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EVOLUTION BY DESIGN

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PREFACE

Evolution by Design encompasses the theme behind the 2011 editorial section of the Annual Report.

The first two articles from *The Economist* explore a new manufacturing technology – three dimensional printing. 'Additive manufacturing' as it is also known allows for the creation of single items on the same cost scale as it would to produce thousands. The consequences of this are far reaching and could have a profound impact on industry not seen since the industrial revolution; the implication on manufacturing now depending less on economies of scale and more on innovation and imagination.

Most tantalising of all is that the finished product can be made of metals, thereby expanding the number of applications many fold. It is also interesting that an international giant like Hewlett Packard has entered a global distribution agreement with one of the leading manufacturers. Unfortunately for those readers who are on the hunt for investible ideas, the number of listed 3D printing companies is small. There may be peripheral plays where one can find sintering companies or those involved with the software development, but one way or another, the industry is already significantly affecting concepts of manufacture and design.

The third article, provided for the second year by Dylan Grice from Société Générale, is titled 'Cheap stocks for an expensive world'.

Written in January this year, the essence of the article entreats investors to "…understand what things are worth to you, evaluate that valuation against prices, and only buy assets when they reach a suitably attractive discount." In the long run, the significance of value will win out.

It is really a lesson in patience and discipline. With all the daily excitement of markets, it is seductive to believe there is no reward for biding one's time but as Dylan illustrates, with a relatively crude portfolio selection method, the tortoise does outdo the hare by quite a margin.

In many ways, we find this article complementary to the commentary within the 30 June 2011 Investment Manager's Report in which we note that despite the turmoil over a century (1900-2008) which witnessed the suspension of market price-setting mechanisms, world and regional wars, the Great Depression and so on, the long-term return from equities still provides the most interesting return among asset classes.

We hope these articles provide you with some inspiration in difficult markets and an awareness that there are always opportunities. Further, that these can be magnified when addressed with a 'system' and patience.

KERR NEILSON
Managing Director, August 2011

PRINT ME A STRADIVARIUS

How a new manufacturing technology will change the world.

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THE industrial revolution of the late 18th century made possible the mass production of goods, thereby creating economies of scale which changed the economy – and society – in ways that nobody could have imagined at the time. Now a new manufacturing technology has emerged which does the opposite. Three-dimensional printing makes it as cheap to create single items as it is to produce thousands and thus undermines economies of scale. It may have as profound an impact on the world as the coming of the factory did.

It works like this. First you call up a blueprint on your computer screen and tinker with its shape and colour where necessary. Then you press print. A machine nearby whirrs into life and builds up the object gradually, either by depositing material from a nozzle, or by selectively solidifying a thin layer of plastic or metal dust using tiny drops of glue or a tightly focused beam.

Products are thus built up by progressively adding material, one layer at a time: hence the technology's other name, additive manufacturing. Eventually the object in question – a spare part for your car, a lampshade, a violin – pops out. The beauty of the technology is that it does not need to happen in a factory. Small items can be made by a machine like a desktop printer, in the corner of an office, a shop or even a house; big items – bicycle frames, panels for cars, aircraft parts – need a larger machine, and a bit more space.

At the moment the process is possible only with certain materials (plastics, resins and metals) and with a precision of around a tenth of a millimetre. As with computing in the late 1970s, it is currently the preserve of hobbyists and workers in a few academic and industrial niches. But like computing before it, 3D printing is spreading fast as the technology improves and costs fall. A basic 3D printer, also known as a fabricator or 'fabber', now costs less than a laser printer did in 1985.

JUST PRESS PRINT

The additive approach to manufacturing has several big advantages over the conventional one. It cuts costs by getting rid of production lines. It reduces waste enormously, requiring as little as one-tenth of the amount of material. It allows the creation of parts in shapes that conventional techniques cannot achieve, resulting in new, much more efficient designs in aircraft wings or heat exchangers, for example. It enables the production of a single item quickly and cheaply – and then another one after the design has been refined.

For many years 3D printers were used in this way for prototyping, mainly in the aerospace, medical and automotive industries. Once a design was finalised, a production line would be set up and parts would be manufactured and assembled using conventional methods. But 3D printing has now improved to the point that it is starting to be used to produce the finished items themselves. It is already competitive with plastic injection-moulding for runs of around 1,000 items, and this figure will rise as the technology matures. And because each item is created individually, rather than from a single mould, each can be made slightly differently at almost no extra cost. Mass production could, in short, give way to mass customisation for all kinds of products, from shoes to spectacles to kitchenware.

By reducing the barriers to entry for manufacturing, 3D printing should also promote innovation. If you can design a shape on a computer, you can turn it into an object. You can print a dozen, see if there is a market for them, and print 50 more if there is, modifying the design using feedback from early users.

This will be a boon to inventors and start-ups, because trying out new products will become less risky and expensive. And just as open-source programmers collaborate by sharing software code, engineers are already starting to collaborate on open-source designs for objects and hardware.

THE JOBLESS TECHNOLOGY

A technological change so profound will reset the economics of manufacturing. Some believe it will decentralise the business completely, reversing the urbanisation that accompanies industrialisation. There will be no need for factories, goes the logic, when every village has a fabricator that can produce items when needed. Up to a point, perhaps. But the economic and social benefits of cities go far beyond their ability to attract workers to man assembly lines.

Others maintain that, by reducing the need for factory workers, 3D printing will undermine the advantage of low-cost, low-wage countries and thus repatriate manufacturing capacity to the rich world. It might; but Asian manufacturers are just as well placed as anyone else to adopt the technology. And even if 3D printing does bring manufacturing back to developed countries, it may not create many jobs, since it is less labour-intensive than standard manufacturing.

The technology will have implications not just for the distribution of capital and jobs, but also for intellectual-property (IP) rules. When objects can be described in a digital file, they become much easier to copy and distribute – and, of course, to pirate. Just ask the music industry. When the blueprints for a new toy, or a designer shoe, escape onto the internet, the chances that the owner of the IP will lose out are greater.

There are sure to be calls for restrictions on the use of 3D printers, and lawsuits about how existing IP laws should be applied. As with open-source software, new non-commercial models will emerge. It is unclear whether 3D printing requires existing rules to be tightened (which could hamper innovation) or loosened (which could encourage piracy). The lawyers are, no doubt, rubbing their hands.

Just as nobody could have predicted the impact of the steam engine in 1750 – or the printing press in 1450, or the transistor in 1950 – it is impossible to foresee the long-term impact of 3D printing. But the technology is coming, and it is likely to disrupt every field it touches. Companies, regulators and entrepreneurs should start thinking about it now. One thing, at least, seems clear: although 3D printing will create winners and losers in the short term, in the long run it will expand the realm of industry – and imagination. ●

3D THE PRINTED WORLD

Three-dimensional printing from digital designs will transform manufacturing and allow more people to start making things.

FILTON, just outside Bristol, is where Britain's fleet of Concorde supersonic airliners was built. In a building near a wind tunnel on the same sprawling site, something even more remarkable is being created. Little by little a machine is 'printing' a complex titanium landing-gear bracket, about the size of a shoe, which normally would have to be laboriously hewn from a solid block of metal. Brackets are only the beginning. The researchers at Filton have a much bigger ambition: to print the entire wing of an airliner.

Far-fetched as this may seem, many other people are using three-dimensional printing technology to create similarly remarkable things. These include medical implants, jewellery, football boots designed for individual feet, lampshades, racing-car parts, solid-state batteries and customised mobile phones. Some are even making mechanical devices. At the Massachusetts Institute of Technology (MIT), Peter Schmitt, a PhD student, has been printing something that resembles the workings of a grandfather clock. It took him a few attempts to get right, but eventually he removed the plastic clock from a 3D printer, hung it on the wall and pulled down the counterweight. It started ticking.

Engineers and designers have been using 3D printers for more than a decade, but mostly to make prototypes quickly and cheaply before they embark on the expensive business of tooling up a factory to produce the real thing.

As 3D printers have become more capable and able to work with a broader range of materials, including production-grade plastics and metals, the machines are increasingly being used to make final products too. More than 20% of the output of 3D printers is now final products rather than prototypes, according to Terry Wohlers, who runs a research firm specialising in the field. He predicts that this will rise to 50% by 2020.

Using 3D printers as production tools has become known in industry as 'additive' manufacturing (as opposed to the old, 'subtractive' business of cutting, drilling and bashing metal). The additive process requires less raw material and, because software drives 3D printers, each item can be made differently without costly retooling. The printers can also produce ready-made objects that require less assembly and things that traditional methods would struggle with.

CLICK TO MANUFACTURE

The printing of parts and products has the potential to transform manufacturing because it lowers the costs and risks. No longer does a producer have to make thousands, or hundreds of thousands, of items to recover his fixed costs. In a world where economies of scale do not matter any more, mass-manufacturing identical items may not be necessary or appropriate, especially as 3D printing allows for a great deal of customisation. Indeed, in the future some see consumers downloading products as they do digital music and printing them out at home, or at a local 3D production centre, having tweaked the designs to their own tastes. That is probably a faraway dream. Nevertheless, a new industrial revolution may be on the way.

Printing in 3D may seem bizarre. In fact it is similar to clicking on the print button on a computer screen and sending a digital file, say a letter, to an inkjet printer. The difference is that the 'ink' in a 3D printer is a material which is deposited in successive, thin layers until a solid object emerges.

The layers are defined by software that takes a series of digital slices through a computer-aided design. Descriptions of the slices are then sent to the 3D printer to construct the respective layers. They are then put together in a number of ways. Powder can be spread onto a tray and then solidified in the required pattern with a squirt of a liquid binder or by sintering it with a laser or an electron beam. Some machines deposit filaments of molten plastic. However it is achieved, after each layer is complete the build tray is lowered by a fraction of a millimetre and the next layer is added.

The researchers at Filton began using 3D printers to produce prototype parts for wind-tunnel testing. The group is part of EADS Innovation Works, the research arm of EADS, a European defence and aerospace group best known for building Airbuses. Prototype parts tend to be very expensive to make as one-offs by conventional means. Because their 3D printers could do the job more efficiently, the researchers' thoughts turned to manufacturing components directly.

Aircraft-makers have already replaced a lot of the metal in the structure of planes with lightweight carbon-fibre composites. But even a small airliner still contains several tonnes of costly aerospace-grade titanium. These parts have usually been machined from solid billets, which can result in 90% of the material being cut away. This swarf is no longer of any use for making aircraft.

To make the same part with additive manufacturing, EADS starts with a titanium powder. The firm's 3D printers spread a layer about 20-30 microns (0.02-0.03mm) thick onto a tray where it is fused by lasers or an electron beam. Any surplus powder can be reused. Some objects may need a little machining to finish, but they still require only 10% of the raw material that would otherwise be needed. Moreover, the process uses less energy than a conventional factory. It is sometimes faster, too.

There are other important benefits. Most metal and plastic parts are designed to be manufactured, which means they can be clunky and contain material surplus to the part's function but necessary for making it. This is not true of 3D printing. "You only put material where you need to have material," says Andy Hawkins, lead engineer on the EADS project. The parts his team is making are more svelte, even elegant. This is because without manufacturing constraints they can be better optimised for their purpose. Compared with a machined part, the printed one is some 60% lighter but still as sturdy.

FORM FOLLOWS FUNCTION

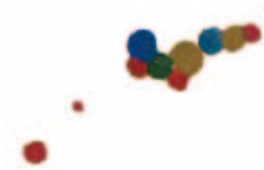
Lightness is critical in making aircraft. A reduction of 1kg in the weight of an airliner will save around $3,000-worth of fuel a year and by the same token cut carbon-dioxide emissions. Additive manufacturing could thus help build greener aircraft – especially if all the 1,000 or so titanium parts in an airliner can be printed. Although the size of printable parts is limited for now by the size of 3D printers, the EADS group believes that bigger systems are possible, including one that could fit on the 35-metre-long gantry used to build composite airliner wings. This would allow titanium components to be printed directly onto the structure of the wing.

Many believe that the enhanced performance of additively manufactured items will be the most important factor in driving the technology forward.

It certainly is for MIT's Mr Schmitt, whose interest lies in 'original machines'. These are devices not constructed from a collection of prefabricated parts, but created in a form that flows from the intention of the design. If that sounds a bit arty, it is: Mr Schmitt is a former art student from Germany who used to cadge time on factory lathes and milling machines to make mechanised sculptures. He is now working on novel servo mechanisms, the basic building blocks for robots. Custom-made servos cost many times the price of off-the-shelf ones. Mr Schmitt says it should be possible for a robot builder to specify what a servo needs to do, rather than how it needs to be made, and send that information to a 3D printer, and for the machine's software to know how to produce it at a low cost. "This makes manufacturing more accessible," says Mr Schmitt.

The idea of the 3D printer determining the form of the items it produces intrigues Neri Oxman, an architect and designer who heads a research group examining new ways to make things at MIT's Media Lab. She is building a printer to explore how new designs could be produced. Dr Oxman believes the design and construction of objects could be transformed using principles inspired by nature, resulting in shapes that are impossible to build without additive manufacturing. She has made items from sculpture to body armour and is even looking at buildings, erected with computer-guided nozzles that deposit successive layers of concrete.

Some 3D systems allow the properties and internal structure of the material being printed to be varied. This year, for instance, Within Technologies, a London company, expects to begin offering titanium medical implants with features that resemble bone. The company's femur implant is dense where stiffness and strength is required, but it also has strong lattice structures which would encourage the growth of bone onto the implant. Such implants are more likely to stay put than conventional ones.



Working at such a fine level of internal detail allows the stiffness and flexibility of an object to be determined at any point, says Siavash Mahdavi, the chief executive of Within Technologies. Dr Mahdavi is working on other lattice structures, including aerodynamic body parts for racing cars and special insoles for a firm that hopes to make the world's most comfortable stiletto-heeled shoes.

Digital Forming, a related company (where Dr Mahdavi is chief technology officer), uses 3D design software to help consumers customise mass-produced products. For example, it is offering a service to mobile-phone companies in which subscribers can go online to change the shape, colour and other features of the case of their new phone.

The software keeps the user within the bounds of the achievable. Once the design is submitted the casing is printed. Lisa Harouni, the company's managing director, says the process could be applied to almost any consumer product, from jewellery to furniture. "I don't have any doubt that this technology will change the way we manufacture things," she says.

Other services allow individuals to upload their own designs and have them printed. Shapeways, a New York-based firm spun out of Philips, a Dutch electronics company, last year, offers personalised 3D production, or 'mass customisation', as Peter Weijmarshausen, its chief executive, describes it. Shapeways prints more than 10,000 unique products every month from materials that range from stainless steel to glass, plastics and sandstone. Customers include individuals and shopkeepers, many ordering jewellery, gifts and gadgets to sell in their stores.

EOS, a German supplier of laser-sintering 3D printers, says they are already being used to make plastic and metal production parts by carmakers, aerospace firms and consumer-products companies. And by dentists: up to 450 dental crowns, each tailored for an individual patient, can be manufactured in one go in a day by a single machine, says EOS. Some craft producers of crowns would do well to manage a dozen a day. As an engineering exercise, EOS also printed the parts for a violin using a high-performance industrial polymer, had it assembled by a professional violin-maker and played by a concert violinist.

Both EOS and Stratasys, a company based in Minneapolis which makes 3D printers that employ plastic-deposition technology, use their own machines to print parts that are, in turn, used to build more printers. Stratasys is even trying to print a car, or at least the body of one, for Kor Ecologic, a company in Winnipeg, whose boss, Jim Kor, is developing an electric-hybrid vehicle called Urbee.

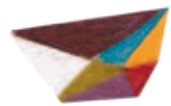
Making low-volume, high-value and customised components is all very well, but could additive manufacturing really compete with mass-production techniques that have been honed for over a century? Established techniques are unlikely to be swept away, but it is already clear that the factories of the future will have 3D printers working alongside milling machines, presses, foundries and plastic injection-moulding equipment, and taking on an increasing amount of the work done by those machines.

Morris Technologies, based in Cincinnati, was one of the first companies to invest heavily in additive manufacturing for the engineering and production services it offers to companies. Its first intention was to make prototypes quickly, but by 2007 the company says it realised 'a new industry was being born' and so it set up another firm, Rapid Quality Manufacturing, to concentrate on the additive manufacturing of higher volumes of production parts. It says many small and medium-sized components can be turned from computer designs into production-quality metal parts in hours or days, against days or weeks using traditional processes. And the printers can build unattended, 24 hours a day.

Neil Hopkinson has no doubts that 3D printing will compete with mass manufacturing in many areas. His team at Loughborough University has invented a high-speed sintering system. It uses inkjet print-heads to deposit infra-red-absorbing ink on layers of polymer powder which are fused into solid shapes with infra-red heating. Among other projects, the group is examining the potential for making plastic buckles for Burton Snowboards, a leading American producer of winter-sports equipment. Such items are typically produced by plastic injection-moulding. Dr Hopkinson says his process can make them for ten pence (16 cents) each, which is highly competitive with injection-moulding. Moreover, the designs could easily be changed without Burton incurring high retooling costs.

Predicting how quickly additive manufacturing will be taken up by industry is difficult, adds Dr Hopkinson. That is not necessarily because of the conservative nature of manufacturers, but rather because some processes have already moved surprisingly fast. Only a few years ago making decorative lampshades with 3D printers seemed to be a highly unlikely business, but it has become an industry with many competing firms and sales volumes in the thousands.

Dr Hopkinson thinks Loughborough's process is already competitive with injection-moulding at production runs of around 1,000 items. With further development he expects that within five years it would be competitive in runs of tens if not hundreds of thousands. Once 3D printing machines are able to crank out products in such numbers, then more manufacturers will look to adopt the technology.



Will Sillar of Legerwood, a British firm of consultants, expects to see the emergence of what he calls the 'digital production plant': firms will no longer need so much capital tied up in tooling costs, work-in-progress and raw materials, he says. Moreover, the time to take a digital design from concept to production will drop, he believes, by as much as 50-80%. The ability to overcome production constraints and make new things will combine with improvements to the technology and greater mechanisation to make 3D printing more mainstream. "The market will come to the technology," Mr Sillar says.

Some in the industry believe that the effect of 3D printing on manufacturing will be analogous to that of the inkjet printer on document printing.

The written word became the printed word with the invention of movable-type printing by Johannes Gutenberg in the 15th century. Printing presses became like mass-production machines, highly efficient at printing lots of copies of the same thing but not individual documents. The inkjet printer made that a lot easier, cheaper and more personal. Inkjet devices now perform a multitude of printing roles, from books on demand to labels and photographs, even though traditional presses still roll for large runs of books, newspapers and so on.

A CUSTOMISED FUTURE

How would this translate to manufacturing? Most obviously, it changes the economics of making customised components. If a company needs a specialised part, it may find it cheaper and quicker to have the part printed locally or even to print its own than to order one from a supplier a long way away. This is more likely when rapid design changes are needed.

Printing in 3D is not the preserve of the West: Chinese companies are adopting the technology too. Yet you might infer that some manufacturing will return to the West from cheap centres of production in China and elsewhere. This possibility was on the agenda of a conference organised by DHL last year. The threat to the logistics firm's business is clear: why would a company airfreight an urgently needed spare part from abroad when it could print one where it is required?

Perhaps the most exciting aspect of additive manufacturing is that it lowers the cost of entry into the business of making things. Instead of finding the money to set up a factory or asking a mass-producer at home (or in another country) to make something for you, 3D printers will offer a cheaper, less risky route to the market. An entrepreneur could run off one or two samples with a 3D printer to see if his idea works. He could make a few more to see if they sell, and take in design changes that buyers ask for. If things go really well, he could scale up – with conventional mass production or an enormous 3D print run.

This suggests that success in manufacturing will depend less on scale and more on the quality of ideas. Brilliance alone, though, will not be enough. Good ideas can be copied even more rapidly with 3D printing, so battles over intellectual property may become even more intense. It will be easier for imitators as well as innovators to get goods to market fast. Competitive advantages may thus be shorter-lived than ever before. As with past industrial revolutions, the greatest beneficiaries may not be companies but their customers. But whoever gains most, revolution may not be too strong a word. ●

CHEAP STOCKS FOR AN EXPENSIVE WORLD

By: Dylan Grice
from Société Générale Cross Asset Research Global Strategy Document, 31 January 2011

People say '*the current juncture is just so murky at the moment*'. But when isn't it? Since all we reliably know is that some things will trade at the wrong price some of the time, understanding what things are worth and waiting for prices to deviate significantly might be a more constructive ideal to aspire to. Today, I think equity markets are generally on the expensive side but opportunities haven't completely dried up. There are *some* stocks with robust balance sheets trading at significant discounts to intrinsic value. Just not that many.

DELU-
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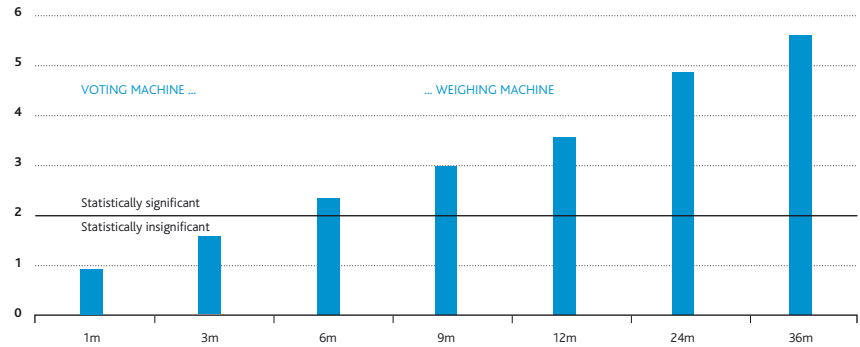
- So, I've been rereading past Berkshire Hathaway shareholder letters these past few weeks (we lead pretty exciting lives here in the SG strategy team). In 2009, referring to his purchase of Allied Irish and Bank of Ireland, Buffett wrote "*I made some other already recognizable errors as well. They were smaller, but unfortunately not that small. During 2008, I spent $244 million for shares of two Irish banks that appeared cheap to me. At year-end we wrote these holdings down to market: $27 million, for an 89% loss. Since then the two stocks have declined even further. The tennis crowd would call my mistakes 'unforced errors'.*" Warren E. Buffett predicted neither the credit crisis nor its magnitude.

- What I find interesting is that it didn't matter, in the sense that at $217m, the loss Berkshire wore on the Irish banks at the time was less than half the annual dividend earned on the 10% preference shares he was able to buy from Goldman Sachs at the height of the crisis. And the reason he managed to extract such favourable terms from Goldman was that he was the only guy around with ample liquidity. And the reason he had ample liquidity was because, the above errors notwithstanding, there weren't enough obvious bargains around in the years preceding the crisis. While he didn't predict *the* crisis, his value-discipline nevertheless prepared him for *a crisis*.

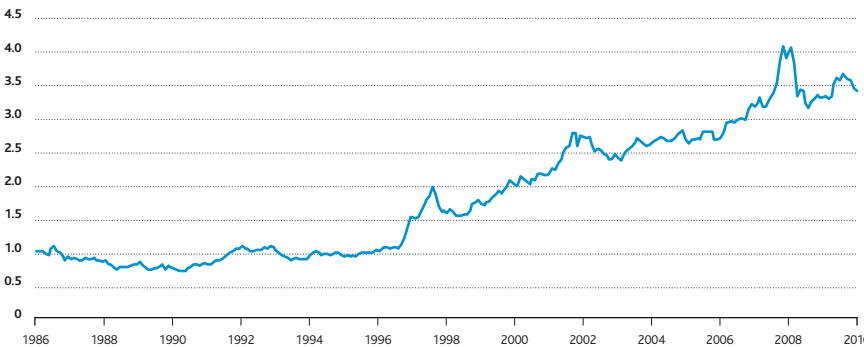
- We don't need to be able to predict the future. Doing our homework, understanding what stuff is worth and transacting when prices depart significantly thereof isn't as easy as it sounds. But, as Ben Graham said, if in the short term the market is a voting machine, in the long run it's a weighing machine. The following chart shows that value is indeed statistically *insignificant* in the short run. But it wins outs in the end.

The statistical significance of 'value' over different time horizons (t-stat shown on l/h axis)
Source: *Factset, SG Cross Asset Research*



Here's an interesting chart. It shows the historic outperformance of 'high quality' stocks versus 'low quality' using the FTSE World non-financial stocks, and using the Piotroski score to classify value[1]. The historical annualized performance has been around 520bp.

Last free lunch in finance? High vs low quality stocks cumulative outperf. (annual return 5.2%)
Source: *SG Cross Asset Research*



1 The Piotroski score is based on a nine-criterion ranking system, calculating various ratios from historical accounts. It ranges from 0 (lowest score) to 9 (highest score) with higher scores suggesting sounder financial health. See *'Value Investing: The Use of Historical Financial Statement Information to Separate Winners from Losers'*, by Joseph Piotroski, Journal of Accounting Research, 2002.

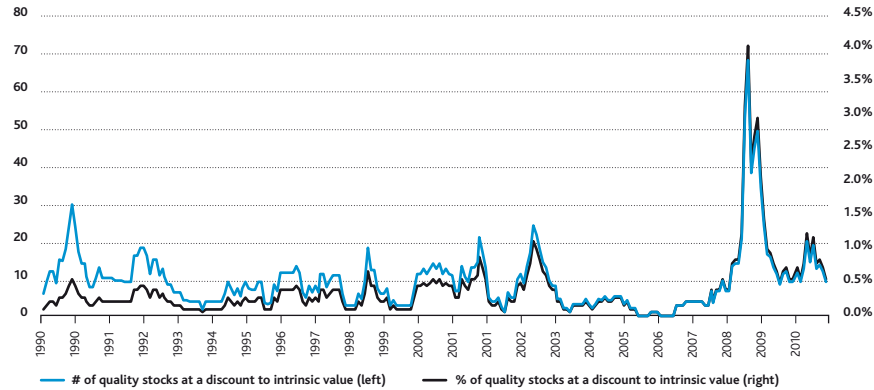
In one sense, this shouldn't be surprising. One of the (many) well-known empirical flaws in the EMH is that low beta stocks that are 'low risk' and which therefore should have a lower return actually don't. Indeed, GMO's Jeremy Grantham has referred to this opportunity of being able to make higher returns by taking on less risk as the last free lunch in finance.

But, the interesting thing about this chart, to me anyway, is that the stock baskets have been selected *entirely* on their Piotroski score. In other words, it shows the returns a hypothetical investor would have made had he bought the basket of high quality stocks and sold short the basket of low quality companies *regardless of their valuation*.

Suppose we use the Piotroski score to isolate high quality companies. Then subject those high quality companies to the usual value discipline by selecting *only* those which trade at a discount to estimated intrinsic value (I use a 33% discount). Such stocks have historically returned around 1.9% per month, which annualises at around 25% per year, a tidy return in anyone's book. The problem is that hardly any stocks pass such a stringent test. Indeed, one might call this *absurdly* deep value. 'Hardly any' doesn't mean 'none' but the following chart shows that you're doing well if half of one percent of the universe passes the test[2].

2 Of course, this apparent paucity of historic opportunities is partly a function of the methodology I've used to estimate intrinsic value, which is quite a stringent version of Steve Penman's Residual Income Model. And one of the most common requests I've had from clients is for a detailed explanation of how I estimate 'intrinsic values.' I will provide this next week.

Closer to famine than feast: incidence of 'high quality' at a discount to intrinsic value
Source: *Factset, SG Cross Asset Research*

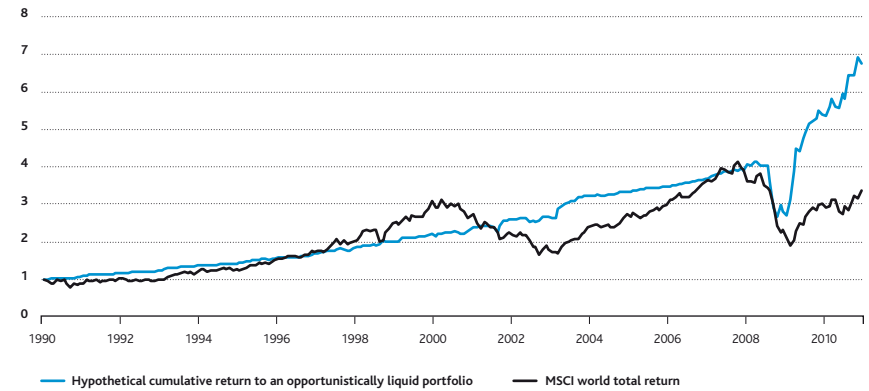


But, as the chart shows, there are times, albeit infrequent, when Mr Market offers up a veritable feast of companies passing such stringent criteria. Although today isn't one of them, neither is it the famine seen in 2005 and 2006. We don't know when these feasts are going to happen. We just know that they will, sometime.

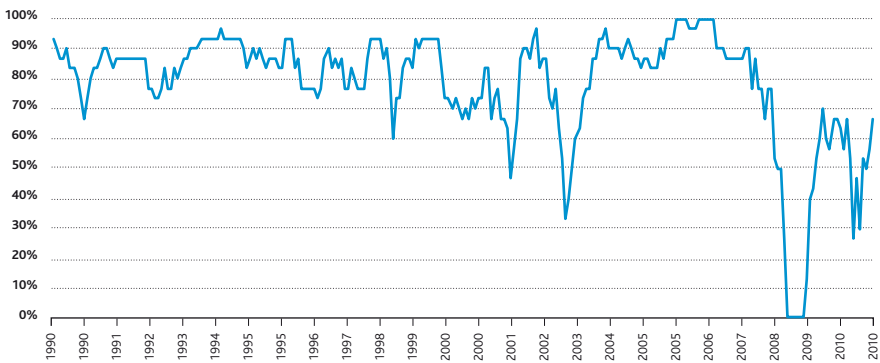
So the 'right' thing to do is to hold on to cash and wait until those opportunities arise. Suppose as your core portfolio – absent any insurance options – you wanted to hold a maximum of 30 stocks.

Each month, you allocate one-thirtieth of your capital to every stock you can find which passes your absurdly deep value screen. If on those rare occasions you find more than 30 stocks then I've assumed you just own them all equally weighted. But if you can't find 30 stocks, I assume the already allocated capital simply sits in cash. That way, you're sitting on cash opportunistically – so if you can find only 15 stocks, you're 50% cash. If you can't find *any* such stocks, you're 100% in cash. The following charts show the hypothetical return profile to this 'opportunistically liquid' portfolio, followed by the hypothetical cash allocation. Currently, this strategy would be 70% in cash at the moment, reflecting the narrowness of the current opportunity set.

Patience, liquidity ... and profitability? (cumulative returns, 1990 = 1)
Source: *SG Cross Asset Research, Factset*



Cash weighting in the opportunistically liquid portfolio
Source: *SG Cross Asset Research, Factset*



And here are the stocks which you'd currently be holding. Bear in mind that this exercise is illustrative and that these stocks are only the output from a quant screen I've built – I don't know much about most of these stocks, and am certainly not recommending you go out and buy them. (As I said, I'll detail the methodology, along with its pros and cons next week.)

High Quality trading at discount to estimated intrinsic value (IVP ratio >1.33)
Source: *SG Cross Asset Research*

Company Name	Country	Market Cap ($bn)	Sector	Bk Val/PS (lcl ccy)	10y ave RoE	Estimated Intrinsic Value	Monthly Closing Price	IVP	Piotroski Score
Telkom S.A.	South Africa	2,612	Integrated Telecommunication Services	58.3	26.0	102	35.1	2.9	8
Persimmon	UK	2,019	Homebuilding	5.4	19.8	9.2	3	2.7	7
BlueScope Steel	Australia	3,741	Steel	3.1	17.2	4.3	2	2.2	8
CME Group	United States	20,766	Specialised Finance	290.2	27.0	607	288	2.1	7
Pacific Corp.	South Korea	1,039	Personal Products	221,551	17.0	381,329	189,000	2.0	7
SK Networks	South Korea	2,758	Trading Companies and Distributors	12,257	22.7	21,285	10,950	1.9	8
TPV Technology	Hong Kong	1,467	Computer Storage and Peripherals	5.3	24.9	8.4	5	1.7	7
Funai Electric Co.	Japan	1,147	Consumer Electronics	4,167	10.6	4,717	2,844	1.7	7
Charter International	UK	2,100	Industrial Machinery	3.3	39.0	10.1	7	1.5	7
Akzo Nobel N.V.	Netherlands	14,540	Diversified Chemicals	33.5	30.7	60	41	1.4	8
Western Digital Corp	United States	7,241	Computer Storage and Peripherals	17.0	39.3	46	34	1.4	7
Ricoh Co.	Japan	10,380	Office Electronics	1,341	10.2	1,577	1,181	1.3	8

So right now, the 'right' thing to do is to be liquid and hold plenty of cash. The problem is that knowing what the 'right' thing to do is, even when it's really simple, doesn't make doing it any easier. People write books and build careers on helping other people lose weight, even though losing weight is one of the simplest things in the world (exercise more, eat less). The same is true for stopping smoking. There are books and courses to help smokers kick the habit because so many people find it so difficult to do (unfortunately I know this only too well – why are Marlboro lights such a great idea the moment you get your first taste of Guinness?!) Yet there's nothing intrinsically complicated in stopping. Stop picking up cigarettes, putting them in your mouth, and smoking them.

Getting from the sequence of short-runs to the long run is the difficult bit. Sometimes the simplest things in theory are the hardest things in practice, and knowing the right thing to do is only the first step. So, understand what things are worth to you, evaluate that valuation against prices, and only buy assets when they reach a suitably attractive discount. If the risk to doing the right thing is of losing business because you're not doing what everyone else is doing, so be it – simple!

…but not easy. So what can we do? Dieters have support groups to help them resist the temptation to eat to excess. Smokers can buy nicotine patches to help resist the temptation to smoke. What do investors have to prevent them chasing higher prices and the seduction of the associated narrative? Not much, other than, perhaps, the wisdom of others. So with this in mind, I thought I'd leave you with this excerpt from the 2005 Berkshire letter, where Mr. Buffett explains the business philosophy behind the success of Berkshire's National Indemnity business (I've taken the liberty of charting the tabulated data from the original report).

2005 BERKSHIRE LETTER – *extract*

"Since Berkshire purchased National Indemnity ('NICO') in 1967, property-casualty insurance has been our core business and the propellant of our growth. Insurance has provided a fountain of funds with which we've acquired the securities and businesses that now give us an ever-widening variety of earnings streams. So in this section, I will be spending a little time telling you how we got where we are.

The source of our insurance funds is 'float,' which is money that doesn't belong to us but that we temporarily hold. Most of our float arises because (1) premiums are paid upfront though the service we provide – insurance protection – is delivered over a period that usually covers a year and; (2) loss events that occur today do not always result in our immediately paying claims, because it sometimes takes many years for losses to be reported (asbestos losses would be an example), negotiated and settled. The $20 million of float that came with our 1967 purchase has now increased – both by way of internal growth and acquisitions – to $46.1 billion.

Float is wonderful – if it doesn't come at a high price. Its cost is determined by underwriting results, meaning how the expenses and losses we will ultimately pay compare with the premiums we have received. When an underwriting profit is achieved – as has been the case at Berkshire in about half of the 38 years we have been in the insurance business – float is better than free. In such years, we are actually paid for holding other people's money. For most insurers, however, life has been far more difficult: In aggregate, the property-casualty industry almost invariably operates at an underwriting loss. When that loss is large, float becomes expensive, sometimes devastatingly so.

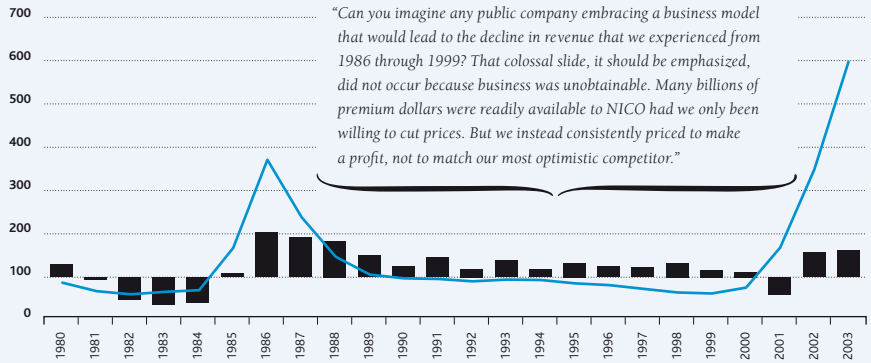
Insurers have generally earned poor returns for a simple reason: They sell a commodity-like product. Policy forms are standard, and the product is available from many suppliers, some of whom are mutual companies ('owned' by policyholders rather than stockholders) with profit goals that are limited. Moreover, most insureds don't care from whom they buy. Customers by the millions say 'I need some Gillette blades' or 'I'll have a Coke' but we wait in vain for 'I'd like a National Indemnity policy, please.' Consequently, price competition in insurance is usually fierce. Think airline seats.

So, you may ask, how do Berkshire's insurance operations overcome the dismal economics of the industry and achieve some measure of enduring competitive advantage? We've attacked that problem in several ways. Let's look first at NICO's strategy.

When we purchased the company – a specialist in commercial auto and general liability insurance – it did not appear to have any attributes that would overcome the industry's chronic troubles. It was not well-known, had no informational advantage (the company has never had an actuary), was not a low-cost operator, and sold through general agents, a method many people thought outdated. Nevertheless, for almost all of the past 38 years, NICO has been a star performer. Indeed, had we not made this acquisition, Berkshire would be lucky to be worth half of what it is today.

What we've had going for us is a managerial mindset that most insurers find impossible to replicate. Take a look at the facing page [DG: see chart]. Can you imagine any public company embracing a business model that would lead to the decline in revenue that we experienced from 1986 through 1999? That colossal slide, it should be emphasized, did not occur because business was unobtainable. Many billions of premium dollars were readily available to NICO had we only been willing to cut prices. But we instead consistently priced to make a profit, not to match our most optimistic competitor. We never left customers – but they left us.

Portrait of a disciplined underwriter
Source: *Berkshire Hathaway 2005 shareholders' letter*



Most American businesses harbor an 'institutional imperative' that rejects extended decreases in volume. What CEO wants to report to his shareholders that not only did business contract last year but that it will continue to drop? In insurance, the urge to keep writing business is also intensified because the consequences of foolishly-priced policies may not become apparent for some time. If an insurer is optimistic in its reserving, reported earnings will be overstated, and years may pass before true loss costs are revealed (a form of self-deception that nearly destroyed GEICO in the early 1970s)." ●

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