21 March 2012 | 28 pages

Metals & Mining

Super Cycle Sunset….

- **…we all know it will come to an end**— We believe that the tail wind of ever higher commodity prices, which has been the principal driver of share prices is now over. The sector faces headwinds of higher inflation, oil prices, operating costs, taxation, royalties and capex which is likely to result in falling margins and returns. We recommend investors seek alpha in the sector and we believe that companies with proven management teams and asset portfolios will deliver higher shareholder returns. Our key stock picks are derived from our 2012 investment themes of 'Sweating for Success' and 'Quality of Resource Companies'.
- **The structural story** — The bulls on the sector point to intensity of use charts for commodities on a kg/capita basis and extrapolate this into the future. This ignores one vital component which is price, as it assumes that developing economies will continue to consume ever increasing quantities of commodities regardless of the price. If we look at **value in use** rather **than intensity of use** this changes the argument and suggests China has already overtaken most of the developed world. Arguably for commodity consumption to increase globally then prices need to come down.
- **Margins have peaked** — Mining margins peaked around 2007 and since then the industry has faced higher depreciation costs, higher operating costs, higher oil prices, higher exchange rates, higher capex costs and higher salaries – all these factors are continuing and margins will continue to come under pressure.
- **Returns have peaked** —On an EVA basis (ROIC – WACC) the peak returns for the sector occurred in 2006, yet earnings momentum peaked two years later in 2008 and has subsequently moved higher. In our view the mining sector bought earnings momentum through M&A, and the mining sector is now buying earnings momentum through unprecedented capex spend. Importantly ROIIC is falling.
- **P/E derating to persist and beta to decline** — The sector will not rerate on a PE basis, simply because capex to depreciation for the sector is now 4x and the current D&A is based on carrying of assets which are largely written down. Moreover earnings revisions are negative for the sector, which is a reversal of what we have seen over the past decade. Beta for the sector has declined from over 2 to 1.5 and given that the mining sector is now 15% of the UK market under a structural decline story we are likely to see net index selling over the next 5-10 years.
- **Alpha the only answer** — We believe that investors can still make money out of the sector by identifying alpha companies. Our key stock picks in the UK mining space are BHP Billiton, Rio Tinto, Arcelor Mittal, ENRC.

- Industry Overview

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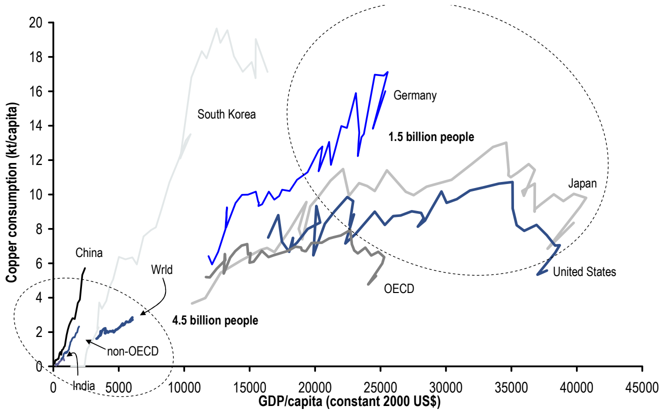
See Appendix A-1 for Analyst Certification, Important Disclosures and non-US research analyst disclosures.

Value in Use versus Intensity of Use

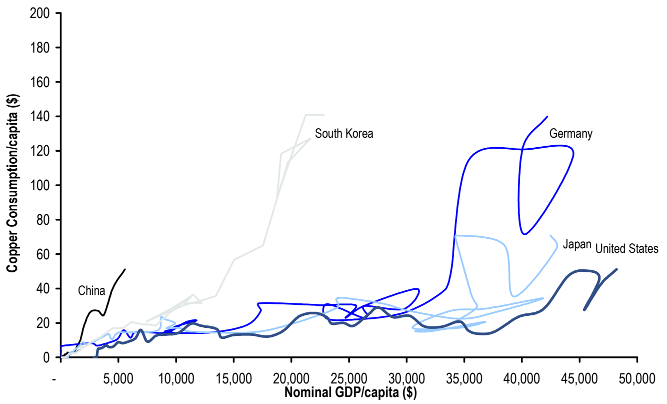
- The bulls on the sector point to the chart of commodities consumed per capita in developing economies and then extrapolate this into the future based on consumption in developed markets – Figure 1.
- This analysis avoids one critical component, which is the PRICE of the commodity. It assumes that a developing economy will continue to increase commodity consumption regardless of whether the price is $1,000, $5,000, $10,000 or even $20,000 per tonne. The laws of supply and demand would suggest otherwise and that higher input prices will impact demand output levels. A booming property and autos market in China has so far allowed higher commodity prices to be offset; however as this abates, the ability to pass through higher input costs will likely also abate.
- On a value in use basis we have plotted consumption in dollar value ($) per capita against nominal GDP (figure 2). We see from this that China is consuming copper at a rate that is slightly above that of the US. In other words, every person in China is consuming more copper on a $ value basis than in the US.

Figure 1. Copper Consumption GDP/Capita kg per capita



Source: Citi Investment Research and Analysis

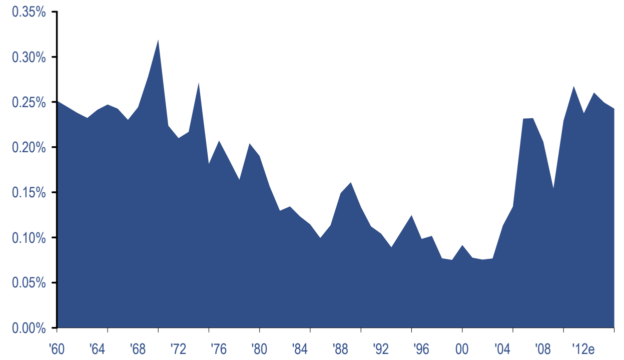
Figure 2. Copper consumption - $ value of copper consumed per capita



Source: Citi Investment Research and Analysis

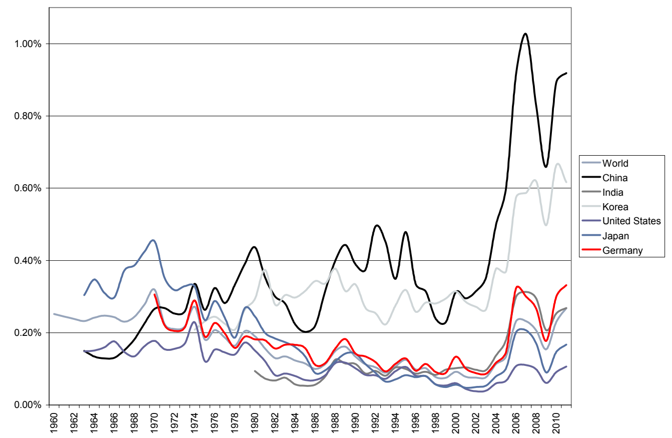
- Moreover, the world copper consumption currently represents around 0.27% of global GDP on a value in use basis which is back to the levels seen in the 1960s.
- Interestingly, China's copper consumption is currently running around 3x the global average at around 1% of its GDP, well above historical levels.
- We think that copper prices of around $7,000 to $8,000 range look consistent with what the global economy can support.

Figure 3. Nominal copper consumption as a % nominal global GDP



Source: Citi Investment Research and Analysis

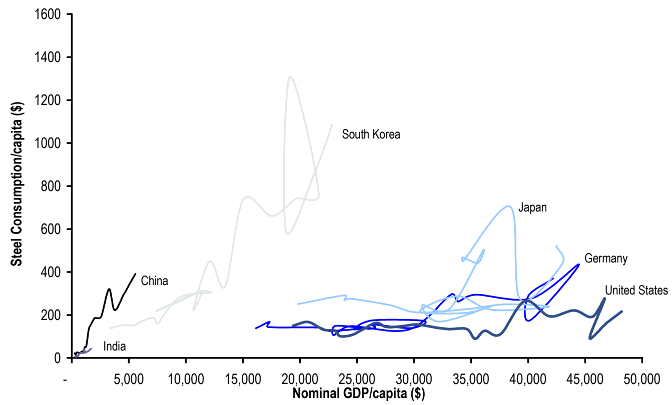
Figure 4. Copper consumed as a % of GDP by country



Source: Citi Investment Research and Analysis

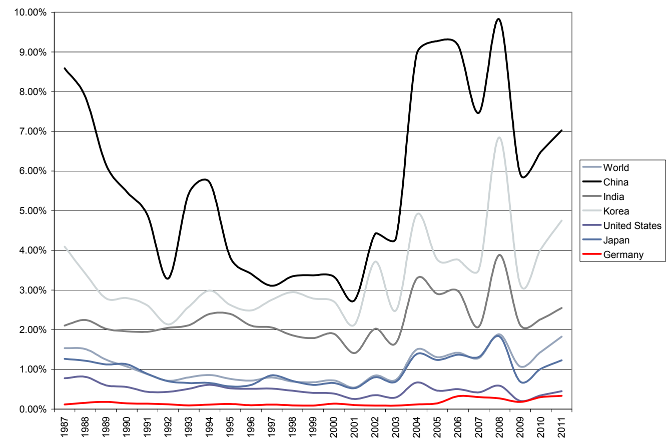
- China is currently spending an equivalent of 7% of its GDP on steel consumption; the peak of this consumption occurred in 2008.
- On a dollar value consumed per capita, China is already consuming at a rate akin to Germany and the US.

Figure 5. Steel consumption - $ value of consumption per capita



Source: Citi Investment Research and Analysis

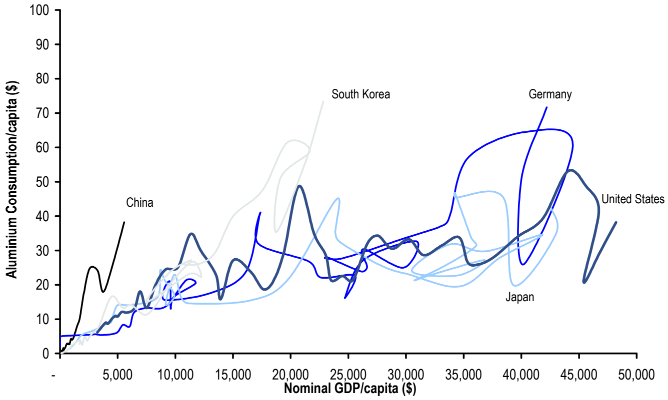
Figure 6. Steel consumed as a % of GDP by country



Source: Citi Investment Research and Analysis

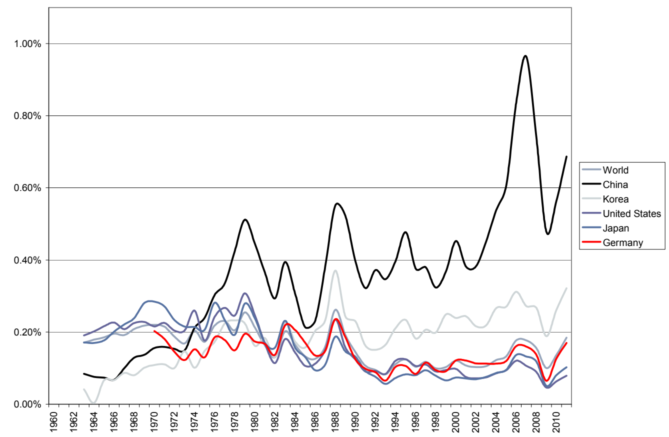
- Aluminium consumption is currently around 1% of Chinese GDP and the peak occurred in 2007.
- On a dollar value consumed per capita, China is already consuming at a rate akin to Japan and the US.

Figure 7. Aluminium consumption - $ value of consumed per capita



Source: Citi Investment Research and Analysis

Figure 8. Aluminium consumed as a % of GDP by country

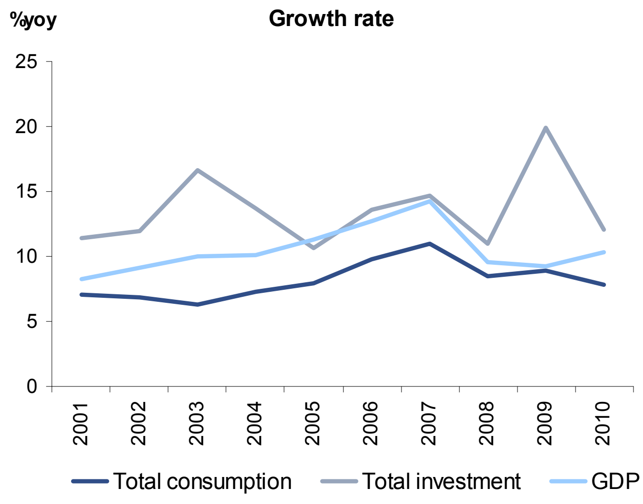


Source: Citi Investment Research and Analysis

Less bang for your buck

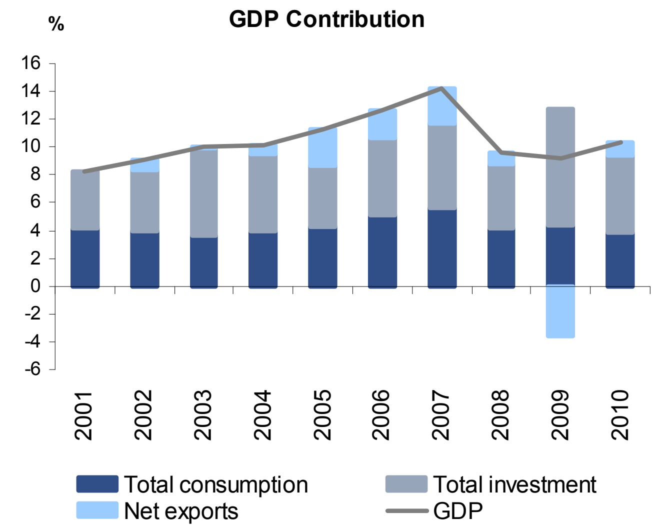
- Arguably the investment boom in China is already becoming less efficient due to higher input costs. In the past decade, China's GDP grew at an average rate of 10.5%. Investment expanded at an average rate of 13.5% during the period, the main contributor of growth. As a result, share of investment in GDP increased from 36.5% in 2001 to 48.5% in 2010.

Figure 9. Investment grew faster than GDP…



Source: Citi Investment Research and Analysis

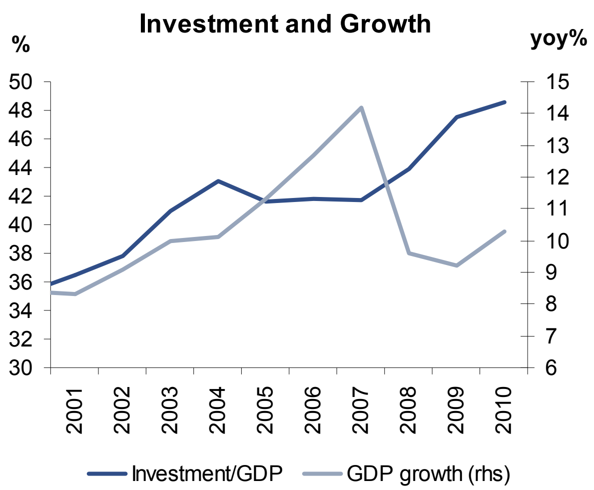
Figure 10. …and was the biggest contributor to growth.



Source: Citi Investment Research and Analysis

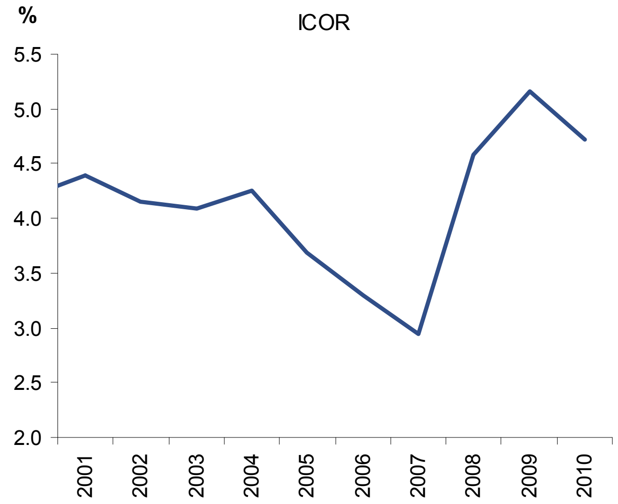
- The efficiency of investment appears to be falling – In the absence of a more reliable metric for assessing the productivity of investment, we employ the Incremental Capital Output Ratio (ICOR) as an indicator of marginal product of investment. During 2001-2010, China's average ICOR topped 4. More recently, the ratio rose to around 5, with a big jump in investment/GDP ratio—associated with stimulus measures introduced to tackle the global financial crisis—producing a relatively small output response.

Figure 11. Investment produced weaker output response recently…



Source: Citi Investment Research and Analysis

Figure 12. … indicating lower marginal product of investment.



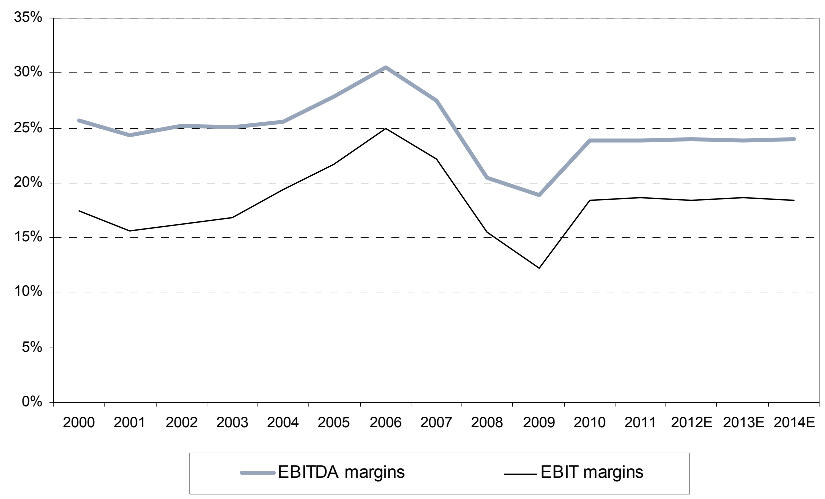
Source: Citi Investment Research and Analysis

- ICOR is obtained by dividing the ratio of investment to GDP with real economic growth. The ratio shows the amount of capital investment incurred per extra unit of output. The higher the ratio, the lower the productivity of capital.

Peak Margins

- On our calculations, margins for the mining industry peaked around 2006 and have subsequently fallen but have remained stable.

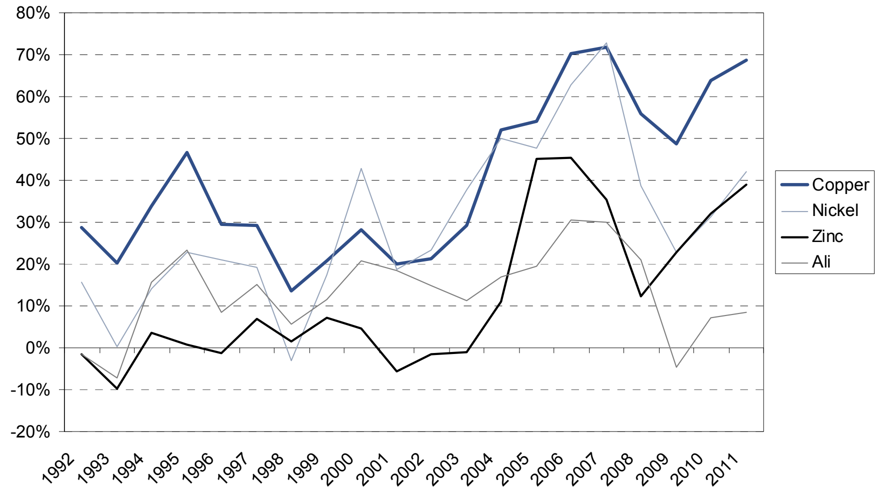
Figure 13. Global metals and mining sector margins



Source: Company Reports and Citi Investment Research and Analysis

- On an individual commodity basis it paints a similar story with margins for most commodities peaking around 2006/07.

Figure 14. Margins at the 3rd quartile by commodity

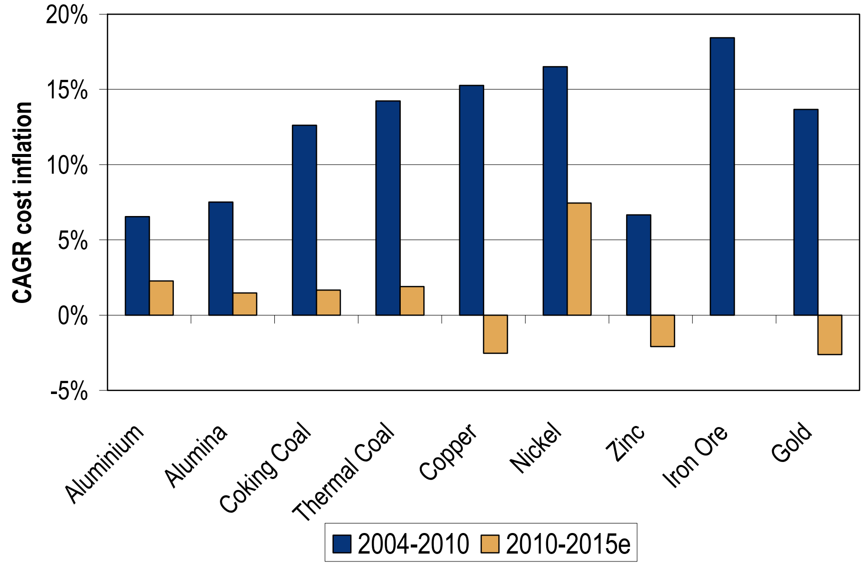


Source: Citi Investment Research and Analysis

- Going forward we expect further margin compression coming from higher depreciation costs, higher operating costs, higher oil prices, higher exchange rates, higher capex costs and higher salaries, all this suggests that margins will continue to come under pressure.

- Furthermore, the market, in our opinion, underestimates the cost increases on earning numbers. Looking at an amalgamated database of company presentations as well as third-party data providers it is clear that the escalation in costs is expected to slow. The table below looks at the growth rates from 2004-10 and from 2010-2015.

Figure 15. Historical and forecast cash cost inflation



Source: Company Presentations, Citi Investment Research and Analysis

- In the current climate we think it is unlikely that we will see the level of cost reduction that is forecast. This presents downside risk to consensus earnings estimates.
- Spot oil prices could indicate c.7% consensus earnings downgrades to come

Figure 16. Cash cost breakdown

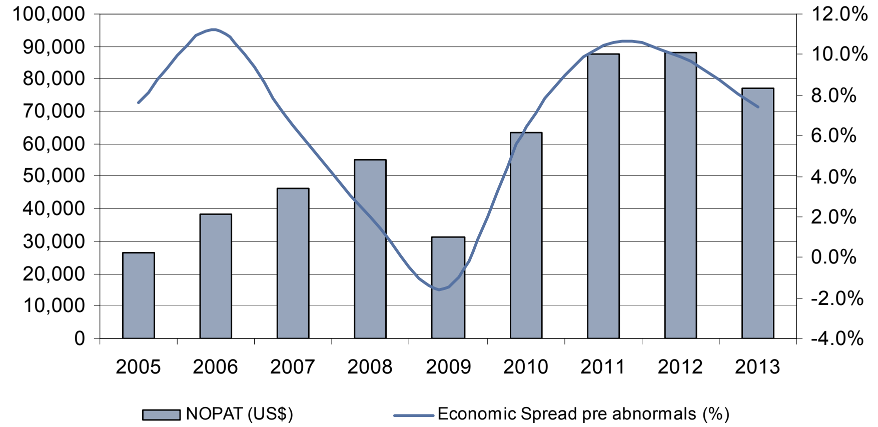
	PGM	Coal	Open pit copper	U/G Copper	Nickel	Gold - US	Iron Ore - Aust	Aluminium	Alumina
Labour	50%	39%	21%	51%	42%	40%	32%	6%	15%
Maintenance	15%	21%	12%				18%	7%	15%
Energy	10%	7%	26%	14%	18%	27%	12%	30%	22%
Raw Material	20%	23%	25%	33%	23%	23%	27%	55%	42%
Other/mining	5%	10%	16%	0%	17%	10%	11%	2%	6%

Source: Company Reports, Citi Investment Research and Analysis

Returns have peaked

- Our analysis of EVA creation (ROIC – WACC) would suggest that the peak value creation occurred in the industry in 2006.
- Earnings momentum peaked two years later in 2008 and has subsequently rebounded. In our view the mining sector bought earnings momentum through M&A from the period between 2006 and 2008, and the mining sector is now buying earnings momentum through unprecedented capex spend.

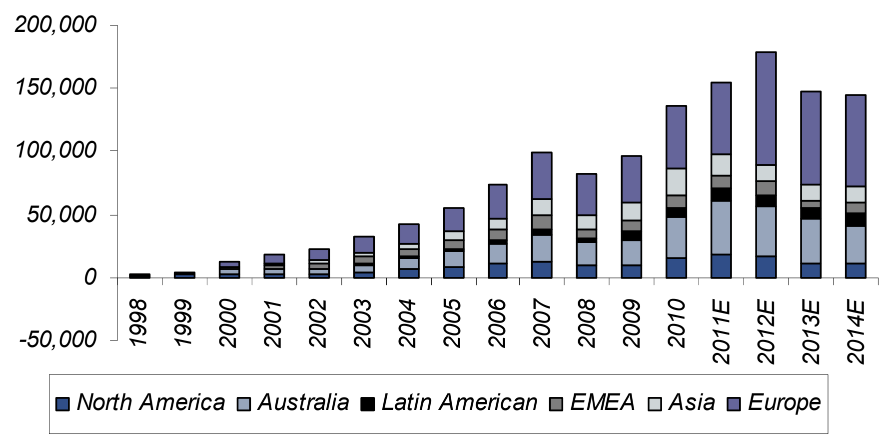
Figure 17. Global EVA creation, 2005-2013 and Earnings momentum



Source: Citi Investment Research and Analysis

- Going forward, the mining companies are expected to spend more on capex over the next five years then they have in the past twenty years. On our calculations the Return on Incremental Invested Capital (ROIIC) will be significantly below that currently enjoyed by the mining sector.

Figure 18. Global capex – Metals and Mining Citi coverage



Source: Company Reports and Citi Investment Research and Analysis

- We have looked at the evolution of project returns by comparing the returns generated by projects now compared to those back in 2001 before the emergence of China as a major growth engine for commodities demand– the so called Super Cycle thesis.

- The long-term commodity prices that we use have on average risen by almost 200% over this period, but IRRs for projects have actually declined on average from 18 to 16%.

- In addition to lower IRRs, the incremental NPV added by the projects relative to the capex invested has also declined – in 2001 for every $1 spent on capex the incremental NPV upside was $1, but now it is 73¢. Although the risk reward on capex has changed, the absolute dollar value of NPV upside has increased, driven by the escalation of capex.

- The key assumptions that we have used in our analysis and the IRRs and NPV/Capex ratios that these generate are shown in Figure 19.

Figure 19. Projects Returns and Assumptions – 2001 v 2011 Prices, Costs and Capex

		Price		Cost		EBITDA Margin		Capex		IRR		NPV/Capex	
Commodity		**2001**	**2011**	**2001**	**2011**	**2001**	**2011**	**2001**	**2011**	**2001**	**2011**	**2001**	**2011**
Iron Ore	US$/t	26	65	9	25	65%	62%	35	170	27%	16%	217%	77%
Coking Coal	US$/t	41	200	25	90	39%	55%	40	350	23%	20%	164%	127%
Thermal Coal	US$/t	30	105	20	65	33%	38%	35	110	17%	22%	92%	153%
Copper	US$/t	1,874	5,842	882	3,086	53%	47%	5,000	15,000	12%	13%	37%	40%
Aluminium	US$/t	1,433	2,205	882	1,323	38%	40%	3,400	6,500	10%	10%	22%	17%
Alumina	US$/t	190	400	90	200	53%	50%	500	1,500	13%	10%	47%	15%
Nickel	US$/t	6,614	19,841	2,205	11,574	67%	42%	30,500	66,138	9%	9%	10%	9%
Gold	US$/oz	350	1,050	170	600	51%	43%	250	850	36%	29%	220%	149%
Average						50%	47%			18%	16%	101%	73%

Source: Company Reports and Citi Investment Research and Analysis

- Although margins have declined slightly from cost escalation outstripping the increase in our long-term prices, the larger issue has been the almost 300% increase in capex costs over the period.
- Capex for all projects has risen, but the rise has been highest in the bulk commodities where increasing infrastructure requirements and currency (a lot of projects located in Australia) have driven capex disproportionately higher.

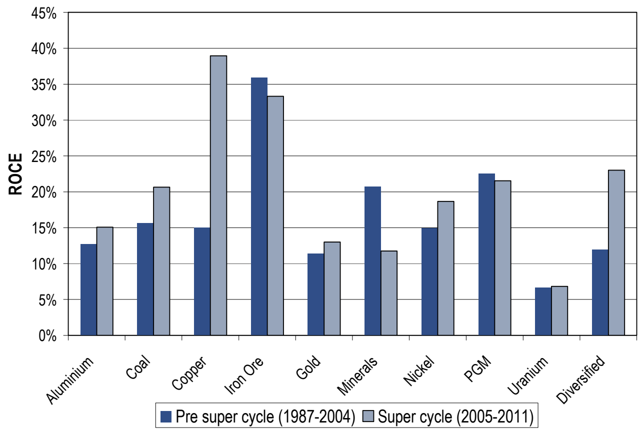
Figure 20. Price, Cost and Capex Escalation – 2001-2011

	Price	**Costs**	**Capex**
Iron Ore	150%	178%	386%
Coking Coal	388%	260%	775%
Thermal Coal	250%	225%	214%
Copper	212%	250%	200%
Aluminium	54%	50%	91%
Alumina	111%	122%	200%
Nickel	200%	425%	117%
Gold	200%	253%	240%
Average	195%	220%	278%

Source: Citi Investment Research and Analysis

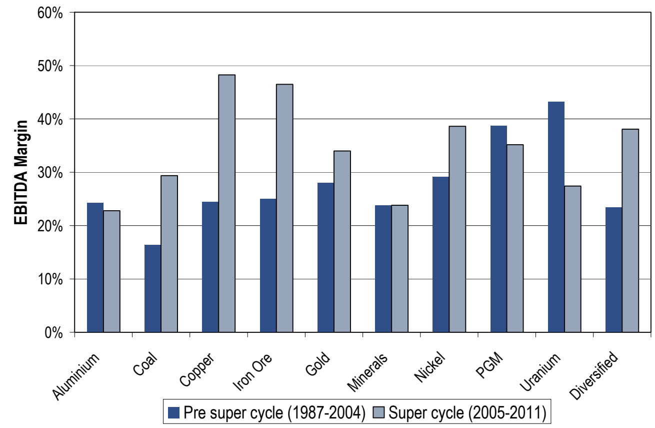
- Interesting the lift in ROCE through the super cycle years has not been as pronounced as one may have thought. The industry wide 'average' ROCE increased from 16% to 21%, which was largely driven by two commodities – iron ore and copper.
- However the massive race in delivering new iron ore supply has the potential to see a flattening of the cost curve. If that happens it would threaten the premium ROCE position of the industry.

Figure 21. ROCEs pre and super cycle years



Source: Company reports, Bloomberg and Citi Investment Research and Analysis

Figure 22. EBITDA Margins pre and super cycle years



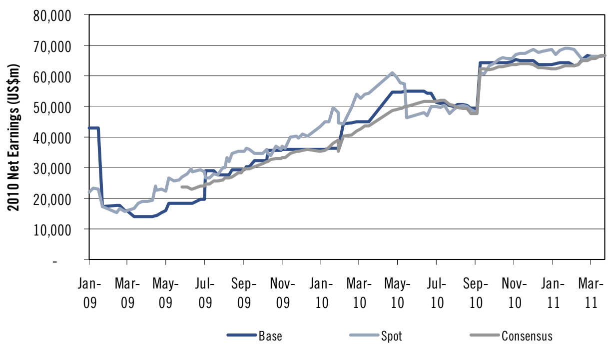
Source: Company reports, Bloomberg and Citi Investment Research and Analysis

Earnings momentum

- Evolution of earnings momentum is important and something that is overlooked, in our opinion. If we look at the periods of 2005-2008 and 2009 to 2011 the sector benefitted from positive earnings revisions. This was largely due to mark to market upgrades driven by spot commodity prices which were higher than forecasts. This provided a strong tail wind for the mining sector.

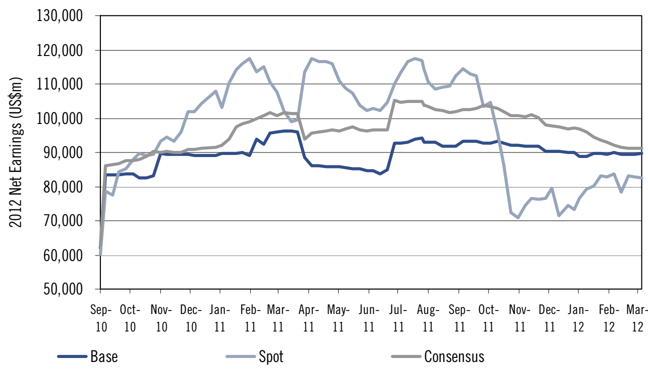
- Earnings momentum changed at the end of 2011, and this has persisted in 2012. If we run spot commodity prices and FX we would now expect to see earnings downgrades of around 10% by consensus.

Figure 23. 2010 earnings forecasts – 2009 to early 2011



Source: Citi Investment Research and Analysis

Figure 24. 2012 Earnings forecasts – 2010 to March 2012

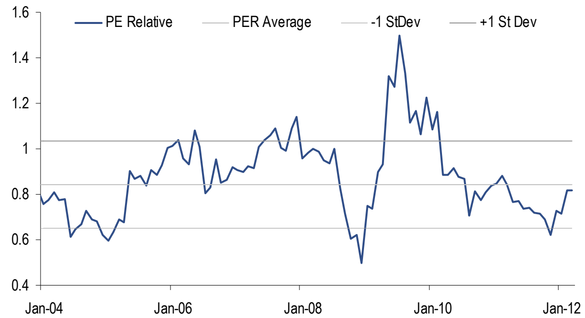


Source: Citi Investment Research and Analysis

- However these earnings downgrades don't take into account higher oil prices and potential rises in other mining costs such as wages. If we factor in the negative impact of current commodity prices and a higher cost base driven by higher oil prices, we are likely to see further earnings downgrades.

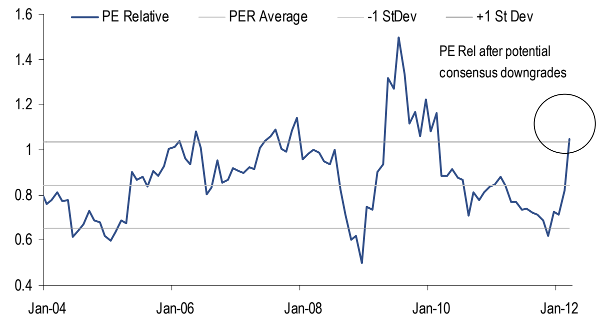
- Anglo American could see potential consensus earnings downgrades of 22%, in our view. On this basis the stock is trading at one standard deviation above its average PE discount to the market and therefore looks expensive.

Figure 25. Anglo PE relative to the FTSE 100 on current consensus



Source: Datastream

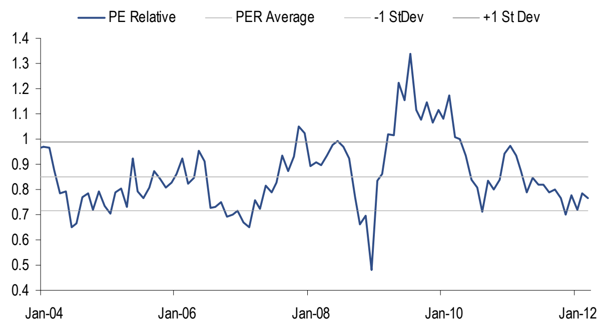
Figure 26. Anglo PE relative to the FTSE 100 after potential consensus downgrades



Source: Datastream

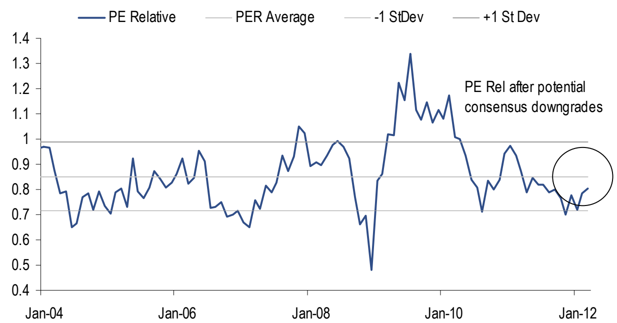
- Factoring in 5% consensus downgrades for BHP still sees it trading below its average PE discount to the market.

Figure 27. BHP PE relative to the FTSE 100 on current consensus



Source: Datastream

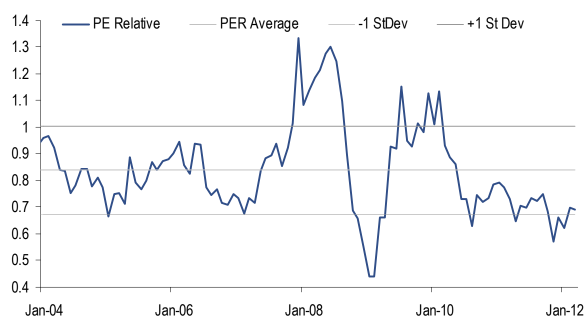
Figure 28. BHP PE relative to the FTSE 100 after potential consensus downgrades



Source: Datastream

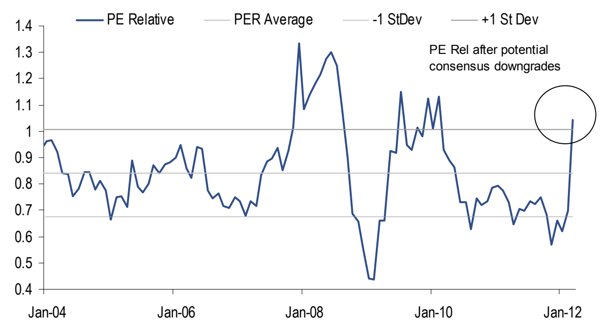
- Potential downgrades of ~34% on a worst case basis would see Rio trading well above its average PE discount.

Figure 29. Rio Tinto PE relative to the FTSE 100 on current consensus



Source: Datastream

Figure 30. Rio Tinto PE relative to the FTSE 100 after potential consensus downgrades



Source: Datastream

Multiple de rating

- We believe that the sector is unlikely to rerate on a PE basis, simply because capex to depreciation for the sector is now 4x and the current D&A is based on carrying of assets that are largely written down.

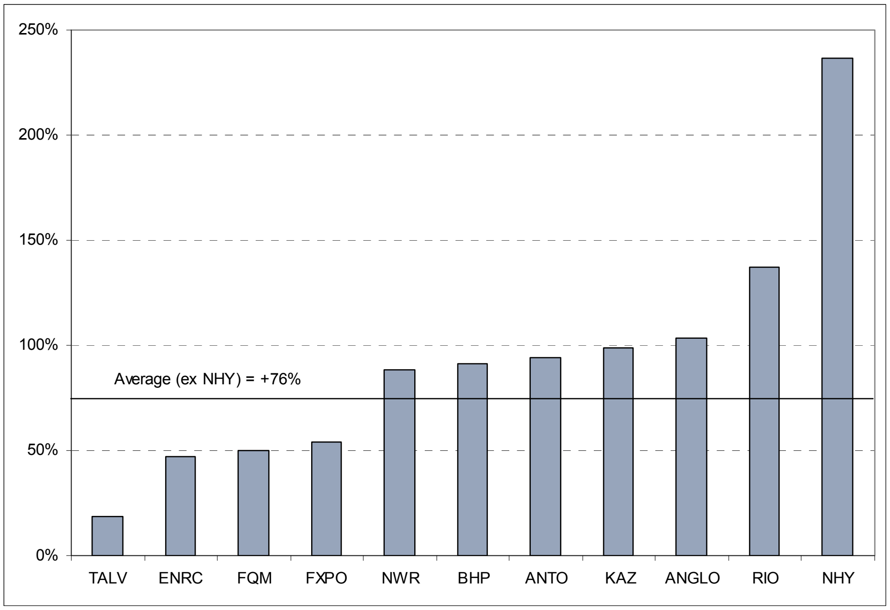
- As we have highlighted in our recent reports recent report The True P/E the concept of the 'stale' depreciation charge that many of the mining companies currently run through the P&L impacts the earnings stream. The thesis behind our analysis is that the only element of a company's profit and loss statements that is based on historical cost is D&A, while all other elements are at today prices (Revenue, Costs, Interest and Tax). All else being equal, companies that have old capital bases should trade on much lower P/Es.

- This reflects an important point we have addressed in recent research including Big Oil versus Big Mining - Cash of the Titans. Peaking commodity prices are forcing miners to expand volumes in an attempt to avoid margin compression. The efficient deployment of capital in pursuit of this volume growth is likely to be the key differentiating factor between companies.

- As Figure 42 shows, historical carrying values reported by the miners are significantly divorced from the current capital cost environment. Once we adjust for the age of the assets on each company's balance sheet average (excluding Norsk Hydro), PPE values are 88% (76%) too low.

Average carrying values (ex-Norsk Hydro) are 76% too low

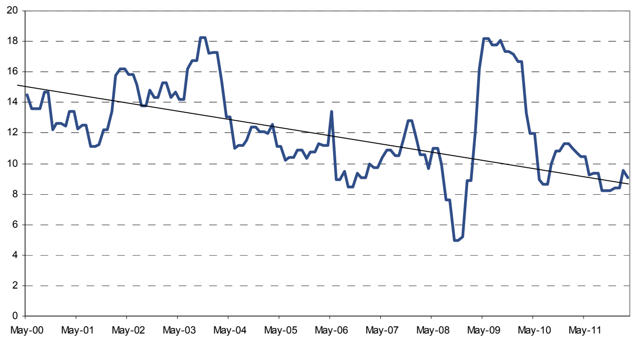
Figure 31. Inflation Adjusted Increase in PPE Base



Source: Company Reports and CIRA Estimates

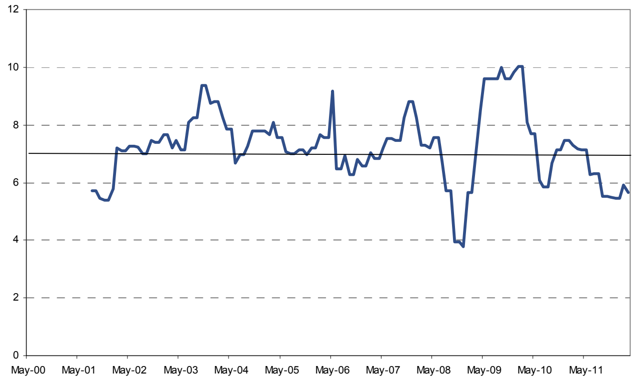
- As a result of realigning the asset base with reality, we can estimate the EPS which we calculate implies a 16-18% earnings downgrade for the sector. We therefore conclude that it looks unlikely that the mining sector is going to rerate on a PE basis and that multiples like dividend yield or EV/EBITDA are a better measure to evaluate the sector.

Figure 32. Forward PE metals and mining sector



Source: Citi Investment Research and Analysis

Figure 33. Forward EV/EBITDA metals and mining sector



Source: Citi Investment Research and Analysis

- Dividend yield of the sector is not supportive, while EV/EBITDA is.

Figure 34. Dividend Yield (%) - metals and mining sector

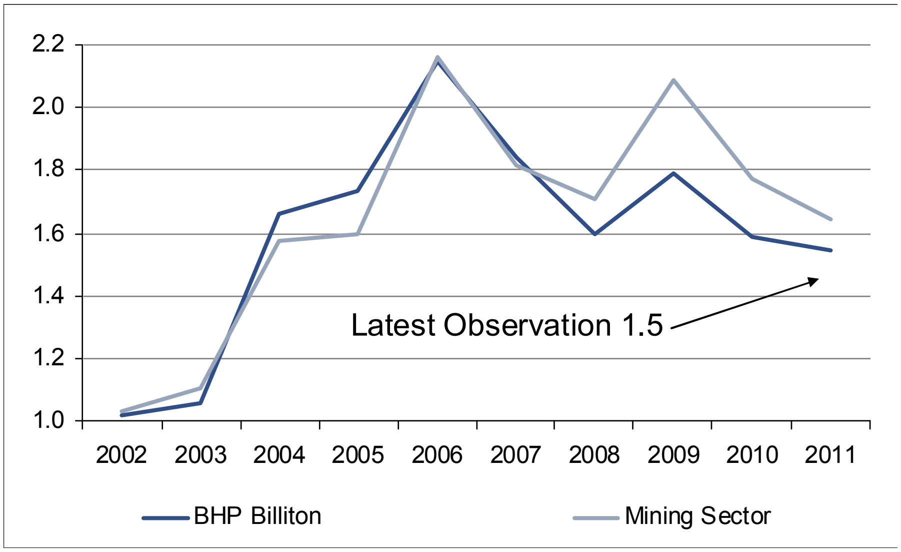
Source: Citi Investment Research and Analysis

BETA fading

- The mining sector has benefitted from a strong beta rally over the past few years. We believe that beta will fade in the sector; in our Sweating for Success report we argued that the mining sector will be more of an alpha play vs. the beta exposure offered historically. While the mining sector beta has declined from 2.16 in 2006 to 1.64 in 2011, BHP Billiton's beta has declined from 2.15 to 1.54 over the same time period. Given below-sector beta, investors would expect BHP to deliver above-sector returns on incremental capital as an alpha.

- In the chart below we have plotted historical beta of BHP Billiton PLC and FTSE Mining Index using FTSE All Share Index as a broad market index.

Figure 35. Beta Play Fading Out



Source: Datastream and CIRA;

It's not all negative

- We recommend investors look for alpha in the sector and we believe that companies with proven management teams and asset portfolios will deliver higher shareholder returns. Our key stock picks are derived from our 2012 investment themes of 'Sweating for Success' and 'Quality of Resource Companies'.

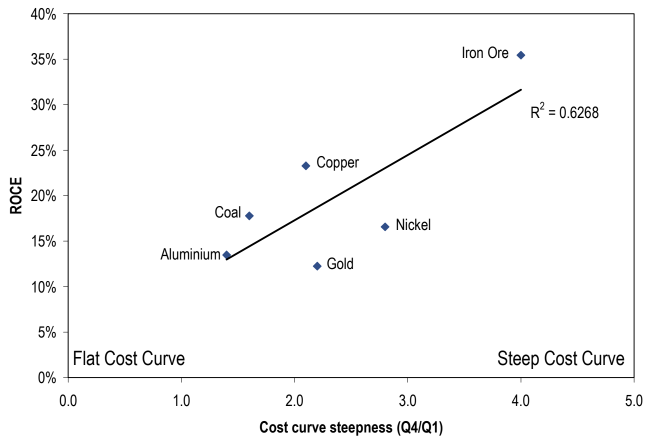
- **Companies with a low cost position and incrementally better capital allocation will outperform. There is a strong correlation between ROCE and cost structure of an industry – the steeper the cost curve, the better the ROCE.**

Figure 36. What drives ROCE?

Factor	Coefficient of determination (R2)
Commodity Risk	0.25
Cost curve steepness	0.59
Industry Concentration	0.32
Resource scarcity	0.18

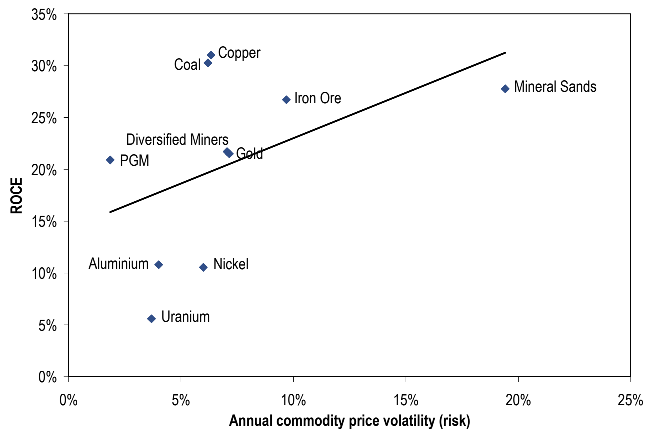
Source: Citi Investment Research and Analysis

Figure 37. ROCE vs cost curve steepness



Source: Company reports, Bloomberg and Citi Investment Research and Analysis

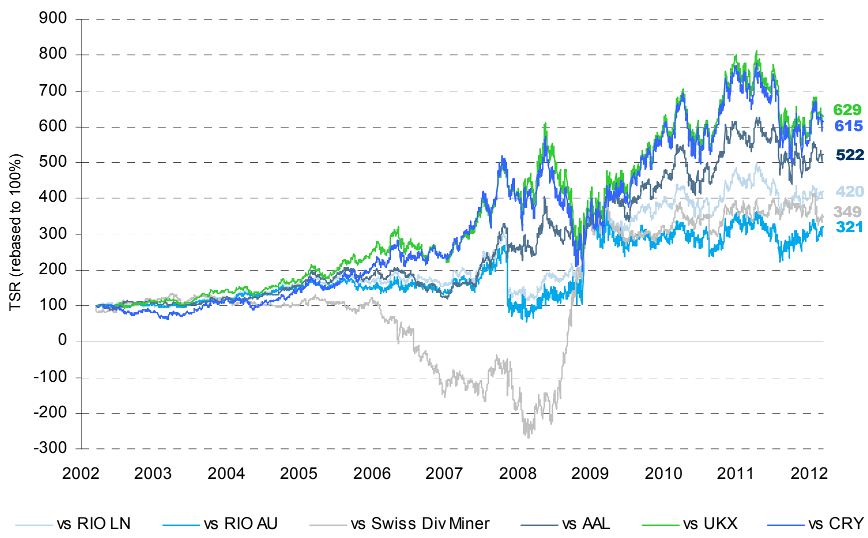
Figure 38. Forecast ROCE and commodity risk (2012-2020)



Source: Company reports, Bloomberg and Citi Investment Research and Analysis

- Moreover, consistent returns lead to long term upside in Total Shareholder Returns. There is a R^2 of over 50% when it comes to ROCE and TSR. We have seen a huge divergence in TSR for the broader mining by picking the alpha trades and we think this is set to continue.

Figure 39. Total Shareholder BHPB vs Peer Group and Broad Index



Source: Bloomberg

Figure 40. UK mining sector PE multiples

PE Multiples	Base				Spot				Consensus			
	2011E	2012E	2013E	11-13E CAGR	2011E	2012E	2013E	11-13E CAGR	2011E	2012E	2013E	11-13E CAGR
Diversified												
Anglo American PLC	8.5	8.9	7.6	6%	8.6	10.4	11.3	-13%	8.6	8.6	7.3	8%
BHP Billiton PLC	8.2	8.8	7.7	3%	8.2	9.0	8.1	1%	7.9	7.9	7.6	2%
ENRC	6.6	7.8	6.9	-2%	6.6	7.1	6.6	0%	6.6	7.2	6.3	2%
Rio Tinto PLC	6.8	7.1	6.2	4%	6.9	7.3	6.1	6%	7.0	7.3	6.6	3%
Vale	5.7	7.1	7.5	-12%	5.7	8.4	8.2	-16%	5.4	6.3	6.3	-7%
Weighted Average	**7.3**	**8.0**	**7.3**	**0%**	**7.3**	**8.6**	**8.0**	**-4%**	**7.1**	**7.4**	**7.0**	**1%**
Bulks												
Ferrexpo PLC	5.5	7.5	7.7	-15%	5.5	8.1	6.1	-5%	5.5	6.7	5.7	-2%
New World Resources	9.3	17.1	12.7	-15%	9.3	13.1	-110.6	na	9.5	8.9	8.0	9%
Zanaga	nm	nm	nm	na	nm	nm	nm	na	nm	nm	nm	na
Base Metals												
Antofagasta PLC	13.9	13.1	10.7	14%	13.9	10.9	10.8	14%	15.6	12.2	10.9	19%
First Quantum Minerals	16.0	29.0	13.8	8%	17.5	23.8	17.4	0%	17.4	12.8	9.2	38%
Kazakhmys Plc	4.7	5.2	4.5	2%	5.2	5.6	4.6	6%	5.3	6.0	5.9	-5%
Nyrstar	18.0	9.4	4.1	110%	18.0	7.5	5.3	84%	17.3	7.7	4.4	99%
Talvivaara	nm	91.1	11.2	na	nm	77.8	23.3	na	nm	14.9	5.9	na
Aluminium												
Norsk Hydro	17.4	16.6	11.5	23%	17.4	18.6	23.5	-14%	27.5	19.9	12.9	46%
Precious Metals												
African Barrick Gold	9.6	9.2	5.7	30%	9.6	10.1	10.7	-5%	9.6	8.5	7.0	18%
Aquarius Platinum Plc	30.2	44.1	12.3	56%	30.2	330.0	182.6	-59%	26.7	39.6	9.3	69%
Centamin Egypt	7.6	5.7	3.7	42%	7.6	6.0	4.4	31%	7.0	5.3	3.6	39%
Fresnillo Plc	22.6	20.2	18.2	12%	22.6	19.7	17.3	14%	25.9	23.2	19.9	14%
Gem Diamonds	11.5	10.7	11.7	-1%	nm	11.9	15.9	na	10.0	8.8	7.9	13%
Hochschild Mining	14.6	20.5	17.4	-8%	14.5	17.7	14.3	1%	15.2	16.8	15.0	1%
Lonmin Plc	16.2	16.3	10.4	25%	15.9	16.8	14.4	5%	17.3	20.9	13.8	12%
Nordgold	14.2	8.7	7.6	37%	14.2	9.0	6.6	46%	14.2	5.3	4.4	80%
Petropavlovsk PLC	6.8	4.7	3.6	37%	6.8	5.0	4.7	20%	6.6	5.8	4.8	18%
Randgold Resources Plc	25.2	16.0	10.8	53%	25.2	17.0	13.6	36%	25.1	15.3	13.7	35%
South Africa												
African Rainbow	11.1	10.3	8.8	12%	11.1	15.3	15.8	-16%	10.9	8.5	7.1	24%
Assore	7.5	7.9	8.1	-4%	7.5	10.3	9.7	-12%	8.3	6.9	6.2	16%
Exxaro	10.1	6.7	5.6	35%	10.1	8.9	8.0	12%	10.1	6.7	6.2	28%
Kumba Iron Ore Ltd	10.3	9.3	9.2	6%	10.3	11.1	9.9	2%	10.3	9.2	8.4	10%

Source: Citi Investment Research and Analysis, * priced at 19/03/2012

Figure 41. UK mining sector EV/EBITDA multiples

EV/EBITDA	Base				Spot				Consensus			
	2011E	2012E	2013E	11-13E CAGR	2011E	2012E	2013E	11-13E CAGR	2011E	2012E	2013E	11-13E CAGR
Diversified												
Anglo American PLC	4.8	4.7	3.5	17%	4.8	5.2	4.6	3%	4.2	4.1	3.5	9%
BHP Billiton PLC	5.4	5.6	4.9	5%	5.4	5.7	5.1	3%	5.7	5.3	4.8	8%
ENRC	3.4	3.5	3.2	4%	3.5	3.6	3.3	3%	3.4	3.7	3.2	3%
Rio Tinto PLC	4.8	4.5	3.9	11%	4.7	4.6	3.8	11%	4.6	5.2	4.6	1%
Vale	4.2	4.8	5.0	-9%	4.0	5.3	5.1	-11%	na	4.2	4.1	na
Weighted Average	**4.9**	**5.0**	**4.5**	**4%**	**4.8**	**5.2**	**4.7**	**1%**	**3.8**	**4.8**	**4.4**	**5%**
Bulks												
Ferrexpo PLC	4.0	4.8	5.0	-10%	4.0	5.1	4.1	-1%	na	4.9	4.4	na
New World Resources	4.0	6.3	5.4	-14%	4.0	5.7	9.5	-35%	4.0	4.3	4.1	-2%
Zanaga	nm	nm	nm	na	nm	nm	nm	na	nm	nm	nm	na
Base Metals												
Antofagasta PLC	4.9	4.7	4.2	8%	4.9	4.0	4.2	8%	na	4.4	4.1	na
First Quantum Minerals	7.3	8.6	4.8	23%	7.3	7.5	5.5	16%	na	5.2	4.1	na
Kazakhmys Plc	4.4	4.8	4.0	6%	4.4	4.3	4.1	4%	4.4	4.7	4.8	-5%
Nyrstar	6.9	4.7	3.0	52%	6.9	4.3	3.5	41%	6.9	4.6	3.4	44%
Talvivaara	17.1	12.5	6.6	60%	17.1	12.2	9.2	36%	17.1	10.7	5.4	77%
Aluminium												
Norsk Hydro	5.4	6.9	5.6	-1%	5.4	7.4	8.3	-19%	7.3	8.1	6.6	5%
Precious Metals												
African Barrick Gold	3.8	3.9	2.6	22%	3.0	2.7	2.8	5%	3.8	3.4	2.9	14%
Aquarius Platinum Plc	11.5	9.4	5.7	42%	11.5	12.3	12.3	-4%	8.5	8.4	4.5	38%
Centamin Egypt	5.5	4.0	2.3	56%	5.5	4.2	2.8	40%	na	4.1	2.3	na
Fresnillo Plc	12.8	11.8	10.4	11%	12.8	11.6	10.2	12%	na	12.1	10.4	na
Gem Diamonds	2.6	2.5	2.7	-3%	2.2	2.6	3.2	-16%	2.3	2.3	2.2	2%
Hochschild Mining	3.7	4.5	4.6	-9%	3.7	4.1	4.0	-3%	3.9	4.2	3.8	2%
Lonmin Plc	8.8	8.1	5.6	25%	8.6	8.2	7.2	10%	9.3	10.2	7.5	11%
Nordgold	4.6	3.2	2.8	28%	4.6	3.3	2.8	27%	na	2.8	2.5	na
Petropavlovsk PLC	5.4	3.5	2.8	39%	5.4	3.7	3.4	26%	4.9	4.1	3.4	20%
Randgold Resources Plc	15.3	10.1	6.8	50%	15.3	10.7	8.3	35%	15.7	9.3	8.0	40%
South Africa												
African Rainbow	5.9	5.4	4.7	12%	5.9	6.9	6.5	-5%	5.8	4.8	4.0	21%
Assore	5.7	6.0	6.5	-6%	5.7	7.5	7.5	-13%	6.1	5.3	4.7	15%
Exxaro	14.3	7.4	5.5	61%	13.1	9.6	8.2	26%	23.8	8.0	6.9	86%
Kumba Iron Ore Ltd	5.3	4.8	4.9	4%	5.3	5.7	5.2	0%	5.3	4.8	4.4	9%

Source: Citi Investment Research and Analysis

Appendix Methodology normalized PE

- The method of our original True P/E report penalised those companies that had not embarked on M&A and relied heavily on capex forecasts. In this note, we focus on published numbers from the most recent annual reports to derive a view on how 'stale' the company's D&A charge is and what the charge would be in today's $.
- By comparing a company's gross PPE to accumulated depreciation and the annual depreciation charge, we can derive the number of years that company's assets have been run down. For example, BHP's FY 2011 annual figures showed around $102.5bn gross PPE, $34bn accumulated depreciation, and $5bn annual charge. From this, we calculate that we are 6.8 years into a total asset life of 20.5 years.
- As a result, we assume that BHP's carrying values, and hence depreciation charge, in the P&L is ~7 years old. Using capex inflation rates of ~10% p.a. we can then arrive at a D&A charge in today's $ and running this number through the P&L, look at the impact on the underlying earnings.

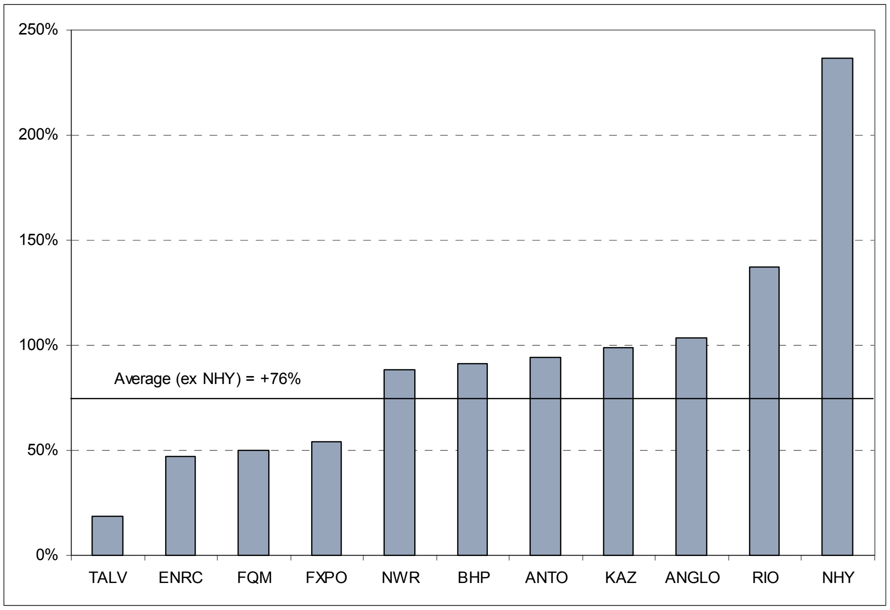
On a sector basis, our analysis appears to corroborate the findings in The True P/E. Replacements costs are running ~1.8x carrying values implying EPS downgrades of around 16%, similar to the 13% from the 'normalising' method. The combination of results from two separate approaches suggests that the de-rating experienced by the sector, as shown in Figure 32 is, at least in part, structural.

In contrast to our previous report however, a number of the winners and losers have traded places. We find one of the largest downgrades for Rio (21%), while BHP (15%) a clear laggard before, is a relative outperformer.

This reflects an important point we have addressed in recent research including Big Oil versus Big Mining - Cash of the Titans. Peaking commodity prices are forcing miners to expand volumes in an attempt to avoid margin compression. The efficient deployment of capital in pursuit of this volume growth is likely to be the key differentiating factor between companies. Those with a less efficient future investment profile relative to existing asset base will screen relatively better in this, historically focused report, than in the forward looking The True P/E. While BHP, for example has existing Tier 1 assets, its future projects are not of comparable quality. In contrast Rio appears well positioned and is one of the only companies in our coverage set to increase ROIC out to 2020 (24% vs. sector -7%).

Average carrying values (ex-Norsk Hydro) are 76% too low

Figure 42. Inflation Adjusted Increase in PPE Base



Source: Company Reports and CIRA Estimates

As Figure 42 shows, historical carrying values reported by the miners are significantly divorced from the current capital cost environment. Once we adjust for the age of the assets on each company's balance sheet average (excluding Norsk Hydro), PPE values are 88% (76%) too low.

As a result of realigning the asset base with reality, we can estimate the EPS impact on 2010 (2011 for BHP) annual results for the companies under coverage. The most affected by some distance is Norsk Hydro, which would have seen its entire earnings wiped out. As Figure 43 shows, Norsk's aged asset base in relation to the sector means that depreciation is running 3.36x lower than its replacement rate.

Those companies that screen relatively well include ENRC, FQM, Ferrexpo and Talvivaara, with minimal impacts between 0% and -7%. Alongside Norsk Hydro, New World Resources would have seen a significant downgrade of ~54%.

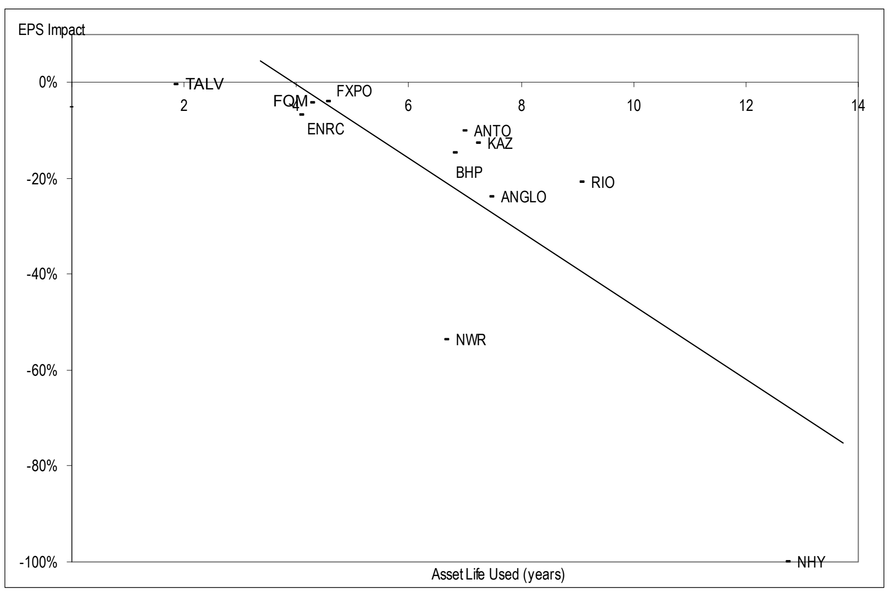
Figure 43. EPS Impact Of Adjusting PPE Base For Inflation

	Reporting Ccy	PPE Asset Life Used (Years)	Inflation Factor	Current DnA Charge (Rep ccy)	Inflation Adjusted DnA (Rep ccy)	U/L EPS (Rep ccy)	Rate for tax shield	Adjusted U/L EPS (Rep ccy)	D/grade
ANTO	USD	7.0	1.94	262	509	1.01	29%	0.90	-10%
KAZ	USD	7.2	1.99	220	437	2.78	14%	2.44	-13%
ANGLO	USD	7.4	2.03	1,985	4,037	4.13	28%	3.14	-24%
BHP	USD	6.8	1.91	5,003	9,566	3.98	30%	3.39	-15%
ENRC	USD	4.1	1.47	424	625	1.70	26%	1.58	-7%
RIO	USD	9.1	2.37	3,068	7,269	7.14	26%	5.66	-21%
FXPO	USD	4.5	1.54	36	55	0.72	15%	0.70	-4%
NWR	EUR	6.6	1.88	161	303	0.88	12%	0.41	-54%
FQM	USD	4.3	1.50	116	174	2.00	23%	1.91	-4%
TALV	EUR	1.8	1.19	51	61	- 5.26	26%	- 5.28	0%
NHY	NOK	12.7	3.36	2,821	9,489	1.33	43%	- 1.06	-100%
Sector Average (Ex Hydro)		**5.7**	**1.8**						**-16%**

Source: Company Reports and CIRA Estimates

Figure 44 shows how the intuitive relationship between the age of a company's reported asset base and subsequent EPS impacts holds across the sector.

Figure 44. Last Reported FY EPS Impact (%) vs. Asset Life Used (Years)



Source: Citi Investment Research and Analysis

BHP: A Worked Example

We have provided a worked example of our analysis in Figure 45 using BHP as a case in point.

- On an accounting basis, BHP has 'used' 6.8 years of the total 20.5 year life of its asset base. Assuming 10% p.a. capex cost inflation, an updated replacement cost of these assets would be approximately 1.91x higher than reported.
- As a result, the Gross PPE value rises from US$102,491m to US$195,965m.

- Assuming the same asset life, and straight line accounting methods, the implied adjusted depreciation charge would be US$9,566m, US$4,563m greater than the amount that the company currently runs through the P&L.

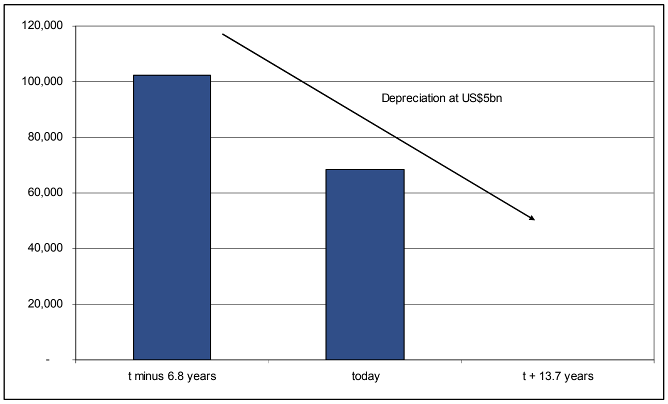
- On an EPS basis, the adjustment to depreciation results in a 15% reduction in reported FY 2011 reported numbers.

Figure 45. BHP Example Based on Reported FY 2011A

Total life of PPE at FYE	Years	20.5
Life left	Years	13.7
Life used to date	Years	6.80
Capex inflation rate p.a.	%	10%
Inflation factor for PPE		1.91
PPE Adjustment		
Gross PPE FY2011A	$m	102,491
PPE Adjusted for Inflation	$m	195,965
DnA Adjustment		
Inflation Adjusted DnA	$m	9,566
DNA Charge at FYE	$m	5,003
Pre-Tax Adjustment required to U/L NI	$m	- 4,563
EPS Impact		
U/L EPS Last FY	$/share	3.98
DnA adjustment post tax	$/share	- 0.60
Minority share of adjustment	$/share	- 0.01
Adjusted FY EPS	$/share	3.39
Downgrade		-15%

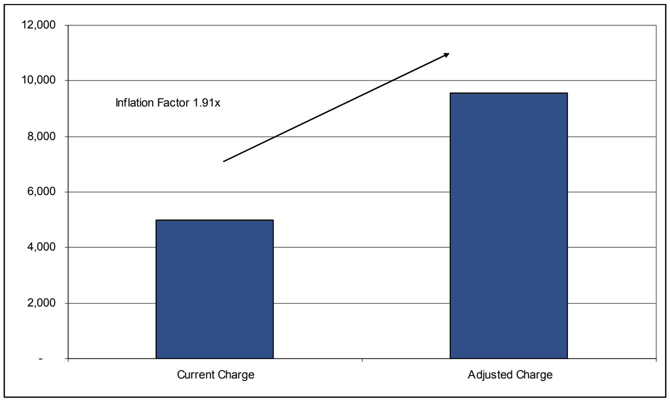
Source: Citi Investment Research and Analysis, Company Reports

Figure 46. BHP PPE Timeline at 2011A FY (US$m)



Source: Citi Investment Research and Analysis, Company Reports

Figure 47. Citi estimate of BHP Adjusted Depreciation Charge (US$m)



Source: Citi Investment Research and Analysis, Company Reports

Paradigm Shift

The results in this report appear to corroborate the findings in The True P/E. While neither report is free from distortion and penalises companies in different ways, combined they suggest that the de-rating experienced by the sector, as shown in Figure 32, is in part structural. From a 1-year forward P/E multiple of 12.5x over a 15-year period the sector has fallen to 10x over a 5 year period and most recently to 7.5x. In our view, the market is moving to price in an inflexion in the depreciation charge that has lagged the surge in capex spend as miners attempt to offset peaking commodity prices with enhanced volume growth.

How companies are positioned for the transition to this new paradigm of volume-driven margins will determine their ability to rerate on an absolute and relative basis. In our view investors should target the most efficient deployers of capital: those able to grow their ROIC over time.

BHP's established tier 1 asset base has enabled it to screen well in our historical report however the efficiency of its future investment profile is inferior to Rio that appeared well positioned in our forward-looking report. It is one of the only companies we expect to increase ROIC (by 24%) vs. a sector-wide fall of 7% out to 2020 (See Cash of the Titans). As such, we think it is the most likely to experience an absolute and relative rerating.

Companies Mentioned

Figure 48. Companies Mentioned

Company	Ticker	Listing Currency	Rating	Prices as at 19-Mar-12	Target price	Upside	Div. yield	ETR
African Barrick Gold	ABGL.L	GBP	3	4.12	4.19	1.7%	0.0%	1.7%
African Rainbow	ARIJ.J	ZAR	1	185.18	230.00	24.2%	3.2%	27.4%
Anglo American PLC	AAL.L	GBP	2	25.69	30.00	16.8%	2.3%	19.1%
Antofagasta	ANTO.L	GBP	3	12.18	10.00	-17.9%	4.3%	-13.6%
Aquarius Platinum Ltd	AQP.L	GBP	2	1.58	1.65	4.3%	3.2%	7.5%
ArcelorMittal	ISPA.AS	EUR	1	15.94	19.00	19.2%	5.0%	24.2%
Assore	ASRJ.J	ZAR	1	256.80	300.00	16.8%	2.7%	19.5%
BHP Billiton PLC	BLT.L	GBP	1	20.03	23.00	14.8%	3.0%	17.8%
Centamin	CEY.L	GBP	1	0.79	1.10	39.7%	0.0%	39.7%
ENRC	ENRC.L	GBP	1	6.73	8.60	27.8%	3.0%	30.8%
Exxaro	EXXJ.J	ZAR	2	207.00	220.00	6.3%	6.3%	12.6%
Ferrexpo	FXPO.L	GBP	1	3.28	4.35	32.6%	1.3%	33.9%
First Quantum Minerals Ltd	FQM.L	GBP	2	12.75	13.60	6.7%	0.6%	7.3%
Fresnillo PLC	FRES.L	GBP	2	17.35	18.74	8.0%	1.0%	9.0%
Gem Diamonds	GEMD.L	GBP	1	2.82	2.61	-7.3%	0.0%	-7.3%
Hochschild Mining PLC	HOCM.L	GBP	2	4.89	5.13	5.0%	0.8%	5.8%
Kazakhmys PLC	KAZ.L	GBP	1	9.38	15.20	62.1%	6.8%	69.0%
Kumba Iron Ore Ltd	KIOJ.J	ZAR	3	539.00	430.00	-20.2%	8.5%	-11.7%
Lonmin PLC	LMI.L	GBP	2	11.13	11.25	1.1%	0.0%	1.1%
New World Resources	NWRR.L	GBP	2	4.38	5.00	14.1%	2.5%	16.6%
Newmont Mining	NEM.N	USD	1	53.53	80.00	49.4%	0.7%	50.2%
Nordgold	NORDNq.L	USD	2	6.69	7.24	8.2%	2.8%	11.1%
Norsk Hydro ASA	NHY.OL	NOK	3	32.65	30.00	-8.1%	1.8%	-6.3%
Nyrstar NV	NYR.BR	EUR	1	6.61	9.00	36.2%	2.4%	38.6%
Petropavlovsk	POG.L	GBP	1	6.19	8.34	34.7%	0.0%	34.7%
Randgold Resources Ltd	RRS.L	GBP	1	63.95	88.84	38.9%	0.3%	39.2%
Rio Tinto PLC	RIO.L	GBP	1	35.14	49.00	39.5%	2.0%	41.5%
Talvivaara	TALV.L	GBP	2	2.63	3.00	14.2%	0.0%	14.2%
Vale	VALE.N	USD	1	23.78	33.00	38.8%	6.3%	45.1%
Zanaga Iron Ore Co	ZIOC.L	GBP	1H	1.09	1.50	37.6%	0.0%	37.6%

Source: Citi Investment Research and Analysis

Appendix A-1

Analyst Certification

The research analyst(s) primarily responsible for the preparation and content of this research report are named in bold text in the author block at the front of the product except for those sections where an analyst's name appears in bold alongside content which is attributable to that analyst. Each of these analyst(s) certify, with respect to the section(s) of the report for which they are responsible, that the views expressed therein accurately reflect their personal views about each issuer and security referenced and were prepared in an independent manner, including with respect to Citigroup Global Markets Inc and its affiliates. No part of the research analyst's compensation was, is, or will be, directly or indirectly, related to the specific recommendation(s) or view(s) expressed by that research analyst in this report.

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