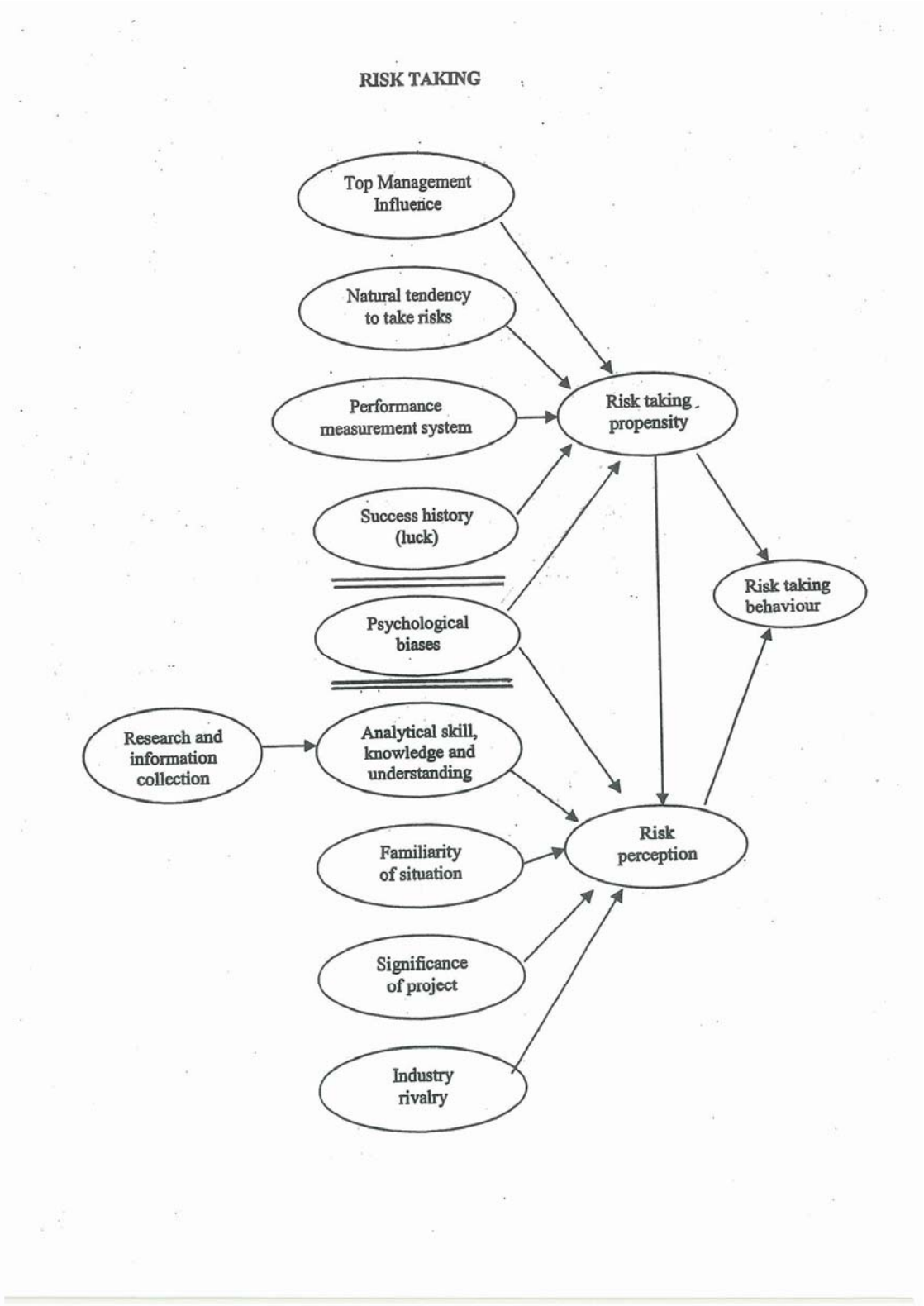
BEHAVIOURAL ASPECTS OF RISK

Consequently the fourth major issue I have with the textbooks is the absence of any coverage of behavioural matters. There is now a lot of interest in behavioural aspects in finance and economics, and Daniel Kahneman, a psychologist, shocked the economics fraternity by winning a recent Nobel Prize in economics. This interest has grown into recognised fields of study with their own label – 'Behavioural Economics and Behavioural Finance" – but it has failed to gain any space in the best selling finance-based textbooks.

Individual behavioural aspects are probably not mentioned because the books focus on risk only as a function of states of the world (business markets and capital markets) which are mostly outside the individual's control. Brunsson (2000), on the other hand, argues that the states of mind of individual (and group) decision makers are at least as important in understanding more about risk. States of mind are reflected in the two powerful behavioural forces of the propensity to take risks that decision makers display, and their perceptions of the riskiness of the projects being evaluated.

There has been a considerable quantity of research and thinking done on the behavioural aspects of risk. In much of this work propensity and perception are seen as the key interacting forces that determine risk taking behaviour. In turn many other contextual factors are seen as affecting these two driving forces. I have developed a conceptual map of these forces which is contained in **figure 1**. To compose the map, I have drawn on the work of many researchers but particularly Khaneman and Tversky, Sitkin, Pablo and Weingart, Raiffa, March and Shapira. From their work I have chosen the moderating forces in the model based on what I deemed to be the strongest arguments in the literature and on my own experiences and observations. Each of the behavioural influences represented in the map are then discussed briefly.

FIGURE 1


RISK TAKING
Top Management Influence
Natural tendency to take risks
Performance measurement system
Risk taking propensity
Success history (luck)
Psychological biases
Risk taking behaviour
Research and information collection
Analytical skill, knowledge and understanding
Familiarity of situation
Risk perception
Significance of project
Industry rivalry

BEHAVIOURAL INFLUENCES ON RISK TAKING

Factors Affecting Risk Taking Propensity

Top Management Influence

An organisation's leaders can have an important influence on risk taking through control of the organisation's culture and through the nature of the performance management system and how it is applied. If the culture is conservative and punishment for the failure of a risky venture to achieve its targets is severe, then individual managers' risk taking propensity will be constrained.

Natural tendency to take risks

Some individuals are obviously more risk averse than others and this natural tendency to take risks appears to be a stable psychological trait. However, it is often strongly moderated by other factors such as top management influence and the performance measurement system.

Performance measurement system

Performance measurement systems are often dysfunctional and induce behaviour that is contrary to stated strategic objectives. If the organisation wants its managers to take at least some high risk projects then it shouldn't have its primary focus on punishment.

Success history

A history of success with risky projects may be more good luck than good management but it is likely to increase confidence and hence the positive influence on risk taking propensity, particularly if managers are rewarded highly.

Factors affecting risk perception

Research and information collection + analytical skill, knowledge and understanding

Our judgement about the riskiness of a proposed venture is strongly related to the amount and quality of information we have and our confidence in it. In turn our confidence in the quality of our information is often a function of the level of our analytical skills and the knowledge and understanding we can extract from base data.

Familiarity of situation

Obvious but important. A project in a brand new and unusual context is likely to be perceived as being at the risky end of the spectrum.

Significance of project

Significance is a better concept than just the size of a possible loss or under performance because it is context specific. A $1m loss can be a drop in the bucket to a large company with deep pockets but could be catastrophic to a lot of smaller organisations

Industry rivalry

Another obvious one. If rivalry within the industry is very high then it is often hard to see where positive NPV projects are going to come from. Therefore there will be scepticism of the quality of any information which claims to underpin a proposal with a high NPV.

Biases, weaknesses and human behaviour in decision making
(A factor affecting both propensity and perception)

All humans appear to suffer from serious biases and other weaknesses in their thinking. Research in human information processing has identified many alarming tendencies which make it difficult for decision makers to understand and use information in the most effective fashion.

For example:

Bias (1) – Many managers fear they will be seen as indecisive if they don't make reasonably quick decisions. So most decision makers attempt to specify the problem quickly and forcefully and immediately start seeking solutions.

Bias (2) – We have a fondness for evidence that will confirm our current beliefs and we tend to reject evidence which challenges that position.

The combination of biases (1) and (2) creates a very dangerous mindset. The human brain is amazingly creative and almost as soon as we believe we have identified a problem correctly it quickly starts to generate possible solutions. Often, however, we start to favour one solution too soon, supported by bias 2, then bias 1 kicks in as well and we often cannot be persuaded that there is a better alternative or variation, or that we may not have identified the correct problem in the first place.

This is the classic situation which, along with "Group think", pervades almost all the famous and well documented decision debacles of our time. Developing a deep understanding of these and other common biases is the best way to defend against getting trapped by them.

There is great and continuing debate in the literature about whether context or personality is the dominant behavioural force in determining risk propensity. While that debate continues, there seems to be majority support for the notion that propensity dominates perception. The considerable volume of commentary on what drives risk-taking

propensity, is sadly not matched by much at all in the way of guidance on what drives risk assessment (perception), or how decision makers can become better (more accurate?) in assessing the true risk of new physical investment projects.

Financial textbooks are not much help in this area either. Schall and Haley, in their 6th edition of 'Introduction to Financial Management', made the promising comment that it would be

> "…helpful to have an objective measure of risk. Such a measure should be independent of how much a given person dislikes risk. In other words, we would like to be able to separate the degree of risk in a situation from the feelings of different people toward bearing risk. We can then look at the question of how much risk is involved in a particular decision as a separate issue from the question of whether enough incentive is provided to warrant bearing the risk."

But all they could do in the end was fall back to beta and CAPM, which is only of minor assistance when the problem perspective is not that of the shareholder/investor and the business project is a one-off, not traded on a stockmarket somewhere everyday.

IN THE CLASSROOM

So what can we do for our students? We can certainly improve their understanding of the many behavioural forces at work in risk-taking. We can also try to off-set the textbooks' influence on the matters discussed earlier, and get out students to understand that the concept of risk used in the books is from the shareholder/investor perspective, and is not particularly helpful when managerial decision makers are dealing with new non-financial investment projects.

But the best thing we can do is to go beyond just lecturing to students about these issues. We can put them in role-playing case studies which force them to think directly about risk, risk assessment, and their own willingness to take risks. I have included in this paper an example of one excellent vehicle I use in class for this purpose. I play a version of a long running American TV gameshow with my students by making them contestants in the game. Details of the case are contained in **attachment 2-**.

This game forces students to think about risk and their own willingness to take risks. In this particular game they do know the probabilities (1/3 of winning the $94,500 Mercedes Benz) but there is a twist in the game in that the host always tries to buy off the contestant by offering them more money to not play the game.

I have experimented by varying the information and influence inputs to the game. Sometimes I have run it where I simply emphasise beforehand that it is wise to have a strategy in place for deciding whether to take the money offered by the host and go, or to play the game with a one third chance of winning the $94.500 car and a two-thirds chance of ending up with nothing. In other words they have to think about what amount of money they would accept from the host for certain to give up their one-third chance of

winning a $94,500 car. In this version 50-60% of students calculate the expected value number as their cut off or indifference number.

When we discuss the reasons for their choices many of them change their mind after they come to appreciate that it is their money they are gambling with, because when the host offers them say $10,000 or $15,000 they can put it in their pocket and go home. Whereas, if they choose to play the game, they have a two-thirds chance of going home with nothing – that is having passed up (lost) the $15,000 that they could have kept for not playing the game. After the discussion only about 30% continue to stay with the expected value amount, and some of the non-expected value students lower their cash bail-out amount.

On other occasions I discuss these issues beforehand and get the students to appreciate (before they think about choosing their cash bail-out amount), that they are effectively betting their own money, and that it might be a significant amount for them. I also emphasise that they could experience considerable regret if they turned down a cash offer for $15,000 and then ended up with nothing. The ex-ante discussion has an important impact on the number of students who calculate their certainty equivalent as the expected value of the outcomes on offer in the game. Once about 20% choose the expected value number in these circumstances. Either way, the class discussion has proved to be very effective in deepening student understanding of their own propensity to take risks, and of important risk concepts.

This exercise is good for forcing students to think critically about expected value decision making and helps them incorporate other ways of thinking about risk into their decision making processes.

Merton Miller, the Nobel Prize winning financial economist, disagrees with me on all this, and expressed the opinion in the April 23 1994 edition of the Economist magazine, that the blending of psychology and economics would lead nowhere. However Bill Sharpe, another Nobel Prize winner, agrees with my viewpoint and in the same issue of the Economist was reported as saying that psychology offers important insights into financial thinking. I think I would rather have Bill Sharpe agreeing with me than Merton Miller. I remember Merton as the man who first said capital structure doesn't matter, then after discovering taxes, said that it mattered very much, then after discovering personal taxes changed his mind again.

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ATTACHMENT

LETS MAKE A DEAL

Monty Hall is the host of a long running TV game show called "Let's make a Deal". In one of the show's segments a contestant gets to play for a brand new Mercedes Benz motor car prices at $94,500. There are 3 doors on stage, behind one of which is the car, and behind the other 2 are booby prizes like an old toaster, or an old tyre.

You have been notified that you have been selected to appear on the above segment next week.

Hall always offers contestants on this segment a sum of cash (often a significant sum) **NOT** to play the game, to see if he can buy you off. He will start low and then build up his offer, but at some point he will stop and you will have to play the game and chose one of the 3 doors. Once he had made 2 or 3 offers you have no way of knowing whether he will increase his offer any further. So each time you say no that may turn out to be your last chance to take the money.

Therefore, you need to make up your mind before the show what amount of money you would rather have for certain, than to play a game which offers a 1/3 chance of winning a brand new Mercedes Benz car.

Come to class prepared to tell me what your cut off cash point is – the amount of cash you will accept, put in your pocket and walk away rather than try for the car. Bring along a half page rationale of your choice for handing up after the class discussion.