

Marketing Material



CROCI Focus

Intellectual Capital

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The combination of lukewarm top line growth, rich valuations and high profitability may well mean low single-digit equity returns for the foreseeable future—perhaps unsurprising, given the high returns enjoyed over the past decade. But although the economic environment appears to be stagnating, many underlying changes have been taking place, both in the broader economy and within equity benchmarks. Companies with apparently little capital have managed to grow at a much faster pace than the rest of the economy. In reality, these companies have made substantial investments in intellectual capital over the years.

This report explains how companies with intangible assets (R&D & Brands) have largely been able to defy a backdrop of lacklustre growth in the global economy. By contrast, companies without intellectual capital have struggled to generate any growth—their aggregate earnings are well below the levels of a decade ago.

This group represents two-fifths of the market (including financials), which is likely to provide a real headwind for investors if this trend is sustained. Nor is valuation supportive. Companies with only physical assets trade at a premium to

companies with intangible assets, an anomaly if the former group is as structurally challenged as it appears.

Ideas have always contributed to economic growth, but in the past the relationship between the idea and economic growth manifested itself through hard assets. Think of railways, shipping, large chemical and steel plants, auto manufacturers. The economics of an idea required significant investment in plant and machinery, as well as needing a substantial amount of labour.

Over the past decade, though, economic growth and equity returns have been driven by companies with apparently little capital and labour. If the future belongs to companies that are able to deliver economic growth with little physical capital, investors in equity benchmarks will continue to have exposure to companies whose businesses are structurally challenged by these changes.

Investing in companies with IC still presents risks, though. Ownership of R&D doesn't guarantee a competitive advantage or that profitability will come through. Within the last section we highlight a number of factors that investors should consider if they want exposure to what appears to be a structural change in the economy.

Important Information

This paper is intended for Professional Investors only, and in the U.S. for institutional investors, who understand the strategies and views introduced in this paper and can form an independent view of them. CROCI represents one of many possible ways to analyse and value stocks. Potential investors must form their own view of the CROCI methodology and evaluate whether CROCI and investments associated with CROCI are appropriate for them.

Please see Glossary A for a brief introduction to CROCI and for definitions of key terms used throughout this piece. Please see Glossary B for the definition of Real Value.

Charts referring to specific sectors or regions show data of CROCI's coverage in these regions and sectors. Unless otherwise noted, charts contain a mixture of historical and current data. This report does not have performance data on any of the CROCI strategies or client accounts in the United States. The charts that represent current and historical data is obtained from the CROCI coverage being run on a live basis as opposed to backtested performance which is simulated by applying the rules of the CROCI coverage in a retrospective manner and has the advantage of hindsight. Live does not represent actual performance. DWS does not represent that strategy or index returns would be similar to actual performance had the firm actually managed accounts in this manner. There typically are differences between (simulated/ model) and actual results achieved by any strategy or index.

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In the data and charts presented throughout this document, "E" refers to financial years that are not yet reported. Forecasts of accounting data for these years are based on market's consensus estimates as reported by Bloomberg Finance L.P. CROCI metrics for the forecast years are calculated by applying the CROCI model to these consensus estimates. The CROCI team does not make any forecasts or projections of accounting data. Data for historical years are derived from company reports and other publicly available sources.

Forward looking statements or projections are subject to risks and uncertainties that may cause actual results to differ materially.

This paper includes simulated performance data. There can be significant differences between simulated and actual performance results. Simulated performance results have many inherent limitations, some of which are described below. One of the limitations of simulated performance results is that they are generally prepared with the benefit of hindsight. In addition, simulated trading does not involve financial risk, and no simulated trading record can completely account for the impact of financial risk in actual trading and other factors related to the markets in general or to the implementation of any specific trading program which cannot be fully accounted for in the preparation of simulated performance results and all of which can adversely affect actual trading results. Simulated performance is therefore not a reliable guide to actual performance.

Please refer to the important information at the end of this document.

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Introduction

Ideas have always contributed to economic growth, but in the past the relationship between the idea and economic growth manifested itself through hard assets. Think of railways, shipping, large chemical and steel plants, auto manufacturers. The economics of an idea required significant investment in plant and machinery, as well as needing a substantial amount of labour.

Over the past decade, though, economic growth and equity returns have been driven by companies with apparently little capital and labour. This is a function of technological change. Many tasks previously performed by people can now be performed by robots and computers. The internet has been able to replace physical markets as a platform for exchanging goods and services. Even so, it is not true to claim that there is no capital at play. A great deal of intangible capital is employed in such businesses, the result of investment in R&D and, in some cases, advertising. Analysis based on accounting data tends to miss these assets but CROCI has recognised them since 1996.

In recent years the emergence of such trends has attracted more and more attention. For those interested in further reading, we suggest the book written by Haskel & Westlake (2017), *Capitalism without Capital*. The book offers a comprehensive analysis of the increasing relevance of intangible capital in our life and economies. The authors also analyse the potential implications of economic growth driven by intangible capital and confirm one of the assumptions presented in our Outlook for 2016, i.e. that economic stagnation may well be linked to the kind of technological innovation seen over the past decade. We highlight some of these issues in chapter 2.

For equity investors the implications are significant, especially if these effects are sustained over time. We estimate that over a third of what we cover in the non-financial part of the market do not have any intangible capital. This would also be the case for Financials, which means that investors are potentially still exposed to two-fifths with either no or negative real earnings growth.

This is nothing new. There is an intrinsic relationship between large investable benchmarks and the economy. As the economy has evolved over the past century, so too has the composition of benchmarks. As new companies have emerged, others have faded away. As an asset class, equities are a perpetuity, but individual companies are not. They are like the cells of an organism: such an organism may have a long life, but there is constant change at the cellular level.

If the future belongs to companies that are able to deliver economic growth with little physical capital, investors in equity benchmarks will continue to have exposure to companies whose businesses are structurally challenged by these changes. Far be it from us to say that this whole group is condemned, but the challenges are evident. Their valuations are an additional problem, because companies with only physical capital trade at a premium. (See figures 8 and 9).

In a Darwinian survival-of-the-fittest approach, avoiding structural declines becomes fundamental as a strategy for offsetting stagnation. At the end of the report we argue that a speculative approach should be avoided, but investors can get exposure to this structural change, as companies with Intellectual Capital now represent a significant part of the listed universe. (See figure 10)

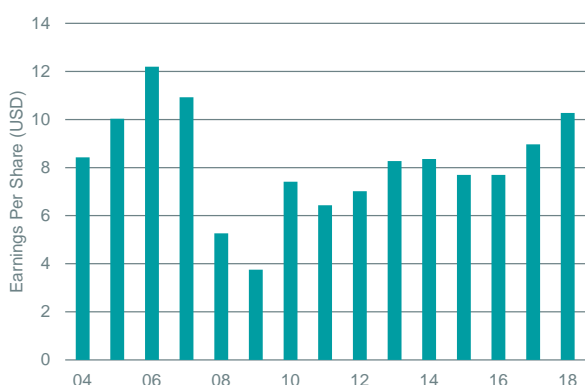
1. Economic changes

Equity benchmarks, listed companies and macroeconomic changes

The New Economy is driving growth

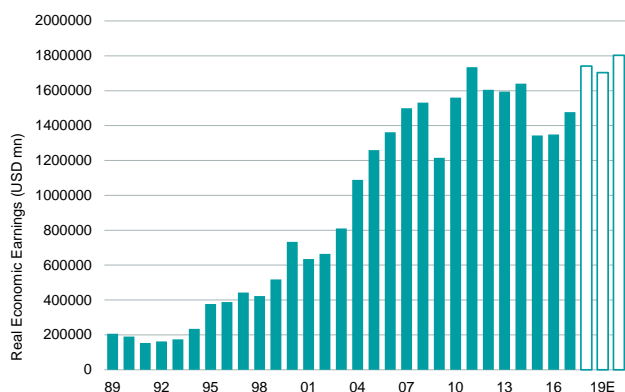
Equity markets have performed strongly over the past decade—something of a surprise given lukewarm GDP and earnings growth as a backdrop. The problems of the Financial sector are well known, but earnings growth in the rest of the market has also stalled since 2007 in real terms.

Figure 1: Financials: Nominal Earnings Per Share



Source: Bloomberg Finance L.P., DWS. The chart shows nominal EPS of the MSCI ACWI Financials Index. Data as available on 21 March 2019.

Figure 2: Non-Financials: Real Economic Earnings



Source: DWS, CROCI. The chart shows inflation-adjusted Economic Earnings of non-financial companies in CROCI's coverage. Aggregate data as available on 21 March 2019.

This strong market performance can be explained, however through (i) central banks policies and (ii) growth in the IT sector.

Central banks' accommodative monetary policies have played a big role, pushing asset prices beyond the levels earnings could justify. The median Economic P/E of CROCI's global coverage universe has risen from 22.8x in 2007 to 28.9x last year. The role of technology and related companies has been equally important. The strong earnings growth that these companies have delivered in recent years has offset much of the weakness in growth elsewhere.

This disconnect between the earnings growth of the IT (and related) companies and the broader market has given IT companies market leadership over recent years. The economic significance of these New Economy companies can be observed by their market valuation. In 2007, four of the ten largest companies were from the energy sector. Two of the remainder were telecoms companies. Of these six, only Exxon remains in the top ten today. Only one IT company—Microsoft—featured in the Top Ten list in 2007 (also present in 1997) with no representation at all from the Consumer Discretionary sector. By contrast, the top ten in January 2019 is made up of five IT and related stocks (two of these have since been reclassified as Communication Services and one is Consumer Discretionary).

Figure 3: Market leadership changes since 1997: The ten most highly valued companies in the MSCI World

Sector	2018		2007		1997	
	# Co	Mkt Cap Wt	# Co	Mkt Cap Wt	# Co	Mkt Cap Wt
C. Services ¹	2	21.0%	2	16.3%	1	7.8%
Discretionary	1	13.8%	-	-	1	7.8%
Staples	1	5.5%	1	8.2%	2	19.6%
Energy	1	6.3%	4	43.9%	2	19.2%
Financials	2	13.0%	1	7.1%	-	-
H. Care	1	7.5%	-	-	1	9.1%
Industrials	-	-	1	13.7%	1	17.1%
IT	2	32.9%	1	10.8%	2	19.3%
Materials	-	-	-	-	-	-
Utilities	-	-	-	-	-	-

Source: DWS, CROCI and MSCI Inc. The table shows sector classification and market cap weights of the 10 largest companies in the MSCI World at the end of 1997, 2007 and 2018. Data as available on 1st February 2019.

¹ The two Communication Services companies that are now part of the ten highly valued companies are both from the Media & Entertainment subsector.

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In 1997 and 2007 Telecom companies were part of this group but have now dropped out.

Unlike in the technology boom of the late 1990s, the change in leadership has not been driven by high valuations, but by earnings growth. Notwithstanding the increasing relevance of these companies, the five IT and related stocks trade on a combined 2019 Economic P/E of 25.1x, a marginal discount to US equities², which trade at 25.3x expected earnings.

The rise of the Intangible Economy

Of course, market leadership changes are not new. As economies evolve, the factors that drive their growth change. Agrarian economies depend upon access to cultivable land, labour, livestock and marketplaces for trading their produce. Industrial revolutions brought fundamental changes to this operating model, by introducing tools and processes to accelerate the production, processing and transportation of the goods that the economy produced. Access to the technologies and infrastructure that were developed during that period became the key differentiators of economic performance. Railways were a transforming innovation. Not only did they lower transportation costs, they also employed vast numbers of people and opened access to new markets, all of which drove economic growth.

Changes in an economy have historically brought changes to the components of its equity benchmark. There is a great deal of information on the components of the Dow Jones Industrial Average (DJIA). Its precursor, first published in 1884, contained nine railway stocks (out of 14 stocks in total that were included), underscoring the importance of railways to the US economy at the time. This was subsequently eclipsed by automobiles, which also brought deep structural changes to the economy. Autos stocks made up almost a fifth of the DJIA in the 1920s. After World War II, the pent-up demand and emerging prosperity led to a boom in consumer demand. The valuation of consumer stocks therefore soared. This was repeated, *mutatis mutandis*, with Energy in the 1970s and IT & Internet in the 1990s.

Since then, the baton has been passed to the ‘new economy’ companies. This may not be evident by looking at the 30 companies that make up the DJIA, but it is evident by looking at the weight of some of the largest names in the S&P500. Modern day technology and knowhow have become the driving force of today’s economy. The companies at the vanguard of this trend are transforming the life of the average person just as fundamentally as the industrial revolution did to the agrarian economy. It’s little surprise that some commentators are calling this transformation the “Fourth Industrial Revolution³”. It is also important to realize that this revolution is not limited to the Technology sector. Retailers, Consumer Goods and even Industrial companies have significantly changed the capital structure of their businesses.

Figure 4: Dow Jones Industrial Average constituents⁴

1896	July 1959	January 2019
American Cotton Oil	Allied Chemical	3M
American Sugar	General Electric	American Express
American Tobacco	Sears	Apple
Chicago Gas	AlCoA	Boeing
Distilling & Cattle Feeding	General Foods	Caterpillar
General Electric	Standard Oil of California	Chevron
Laclede Gas	American Can	Cisco Systems
National Lead.	General Motors	Coca-Cola
North American	Standard Oil of New Jersey (now Exxon)	DowDuPont
Tennessee Coal, Iron and Railroad	AT&T	ExxonMobil (Standard Oil of New Jersey)
U.S. Leather	Goodyear Tire	Goldman Sachs
United States Rubber	Swift & Co.	The Home Depot
	American Tobacco	IBM
	Int'l Harvester	Intel
	Texaco	Johnson & Johnson
	Anaconda Copper	JPMorgan Chase
	Int'l Nickel	McDonald's
	Union Carbide	Merck & Co
	Bethlehem Steel	Microsoft
	Int'l Paper	Nike
	United Aircraft	Pfizer
	Chrysler	Procter & Gamble
	Johns-Manville	Travelers
	United States Steel	UnitedHealth Group
	E.I. du Pont de Nem	United Technologies
	Owens-Illinois	Verizon
	Westinghouse Electric.	Visa
	Eastman Kodak	Walmart
	Procter & Gamble	Walgreens Boots
	Woolworth	Walt Disney

Source: DWS and CROCI, S&P Dow Jones Indices LLC and Bloomberg Finance L.P. Data as available on 1 February 2019.

² Based on CROCI's US coverage. Data as on 13 February 2019.

³ The Fourth Industrial Revolution, Klaus Schwab, World Economic Forum 2016. The First Industrial Revolution used water and steam power to mechanize production. The Second used electric power to create mass production. The Third used electronics and information technology to

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automate production. Now a Fourth Industrial Revolution is building on the third.

⁴ For illustrative purposes only. This material does not amount to a recommendation or advice.

Investments for a knowledge driven economy

Within this report we analyse the changes in the market by using the CROCI database. Our conclusion is that there is clear evidence that companies investing primarily in intangible assets are the ones that have been able to grow earnings whilst those with physical assets have lagged. Companies with intangible assets now represent just under two-thirds of the market. If this diverging trend in earnings growth continues, investors need to consider moving away from companies that don't have intangible assets, or Intellectual Capital as we call them in this report. Sector investing is unlikely to be of much help as the sector definitions used by the major index providers and commonly followed by investors are a hodge-podge of companies with hard physical assets and Intellectual Capital.

The rest of the document is organised as follows:

- **Chapter two looks at the economic performance of companies over the past decade. A significant portion of listed companies have struggled to grow their revenues and earnings.** For much of the past decade, the strategy of this group of companies has been to postpone fixed asset investments and focus on margin improvements. Their efforts so far have been remarkable but are likely to prove unsustainable, given the inherent limits to cost cutting.

Analysing companies based on their sector classification provides interesting insights. Much of the listed companies' earnings growth since 2007 has come from IT and Health Care. By comparison, Energy, Materials

and Utilities have seen their earnings fall (after inflation). **Analysing this growth based on whether or not the companies have intangible assets presents more intriguing results.** Our analysis finds that the existence of intangible assets is a stronger indicator of growth than sector classification.

- **Chapter three looks at the rationale for capitalising expenditure on such assets.** Following accounting rules, intangible assets are commonly not reported on balance sheets. This distorts profitability and valuation ratios calculated using reported accounts. This section also studies the impact of intangible intensity (the proportion of total assets represented by Intellectual Capital) on performance. Interestingly, what matters is the existence of such assets and not necessarily how much is spent on those assets.
- **Chapter four looks at the impact of 'Intellectual Capital' on the broader economy.** There is plenty of evidence that this new type of economic growth is generating few jobs and is particularly challenging for workers with middle-skills. The economy is polarising between workers with high- and low-skills—a possible cause of stagnation that has been seen over the past decade.
- **Chapter five discusses how these findings can be used to provide investors with exposure to this theme.** Investors may benefit by seeking exposure to (i) companies with IC, (ii) removing companies with poor profitability, (iii) a systematic implementation that removes views about the future, (iv) weights the companies according to their earnings delivery, thus still providing potential exposure to structural themes, without the overvaluation component.

2. Intellectual Capital is driving growth

The rise of asset light companies

The absence of aggregate real earnings growth presents a genuine challenge for equity investors, who will be familiar with how important a generator of wealth equities have been over the past 50 years. But that was thanks to the exposure they provided to strong underlying earnings growth.

Financials have been under particular pressure since the financial crisis but, even excluding them, we estimate that real earnings growth has been 16.3% since 2007. This in turn has been caused by the absence of revenue growth.

Our analysis⁵ shows that median revenue growth experienced a steady decline up till 2016, at which point the trough of 1.1% was achieved. US tax reforms briefly pushed revenues up, but now they are fading again.

Figure 5: Median revenue growth for global equities



Source: DWS, CROCI. The chart shows median revenue growth of CROCI's coverage of companies. Data on 01 March 2019.

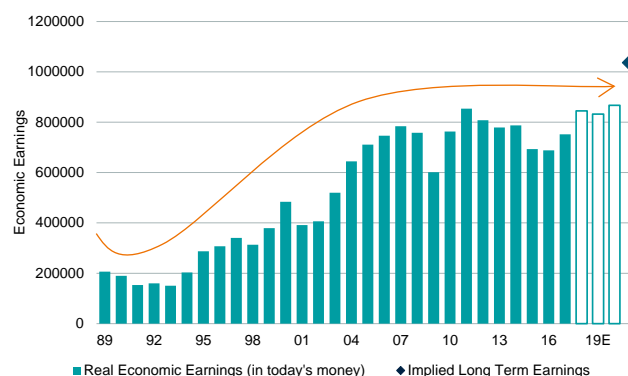
In order to better understand this anemic growth, we analysed those companies for which we have comparable data going back to 1989. This smaller subgroup consists of 300 companies with a combined market capitalisation of USD 16.9 trillion⁶ (half the market cap of our full coverage). Analysis of these companies helped provide additional insights into the recent sluggishness of revenues and earnings growth.

- The annual pace of economic earnings growth has slowed to 0.7%⁷, since 2007 (down from 8% in the previous eight years); much of this was simply the result of margin improvements.

- 2018 aggregate nominal revenues were in line with 2008 revenues and below the nominal levels seen in 2011, 2012 and 2013.
- Real earnings are no higher today than they were in 2011 and only a fifth higher than in 2007
- Cash returns have come under pressure since their peaks in 2005 and 2006 as the increase in margins has not managed to offset the fall in the productivity of capital.

This group of companies has gone ex growth since 2007, as Figure 6 shows. Readers concerned that this group is skewed towards mature companies need only look at Figure 7, which shows that, by widening the universe and looking at the current universe, the result is unchanged. There has been only negligible growth in earnings, with the current universe generating just 0.1% growth since 2011.

Figure 6: Real Economic Earnings of 1989 comparable companies



Source: DWS, CROCI. The chart shows inflation-adjusted Economic Earnings of companies for which CROCI has comparable data going back to 1989. Data in USD mn as available on 13 February 2019.

⁵ Based on CROCI's coverage of nearly 900 companies globally, which represents 70% by market cap of MSCI All Countries World Index (MSCI ACWI).

⁶ Data as available on 1 March 2019

⁷ Annualised growth between 2007 and 2018

Figure 7: Operational characteristics of CROCI's current and 1989 comparable universe

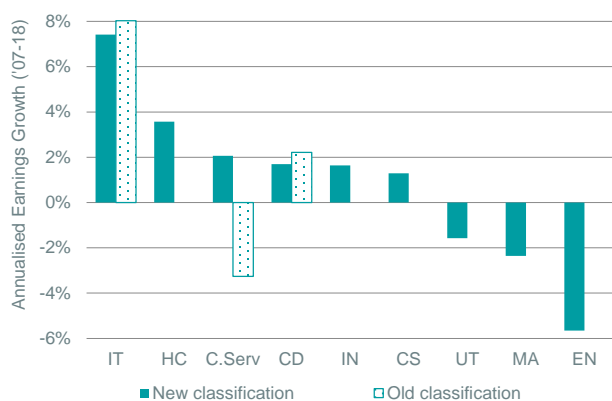
	Current universe	1989 Comparable
Nominal Sales growth (Annualised)		
2007-18	2.8%	1.1%
2011-18	0.6%	-0.6%
Real Economic Earnings growth (Annualised)		
2007-18	1.4%	0.7%
2011-18	0.1%	-0.2%

Source: DWS and CROCI. Aggregated data of companies in CROCI's coverage. Data as available on 15 February 2018.

Asset-light companies have delivered higher earnings growth

Analysing earnings growth by sector reveals an interesting picture. The weakness in growth is not uniform—some sectors (IT and Health Care for example) have managed to deliver strong earnings growth, whilst others have lagged. The sectors that have managed to deliver growth can be classified as “asset-light” whereas those that have delivered negative growth since 2007 are all “asset-rich”, requiring large fixed capital investments to generate revenues and earnings.

Figure 8: Real Economic Earnings Growth by Global Sector



Source: DWS, CROCI. The chart shows annualised inflation-adjusted growth in Economic Earnings between 2007 and 2018. “Old classification” of Communication Services represents the legacy Telecommunication Services. Agglomerated data of companies in CROCI's coverage. Data as available on 11 February 2019.

Figure 8 shows the annualised aggregated earnings growth of various economic sectors between 2007 and 2018. The strongest growth has come from the IT sector. Health Care and legacy Consumer Discretionary are next best.

The newly formed Communication Services sector consists of the old Telecom Services sector and Media &

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Entertainment (companies previously part of the IT and Consumer Discretionary sectors). The aggregate 2% annual growth in real economic earnings all comes from Media & Entertainment. The more capital intensive Telecoms lagged.

The growth statistics of the other physical-asset-driven sectors (namely Energy, Materials and Utilities) is similar. All have delivered negative real economic earnings growth. This explains the weakness in fixed capital expenditure observed since the 2008 financial crisis. **Faced with uncertain return prospects, companies operating in capital-intensive sectors have deferred expenditure on fixed assets.** The disparity in growth between the asset-light and the asset-rich sectors also points to a more fundamental change taking place within the broader economy. Asset-light companies are managing to grow despite the weak macroeconomic environment.

Figure 9: Returns and Valuation by Global Sector

2019E	CROCI	EV / NCI	Ec. PE	Ec. Earn'gs Gth. Rank
Comm. Svcs.	6.6%	1.82x	27.5x	3
Discretionary	5.1%	1.57x	31.0x	4
Staples	13.2%	3.49x	26.5x	6
Energy	3.0%	0.81x	27.0x	9
Health Care	16.0%	3.48x	21.8x	2
Industrials	8.2%	1.98x	24.2x	5
IT	15.7%	3.81x	24.3x	1
Materials	5.8%	1.32x	23.0x	8
Utilities	3.1%	0.96x	31.0x	7

Source: DWS and CROCI. Sector ranks are based on economic earnings growth between 2007 and 2018. Aggregate data of companies in CROCI's coverage. Data as available on 5 March 2019.

The fallacies of conventional sector classifications

Nevertheless, investors need to be careful about following sector classifications. Sector classification is nothing but a typology that aims to bring together companies that are supposed to have similar characteristics.

We have always had concerns about the classifications proposed by the main index providers. Car manufacturers (which seem naturally to fit into the manufacturing sector) are sometimes deemed as Consumer, and Airlines are often labelled as manufacturers. We would argue that the operational characteristics of railway stocks resemble those of utilities more than manufacturing companies. Both railways and utilities require upfront and significant investments in assets with long lives, producing relatively low but stable cash returns. The recent creation of a communications sector

which combines capital-intensive telecom operators with capital-light companies makes little sense in our view.

Only companies with intangible assets have been able to generate earnings growth recently

Given the ambiguities associated with conventional sector classification, we follow a different line of analysis and instead distinguish between companies where we need to capitalize intangibles and companies where we do not.

Figure 10 shows the results of a comparative analysis since 2007. At an aggregate level it is clear that companies with intangible assets have been able to grow their earnings, unlike companies with only physical capital. Between 2007 and 2018, for our comparable universe, companies with intangible assets have had much stronger earnings growth than the remainder of our global coverage.

Figure 10: Earnings growth has come from companies with Intellectual Capital



Source: DWS, CROCI. Data as available on 1 March 2019.

As this phenomenon could potentially be the result of a few abnormally large companies, we have deliberately performed our analysis whilst removing any size component. This analysis confirms that only companies with intangible assets have been able to grow their real earnings. The trend seems to be even stronger in companies with brands than in companies with R&D, but the results are clear.

Figure 11: Median earnings growth: Global coverage

	# of companies	Median growth (annualised '07-'18)
Companies with brands	80	3.4%
Companies with R&D	286	3.0%
Companies without IC	421	-0.6%
Total	787	1.4%

Source: DWS and CROCI. The table shows median annualised inflation-adjusted Economic Earnings growth of companies with and without brands and R&D. This table excludes certain companies with negative earnings whose growth could not be calculated. Data as available on 31 January 2019.

This could equally be the result of strong growth in a specific sector but, controlling for sector, we find the same outcome. Companies with intangible assets have been able to grow their earnings at a higher rate than companies that are reliant only on fixed assets.

Figure 12: Median earnings growth: by sectors

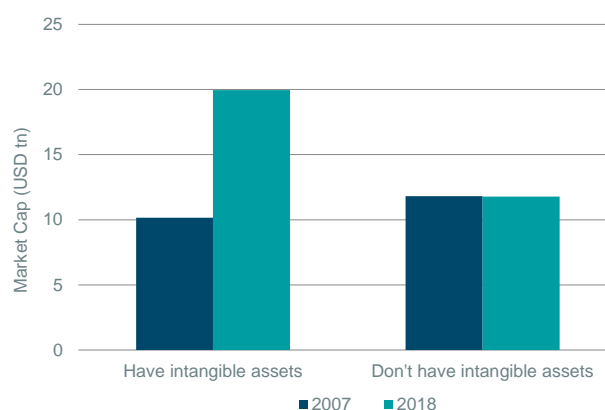
Median 2007-18 annualised growth	Companies with intangible assets	Companies that don't have intangible assets
Communication Services	13.5%	-4.9%
Consumer Discretionary	2.8%	2.9%
Consumer Staples	2.7%	-1.0%
Health Care	4.5%	3.8%
Industrials	1.9%	1.5%
IT	4.4%	4.1%
Materials	3.8%	-3.4%

Source: DWS and CROCI. The table shows median annualised inflation-adjusted Economic Earnings growth of companies with and without brands and R&D. This table excludes Energy, Financials and Utilities companies. Data as available on 31 January 2019.

Share price performance has followed earnings growth

As one would expect this higher earnings growth was rewarded by the market. Companies with Intellectual Capital have seen their aggregate market values double since 2007. By comparison, the market value is almost unchanged for the rest of our coverage relative to the 2007 level.

Figure 13: Share price performance has followed earnings growth

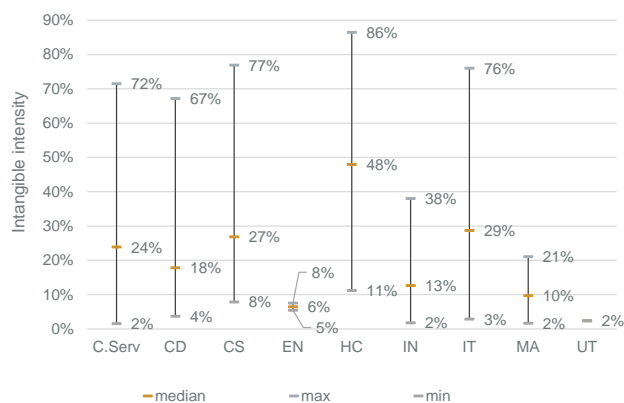


Source: DWS, CROCI. Aggregate data of companies with comparable data going back to 2007. Data as available on 1 March 2019.

Intangible intensity not a driver of performance

With intangibles correctly included on companies' balance sheets, it becomes much easier to compare intangible intensity across different sectors. We define a company's intangible intensity as the proportion of that company's total assets made up by intangible assets. Figure 14 shows that Health Care and IT have the highest median intangible intensity. But there is a broad range of intensities, even within sectors that are generally perceived as innovative. On the other hand, there are some materials companies that are fairly innovative, like speciality chemicals companies. This innovation tends to be focused on processes rather than products.

Figure 14: Innovation itself is more important than intangible intensity



Source: DWS and CROCI. The chart shows the median intangible intensity of the global GICS economic sectors and the maximum and minimum within the sectors. The medians are calculated using companies in CROCI's coverage. Data as of 29 November 2018.

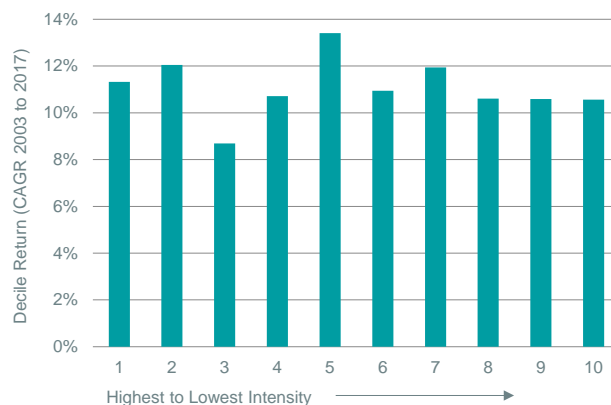
Intangible intensity is not a driver of stock performance

One might expect that the higher a company's intangible intensity, the higher its competitive advantage, but in fact there is no clear evidence supporting such a hypothesis.

A Fama-French style analysis, where stocks are ranked based on their intangible intensity and grouped into deciles, shows little difference between stocks with high and low intangible intensity within CROCI's coverage universe, as shown in Figure 15: Intangible intensity did not have an

impact on performance. The first two deciles (comprising stocks with highest intangible intensity) may have outperformed the lowest intangible intensity deciles, but the strongest performance over this period actually came from the fifth decile, whilst the weakest came from the third decile (above-average intangible intensity).

Figure 15: Intangible intensity did not have an impact on performance



Source: DWS, CROCI. The chart shows annualised local currency return of deciles constructed based on intangible intensity. Deciles are rebalanced monthly using the data that were available at the time of rebalancing. Return is calculated on a buy and hold basis and assumes no transaction costs. Return between 31 December 2003 and 29 December 2017. Past performance is not a reliable indicator of future results. Data as available on 29 November 2018.

Although this may seem surprising, the result can easily be reconciled with other evidence derived from analysing the development of industries over time. In the pharmaceutical sector, for example, there is no clear evidence that the amount of money spent corresponds to the number of new patents registered. In fact, many large companies were only able to offset their decline in profitability through acquisitions. In 2010, Apple only spent 2.7% of its revenues on R&D whilst, Microsoft spent over 14%. But Apple was able to generate far greater profits in the following decade than Microsoft.

The US manufacturing sector in the 1960s provides another striking example. The sharpest competition came from smaller companies. But if size was all that mattered, concentration in the market would have increased rather decreased.

3. Intangible Assets in CROCI

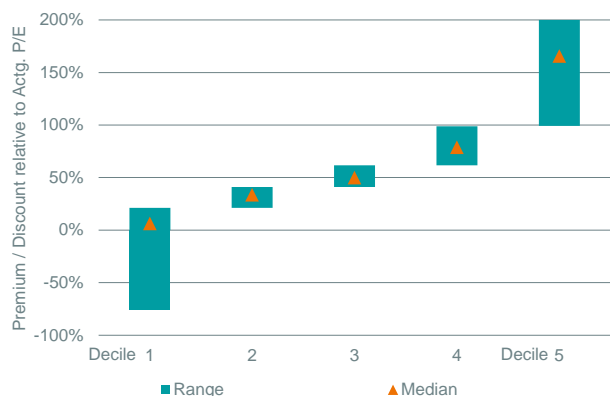
Why investors cannot ignore intangible assets

Intangible assets in CROCI

At the heart of CROCI's approach is the observation that equity investors are part owners of companies. A company's price-to-earnings (P/E) ratio is nothing but its price-to-book (P/B) divided by its return on invested capital (ROE). A thorough analysis of a company's assets and returns is therefore necessary for any meaningful investment analysis. Significant adjustments are required to make reported accounting data fit for a fundamental investor's purpose in our view.

CROCI makes the adjustments necessary for capturing the genuine economic assets and cash flows of a company for all of its ~900-company coverage universe. These adjustments can have a substantial impact on valuations, as shown in Figure 16. CROCI's economic data is comparable across all regions and sectors⁸, providing a sound basis for analysing industrial and corporate dynamics.

Figure 16: Economic valuations differ substantially from accounting valuations



Source: DWS, CROCI. The chart shows the ratio of Economic P/E and Accounting P/E. The coverage is divided into quintiles. Individual columns showing the range for the respective quintile. The y-axis is restricted to 200%. Data as available on 22 February 2019.

There are two types of intangible assets that generate cash flow within companies, but that are routinely left-off the reported balance sheet—R&D and brands. Accounting standards conventionally treat expenditure on creation of such assets (R&D and advertising cost) as operating costs, but we disagree with such an approach. These expenditures tend to be important drivers of companies' earnings—patents and knowhow in the Health Care sector, for example—and need to be capitalised on balance sheets, just as expenditure on physical fixed assets is. This issue may not be relevant to

⁸ See CROCI Focus, *The Performance of Economic Value*, 30 April 2015

an accountant, but it is of fundamental importance to investors as the providers of financial capital.

What about goodwill paid by an acquirer during an acquisition—how does CROCI treat that? This goodwill can generally be split into two components. One part will be the crystallisation of the cash-generative assets of the type mentioned above, brands or R&D that were not on the accounting balance sheet. The other element tends not to generate cash flow, though, and can be thought of as the genuine premium paid over asset values. This is not an operating asset, so we tend to exclude it from our analysis.

A case study on capitalising R&D: Pfizer's acquisition of Pharmacia in 2003

Pfizer acquired Pharmacia for approximately \$56 billion in 2003. Before the acquisition in December 2002, Pfizer had \$10.7bn of tangible fixed assets and \$0.9bn of intangible assets other than goodwill. The reported accounts of Pharmacia from the same period show \$5.6bn of tangible fixed assets, \$1.15bn of goodwill and \$393m of intangible assets other than goodwill. On completion of this acquisition in April 2003, Pfizer recorded Pharmacia's assets and liabilities at their respective fair values in its books.

This revaluation of Pharmacia's assets and liabilities was expected to result in a restatement but the scale was hard to anticipate. Intangible assets saw the biggest jump. Their value increased from the \$393m that was reported in Pharmacia's books to \$37.2bn. The largest component of these acquired intangibles were Developed Technology Rights which were valued at \$31.2bn.

These Developed Technology Rights represent the right to develop, use or sell the acquired products, compounds and intellectual property. These and similar assets are some of the most important assets of pharmaceutical companies, upon which future revenues and profits depend. But they are not reported in the financial statements in a consistent manner. The accounting treatment seems to suggest that these assets were created as a result of the acquisition. Of course, in reality these intangible assets existed before Pfizer acquired Pharmacia, but were simply not reported on the latter's balance sheet.

Even the \$31.2bn of Developed Technology Rights does not represent the entirety of Pharmacia's extant intangible assets. The recognised value only accounts for those assets whose development is sufficiently advanced. A further \$5.0bn of such assets were disclosed as "In Process Research & Development", all of which were written off as expenses in Pfizer's books.

There is wide evidence for the relevance of intangible capital

A simple test for identifying operating expenditure as capital expenditure is to ask ‘over how many years would the expenditure help companies generate revenues’. If the period is greater than one year, then the principle of matching revenues with costs demands the capitalisation of those costs.

It’s difficult to argue that R&D in a pharmaceutical company does not have any value or that the benefit of such expenditure lasts only one year. Following the principle of conservatism, accounting standards require those costs to be written-off as the assets that would otherwise be created are difficult to determine with precision. This has been the case for R&D and advertising for many decades. IFRS allows the capitalisation of some R&D costs, unlike US GAAP, but such assets are only recognised when an acquisition takes place, as the previous example clearly illustrates with regard to Pfizer’s acquisition of Pharmacia in 2003 or of Wyeth in 2009.

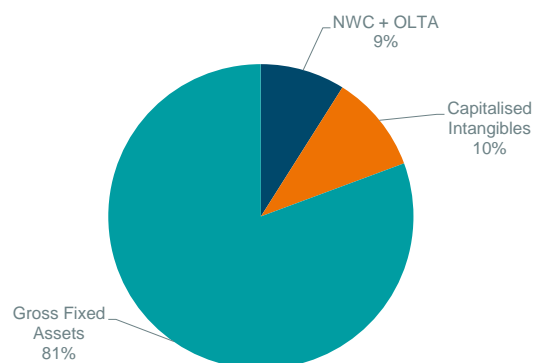
Estimating the economic life of intangibles requires in-depth fundamental analysis and time, but it is possible. References emerge when we diligently scour company accounts and other primary sources. The FDA database has, for example, extensive information related to R&D in the Healthcare sector. IT companies occasionally provide important anecdotes, such as how long it has taken to develop new software, and we also know how often those assets are replaced. For companies where loyalty is generated by advertising (luxury goods or non-cyclical consumer goods), the economic life is based on estimations of what happens to sales when marketing campaigns are ended. Such analysis can be difficult, but our view is that is better to be approximately correct than precisely mistaken, namely the assumption that the economic life of R&D in the pharma sector is one year or less. Even so, the CROCI approach remains conservative and does not capitalise brands in IT or pharmaceutical companies, as we believe the source of the competitive advantage in these sectors is the R&D. Sony, Nokia, Motorola and AOL were all household names until their product leadership faded, and their brand name soon followed.

Sceptics might well argue that this approach is subjective but the same is true for other fixed assets. Estimation of the useful life of intangible assets is not very different from that of fixed assets. The capitalisation of fixed assets in the cement and steel industry in China assumes that the current rate of investment in infrastructure, which some deem unsustainable, will be maintained over the next two decades. When the investment rate eventually comes down, assets employed in such industries will need to be written off. This is just another way of saying that the economic life of those assets is shorter than the period over which these companies are depreciating their assets. Longer assumed asset lives naturally result in lower depreciation charges and therefore an artificial boost in earnings.

As a final note, the US GDP Statistics Office has been capitalising research and development expenditure since 2015. R&D investments are reported in ‘intellectual property products’. Within the CROCI Investment and Valuation Group, we have recognised the need to capitalise R&D costs since 1996.

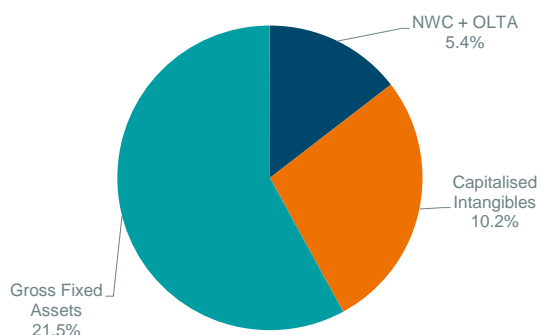
CROCI treats Intellectual Capital as a genuine asset

Figure 17: Asset composition: global coverage



Source: DWS, CROCI. The chart shows composition of gross assets of companies in CROCI’s coverage. Agglomerated data as available on 13 February 2019.

Figure 18: Asset composition: global coverage with intellectual capital



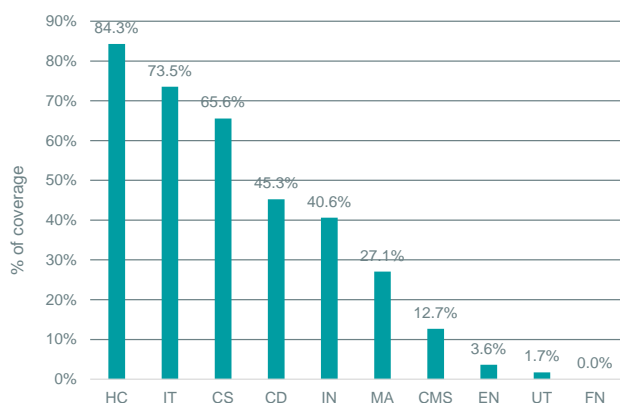
Source: DWS, CROCI. The chart shows composition of gross assets of companies in CROCI’s coverage. Agglomerated data as available on 13 February 2019.

Companies with intellectual capital are ubiquitous

As expected, Figure 19 shows that intangible assets are clearly more important in certain sectors than in others. For example, four-fifths of Health Care companies have intellectual capital. Even so, sectors that are less keenly associated with Intellectual-Capital, such as Industrials and Consumer Discretionary, also have intellectual capital assets. Nearly two-fifths of CROCI’s coverage in both these sectors

have Intellectual Capital. Even Materials and Energy sectors have such assets, albeit more localised in narrow sub-sectors such as Speciality Chemicals and Drillers.

Figure 19: Proportion of companies by sector with intellectual capital



Source: DWS, CROCI. The chart shows proportion of companies in CROCI coverage with Intellectual Capital assets. Data as available on 29 November 2018.

Capitalising intangibles can substantially alter profitability

Adding intellectual capital to companies' balance sheets can have a significant impact on profitability as well as valuation ratios.

The impact is not uniform though. The degree to which profitability falls depends upon the relative mix of reported and hidden assets on companies' balance sheets, as well as the expenditure on those assets and the period over which economic benefits from those expenditures are likely to flow to the company.

Figure 20: Estimated life of capitalised intangibles



Source: DWS, CROCI. The chart shows estimated life of intangible assets capitalised by CROCI. Agglomerated data of companies in CROCI's coverage. Data as available on 13 February 2019.

As Figure 20 shows, the useful life of these assets varies depending upon the type of the asset, the sector in which the company operates and unique characteristics of those assets.

For example, intangible expenditure forms a large part of a pharmaceutical company's capital expenditure and the resulting assets have a long life. The result is that the total capital employed in pharmaceutical companies is over 3x times their reported assets. *Caeteris paribus*, the same level of profits over a much larger asset base will bring down the expected rate of return on equities, but also the price-to-book ratio.

Figure 21 shows three case studies of the impact such capitalisation can have on reported assets and profitability. The companies are selected from the three sectors with the highest concentration of intangible assets. Each company spends between 13% and 17% of its sales on intangibles. But, because of the differences in the useful lives of the resulting assets, their capitalised values are quite different. These intangibles make up 28% of CROCI's estimate of Microsoft's net capital invested but 76% of Coca-Cola's.

Figure 21: Impact of capitalisation on reported assets and profitability⁹

2017 data (mn)	Microsoft (USD)	Sanofi (EUR)	Coca-Cola (USD)
Intangible Type	Software R&D	Pharma R&D	Brands
Average life of intangibles	4y	12y	15y
% of sales capitalized	13%	15%	17%
Assets			
Shareholder equity ex GW	41,286	5,330	363
CROCI Net Cap. Intangibles	24,494	29,785	38,431
CROCI Net Cap. Invested ex GW	87,347	50,224	50,625
Intangible Intensity	28%	59%	76%
Profitability (ex GW)			
ROE	73.9%	100.8%	896.4%
CROCI	27.5%	11.7%	11.8%
EV / NCI	7.71x	2.13x	3.69x
P / B (ex Goodwill)	16.2x	19.4x	528.3x

Source: DWS and CROCI. Data as available on 13 February 2019.

⁹ For illustrative purposes only. This material does not amount to a recommendation or advice.

The opinions and estimates contained herein are based on or derived from publicly available information from sources that we believe to be reliable. We do not guarantee their accuracy. The underlying assumptions and these views are subject to change without notice. This material is for informational purposes only and should not be construed as, investment advice or recommendations with respect to the securities or investments mentioned. Past performance is not an indicator of future results. Market and index performance data is sourced from 20 Bloomberg Finance L.P. Company data is from the CROCI database. Unless stated this data is as of February 2019.

These capitalised intangibles have a substantial impact on the profitability of these companies. All three companies look quite profitable on conventional measures but less-so once all of their assets are taken into account. In the case of Coca-Cola, the return on equity of 896% translates into a CROCI of just 11.8%.

Capitalising intangibles and the economics of sectors

Figure 22 and Figure 23 show the economics of the various sectors once we capitalise intangibles:

- The IT sector invests as much (as a percentage of revenues) as the Utilities sector (13.4% vs 15.6%) and more than Energy (13.4% vs 11.1%), but its split is very different, with 6.5% in tangible capex and 6.9% in R&D, whilst investments made in Utilities and Energy only take the form of tangible capital.
- Capital invested in IT & Health Care is a fraction of the capital employed in Utilities, Telecoms and Telecoms,

but the former generate a much higher level of Economic Earnings.

- Health Care, Materials and Energy have similar levels of capital intensity. They generate the same sales output per unit of gross inflation-adjusted capital, but Health Care has a much higher margin, a sign of a strong competitive advantage. IT and Industrials also have the same capital productivity but very different margins.
- Telecoms has the highest margins, but also the lowest capital productivity, which is why the sector only manages to deliver a 4.5% CROCI. Their capital productivity is similar to that of the Utilities sector, but the latter has an even lower margin.
- Let's not forget that margin ought to be a function of capital intensity. The higher the required capital, the higher the margins ought to be. Margins in isolation can only tell part of the story.

Figure 22: Operational characteristics: Global coverage by sectors

Average (2007-18)	Comm. Svcs.	Telecom	C. Disc.	Staples	Energy	H. Care	Indus'ial	IT	Material	Utilities
Annual Earnings Growth										
2007-17	-0.2%	-6.7%	0.7%	0.7%	-11.3%	3.0%	0.5%	6.2%	-3.9%	-2.5%
2007-18	2.1%	-3.3%	1.7%	1.3%	-5.7%	3.6%	1.6%	7.4%	-2.4%	-1.6%
CROCI	6.2%	4.5%	5.2%	11.8%	5.0%	15.0%	7.6%	14.6%	5.8%	3.6%
Sales / GCI	0.39	0.33	0.79	1.13	0.58	0.62	0.94	0.96	0.61	0.28
CROCI Cash Flow Margin	29.3%	30.3%	14.7%	13.7%	14.0%	28.7%	12.1%	24.1%	14.5%	18.0%
Ec. Life of Tangible Assets	13	13	11	15	19	13	15	9	19	34
Tangible Capex / Sales	15.5%	17.7%	7.0%	3.7%	11.1%	4.0%	5.0%	6.5%	7.7%	15.6%
Intangible Capex / Sales	0.7%	0.0%	3.4%	2.9%	0.0%	9.2%	1.5%	6.9%	0.9%	0.0%
Ec. Earnings (USD bn)	165	106	161	173	214	184	192	190	95	101
Real NCI (USD bn)	2,676	2,386	3,074	1,464	4,417	1,225	2,520	1,284	1,650	2,820
# Employee ('000s)	4,581	3,315	13,776	9,569	3,085	3,239	11,674	9,201	3,042	1,473

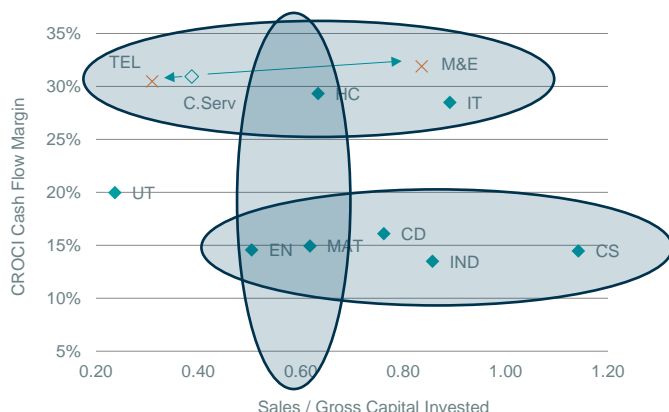
Similar asset productivity but different margins...

Similar capex but different mix...

More capital but lower earnings

Source: DWS and CROCI. The table shows selected operational characteristics of companies in CROCI's coverage. GCI and NCI stand for Gross and Net Capital Invested. Average agglomerated data between 2007 and 2018 as available on 11 February 2019. Number of Employees and Sales per employee data is of 2018.

Figure 23: Drivers of returns



Source: DWS, CROCI. The chart shows the two main drivers of cash returns namely Cash Flow Margins and Capital Intensity (Sales / Gross Capital Invested) of non-financial sectors. Agglomerated 2018 data of companies in CROCI's coverage. Data as available on 11 February 2019.

Intangibles in Financials

In 2009 Paul Volcker gave an interesting talk at the Wall Street Journal Future of Finance Initiative when he said that “the most important financial innovation I have seen in the past 20 years is the automatic teller machine”. In the CROCI team we believe there is no meaningful intangible asset at most large banks. This is also the case for many Food Retailers, Utilities, Energy and Telecom stocks. Some may argue their brand names are such assets but for us those brand names are of little value as those do not provide these companies with competitive advantages. A bigger source of competitive advantage at such companies is their location. This is clear from the analysis of profitability of these companies that tend to be at or below the cost of capital.

4. The rise of the knowledge-based economy

Earnings growth reflect underlying macroeconomic changes

The dynamics we have described in the previous pages reflect the changes taking place in the underlying economy. There was certainly a bubble in equities in 2000 on the back of the TMT (Technology-Media-Telecoms) frenzy in the expectation of dramatic changes to the economy. Twenty years on, many of the changes have actually taken place. Our living and working styles have been profoundly affected.

The new economy companies now dominate every aspect of modern life, providing the hardware for accessing the internet, the ability to search it, one platform for accessing news and people, and another for buying things. Their position must remind students of the economic history of the famous monopolies enjoyed a century ago by companies such as Standard Oil. It is certainly fair to say that a few IT stocks now have economic power and wealth similar to the old Rockefeller hegemony.

The labour-light economy and the decline of middle-skilled labour

The change in the structure of the economy is especially evident when looking at sectors such as retailing. The Centre for Retail Research in the UK shows that 148,000 jobs were lost in UK retail and hospitality over the course of 2018 and almost 20,000 shops and restaurants closed down¹⁰. Retailing had been a very stable industry for decades. There have been changes in the way the industry operated, such as the emergence of shopping malls and large out-of-town supermarkets as shopping habits changed thanks to the increasing penetration of autos and white goods over the 1950s and 1960s. But 'location, location, location' was always the fundamental driver of the industry's structure. Suddenly the internet made location irrelevant, leading to fundamental changes.

Access to stores is now increasingly through portals. One can shop virtually in any shop at any time. Machine-learning software is now aware of shoppers' habits, frequently presenting them with options that suit their individual tastes and needs, largely replacing (i) the need for physical stores and (ii) the customer service traditionally provided by vendors. This is in addition to the discounting power generated by scale and no requirement for traditional bricks and mortar investment.

Technology is polarising the job market and is changing the structure of the economy

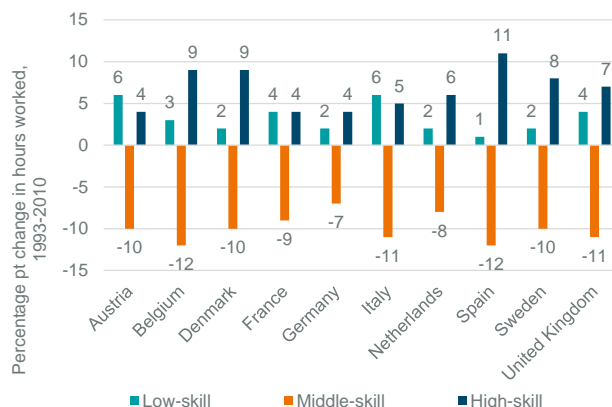
In 1931, John Maynard Keynes warned about the risks of technological unemployment due to the discovery of

technology capable of economising the use of labour at a rate outpacing our ability to find new uses for labour (*Economic possibilities for our grandchildren*, 1931).

One should not be overly pessimistic about the long term, but there is little doubt that technological improvements are continuing to bring deep changes to the economy and wider society.

In a paper published in 2016, Berger and Frey, from the Oxford Martin Programme on Technology & Employment, argued that technological change since the computer revolution had reduced demand for workers with middle skills and increased demand for high skills and low skills, resulting in a more polarised society.

Figure 24: Labour market polarisation



Source: Structural Transformation in the OECD, Berger & Frey, OECD publishing, p 13

They also estimated that only 0.5% of the workforce was employed in industries that did not exist at the turn of the century. This compared with 8% of new jobs created by new industries in the 1980s and 4.5% of new jobs created by new industries in the 1990s.

Thus they suggest that new technology is responsible for a more polarised job market which does not create many new jobs, and that the nature of current technological development is a key driver behind widening earnings disparities.

¹⁰ 150,000 high street jobs lost in 2018, *Retail Gazette*, 24th December 2018,

<https://www.retailgazette.co.uk/blog/2018/12/150000-high-street-jobs-lost-2018/>

The low growth in jobs in new technologies could also explain the anaemic rate of economic growth. Frey and Osborne¹¹ argued that 47% of US jobs are at risk to automation in the coming decade. 'Our model predicts that most workers in transportation and logistics occupations, together with the bulk of office and administrative support workers, and labour in production occupations, are at risk.'

The increasing importance of brands within the economy

If the importance of R&D and new technology is becoming increasingly evident, brands have also historically played an important role. The concept behind brands is not new. They are historically associated with companies trying to create an image of a physical product so as to create attachment such that, in a supermarket or on the high street, a consumer would prefer a particular branded product to a generic one.

In a world without physical capital attached to distributing a product, the brand will continue to have an important role.

¹¹ Frey & Osborne, *The Future of Employment: How Susceptible are Jobs to Computerisation*, Oxford Martin School, 2013

5. CROCI Intellectual Capital

From Economic Analysis to Investments

The Valuation Conundrum

Creating a definitive analysis which identifies the impact of individual changes on the reasons behind lukewarm earnings growth can be challenging. However, one line of thinking is that the weak earnings growth since the 2008 financial crisis is a function of the inability of new technologies to generate new jobs, at the same time as disrupting the middle-skilled job market.

Labour polarisation, the rise of the gig economy and growing disparity in income and wealth distribution are all results of this change. In this evolutionary context, it makes sense for investors to protect themselves and not invest in old economy companies driven primarily by fixed assets.

Within this section we analyse the valuation of the two groups and highlight some principles that we believe should be considered in investing in Intellectual Capital.

Figure 25: Operational and Valuation characteristics of companies with and without Intellectual Capital

2018	With IC	Without IC (ex Fin.)	Financials
Assets			
Accounting P/E	18.8x	14.7x	9.7x
Economic P/E	23.7x	26.6x	16.2x
Adj. CROCI P/B	2.88x	1.30x	1.31x
Annualised 5Y Growth			
Sales Growth	2.7%	-1.3%	-
Real Economic Earnings	5.7%	-2.3%	6.9%
Profitability and Cash Flow			
CROCI (RoC for Financials)	12.1%	4.9%	11.2%
FCF / Sales (Post-Tax)	9.7%	5.1%	-
Leverage			
Net Financial Liabs / M. Cap	18.3%	50.7%	-

Source: DWS and CROCI. The table shows selected operational and valuation characteristics of companies with and without Intellectual Capital. Aggregate data of companies in CROCI's coverage. Data as available on 1 March 2019.

It would seem reasonable to expect old economy companies to trade at a discount to the broader market, given the structural challenges that they face, but this is not the case. Figure 25 shows that they are in fact at a premium while demonstrating lower growth and higher leverage risk.

Companies without IC generate a cash return of 4.5%, below cost of capital. Despite this, the group trades on an economic price-to-book of 1.24x. Meanwhile, the IC group's price-to-book is 2.7x, reflecting its much higher cash return of 11.9%.

Figures 26 and 27 further indicate that the significant differential of real economic earnings between companies with and without intellectual capital. Although growth in both was relatively similar between 1989 and 2007, this trend has dramatically diverged over the past ten years.

There is more supporting analysis on the operational and valuation characteristics of companies with and without Intellectual Capital assets in Appendix 1.

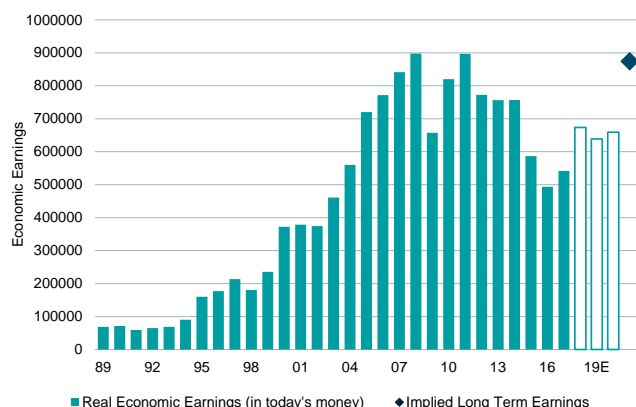
Figure 26: Economic Earnings of companies with Intellectual Capital



Source: DWS, CROCI. The chart shows aggregated inflation-adjusted Economic Earnings of CROCI's coverage of companies that have Intellectual Capital. Data as available on 27 February 2019.

The opinions and estimates contained herein are based on or derived from publicly available Information from sources that we believe to be reliable. We do not guarantee their accuracy. The underlying assumptions and these views are subject to change without notice. This material is for informational purposes only and should not be construed as, investment advice or recommendations with respect to the securities or investments mentioned. Past performance is not an indicator of future results. Market and index performance data is sourced from 20 Bloomberg Finance L.P. Company data is from the CROCI database. Unless stated this data is as of February 2019.

Figure 27: Economic Earnings of companies without Intellectual Capital



Source: DWS, CROCI. The chart shows aggregated inflation-adjusted Economic Earnings of CROCI's coverage of companies that don't have Intellectual Capital. Data as available on 27 February 2019.

Investment strategy for the knowledge driven economy

So, how should investors position themselves to benefit from this structural shift?

Thematic investing has been on the rise over the past few years, but we shy away from ultra-specialised approaches. Instead we seek long term sustainability of an investment approach, not speculative analysis. The rise and fall of cryptocurrency or the 2001 dot-com bubble provide poignant reminder of the risks that lurk. In the latter example, investors correctly judged the Internet to be a major driver of future commerce. But many of the companies that were set up to take advantage of that future didn't survive the crash that followed. Such trend-following commonly drives up valuations allowing companies with even dubious business models to spread.

Our approach requires something broader, something that captures the structural rise of Intellectual Capital across multiple industries and regions/markets. In particular, such an investment strategy ought to:

- Take all listed firms into consideration that have intangible assets, regardless of sector or region, including emerging markets;
- Remove unnecessary risks, in particular avoiding:
 1. Poor profitability. Investments in Intellectual Capital that do not enhance profitability are of little use to investors. Superior profitability is a measure of competitive strength. Companies at the bottom-end of the profitability scale vs. their peers clearly lack this advantage. In any case, it is hard to argue that companies with continued weak profitability will be

able to grow their earnings or even survive in the long term.

2. High financial leverage. This is a risk that overlaps with the one above. High debt levels introduce additional risks, as well as providing an indication of maturity. At companies that don't have stable returns (such as Utilities), high debt levels commonly indicate that these companies are not able to generate enough cash organically, preventing any sustainable earnings growth.
3. Poor ESG rating. We do not believe that growing with poor governance or at the expense of others is sustainable in the long term. We are unwilling to risk such exposure in a world characterised by ever increasing scrutiny.

- Focus on companies that are able to leverage their Intellectual Capital to drive profitability and earnings growth. Our preferred strategy focuses on the 100 largest companies based on their real economic earnings.
- Avoid overpaying. A company's weight in the portfolio should reflect the real level of earnings of a company rather than the market cap, which risks embedding excess expectations.
- Transparent and systematic. This helps avoid any style drift that often arises in ultra-specialised or more discretionary approaches.
- Reassess changes in the structure on a regular basis. We review the process every three months to ensure we capture new entrants and capture the changes that are taking place in the underlying economics of the business.

Performance, Sector and regional characteristics

Using the CROCI database of around 900 large-cap companies, we analyse the results of this approach. Our simulation runs from February 2004 (when the CROCI team started to create "as seen" data, with a daily snapshot of the database). This removes biases created by looking at data ex-post, and which may contains survival bias. Our analysis instead considers the universe in existence at the relevant point in time along with its relative valuation.

This simulation¹² produces the following results:

- This investment strategy delivered a 9.3% annual return up to the end of 2018, outperforming the MSCI All Countries by 270 bps. The volatility of this strategy was 12.9%, a full 160 bps below the benchmark.
- This higher performance combined with the lower overall risk increased the Sharpe Ratio of the strategy to 0.61—80% higher than the benchmark at 0.34.

¹² There is no guarantee that stated returns will be realised. Please refer to page 2 for additional disclosure on simulated data.

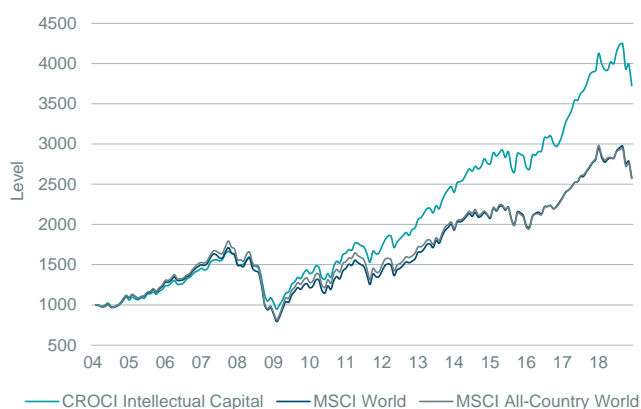
The opinions and estimates contained herein are based on or derived from publicly available Information from sources that we believe to be reliable. We do not guarantee their accuracy. The underlying assumptions and these views are subject to change without notice. This material is for informational purposes only and should not be construed as, investment advice or recommendations with respect to the securities or investments mentioned. Past performance is not an indicator of future results. Market and index performance data is sourced from 20 Bloomberg Finance L.P. Company data is from the CROCI database. Unless stated this data is as of February 2019.

- The strategy outperformed the benchmark in all but four years over this period. In two of those four years—2005 and 2006—the underperformance was because of substantial outperformance of Financials and Real Estate sectors. The only other year showing a material underperformance was 2016, when high capital-intensity sectors with high operational leverage outperformed on expectations of Trumponomics.
- A multi-factor attribution of the performance shows that the outperformance has come from (i) specific factors (stock selection), (ii) sector and (iii) country bets. Style exposure (“risk indices”) was generally neutral.
- The strategy is currently exposed to seven of the ten economic sectors. IT, Health Care and Consumer

Staples have the largest weights but the strategy continues to have a meaningful exposure in Consumer Discretionary, Industrials and Materials sectors as well.

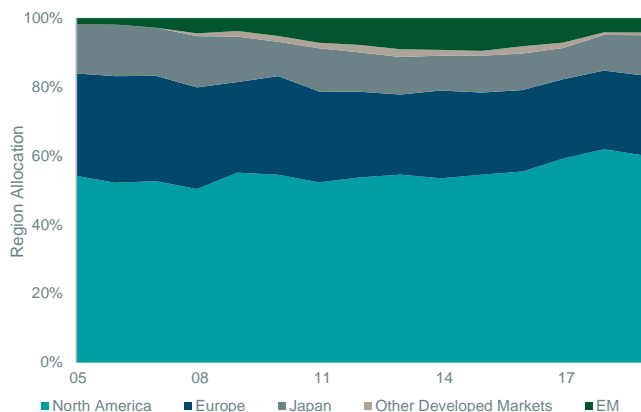
- The strategy is currently overweight North America, Europe and Japan. The weight in Emerging Markets is nearly a third of that of the MSCI All-Countries World Index.
- Historically the strategy has overweighted different sectors and regions depending on their ability to leverage Intellectual Capital to drive earnings growth. The strategy seeks exposure to this ability regardless of the region or sector classification of individual companies.

Figure 28: Simulated CROCI Intellectual Capital Strategy Performance



Source: DWS, CROCI. The chart shows simulated Strategy performance between 27 February 2004 and 31 December 2018. The performance is calculated by retroactive application of the strategy model. Past performance is not a reliable indicator of future results. Please refer to page 2 for additional disclosure on simulated data. Data as available on 5 March 2019.

Figure 29: Simulated regional allocations of CROCI Intellectual Capital Strategy



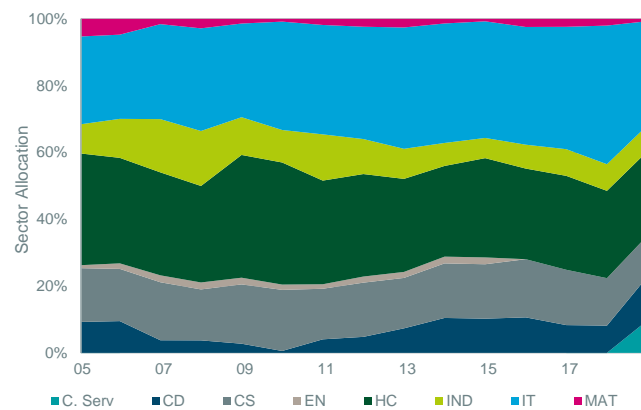
Source: DWS, CROCI. Data between 27 February 2004 and 31 December 2018. Regional allocations are derived by applying the CROCI Intellectual Capital Strategy model retroactively. Past performance is not a reliable indicator of future results. Please refer to page 2 for additional disclosure on simulated data. Data as available on 5 March 2019.

Figure 30: Performance analysis

	CROCI IC	MSCI World	MSCI ACWI
Comp. Annual Growth	9.3%	6.6%	6.6%
Annualised Monthly Vol	12.9%	14.5%	14.9%
Sharpe Ratio (1.41%)	0.61	0.36	0.34
% of months with gains	64.0%	62.9%	61.8%
Tracking Error		4.1%	4.5%
Information Ratio		0.66	0.61
Worst drawdown	-43.1%	-53.7%	-54.6%
Time to Recov. (month)	33	69	69

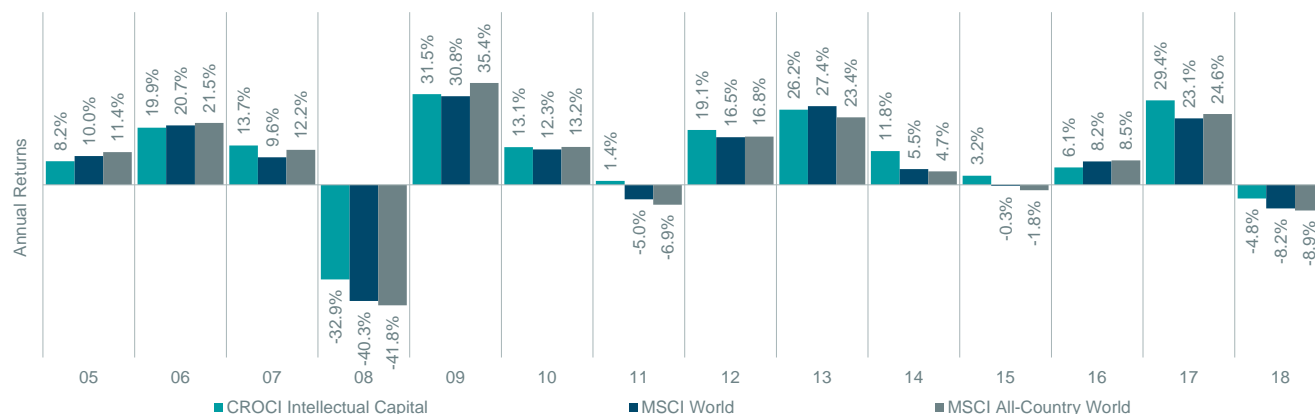
Source: DWS, CROCI. The chart shows simulated Strategy performance between 27 February 2004 and 31 December 2018. The performance is calculated by retroactive application of the strategy model. Past performance is not a reliable indicator of future results. Please refer to page 2 for additional disclosure on simulated data. Data as available on 5 March 2019.

Figure 31: Simulated sector allocations of CROCI Intellectual Capital Strategy



Source: DWS, CROCI. Data between 27 February 2004 and 31 December 2018. Sector allocations are derived by applying the CROCI Intellectual Capital Strategy model retroactively. Past performance is not a reliable indicator of future results. Please refer to page 2 for additional disclosure on simulated data. Data as available on 5 March 2019.

Figure 32: Simulated CROCI Intellectual Capital Strategy annual total returns in USD



Source: DWS, CROCI. The chart shows simulated CROCI Intellectual Capital Strategy performance between 27 February 2004 and 31 December 2018. The performance is calculated by retroactive application of the strategy model. Past performance is not a reliable indicator of future results. Please refer to page 2 for additional disclosure on simulated data. Data as on 5 March 2019.

Operational characteristics and an evolutionary conclusion

Looking at the operational characteristics of the CROCI Intellectual Capital portfolio, we note:

- High Cash Returns: CROCI Intellectual Capital Strategy has a weighted average cash returns of 23% (5 pp ahead of the market-cap weighted selection pool). This cash return is driven by higher margins whilst asset productivity (sales / gross capital invested) is slightly below the selection pool. Higher cash returns are a sign of a competitive advantage.
- Higher cash generation: Free cash flow-to-sales is substantially higher than the selection pool (17.3% vs 13.6%). A significant proportion of this higher free cash flow is retained, reducing the need for debt to fund growth. The weighted dividend yield of CROCI Intellectual Capital Strategy is 2.2%.
- Higher Economic Price-to-Book (EV / NCI): consistent with higher cash returns.
- Attractive valuation: Both on Economic P/E and FCF yield.
- Revenue growth is below that of the selection pool but still attractive at 8%.
- Financial Leverage of only 6.7%. The weighted average for the selection pool is 31.8%.
- The combined market cap of this group of companies is USD 11.3 tn.

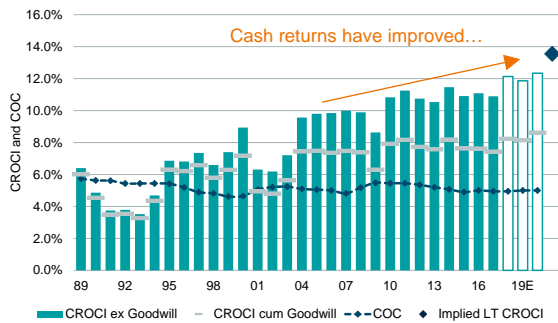
Figure 33: Simulated Operational Characteristics

FY1 data on 31 December 2018	CROCI IC	Selection Pool
Profitability		
CROCI	23.0%	18.0%
EBITDA Margin	30.5%	27.1%
Sales / Gross Capital Invested	0.86x	0.90x
Sales Growth	8.0%	8.8%
Cash Generation		
FCF / Sales	17.3%	13.6%
FCF after dividends / Sales	12.3%	8.1%
Valuation and Leverage		
EV / NCI (Economic P / B)	5.62x	5.02x
Economic P / E	18.4x	24.9x
Accounting P / E	14.2x	15.1x
FCF Yield	5.7%	4.6%
Dividend Yield	2.2%	2.7%
Net Fin. Liabilities / Mkt Cap	6.7%	31.8%

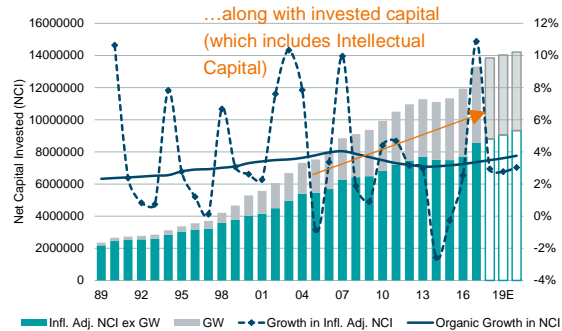
Source: DWS and CROCI. The table shows weighted characteristics of CROCI Intellectual Capital Strategy and of the selection pool. The latter is made up of CROCI's global coverage and for this table excludes Financials. The selection pool is weighted using market cap of individual stocks. Simulated data calculated by retroactive application of the strategy models. Past performance is not a reliable indicator of future results. Please refer to page 2 for additional disclosure on simulated data. Data as available on 5 March 2019.

Appendix 1: Intellectual Capital — CROCI

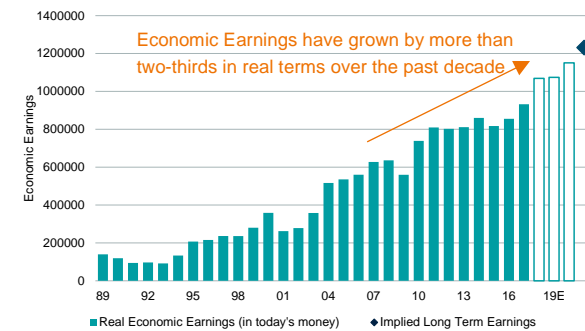
CROCI cum and ex Goodwill & Implied CROCI



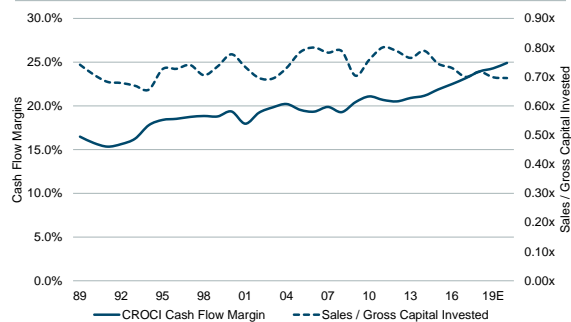
Net Capital Invested*



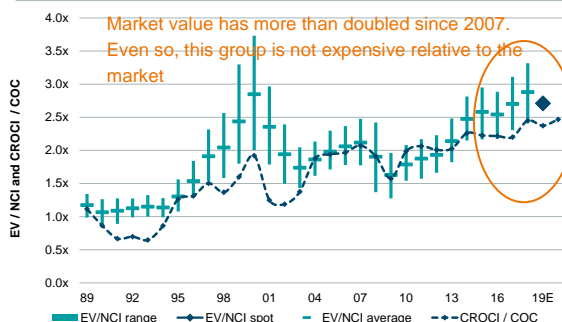
Economic Earnings & Implied Economic Earnings*



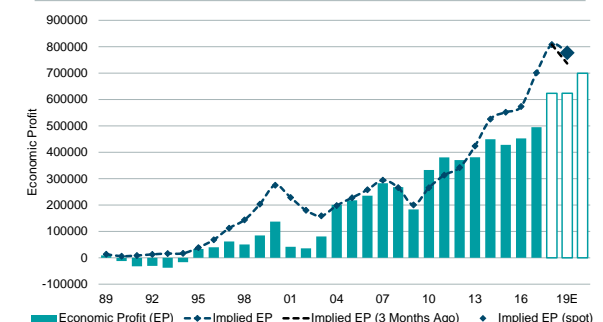
CROCI Drivers



Value & Returns ex Goodwill



Economic Profit & Implied EP ex Goodwill



	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018E	2019E	2020E
Enterprise Value (USD bn)	9116	7845	7120	7139	8377	9097	10015	11570	10813	9479	11060	12310	13253	15286	17398	18386	18905	22493	25008	24625	23991
Market Cap (USD bn)	8433	6943	5954	5970	7157	7860	8954	10304	8896	7662	9425	10483	11293	13547	15493	16315	16481	19523	21592	21541	21541
EV/NCI Ex. GW	2.85x	2.36x	1.94x	1.74x	1.86x	1.98x	2.06x	2.12x	1.90x	1.63x	1.79x	1.88x	1.93x	2.14x	2.47x	2.58x	2.54x	2.70x	2.88x	2.71x	2.52x
Economic PE	31.9x	37.3x	31.4x	24.1x	19.5x	20.2x	20.9x	21.2x	19.2x	18.9x	16.5x	16.7x	18.0x	20.3x	21.6x	23.7x	22.9x	24.8x	23.7x	22.8x	20.4x
Accounting PE	30.6x	35.6x	24.4x	19.2x	17.6x	18.4x	18.6x	18.0x	18.6x	17.0x	13.8x	13.9x	14.6x	16.5x	18.0x	19.1x	18.6x	19.1x	18.8x	18.0x	16.3x
Cost of Capital	4.65%	5.06%	5.21%	5.24%	5.10%	5.05%	5.00%	4.82%	5.18%	5.48%	5.45%	5.45%	5.35%	5.20%	5.07%	4.90%	5.00%	4.95%	4.95%	5.00%	5.00%
CROCI Ex. GW	8.9%	6.3%	6.2%	7.2%	9.6%	9.8%	9.8%	10.0%	9.9%	8.6%	10.8%	11.3%	10.7%	10.5%	11.5%	10.9%	11.1%	10.9%	12.1%	11.9%	12.3%
Implied CROCI	13.2%	11.9%	10.1%	9.1%	9.5%	10.0%	10.3%	10.2%	9.9%	8.9%	9.7%	10.2%	10.3%	11.1%	12.5%	12.6%	12.7%	13.4%	14.3%	13.6%	12.6%
Implied Economic Earnings/ Economic Earnings	148%	189%	163%	126%	99%	102%	105%	102%	100%	103%	90%	91%	96%	106%	109%	116%	115%	123%	118%	114%	102%

Source: DWS CROCI Database. Data as of 28 February 2019. The CROCI database is created from historical data which is derived from company sources, Bloomberg consensus analyst forecasts, and DWS estimates

* Displayed in today's money day's money

These charts show operational and valuation characteristics of various regions and sectors. Past performance may not be a reliable indicator of future results. Market and index performance data is sourced from Bloomberg Finance L.P. Company data is based on historical and current data from the CROCI database and is based on CROCI'S coverage in these regions and sectors. Unless stated this data is as of February 2019. Forecasts are based on assumptions, estimates, views and hypothetical models or analyses, which might prove inaccurate or incorrect. A is based on historical and current data from the CROCI database and is based on CROCI'S coverage in these regions and sectors. All opinions and forecasts are subject to change at any time.

Intellectual Capital — RtN

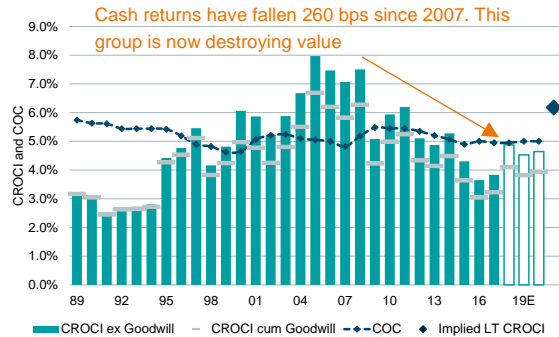
	2010	2011	2012	2013	2014	2015	2016E	2017	2018E	2019E	2020E
Economic P / E (x)	16.5	16.7	18.0	20.3	21.6	23.7	22.9	24.8	23.7	22.8	20.4
Accounting P / E (x)	13.8	13.9	14.6	16.5	18.0	19.1	18.6	19.1	18.8	18.0	16.3
Yield (%)	2.4	2.4	2.4	2.3	2.3	2.2	2.3	2.1	2.0	2.1	2.2
P / BV (x)	2.4	2.5	2.5	2.8	3.2	3.3	3.2	3.3	3.6	3.2	2.8
EV / Sales (%)	137.9	137.8	144.7	165.9	186.7	206.2	206.6	230.6	240.2	231.1	214.6
EV / Adj. EBDIT (x)	7.8	8.0	8.4	9.4	10.3	11.0	10.8	11.6	11.8	11.2	10.0
EV / Free Cash Flow (x)	15.2	19.8	20.5	21.7	23.2	25.2	23.9	26.4	24.8	21.2	18.4
EV / Capital Employed (x)	1.7	1.8	1.8	2.0	2.3	2.3	2.2	2.3	2.4	2.3	2.2
Avg. Market Cap. (bn)	9,425	10,483	11,293	13,547	15,493	16,315	16,481	19,523	21,592	21,541	21,541
Enterprise Value (bn)	10,474	11,673	12,587	14,585	16,696	17,651	18,141	21,622	24,079	23,658	22,978
Key Ratios	2010	2011	2012	2013	2014	2015	2016E	2017	2018E	2019E	2020E
Revenue Growth	14.5	11.5	2.7	1.0	1.7	-4.2	2.6	6.8	6.9	2.1	4.6
Revenue Growth (Median)	-4.3	9.6	7.5	4.3	3.2	3.2	1.3	0.5	3.4	3.6	3.6
Adj. Net Profit Pre-Min. Growth	19.9	9.5	2.6	6.4	4.2	-1.0	3.8	15.5	12.5	3.7	10.4
Adj. EBDIT Mgn	17.7	17.2	17.3	17.7	18.1	18.8	19.1	20.0	20.3	20.7	21.4
Adj. EBIT Mgn	13.3	13.0	13.1	13.5	13.7	14.1	14.3	15.2	15.4	15.7	16.4
Adj. Net Prof. Pre-Min. Mgn	9.3	9.2	9.2	9.7	9.9	10.2	10.3	11.2	11.8	12.0	12.6
Depreciation / Sales	4.5	4.4	4.5	4.5	4.6	4.9	5.0	5.0	5.0	5.0	5.0
Capex / Sales	5.1	5.8	6.1	6.2	6.4	6.9	7.0	7.0	7.2	7.0	6.7
Free Cash-Flow / Sales (Post-Tax)	9.0	7.0	7.1	7.6	8.0	8.2	8.7	8.7	9.7	10.9	11.6
Dividends / Sales	2.9	3.0	3.6	3.5	4.0	5.1	4.6	4.7	4.7	4.3	4.2
Interest Cover (x)	12.8	14.5	14.7	15.7	16.8	16.9	15.4	16.0	15.8	15.8	18.7
Net Debt (-) Cash (+) / Equity	-18.1	-20.9	-20.6	-18.5	-21.3	-25.8	-28.5	-29.3	-33.6	-22.2	-10.2
Return on Stated Equity	16.6	16.3	15.2	15.8	15.8	15.8	15.5	15.9	16.3	17.2	17.1
Return on Cap. Employed (Post-Tax)	12.9	13.0	12.4	12.3	12.3	12.0	11.8	12.1	12.5	12.5	13.3
P&L (USD bn)	2010	2011	2012	2013	2014	2015	2016E	2017	2018E	2019E	2020E
Turnover	7,596	8,470	8,702	8,793	8,940	8,561	8,780	9,378	10,024	10,237	10,709
Adjusted EBDIT	1,341	1,457	1,505	1,558	1,615	1,607	1,679	1,872	2,035	2,116	2,294
Depreciation	346	374	387	393	411	417	440	467	499	516	541
Adjusted EBIT	1,013	1,103	1,142	1,183	1,221	1,211	1,260	1,423	1,546	1,604	1,755
Pre-Tax Profit	841	905	908	993	1,030	998	1,025	1,152	1,243	1,408	1,578
Income Tax	225	248	272	277	293	287	291	323	309	321	355
Stated Net Profit Pre-Min.	683	721	714	811	819	806	834	910	1,043	1,137	1,274
Adj. Net Profit Pre-Min.	710	777	798	849	884	876	909	1,049	1,181	1,225	1,352
Minorities	20	20	20	21	19	18	19	21	23	25	26
Cash Flow (USD bn)	2010	2011	2012	2013	2014	2015	2016E	2017	2018E	2019E	2020E
EBIT before stock options	1,024	1,115	1,151	1,205	1,249	1,216	1,271	1,451	1,597	1,682	1,845
Depreciation	346	374	387	393	411	417	440	467	499	516	541
NWC and Provisions	-45	-143	-148	-99	-75	-32	-36	-123	-108	-23	-29
...Operating Cash Flow	1,325	1,346	1,390	1,499	1,584	1,601	1,675	1,794	1,988	2,176	2,357
Proceeds from Share Issues	-64	-153	-160	-198	-190	-182	-163	-133	-240	-27	0
Dividends Paid	-221	-257	-316	-309	-354	-440	-407	-438	-475	-437	-455
Capex	-391	-487	-531	-548	-575	-593	-611	-659	-723	-712	-722
Net Other Investments	-180	-250	-108	-114	-270	-334	-365	-354	-501	-38	4
Change in Net Debt (-) Cash (+)	146	-134	-41	24	-120	-263	-202	-254	-321	555	747
Balance Sheet (USD bn)	2010	2011	2012	2013	2014	2015	2016E	2017	2018E	2019E	2020E
Net Working Capital	405	470	505	494	447	381	335	427	426	427	437
Net Financial Debt (-) Cash (+)	-751	-912	-955	-931	-1,051	-1,312	-1,524	-1,778	-2,100	-1,544	-797
Gross Tangible Fixed Assets	4,702	4,946	5,141	5,329	5,265	5,363	5,663	6,351	6,613	6,972	7,344
Net Tangible Fixed Assets	1,931	2,050	2,174	2,283	2,294	2,354	2,512	2,840	2,992	3,168	3,336
Other LT Assets	652	696	745	812	811	837	885	994	1,019	1,036	1,056
Stated Shareholder's Equity	4,002	4,191	4,483	4,873	4,792	4,909	5,170	5,840	6,045	6,759	7,623
Minorities	148	165	165	156	148	172	186	220	207	209	212

Source: Company reports, Bloomberg Finance L.P., DWS and CROCI. The table shows aggregate data of companies in CROCI's global coverage. Data in USD as on 28 February 2019.

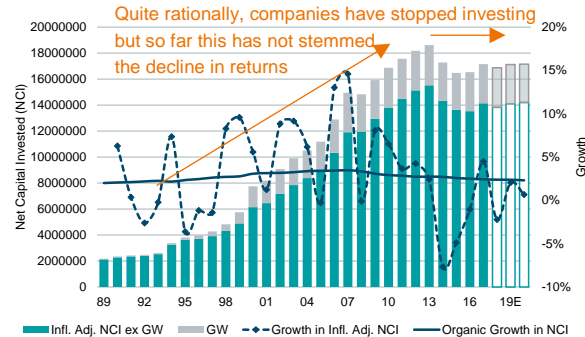
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Excluding Intellectual Capital — CROCI

CROCI cum and ex Goodwill & Implied CROCI



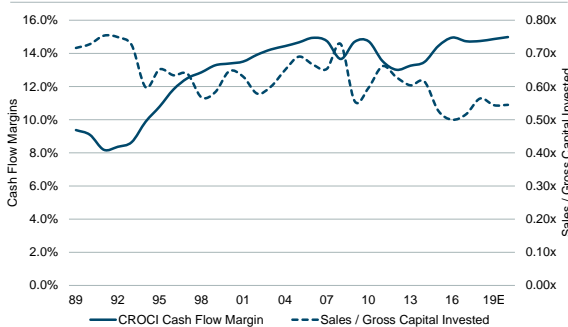
Net Capital Invested*



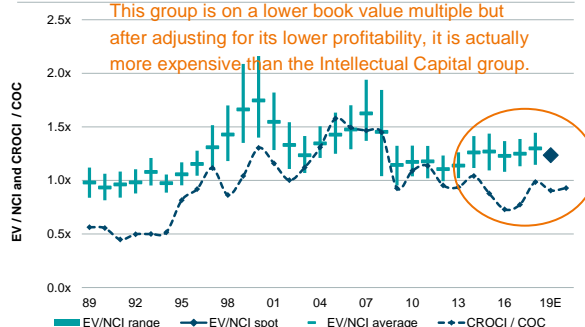
Economic Earnings & Implied Economic Earnings*



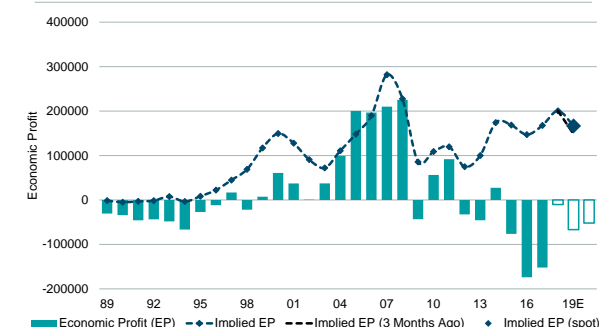
CROCI Drivers



Value & Returns ex Goodwill



Economic Profit & Implied EP ex Goodwill



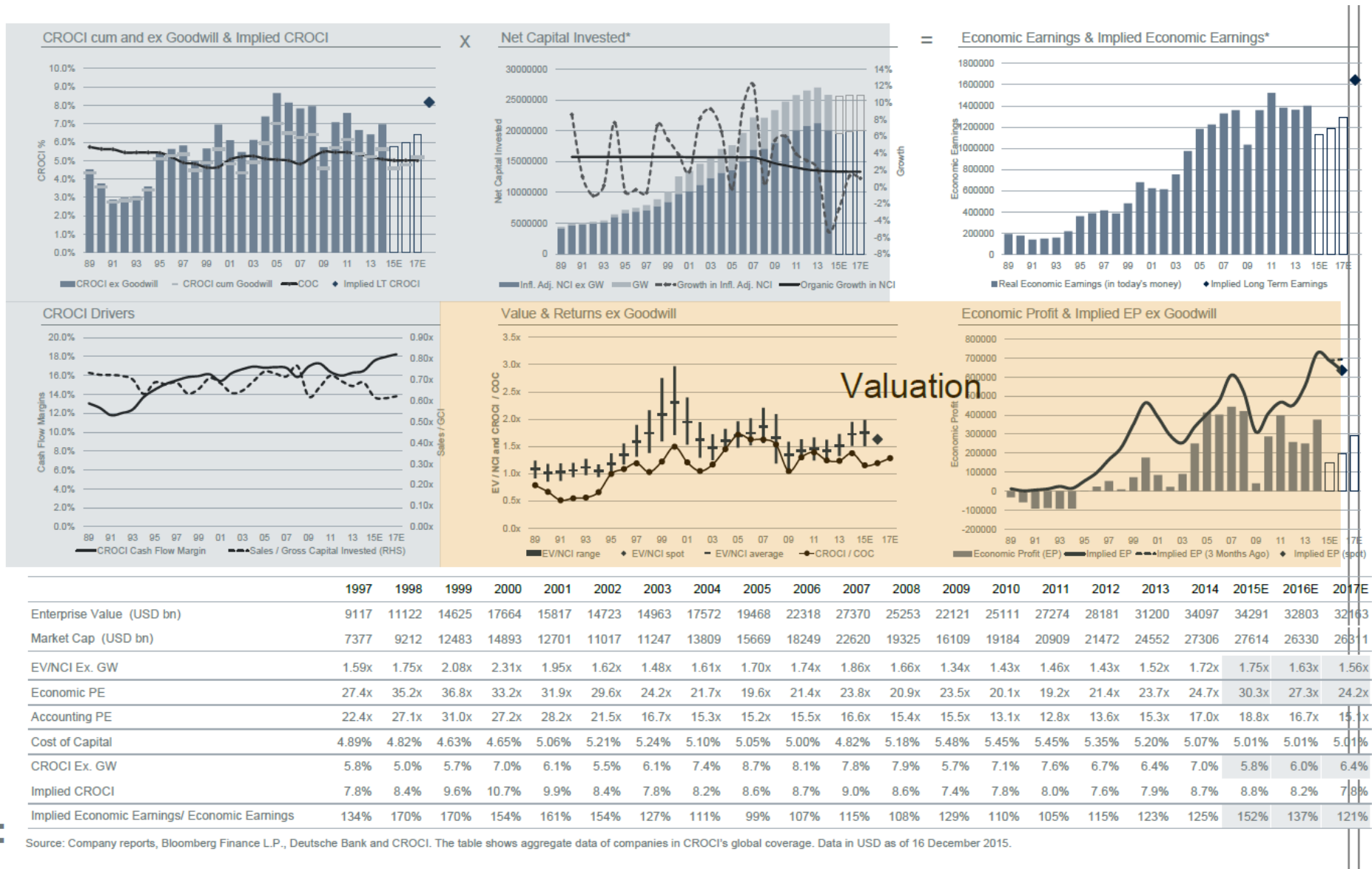
	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018E	2019E	2020E
Enterprise Value (USD bn)	7519	7145	7011	7224	8454	9795	11770	15203	14089	12362	13594	14565	14656	15816	16593	16221	15797	16991	17611	17482	17226
Market Cap (USD bn)	5596	5135	4682	4868	6100	7383	8950	11918	10214	8289	9484	10170	9949	10858	11665	11265	10726	11718	12284	12292	12291
EV/NCI Ex. GW	1.75x	1.55x	1.33x	1.24x	1.35x	1.43x	1.48x	1.63x	1.45x	1.14x	1.17x	1.18x	1.11x	1.14x	1.26x	1.27x	1.23x	1.25x	1.30x	1.24x	1.18x
Economic PE	28.8x	26.4x	25.5x	21.0x	20.1x	17.9x	19.8x	23.0x	19.4x	22.5x	19.8x	19.0x	21.7x	23.4x	23.9x	29.5x	33.7x	32.6x	26.6x	27.3x	25.5x
Accounting PE	21.2x	20.3x	18.0x	14.0x	12.9x	12.5x	13.0x	15.3x	13.3x	13.9x	12.2x	11.6x	12.3x	13.7x	15.3x	18.6x	18.4x	16.5x	14.7x	14.4x	13.4x
Cost of Capital	4.65%	5.06%	5.21%	5.24%	5.10%	5.05%	5.00%	4.82%	5.18%	5.48%	5.45%	5.45%	5.35%	5.20%	5.07%	4.90%	5.00%	4.95%	4.95%	5.00%	5.00%
CROCI Ex. GW	6.1%	5.9%	5.2%	5.9%	6.7%	8.0%	7.5%	7.1%	7.5%	5.1%	5.9%	6.2%	5.1%	4.9%	5.3%	4.3%	3.6%	3.8%	4.9%	4.5%	4.6%
Implied CROCI	8.1%	7.8%	6.9%	6.5%	6.9%	7.2%	7.4%	7.8%	7.5%	6.3%	6.4%	6.4%	5.9%	5.9%	6.4%	6.2%	6.1%	6.2%	6.4%	6.2%	5.9%
Implied Economic Earnings/ Economic Earnings	134%	133%	133%	110%	103%	90%	99%	111%	100%	123%	108%	104%	116%	122%	121%	145%	168%	161%	132%	136%	127%

Source: DWS CROCI Database. Data as of 28 February 2019. The CROCI database is created from historical data which is derived from company sources, Bloomberg consensus analyst forecasts, and DWS estimates

* Displayed in today's money day's money

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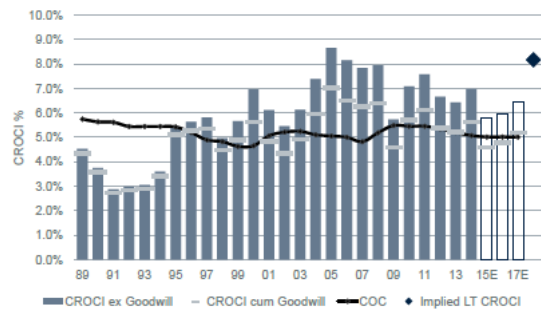
How to read the CROCI charts within Appendix 1



These charts show operational and valuation characteristics of various regions and sectors. Past performance may not be a reliable indicator of future results. Market and index performance data is sourced from Bloomberg Finance L.P. Company data is based on historical and current data from the CROCI database and is based on CROCI'S coverage in these regions and sectors. Unless stated this data is as of February 2019. Forecasts are based on assumptions, estimates, views and hypothetical models or analyses, which might prove inaccurate or incorrect. A is based on historical and current data from the CROCI database and is based on CROCI'S coverage in these regions and sectors. All opinions and forecasts are subject to change at any time.

CROCI cum and ex Goodwill / Implied CROCI

CROCI cum and ex Goodwill & Implied CROCI



CROCI[®] is the real post-tax return on total capital invested in the company. The solid bars in the chart above show our core measure of CROCI when we exclude goodwill⁴ from the capital base.

The split in the bar shows the level of CROCI that the company would generate if we included goodwill as part of the capital base.

The dotted line reflects our market implied cost of capital. If CROCI exceeds this level, the company is value creative.

The diamond shown next to the forecast period reflects the level of CROCI that the market currently implies is sustainable, calculated as $EV/NCI \times CoC$.

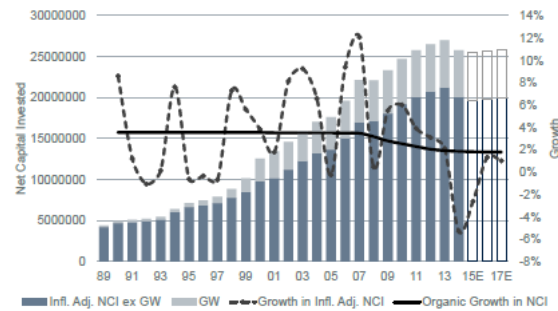
Use this chart to assess:

- whether returns are growing or fading. (Excess returns are a measure of competitive advantage, giving information about the company's competitive position.)
- the volatility and cyclical nature of the business
- whether the company creates or destroys value
- the impact of acquisitions on CROCI

In this example, Coca Cola has shown stable and high levels of returns over the very long term, exceeding the cost of capital (dotted line) on average by 2.5x. Goodwill has had a limited impact on returns.

Net Capital Invested

Net Capital Invested*



Net Capital Invested reflects our estimate of the level of economic assets invested in the business in today's money after taking into consideration inflation, capitalisation of intangibles and other off-balance sheet assets (such as operating leases).

The chart shows the dynamics of growth in real assets.

Each annual bar shows the absolute value of the Net Capital Invested (NCI) excluding goodwill in blue. The amount of goodwill accumulated historically is indicated in grey.

The line shows the year on year change in the NCI and its trend over time can be seen as an indicating of the growth rate of the business.

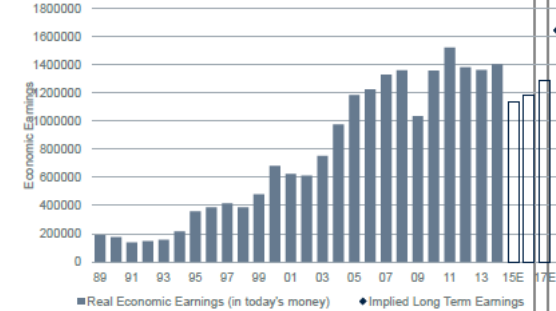
Use this chart to assess:

- the nature of the growth in capital
- the level of organic growth in capital

In this example, Coca Cola has shown strong growth till 2011, mostly organic, with limited contribution from acquisitions. Since then, NCI is barely stable with no growth expected by the consensus in 2015E-17E

Economic Earnings & Implied Economic Earnings

Economic Earnings & Implied Economic Earnings*



Economic Earnings show, in today's money, the absolute level of economic return generated each year, calculated as $CROCI \times Net\ Capital\ Invested$, the two charts to the left.

Implied Economic Earnings is calculated as the implied CROCI (see left) multiplied by the Net Capital Invested.

Economic Earnings and implied Economic Earnings are shown excluding the effect of goodwill.

Economic Earnings are not impacted by assumptions concerning the cost of capital, although the Implied Economic Earnings are.

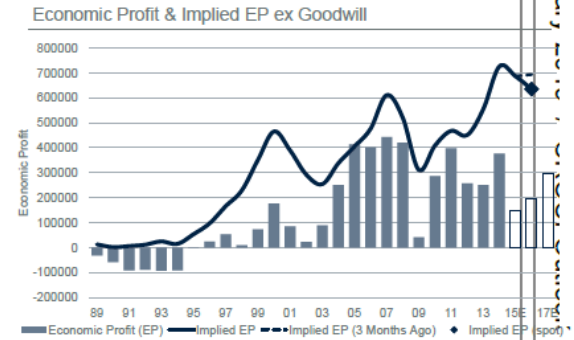
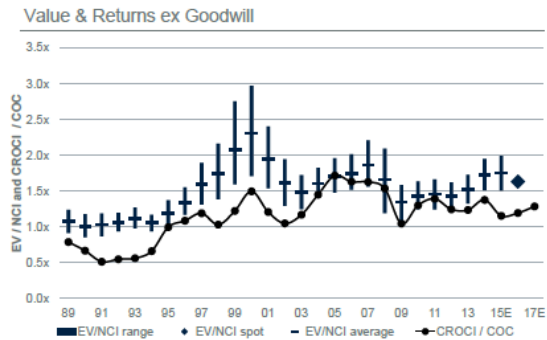
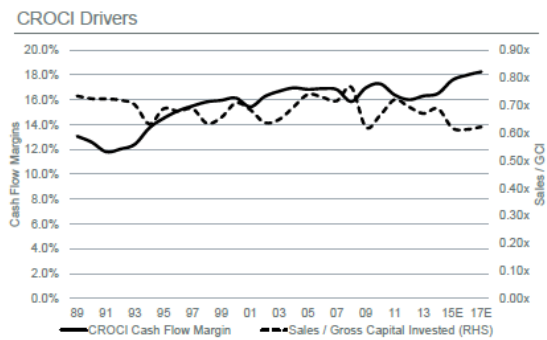
Use this chart to assess:

- whether the company has generated, in real terms, growth in Economic Earnings
- the level of Economic Earnings that the market presently discounts as sustainable.

In this example, strong NCI growth and a stable return profile allowed Economic Earnings to compound rapidly till 2011; barely stable since then. The market implies a premium over current projected levels of earnings.

⁴ CROCI defines goodwill as the acquisition premium post adjustment for the capitalisation of intangibles

CROCI Drivers	Value / Returns	Economic Profit / Implied Economic Profit
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<p>The drivers of CROCI returns can be broken down into productivity of the invested capital (defined as Sales to Gross Capital Invested (GCI)) and sales margin (defined as the CROCI cash flow to sales).</p>	<p>The price paid for an asset should be equal to the return of that asset relative to the cost of capital (adjusted for growth).</p> <p>In CROCI-speak, the economic price to book is called EV/NCI (bars) and we compare this to the CROCI / CoC (line).</p> <p>For each year we show the EV/NCI using the high, low and average share price for the year to allow an historical valuation range to be determined.</p> <p>The diamond is today's EV/NCI and allows comparison with historic valuation and current return generation</p>	<p>Economic Profits (bars) represent Economic Earnings after paying for the cost of capital and is defined as excess returns times operating assets (i.e. (CROCI – COC) x NCI) and can be seen as the 'value added' each year.</p> <p>Implied Economic Profit (line) shows the average annual economic profits discounted by the market in each year, (EV - NCI)*COC.</p> <p>If the Implied Economic Profit (line) exceeds the Economic Profit (bar), the market is discounting growth in EP.</p>
<p>Use this chart to assess whether:</p> <ul style="list-style-type: none"> • the improvement in CROCI has been driven by improving margins and/or by improving asset productivity (or the converse) • the trend that has driven any change in returns so far is losing/gaining momentum 	<p>Use this chart to assess:</p> <ul style="list-style-type: none"> • the trend level of CROCI/CoC over the cycle • the premium/discount of EV/NCI vs. CROCI/CoC over time • where the current EV/NCI is, relative to its own past range as well as the trend developing in CROCI/CoC, i.e. if the market is pricing a structural change in relative return 	<p>Use this chart to:</p> <ul style="list-style-type: none"> • assess the absolute level of value creation over time • compare the level of value creation that the market is discounting today with historical levels
<p>In this example, there has been remarkable consistency in both drivers over time, with structural change in 2000 and 2011.</p>	<p>In this example, the market afforded the company a significant growth premium between 1994 and 2004. Between 2005 and 2010, EV/NCI has moved in line with CROCI/CoC suggesting no significant growth premium is valued by the market which has again marginally reversed from 2011 onwards</p>	<p>In this example, the economic profit did indeed grow between 1994 and 2004, but never reached the level implied by the market. Between 2005 and 2010, market implied level has moved in line with economic profit suggesting no growth premium which reversed again from 2011. Currently, the market expects that economic profit creation will be higher than the level expected by the consensus in 2015E-17E</p>

These charts show operational and valuation characteristics of various regions and sectors. Past performance may not be a reliable indicator of future results. Market and index performance data is sourced from Bloomberg Finance L.P. Company data is based on historical and current data from the CROCI database and is based on CROCI'S coverage in these regions and sectors. Unless stated this data is as of February 2019. Forecasts are based on assumptions, estimates, views and hypothetical models or analyses, which might prove inaccurate or incorrect. A is based on historical and current data from the CROCI database and is based on CROCI'S coverage in these regions and sectors. All opinions and forecasts are subject to change at any time.

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Excluding Intellectual Capital — RtN

	2010	2011	2012	2013	2014	2015	2016E	2017	2018E	2019E	2020E
Economic P / E (x)	19.8	19.0	21.7	23.4	23.9	29.5	33.7	32.6	26.6	27.3	25.5
Accounting P / E (x)	12.2	11.6	12.3	13.7	15.3	18.6	18.4	16.5	14.7	14.4	13.4
Yield (%)	3.3	3.5	3.5	3.4	3.2	3.1	3.2	3.4	3.3	3.4	3.5
P / BV (x)	1.7	1.7	1.6	1.7	2.0	2.0	1.9	1.9	1.9	1.8	1.7
EV / Sales (%)	109.6	100.0	98.9	105.8	114.9	133.5	134.4	131.8	125.9	123.7	117.7
EV / Adj. EBDIT (x)	6.4	6.2	6.5	6.9	7.5	8.6	8.4	8.2	7.8	7.6	7.2
EV / Free Cash Flow (x)	23.3	30.7	41.0	39.1	36.1	36.4	29.1	27.6	24.8	21.5	19.4
EV / Capital Employed (x)	1.2	1.2	1.2	1.2	1.3	1.3	1.3	1.3	1.3	1.3	1.3
Avg. Market Cap. (bn)	9,484	10,170	9,949	10,858	11,665	11,265	10,726	11,718	12,284	12,292	12,291
Enterprise Value (bn)	12,595	13,529	13,539	14,598	15,392	15,014	14,567	15,672	16,283	16,120	15,836
Key Ratios	2010	2011	2012	2013	2014	2015	2016E	2017	2018E	2019E	2020E
Revenue Growth	15.2	17.7	1.2	0.7	-2.9	-16.0	-3.7	9.8	8.8	0.7	3.3
Revenue Growth (Median)	-4.3	9.6	7.5	4.3	3.2	3.2	1.3	0.5	3.4	3.6	3.6
Adj. Net Profit Pre-Min. Growth	0.2	12.6	-7.5	-1.9	-5.4	-20.5	-2.7	22.3	16.9	2.9	7.1
Adj. EBDIT Mgn	17.2	16.1	15.3	15.3	15.3	15.6	16.1	16.2	16.1	16.2	16.4
Adj. EBIT Mgn	11.4	10.8	9.9	9.7	9.4	8.8	9.0	9.6	9.9	9.9	10.1
Adj. Net Prof. Pre-Min. Mgn	7.2	6.9	6.3	6.1	6.0	5.6	5.7	6.4	6.8	7.0	7.2
Depreciation / Sales	6.2	5.7	5.9	6.1	6.7	8.6	7.9	7.1	6.4	6.3	6.3
Capex / Sales	8.8	8.9	9.4	9.3	9.4	10.0	9.1	8.5	8.1	8.0	7.7
Free Cash-Flow / Sales (Post-Tax)	4.7	3.3	2.4	2.7	3.2	3.7	4.6	4.8	5.1	5.7	6.1
Dividends / Sales	2.6	2.8	2.8	2.7	3.0	3.3	3.3	3.3	3.3	3.1	3.1
Interest Cover (x)	9.3	9.9	9.1	8.6	8.0	6.6	6.3	7.1	7.7	7.8	8.6
Net Debt (-) Cash (+) / Equity	-46.4	-49.4	-50.0	-51.5	-56.1	-61.3	-61.3	-58.2	-55.7	-49.2	-42.1
Return on Stated Equity	13.7	13.8	12.0	11.1	11.4	8.8	9.4	10.8	12.2	12.2	12.3
Return on Cap. Employed (Post-Tax)	9.0	9.2	8.0	7.7	7.4	6.2	6.1	6.8	7.7	7.8	8.0
P&L (USD bn)	2010	2011	2012	2013	2014	2015	2016E	2017	2018E	2019E	2020E
Turnover	11,493	13,529	13,695	13,797	13,398	11,248	10,835	11,892	12,935	13,030	13,459
Adjusted EBDIT	1,974	2,180	2,092	2,108	2,045	1,754	1,744	1,922	2,078	2,112	2,207
Depreciation	709	765	806	836	897	962	853	848	828	826	848
Adjusted EBIT	1,306	1,464	1,358	1,337	1,260	995	975	1,136	1,275	1,288	1,361
Pre-Tax Profit	1,073	1,189	1,034	999	919	533	681	861	1,039	1,101	1,185
Income Tax	376	449	418	394	353	250	243	291	307	304	326
Stated Net Profit Pre-Min.	812	833	731	864	656	392	511	768	853	876	942
Adj. Net Profit Pre-Min.	825	929	860	844	798	634	618	755	883	908	973
Minorities	46	51	47	47	34	29	34	45	48	51	54
Cash Flow (USD bn)	2010	2011	2012	2013	2014	2015	2016E	2017	2018E	2019E	2020E
EBIT before stock options	1,283	1,435	1,296	1,287	1,169	808	910	1,095	1,271	1,310	1,384
Depreciation	709	765	806	836	897	962	853	848	828	826	848
NWC and Provisions	-15	-30	-11	-21	20	38	6	-166	-60	-7	-11
...Operating Cash Flow	1,977	2,170	2,091	2,102	2,086	1,808	1,769	1,777	2,039	2,129	2,221
Proceeds from Share Issues	40	-80	-15	-135	-15	-5	35	-42	-56	5	0
Dividends Paid	-301	-384	-383	-374	-404	-374	-356	-391	-425	-404	-417
Capex	-1,016	-1,199	-1,283	-1,288	-1,259	-1,128	-986	-1,017	-1,049	-1,039	-1,041
Net Other Investments	-126	-115	-110	-32	-97	-191	-205	-58	-67	-43	1
Change in Net Debt (-) Cash (+)	42	-198	-175	-212	5	-142	-88	-186	85	209	321
Balance Sheet (USD bn)	2010	2011	2012	2013	2014	2015	2016E	2017	2018E	2019E	2020E
Net Working Capital	138	197	209	200	135	62	21	7	46	48	54
Net Financial Debt (-) Cash (+)	-2,808	-3,103	-3,283	-3,516	-3,510	-3,652	-3,766	-3,952	-3,867	-3,658	-3,337
Gross Tangible Fixed Assets	13,801	14,618	15,221	16,000	15,419	15,335	15,708	16,780	16,711	17,378	17,922
Net Tangible Fixed Assets	6,855	7,342	7,771	8,181	7,889	7,684	7,752	8,154	8,082	8,362	8,554
Other LT Assets	533	565	568	624	628	651	651	717	742	758	766
Stated Shareholder's Equity	5,670	5,870	6,107	6,345	5,844	5,537	5,683	6,280	6,432	6,915	7,405
Minorities	381	417	453	480	412	417	456	512	506	514	522

Source: Company reports, Bloomberg Finance L.P., DWS and CROCI. The table shows aggregate data of companies in CROCI's global coverage. Data in USD as on 28 February 2019.

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Introduction to CROCI

Cash Return on Capital Invested (CROCI) is a cash-flow-based analysis which, by making a series of economic adjustments to traditional accounting data, aims to make non-financial companies comparable - regardless of industry or domicile. The main areas where CROCI “economic data” differ from accounting data are as follows:

- Accounting for “hidden” liabilities – CROCI Enterprise Value (EV) includes not only financial liabilities (such as debt) but also operational liabilities (such as operating lease commitments, warranties, pension funding, specific provisions etc).
- Depreciating similar assets in a similar manner - Adjusting depreciation to reflect “economic depreciation” and effective useful economic life.
- Replacement value of assets – Inflating the value of net assets using the relevant inflator (based on the real age of assets).
- Unreported assets – Systematically capitalizing real cash-generative assets that are left off the balance sheet. Research and development costs and advertising are examples of such assets.

Economic PE (Ec.PE): is the CROCI version of the PE ratio and is calculated as $EV/(CROCI * NCI)$ or $(EV/NCI)/CROCI$

Definitions:

Cost of Capital is the return investors collectively demand for providing risk capital. This is a market derived number calculated from observed market prices using a reverse DCF model that solves for the discount rate, which is the only unknown.

Enterprise Value (EV): Market value of equity (market cap), debt, and other liabilities, such as pension underfunding, warranties, leases.

Net Capital Invested (NCI): Estimated replacement value of the economic asset base, comprising the inflation-adjusted tangible assets, capitalised intangible assets (e.g brands, R&D), leases and net working capital.

Cash Return on Capital Invested (CROCI): the economic equivalent of return on equity, is a real (inflation-adjusted) economic cash return. It is the internal rate of return of gross cash flows (taxed, adjusted EBDIT) over the average asset life of the company’s assets against the gross capital invested.

CROCI 5YA: Average CROCI over the past five years

Economic PE (Ec PE): is the CROCI version of the PE ratio and is calculated as $EV/(CROCI * NCI)$ or $(EV/NCI)/CROCI$

EV/NCI: is the CROCI version of the price-to-book ratio and can be thought of as a proxy for replacement value or Tobin’s Q at a company level. It is calculated by dividing EV by Net Capital Invested.

Free Cash Flow (FCF) Yield: represents firm level free cash flow yield on EV. It is calculated before payment of interest on borrowed capital.

Implied CROCI: Level of return implied by the market as sustainable. It is calculated as $EV / NCI * Cost\ of\ Capital$.

CROCI & Real Value

Real Value Economic value as calculated by the CROCI process via the adjustments to and normalisations of reported financial statements, conducted by CROCI’s team of company analysts.

Notes: The CROCI process seeks to make company financial data more consistent, comparable and economically meaningful through a series of reviews and adjustments. This contrasts with more conventional definitions of “Value” that tend to be based on accounting measures such as equity or profits.

The term Real Value can be used attributively to refer to companies with the lowest CROCI Economic P/E.

Real Investor An investor whose investments are driven principally by the careful analysis of company fundamentals, including their economic cash returns and their economic valuation. Specifically, a Real Investor has two characteristics:

1. **Fundamental:** any investment is informed or driven by the interplay between the cash flow generation, the capital intensity and the valuation of that company.

2. **Skeptical of reported financial statements as a guide to investing:** Real Investors believe that the income statement and balance sheet in a company's accounts are not necessarily designed to be helpful to equity investors, and that a synthesis of all the notes to the accounts and diligent restatement of the accounts must happen in order to render valuations comparable and meaningful; and

Real Investors look to economic value to inform investment, and believe that the reported financial statement data may not be representative of the economic reality of a company.

Since CROCI makes adjustments to financial statements in order to include all relevant information in the notes to the accounts, and to restate the accounts in order to render economic valuations, which are meaningful and comparable, CROCI may be one valuable approach.

IMPORTANT INFORMATION

This paper is intended for Professional Investors only, who understand the strategies and views introduced in this paper and can form an independent view of them. CROCI represents one of many possible ways to analyze and value stocks. Potential investors must form their own view of the CROCI methodology and evaluate whether CROCI and investments associated with CROCI are appropriate for them.

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In the data and charts presented throughout this document, “E” refers to financial years that are not yet reported. Forecasts of accounting data for these years are based on market’s consensus estimates as reported by Bloomberg Finance L.P. CROCI metrics for the forecast years are calculated by applying the CROCI model to these consensus estimates. The CROCI team does not make any forecasts or projections of accounting data. Data for historical years are derived from company reports and other publicly available sources.

RISK CONSIDERATIONS

CROCI Methodology: The analysis above has been built on the CROCI premise that stocks with lower CROCI Economic P/E ratios may outperform stocks with higher CROCI Economic P/E ratios over time. This premise may not be correct and prospective investors should evaluate this assumption prior to investing based on CROCI analysis. CROCI represents one of many possible ways to analyse and value stocks. Potential investors must form their own view of the CROCI methodology and evaluate whether CROCI and investments associated with CROCI are appropriate for them. The CROCI Team does not provide investment advice.

CROCI analysis: The discussion above is based on analysis of agglomerations of the companies in the CROCI universe, which consists of around 900 companies globally. These agglomerations of companies may not be representative of the countries, regions, and sectors which they are intended to reflect.

Past Performance is not a reliable indicator of future results and any forecasts may not be realised.

IMPORTANT INFORMATION ON BACKTEST OR SIMULATED DATA

Backtested performance is not an indicator of future actual results. The results reflect performance of a strategy not historically offered to investors and do not represent returns that any investor actually attained. Backtested results are calculated by the retroactive application of a model constructed on the basis of historical data and based on assumptions integral to the model which may or may not be testable and are subject to losses.

General assumptions include: The index would have been able to purchase the securities recommended by the model and the markets were sufficiently liquid to permit all trading. Changes in these assumptions may have a material impact on the backtested returns presented. This information is provided for illustrative purposes only. Backtested performance is developed with the benefit of hindsight and has inherent limitations. Specifically, backtested results do not reflect actual trading or the effect of material economic and market factors on the decision-making process. Since trades have not actually been executed, results may have under or over-compensated for the impact, if any, of certain market factors, such as lack of liquidity, and may not reflect the impact that certain economic or market factors may have had on the decision-making process. Actual performance may differ significantly from backtested performance. Backtested results are adjusted to reflect the reinvestment of dividends and other income and, except where otherwise indicated, are presented gross-of-fees and do not include the effect of backtested transaction costs, management fees, performance fees or expenses, if applicable. All CROCI indices have a history that combines backtested data with live data. Inception dates refer to the first instance of a CROCI index which would have been backtested and live dates refer to the moment in time when a particular CROCI index was no longer backtested (i.e. "live").

All CROCI performance shown reflects the returns of an index and not any investment product, portfolio management or mandated strategy.

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