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Valuation and the New Economy

A report from the 9 May 2000 Seminar

Global

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Highlights

This report is based on the first in the new series of Merrill Lynch Seminars, "Controversies that Matter for Markets". The focus of these seminars will be on real world issues that will affect financial markets around the world.

This series follows on from the seminars organised by David Bowers and David Miles last year, "Controversies in Asset Allocation". The aim is to continue from where that series ended, taking major issues that have significant implications for financial markets and presenting the views of people who have thought long and hard about them. Often those views will be conflicting, but they always will be lucid and informed. We believe this series of seminars brings together people who have important things to say about important issues.

A list of the upcoming seminars is attached. Shortly, after each seminar, a report will be produced based on the presentations and discussions.

In the first of the seminar series, Janette Rutterford, Danny Quah and Mark Lambert spoke on "Valuation and the New Economy: How to value firms when opportunities for growth are uncertain?" With New Economy (TMT: technology, media and telecoms) stocks accounting for 40% of global market capitalisation, this question is more important than ever.

Danny Quah, Professor of Economics at the London School of Economics, describes the ways in which recent developments in technology differ from those which have driven economic growth over the last 200 years.

Mark Lambert, Telecoms Analyst at Merrill Lynch, considers issues in the valuation of companies for whom information technology is important. He points to a gap between the prices at which many companies trade and their value based on an application of standard discounted cash flow techniques.

Janette Rutterford of the Open University takes up this issue and considers how insights from the real options literature may help understand this gap.

David Miles is an Economic Consultant to Merrill Lynch

Seminar Series List

- The Merrill Lynch 2000 Lecture Series commenced on Tuesday 9 May 2000 with “Valuation and the New Economy”.
- Below is an outline of the programme of seminars for the next seven months and a reservation fax form. To reserve a space, fill out the form overleaf.
- All seminars are at the Grocers’ Hall, Princes Street, London EC2R 8AD. A buffet lunch is served at 12:30, and the seminar begins promptly at 1:00, lasting until 2:15.

Wednesday 14 June: Information Technology and the Real Economy

Will productivity be higher and unemployment lower in a wonderful new age?

Professor John Kay London Economics
Peter Bradshaw Merrill Lynch

Wednesday 12 July: European Enlargement and the European Economy

How will enlargement of the EC affect the European economy?

Professor David Begg Birkbeck College, London

Tuesday 19 September: Threats to the Global Capital Market

How much should we worry about instability in markets and the hostility to the perceived evils of globalization?

Martin Wolf Financial Times
David Henderson Former Head of OECD*

Wednesday 11 October: Debt Policy in a World of Shrinking Debts

What is the impact of low deficits in many countries and how should governments structure debt issuance?

Joe Grice HM Treasury
Professor Andrew Scott LBS

Tuesday 31 October: The Changing Face of Corporate Governance in Europe

Are hostile takeovers going to become much more common and are the ways companies will be run really changing?

Alistair Ross Goobey Hermes
John Plender Financial Times*

Wednesday 15 November: Should Monetary Policy Bend to Influence Asset Prices?

Should central banks care about stock prices?

Professor Charles Goodhart MPC at the Bank of England *
Professor Charles Bean LSE

Wednesday 6 December: All Change Please – Relocation and Information Technology Within Europe

In the longer term, which types of firm and which regions will really be affected by new technology?

Professor Nick Crafts CEPR
Professor Anthony Venables LSE

* to be confirmed

Please contact Clare Challis if you would like to attend any of the seminars and lunches, or seminars only.

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Controversies That Matter for Markets

Name:	
Company:	
Telephone:	
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E-mail:	

- 14/06/00 ***Information Technology and the Real Economy*** I would like to attend the Seminar I would also like to attend the buffet
- 12/07/00 ***European Enlargement and the European Economy*** I would like to attend the Seminar I would also like to attend the buffet
- 19/09/00 ***Threats to the Global Capital Market*** I would like to attend the Seminar I would also like to attend the buffet
- 11/10/00 ***Debt Policy in a World of Shrinking Debts*** I would like to attend the Seminar I would also like to attend the buffet
- 31/10/00 ***The Changing Face of Corporate Governance in Europe*** I would like to attend the Seminar I would also like to attend the buffet
- 15/11/00 ***Should Monetary Policy Bend to Influence Asset Prices?*** I would like to attend the Seminar I would also like to attend the buffet
- 6/12/00 ***All Change Please – Relocation and Information Technology within Europe*** I would like to attend the Seminar I would also like to attend the buffet



Aspects of Valuation, the New Economy and New Technology

Professor Danny Quah, London School of Economics

5,000 Years of a Knowledge Driven Economy

Changes in how companies are assessed and valued are happening against a background of changes in the real economy. What are these changes? There is now a huge focus on technology and the knowledge-based or knowledge-driven economy. Government departments and policy makers all over the world have high on their agendas the development of the knowledge-based economy.

For the past five millennia of human history there has been virtually zero progress in economic welfare and economic performance

Is this something real? How are recent structural changes in the real economy different from changes in technology and knowledge development over the last 5,000 years? For practically the entire past five millennia of human history there has been virtually zero progress in economic welfare and economic performance. Everything interesting in economic growth and changes in the real economy has happened within the last 200 years and technology and knowledge drove all that happened.

But how is what is happening now, and what has happened in the last five years, different from the last 200 years? Although similarities exist, it is the profound and fundamental differences that drive changes in financial markets. Understanding these changes will have implications for how we value companies, how we understand social inequality and how we assess the effectiveness of government policy.

For the last 150 years, capital deepening has been the name of the game

First, think about what economists have been saying for the last 150 years about economic growth. Economists, as well as people in the development community, thought that the way in which economies grew was by capital deepening. They believed that economies grew by putting up more physical infrastructure, by building bridges, constructing buildings and making heavy metal machines. Look at India, China, and the Soviet Union. The United States was scared silly of Joseph Stalin when he built steel factories – capital deepening was the name of the game.

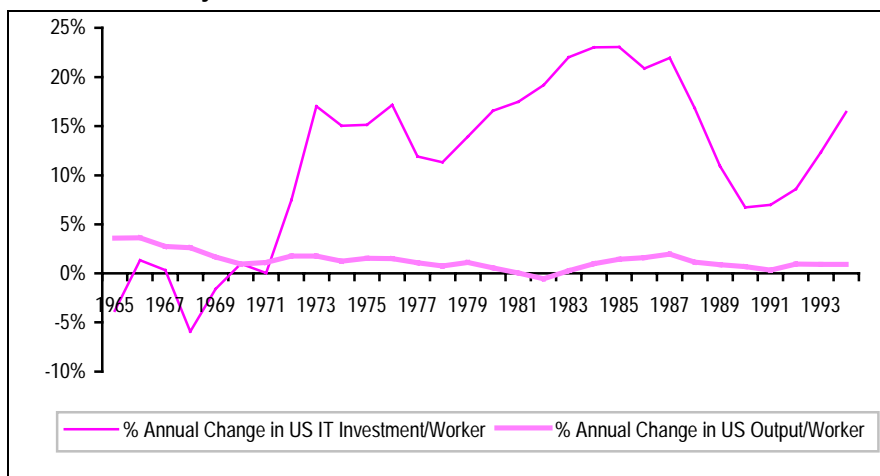
However, capital deepening only provided 10% of the progress in economic welfare and advances in economic life. The development of technology accounted for the rest

It is important to keep sight of this so as to not short-change the things that are happening in the economy today. It turns out that despite the importance placed on capital deepening as the source of macroeconomic changes, studies show that it provided only 10% of progress in economic welfare and advances in economic life. The development of technology accounted for almost 90% of economic growth. Despite the rhetoric about capital deepening, and the belief that it would be good for the Soviet Unions and the Singapores and the Indias, the truth of the matter is that technology and the development of knowledge ultimately matter most.

Productivity Paradox

The Nobel prize-winning neo-classical economist Robert Solow is most associated with the idea that capital deepening drives economic growth. For the last 10 or 15 years he has been very sceptical of the significance of new technology and knowledge. He is known famously to have quipped “You see computers everywhere except in the productivity statistics”. Productivity improvement for Solow and for many other neo-classical economists is what is important for economic life. While there is a massive increase in investment in computers and new technology, Solow and other neo-classical economists do not see a corresponding improvement in productivity.

Chart 1: Productivity Paradoxes



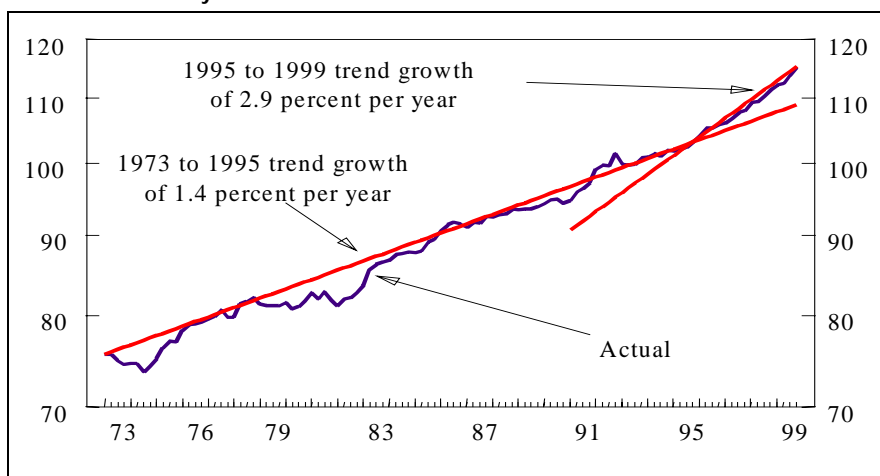
Source: Danny Quah, 1999-2000

Chart 1 shows the annual change in information technology investment per worker in the United States and the annual change in US output per worker. From 1965 to 1972 the line of IT investment hovers around zero, which reflects the view that most of human civilisation would not need computers – it was thought that five IBM mainframes would pretty much do. After 1972 investment in information technology simply exploded.

The US productivity line starts high when information technology investment is low, and when information technology investment took off, productivity fell precipitously and until very recently practically hugged the zero axis. Hence the productivity paradox. While machines in the sense of computers were in place, for Robert Solow those machines were not the same calibre as bridges and factories. In the situation above, the business community was being told by the information technology industry to buy computers and invest in software, and there was no improvement in productivity.

However, I argue that the information technology productivity paradox is not real. Chart 2 shows the growth in productivity in the non-farm business sector that is updated to show what has happened more recently at the end of the last decade.

Chart 2: Productivity in Nonfarm Business Sector



Note: Index 1992 = 100

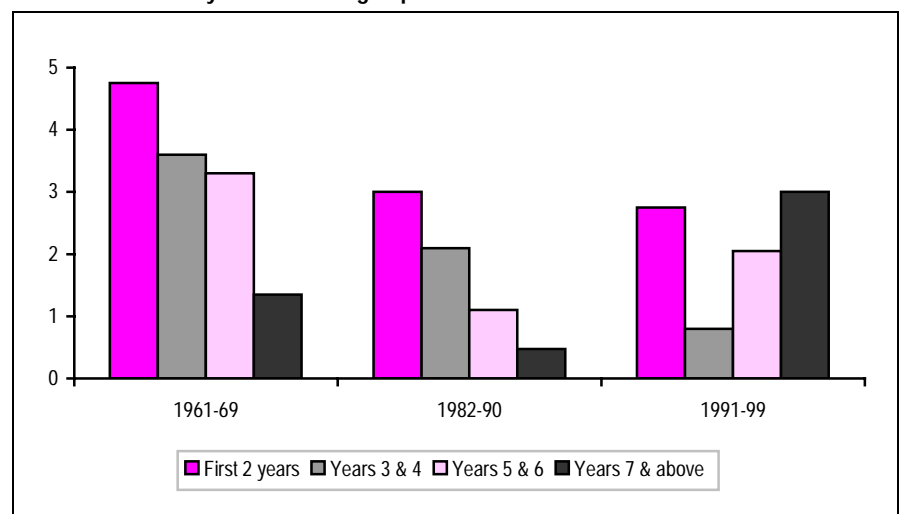
The productivity paradox is that investment in technology did not bring a corresponding increase in productivity growth

The traditional business cycle of galloping productivity growth in the early part of the cycle followed by an inevitable slowdown may no longer be the case

What has happened since the mid-1990s? Productivity growth has just taken off. The trend line has now practically doubled its slope from the previous trend. The productivity paradox is no longer particularly compelling.

Many macro economists seem to carry around in their heads the idea that galloping productivity growth always comes in the early part of the business cycle and is followed by an inevitable slowdown. That is true for the business cycle from 1961 through 1969. Chart 3 shows productivity growth during a business cycle expansion and, indeed, the high productivity growth during the early part of the business cycle does rapidly tail off. This happens also for the 1892-90 business cycle. However, what has happened most recently is the opposite. Although productivity growth slowed down in the early part of an upturn over the 1990s, since then it has continued to rise. The implication is that this business cycle is different from the past.

Chart 3: Productivity Growth During Expansions

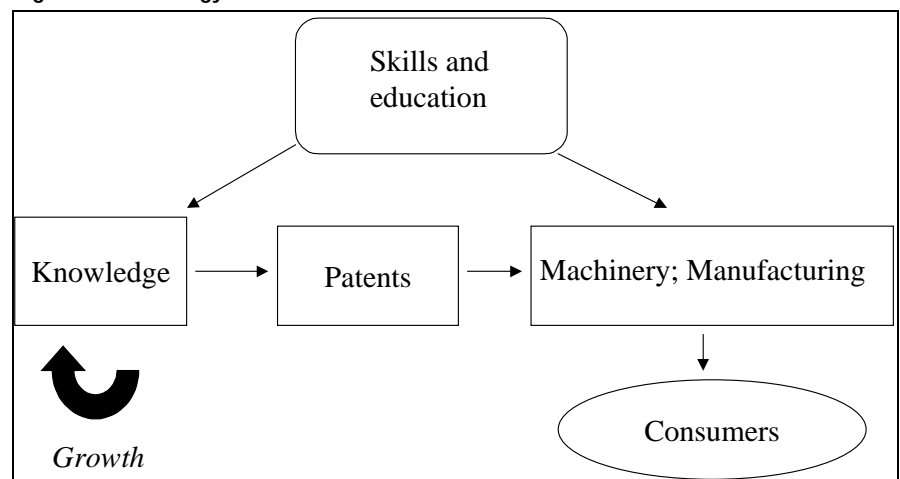


Source: Danny Quah, 1999-2000

The Weightless Economy

Figure 1 shows a model of growth that is quite widely held by many macro economists. Human capital (the skills and knowledge of people) ultimately drives economic growth and propels the economy.

Figure 1: Technology and Growth: Old and New



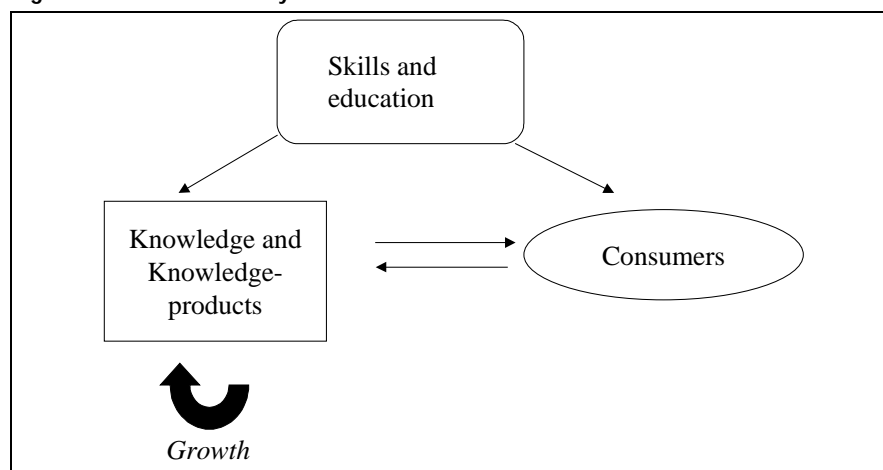
However, that is not the only thing that happens in this traditional view of growth. The right side of this picture shows the machinery and manufacturing component, or the industrial sector, of the economy. The industrial sector ultimately delivers the goods and services to consumers. The industrial and the knowledge sectors interact through a system of intellectual property rights, which is controlled through a system of patents or copyright. This is the picture we should think about for the Industrial Revolution. When James Watt and Matthew Bolton raced between the Patent Office in London and their workshops in the Midlands, they were racing between the knowledge box and the machinery/manufacturing box. This interface drives the industrial economy.

The weightless economy allows the knowledge consumer and producer to interact directly

In the New Economy the patents and machinery/manufacturing boxes have become much less important (see Figure 2). The manufacturing sector is no longer the chief deliverer of goods and services to consumers. As a result, the way in which ideas and knowledge are protected in the intermediation between those two boxes is much less important as well. The New Economy, or as I like to call it the weightless economy, is one that sees a transition from figure 1 to figure 2, where the consumer side and the producer side of the economy interact directly with each other.

The producer side of the economy directly reproduces knowledge and knowledge products such as computer software, video entertainment, financial services, consulting services, health services, genetic products and biotechnology. These are knowledge products because the product is not necessarily encased in a machine or a piece of heavy metal before it is delivered to the consumers. Consumers directly interact with a knowledge producer and an education provider at the other end of an Internet connection, or at the other end of a Hollywood value chain of production. This interaction characterises the New Economy. I call this the weightless economy, because in this economy, knowledge products – whether computer software or an idea about production – behave exactly as if it were knowledge.

Figure 2: The New Economy



Knowledge products are not encased in a machine or piece of heavy equipment before being delivered to the consumer

The weightless economy is not just a knowledge-based economy. It is not just high-tech nor is it just services, nor is it a destroyer of jobs

The weightless economy is not purely a knowledge-based economy. It is not purely services, even though services are an important part of the weightless economy. It is not purely high tech in the sense of scientists and engineers and research and development laboratories. It is an important and integral component of e-commerce in the sense that weightless knowledge products can be delivered over a supply chain between firms and between business and their customers. E-commerce is basically a shifting of the weightless economy and a moving of intellectual property.

Think of a copy of Windows 2000. While computer software is not a scientific theorem or an engineering process, it has similar properties. It is expensive to create in the very first instance and is easy to duplicate. After the initial creation expense, the additional copies of research are disseminated freely – and in many industries that is exactly the right thing to do. This problem is endemic to everything that happens in the weightless economy where products have a high concentration of knowledge but they are not themselves knowledge. Products behave as if they were knowledge, with a property of infinite expandability and can spread like wildfire. As an economist, I think that is great because that is a socially efficient outcome. For social efficiency you want marginal benefit to equal marginal cost. The marginal cost of additional copies of Windows 2000 is basically zero. As long as there is someone in Ulan Batai who has a use for Windows 2000, the global socially efficient outcome is that he or she receives it for free. But Bill Gates has a problem – he has to pay his software engineers and designers.

Every industry, every firm, every participant in the knowledge-driven weightless economy faces this tension between short-run incentives and long-run efficiency. How do we solve incentive profit making dissemination distribution problems in that kind of economy? That is the central problem that we have to worry about when we think about valuing companies in the New Economy.

Issues in Valuation

Mark Lambert, Telecommunications Analyst, Merrill Lynch

I should start by saying that I am deeply sceptical of the New Economy. While I am not a disbeliever in the Internet and all that goes with it, I am not convinced of the need, the benefit or the appropriateness of any New/Old Economy split. The New is a simple evolution of the Old and most of the “Old” theory applies equally to the New. Nevertheless, there are undoubted issues surrounding valuation that are specific to the New Economy, and in the telecom sector we have been grappling with them for a while.

Price and Value

Price and value are often confused, but it is important to draw a distinction. Price balances supply and demand, and in the investment industry stock markets provide a great forum to establish equilibrium price. Value, while easily defined as the net present value of future cashflows, is altogether more difficult to establish and measure. The process is unavoidably subjective and numerous assumptions have to be made.

In my opinion, there is only one valuation method – discounting future cash flows (DCF). P/E, EV/EBITDA, price to sales, price to capex – while these are all useful forms of benchmarking *they are not in their own right in any way valuation tools*. They are very useful as benchmarks and we make use of any of these that we possibly can.

The dynamic nature of marketplaces, companies, strategies and management teams means that there is also a dynamic aspect to value. Were you to make your investment decision by applying DCF techniques to value a typical New Economy company, you would generally sell the stock. I want to explore why this is the case.

Price Distortions

In theory, price should equal value. In the long term price *must* equal value, but in practice – and particularly in the short term – other factors materially influence price and can take it away from value.

A limited free float distorts the supply/demand balance because with a restricted supply, price trades over value. Combined with an index characteristic, for example, where the free float is only 25% but 100% of the stock is in the index, then you have a supply/demand imbalance which accentuates that distortion and creates an even greater imbalance. The second reason is strategic premium. If a company is considered to have particular value to its business model then there may be a willingness to pay a strategic premium – a price over value.

Portfolio management has been an issue over the last two or three years. Two years ago, when a traditional fund manager was perhaps 95% weighted in the Old Economy and only 5% weighted in the New, there was clearly an imbalance in terms of portfolio exposure across the board. As fund managers re-weight and re-position we have seen New Economy stocks trading way above value. What worked on the upside, would also work on the downside. On the way up portfolio management issues lead to a supply/demand imbalance, and on the way down people sometimes will use a stock as a proxy to re-balance their portfolio. Their selling decisions have nothing to do with changes in underlying value.

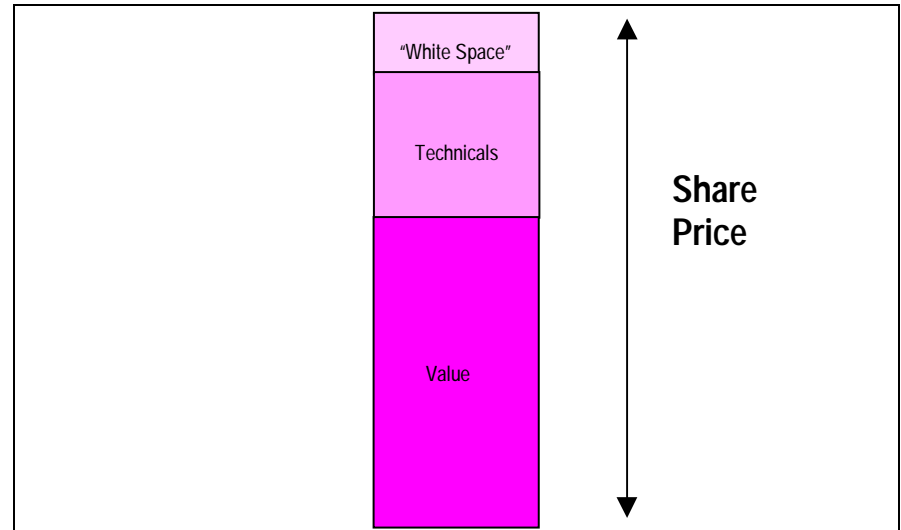
White Space

White space is a term we coined to describe something that we observed, and is worth a little attention. White space is the name for that part of the gap between price and value not explained by technical factors, such as restricted supply of

There is only one valuation method – discounted cash flow – and the rest is simply benchmarking

stock. Figure 3 builds up that picture. “Technicals” include any strategic premium and the impact of any imbalance between supply and demand because of limited free float.

Figure 3: White Space as a Component of Stock Price



The share price of New Economy companies can be thought of in three parts; the explained components of value and technical factors, and an unexplained component termed White Space. White space is what used to be called the management premium, the belief in management to create value from their future investment decisions. Our view tends to be that it comes down to management time and time again. When management’s ambition and strategies combine with the market, the business model evolves. As that business model evolves it will either create more value, destruct value, or do nothing.

The investment community attaches a value to the flexibility companies have over future strategy. They express a belief in the ability of management to continue to move the business model forward to take advantage of additional opportunities. Recently, the markets have been sufficiently aggressive to price these developments in before they happen, although by definition it is impossible to value with certainty something uncertain before it has happened. You cannot value the real worth of a company’s next capital raising and execution of that capital raising; so what happens is the market simply prices it. This gives rise to the emergence of white space.

What defines white space? What sets its level? The market does, as white space is just a pricing phenomenon. What *influences* the market is another question.

Value and Uncertainty

Arguably all valuations are made in conditions of extreme uncertainty. However, it does appear that we currently have particularly dynamic conditions. The key thing is that those dynamic conditions have in many ways become much more explicit rather than implicit. That must lead to greater subjectivity in our forecasts going forward, with therefore a greater margin of error, and therefore a greater risk. So how do we deal with that? In two ways: be conservative in assumptions and increase your discount rate. An increase in discount rates to reflect greater risk could be factored in one way or another. Interestingly, the markets have not particularly demanded that.

Global capital markets in the last 10 years have changed quite dramatically. Part of it is development; part of it is cyclical; part of it is just the prevailing economic and social conditions. There are four areas affecting the global appetite for risk.

White space is a pricing phenomenon that is influenced by management time and time again

*How to deal with greater risk?
Be conservative in your assumptions and increase your discount rate*

But a warning – being too conservative is no better than being too aggressive. In the last three years, a too-conservative stance in tech stock valuation was a passport to underperformance

1. Over the last 10 years ***investor ability to spread risk has improved***. The introduction of the euro is a very good example. People can now spread across Europe without the currency risk, allowing people to diversify their risk away. If you wanted to invest in a European PTT 12 years ago you had one choice - British Telecom. Now you have a choice of about a dozen companies, so risk away can be diversified away.
2. Secondly, ***markets tend to be more aggressive***. We can be conservative in our forecasts to take into account the extreme uncertainty of the current market environment but being conservative when analysing tech stocks over the last two or three years was a passport to under-performance and little more. Being too conservative is no better than being too aggressive. The margin of error is just on the other side, and the stock is sold too early.
3. ***Relatively low bond yields*** clearly imply lower discount rates, and therefore more value to future growth. Whether this is a true impact on the long-term weighted average cost of capital and the true discount rate is more debatable, but this is certainly something that has been going on for the last three or four years.
4. Finally ***the markets' understanding of valuation has improved dramatically over the last 10 years***. I have been a telecoms analyst now for 12 years and I can remember the early days of Vodafone. UK holders were particularly heavy sellers of the stock because there were negative earnings. People did not know how to value it.

We have come a long way and the market is certainly a lot more sophisticated. We may not be any more right, we may not be better at making investment decisions, although we hope we are not worse. Opportunities for portfolio diversification and low bond yields have all combined to drive values as people's attitudes towards and appetite for risk has changed and increased.

Whether old or new, we think valuation issues are pretty much the same. Our view in the London-based European telecoms research team is that you need to use DCF as your starting point. That is our only valuation approach but we use pricing benchmarks to support that. The pace of change is what is making the most impact at the moment and is increasing the volatility and the uncertainty within these models. The evolution of capital markets has undoubtedly also continued to have a material impact and will continue to do so.

The pace of change puts undoubted pressures on both pricing and valuation in people's models. The resulting uncertainty of the pace of change at the moment in my opinion creates massive opportunity – so long may it live.

Valuation and the Use of Real Options

Professor Janette Rutterford, Open University

Why “old-fashioned valuation” has failed us

In the last few years investors have had to radically re-think some of the old favourite valuation tools such as Price to Book and P/E ratios, and look for new ways of valuing companies. Major drivers for this have been:

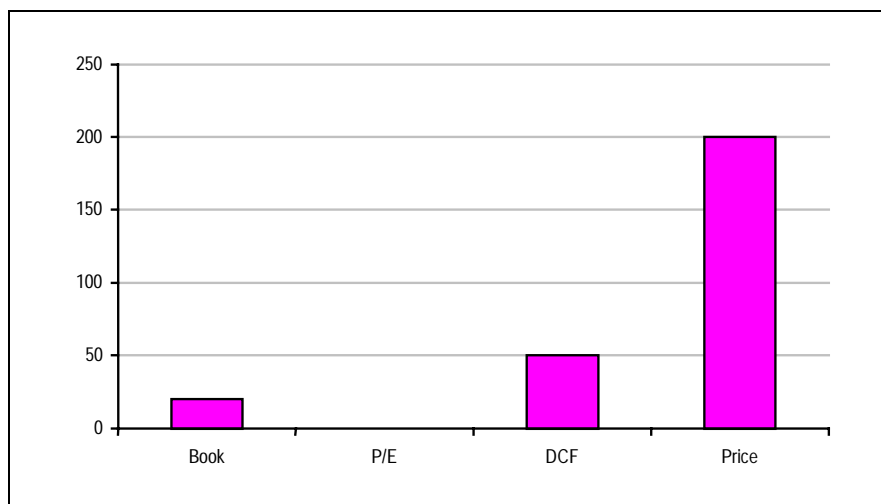
1. The **increase in IPOs**: when New Economy companies come to the market with no track record and with balance sheets and income statements giving little indication of future potential, traditional valuation methods are no longer appropriate. Consider also the **speed of change and the issue of timing** – the time between start-up and positive cash flows is long for New Economy companies and success is uncertain in ever-changing markets.
2. The **breakdown of sector boundaries** means cash flows will be generated across traditional market boundaries. For example, when valuing Old Economy companies, consideration must be given as to whether they have a role to play in the New Economy and how the New Economy will change the market in which they operate.
3. We need to consider how **increased uncertainty** affects the value of companies. Analysts comment that “in the old days”, the growth curve was quite straightforward: monopoly profits were made in the first few years and then the competition came in, with perfect competition thereafter. Now, analysts are forecasting growth curves in some cases that are, effectively, upside down. They forecast low growth initially and once the opposition has been eliminated through high advertising or investment outlays, they estimate exponential growth thereafter. This change in growth pattern has forced investors to think carefully not only about sustainable long-term growth rates but also about the uncertainty that surrounds their growth estimates.
4. Traditional valuation approaches were concerned with **steady states**. Economic cycles were dealt with by such adjustments as normalised PE ratios. One could identify trends and estimate long term growth rates, and then simple valuation ratios could be used with some confidence. Today’s more volatile growth rate curves require a more complex approach to valuation.
5. Although attention is now routinely given to **strategic planning** (evident in analyses such as Porter’s five forces model of sector profitability), such approaches may not give enough attention to dynamic market forces. For example, first mover advantage is particularly relevant in a fast moving market (“If I don’t do something now will the competition come in...”) We need to think beyond the accounting and cash flow elements of valuation.
6. The 1990s strategy of concentrating on core competences has become old hat. Companies are no longer staying with what is familiar; they are aware of and taking advantage of options to change. Take Amazon.com, which started as a distributor of books and now sells CDs and runs on-line auctions. How do we value such flexibility in future plans? We could term this ‘the present value of growth opportunities (PVGO)’, representing the unquantified element in a DCF analysis. In earlier times, PVGO was called ‘management’. Remember conglomerates such as Hanson. Why did Hanson trade at more than the sum of its parts? Because management was perceived as being able to identify opportunities which would be, in effect, positive net present value projects. These positive net present value projects weren’t visible, were not yet talked about, and existed only as future prospects.

Traditional valuation assumes a steady state. Today’s more volatile growth rate curves require a more complex approach to valuation

Black Holes

Similarly, why do investment trusts sometimes trade at a premium? It could be because of scarcity and difficulty of access to the shares, or it could be that fund managers somehow add value via stock selection and asset allocation skills. While this value addition can be attributed to management skills or growth opportunities, it can also be attributed to “options”.

Chart 4: Valuation and Price



The valuation “black hole” can perhaps be explained by real options. Think of companies not as a set of projects already cast in stone but as a set of choices

Chart 4 is typical of the valuation of a New Economy company. Such a company will have a low net asset value. The P/E in the chart is shown as zero; in practice, it might even be negative. A traditional DCF approach would generate a higher value than book or P/E approaches. However, it is still likely to be well below the share price. *How can the fact that this New Economy company has a price which is much higher than that be explained by traditional valuation approaches?* The problem faced by analysts and fund managers, and even the companies themselves as they use their shares to make acquisitions, is that they often have a black hole in their valuation – a gap between price and value based on simple ratio or DCF techniques.

While we may agree that conventional DCF is theoretically the best method, DCF does not necessarily explain the share prices that we are seeing in some sectors. Instead of viewing companies as a set of steady state projects, maybe we should think of them in terms of possessing by their very nature a set of real options. While ‘real options’ sounds rather daunting, put simply it means options on real assets rather than the more familiar options on financial securities.

A real option is the option to switch to a different set of cash flows during the project. This allows for a choice of alternatives and delays decisions until uncertainty is resolved

The Right but not the Obligation

Think of a standard financial option, where a payment is made for the right but not the obligation to invest money in the future to generate a pay-off. This thinking can be applied to companies. A conventional DCF model and its net present value decision criteria fails to take consider, for example, that a project does not necessarily have to be undertaken today. There may be better information in a year or two’s time that will change the estimated cash flows for this project.

Real options recognise discretionary investment in the future, upside potential and downside risk

Consider the classic example of R&D for pharmaceuticals. The idea here is that an initial investment in the project provides the opportunity, if trials are successful, to then invest more money and generate a successful pharmaceutical product later. Put plainly, an option allows a company to delay full financial commitment to a project, instead investing little by little, as more information is obtained, leading to greater certainty about future cash flow estimates.

Another example is land with planning permission, with the option to develop the land into a supermarket site. This investment could be made today or next year, or left until the market for property had gone up or the retailing market was more attractive.

One area where options are particularly relevant to the New Economy is in the context of small investments, alliances, joint ventures, etc. For example, Microsoft has bought options to expand into a number of new sectors, should these turn out to warrant further investment. Similarly, Old Economy companies have, instead of making 100% acquisitions in the New Economy, bought minority stakes in companies and invested limited amounts in a number of joint ventures. The initial option premia are small, giving investors the option – but not the obligation – to invest more money in the future to then take their profits.

Consider valuing a New Economy company such as a B to C Internet site. In Year Zero the company raises capital for a start-up. That money will be spent in Year One and Two as the company is set up. Assuming this goes according to plan, in Year Three a large marketing spend is forecast to turn the company into an established player which can be valued on a conventional multiple basis. The real option approach can be used to value this company because the key is that the marketing spend does not have to be done until Year Three, it can wait until there is more information available about the viability of the company. Because the investor has the option just to walk away at the end of Year Two and write off my initial investment without making the marketing investment in Year Three, investment in this company can be valued as a real option. Had the traditional discounted cash flow model been used for this example, the net present value might well be negative. With the option approach, where flexibility is taken into account and attributed value, the net present value might well be positive.

Risk is attractive in the context of option theory. The more risk, the more valuable the option

This partly explains why the New Economy is so expensive, because the economy faces a huge amount of volatility and volatility is valuable in the option sense

One of the problems with real options is finding an estimate for **volatility**, a key parameter in option pricing. Volatility is the *total* risk of the asset. Using DCF, beta risk is relevant, which is the *undiversifiable* risk. Notice that real options use the total risk, and do not evaluate companies in the context of a portfolio. In the option context, risk is attractive. The more risk that is present, the more valuable the option, because option holders have the right but not the obligation to invest in the future. A desired scenario in the context of options is a huge risky bet from which the investor can walk away. *This partly explains why New Economy stocks can look so expensive, because they face a huge amount of volatility and volatility increases the value of options.*

Time is also an important factor in option valuation. The longer the option is open and the future investment can be delayed, the more valuable is the option. However, time also affects first mover advantage. A too-long delay allows the competition to enter the market and the option loses value, sometimes referred to as “leakage value”.

Despite the attractions of the real options approach, filling the black hole in valuation with real options is not easy in practice. Real options are typically more complex than financial options. For example, they may be compound – options on future options. Also, volatility estimates may be less straightforward than say for the volatility of the oil price, as in the case of a pharmaceutical product or an Internet company. There may be no market surrogate with prices for volatility estimation and historic volatility may not be appropriate for future volatility. Real option values are highly sensitive to input values and are more volatile than the underlying assets.

A final reminder: *all sectors have real options* hidden in them. It may be that the Old Economy is undervalued because no one takes into account the kind of options that these companies have. But some New Economy companies are just pure options and values obtained using real options are like DCF values - they depend on the assumptions made. Nevertheless, real options are a useful way of thinking, offering new insights into corporate value drivers.

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