

## Equities

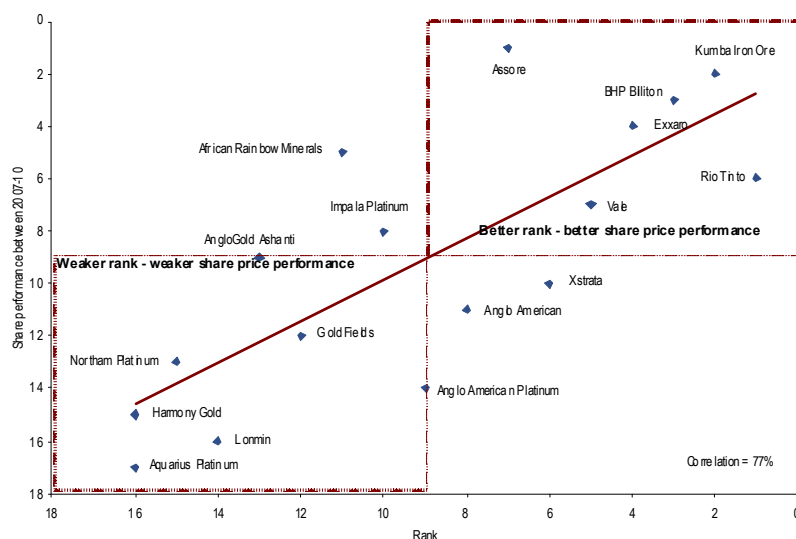
15 January 2012 | 52 pages

# Metals & Mining

## Sweating for Success

- **“Sweating for Success” is our global mining theme for the next decade** — The mining sector was given a free kick with surging commodity prices over the past decade, which hid a number of sins. Mining companies will now have to sweat it out to deliver shareholder returns. This is likely to drive significant alpha in the sector rather than the large beta trade that we have seen.
- **Performance gets rewards** — We believe management teams and asset portfolios with proven track records are better positioned to continue delivering sustainable value creation through the cycle. We have analysed mining companies on the following performance factors to determine leaders and laggards 1) volume growth; 2) labour productivity; 3) cost control; 4) safety performance; 5) asset efficiency; 6) revenue per employee and 7) EBITDA per employee. Miners that performed strongly in our analysis have generally shown good relative share price performance (Figure 2).
- **The leaders and laggards** — We have looked at what is being priced in and believe the best risk adjusted returns over the next five to ten years will be Rio Tinto, ENRC, Glencore, Randgold, Petropavlovsk, Kazakhmys and Nyrstar. Potential laggards are Norsk Hydro, Aquarius Platinum, Lonmin, Hochschild, and Talvivaara.

Figure 1. Relationship between miners performance ranking\* and 2007-10 share performance\*



Source: Citi Investment Research and Analysis; Datastream and CIRA \*1=best; 17=worst

### Industry Overview

#### Heath R Jansen

+44-20-7986-3921  
heath.jansen@citigroup.com

#### Johann Pretorius

+27-11-944-0820  
johann.pretorius@citigroup.com

#### Anindya Mohinta

+44-20-7986-4210  
anindya.mohinta@citigroup.com

#### Jon H Bergtheil

+44-20-7986-4453  
jon.bergtheil@citigroup.com

#### Jatinder Goel, CFA

+44-20-7986-9924  
jatinder.goel@citigroup.com

#### Michael E Flitton

+44-20-7986-3943  
michael.flitton@citigroup.com

#### Thomas O'Hara

+44-20-7986-4557  
thomas.joseph.ohara@citigroup.com

#### Johann Steyn

+27-11-944-0087  
johann.steyn@citigroup.com

#### Alexander Hacking, CFA

+1-212-816-6232  
alex.hacking@citigroup.com

#### Craig Sainsbury

+61-2-8225-4871  
craig.sainsbury@citigroup.com

#### Clarke Wilkins

+61-2-8225-4858  
clarke.wilkins@citigroup.com

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

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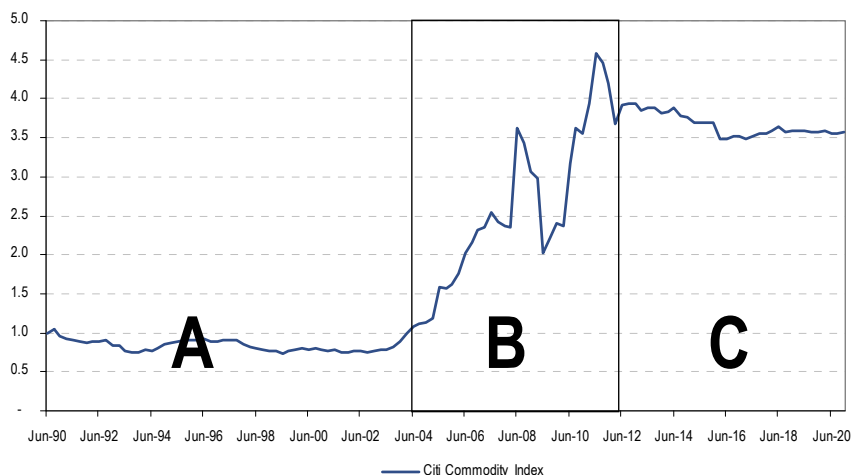
## Back to the Future for mining

The mining sector's performance over the next 5-10 years is likely to mirror the late 1990s and early 2000s, in our view (Back to the Future). Under this environment Alpha will be more important than Beta, so we aim to identify those companies that will outperform.

### Period A – efficiency wins

During 1990 to 2004, commodity prices generally traded sideways (refer Figure 2 – period A). However, mining companies such as Rio Tinto managed to deliver exceptional earnings growth over this period.

Figure 2. Citi commodity price index (bulks, base and precious) – unique periods



Source: Citi Investment Research and Analysis

### Period B – a free ride

In the period from 2005 to 2011 (period B) the mining sector was a massive Beta play, driven by surging commodity prices. Correlations between commodities and equities increased from around 0.4 to around 0.8. Mining companies were arguably less efficient in converting revenue into profits with underlying commodities outperforming equities over this period. Amazingly, a number of miners even made rights issues during this mostly favourable period.

Figure 3. Correlation R2

#### 1994-2004

|        | BHP   | Rio   | Copper |
|--------|-------|-------|--------|
| BHP    |       | 0.804 | 0.421  |
| Rio    | 0.804 |       | 0.374  |
| Copper | 0.421 | 0.374 |        |

#### 2005-2011

|        | BHP   | Rio   | Copper |
|--------|-------|-------|--------|
| BHP    |       | 0.91  | 0.765  |
| Rio    | 0.91  |       | 0.798  |
| Copper | 0.765 | 0.798 |        |

Source: Bloomberg Data, Citi Investment Research and Analysis

Going forward we believe commodity prices will generally trade sideways over the next decade, albeit with increased volatility (Period C). Commodity markets enter 2012 relatively well balanced, but are torn between the lower demand impact of a potential double-dip in the US, European recession and sharply lower Chinese growth (downside price risk) vis-à-vis weather and political disruptions to supplies (upside price risk). Large capex spends from the mining companies may alleviate tight historical supply. The key conclusion under this environment is that Alpha is likely to win out.

## Finding Alpha

Under a flat commodity environment (period C) **Efficiency Performance** gets rewarded. In this report we compare miners' historical performance in terms of: 1) volume growth; 2) labour productivity; 3) cost control; 4) safety performance; 5) asset efficiency; 6) revenue per employee and 7) EBITDA per employee. Miners that performed strongly in our analysis have generally shown good relative share price performance over the period (77% correlation).

Figure 4. Sweating for Success – Efficiency drives Returns



Source: Citi Investment Research and Analysis

#### Back miners with proven track records

We believe management teams and asset portfolios with proven track records are better positioned to continue delivering sustainable value creation through the cycle. Figure 5 ranks the miners in terms of actual historical performance.

- Rio Tinto was the top performer (Figure 4). Superior productivity, good cost control and a favourable commodity mix resulted in 2010 EBITDA per employee of \$194 000. It performed consistently strong across all metrics.
- The top eight miners in our analysis are base metal and bulk commodity producers, while the bottom six are precious metal producers.
- Generally speaking, top ranked miners also had the best safety record.
- Our analysis indicates that there is a 94% correlation between average employee cost and productivity (Figure 29). Revenue generated for each dollar of labour cost paid is far more important than the level of mining companies' average salary per employee.

Figure 5. Mining company report card (1 = best, 17 = worst)

| Rank | Company                  | Production growth | Productivity | Cost control | Safety | Avg. Revenue per employee | Avg. EBITDA per employee | Asset utilization efficiency | Total score (lowest = best) |
|------|--------------------------|-------------------|--------------|--------------|--------|---------------------------|--------------------------|------------------------------|-----------------------------|
| 1    | Rio Tinto                | 5                 | 1            | 14           | 3      | 1                         | 2                        | 3                            | 29                          |
| 2    | Kumba Iron Ore           | 1                 | 5            | 15           | 2      | 4                         | 3                        | 2                            | 32                          |
| 3    | BHP Billiton             | 7                 | 2            | 12           | 7      | 2                         | 1                        | 4                            | 35                          |
| 4    | Exxaro                   | 2                 | 3            | 9            | 6      | 7                         | 8                        | 1                            | 36                          |
| 5    | Vale                     | 6                 | 5            | 3            | 1      | 5                         | 5                        | 15                           | 40                          |
| 6    | Xstrata                  | 9                 | 5            | 4            | 7      | 3                         | 4                        | 13                           | 45                          |
| 7    | Assore                   | 4                 | 9            | 6            | 10     | 8                         | 6                        | 4                            | 47                          |
| 8    | Anglo American           | 12                | 3            | 5            | 4      | 6                         | 7                        | 14                           | 51                          |
| 9    | Anglo American Platinum  | 8                 | 5            | 7            | 14     | 10                        | 12                       | 9                            | 65                          |
| 10   | Impala Platinum          | 11                | 13           | 1            | 15     | 11                        | 10                       | 9                            | 70                          |
| 11   | African Rainbow Minerals | 3                 | 15           | 17           | 16     | 9                         | 9                        | 7                            | 76                          |
| 12   | Gold Fields              | 14                | 13           | 18           | 4      | 14                        | 14                       | 8                            | 85                          |
| 13   | AngloGold Ashanti        | 15                | 9            | 13           | 17     | 12                        | 16                       | 6                            | 88                          |
| 14   | Lonmin                   | 13                | 16           | 8            | 12     | 16                        | 15                       | 11                           | 91                          |
| 15   | Northam Platinum         | 10                | 12           | 16           | 9      | 15                        | 13                       | 17                           | 92                          |
| 16   | Aquarius Platinum        | 17                | 17           | 10           | 11     | 13                        | 11                       | 15                           | 94                          |
| 17   | Harmony Gold             | 16                | 9            | 11           | 13     | 17                        | 17                       | 11                           | 94                          |

Source: Citi Investment Research and Analysis

### Key conclusions:

- **It starts with strategy** — Our analysis suggests that: 1) companies should focus on industries with strong fundamentals, 2) assets should be competitively positioned to maximize margins through the cycle, 3) scale benefits drive productivity, 4) opencast trumps underground.
- **Discipline and performance culture** — Strong management is required to consistently drive productivity and efficiency improvements to offset industry challenges like increasing mining complexity and grade decline. Revenue should be maximized for each unit of cost. Safety performance has an increasing impact on miners' productivity and bottom line.
- **And don't overpay** — Poor capital allocation is a key risk now that many miners have strong balance sheets and healthy cash generation. We analyse miners' asset turnover and return on incremental investment, which provides a track record for capital allocation.

### What will and have the companies achieved

#### Earnings rose more than commodities in period A

We compare revenue growth to earnings growth over periods A, B and our expectations for C in Figure 6. In period A, the commodity basket rose 46% and BHP and Rio delivered revenue growth of 73% and 133% respectively and earnings growth of 252% and 258% respectively. Both companies delivered higher revenue growth than the underlying commodity prices through volume growth / change in commodity mix. They also translated a significant proportion of that revenue growth into earnings growth (our EPS conversion number) delivering an EPS conversion of above 1.5x.

#### Period B – conversion rate fell below 1.5x

In period B, the commodity basket rose by 258% generally the revenue stream of the miners was below this level and more importantly the EPS conversion rate fell below 1.5, with the exception of Anglo American (who divested assets, slimmed down and high graded its portfolio). This can also be seen in the Return on Incremental Invested Capital (ROIIC) that each company achieved (Figure 50).

#### Miners will have to sweat going forward

Going forward we think companies with proven track records, which performed well in our analysis (Figure 5) could outperform.

Figure 6. Efficiency Evolution – The bottom line

|              | 1996-2005 (Period A) |               |          | 2006-2011 (Period B) |               |          | 2012-2015 (Period c) |               | 2012-2020 (Period C) |               |
|--------------|----------------------|---------------|----------|----------------------|---------------|----------|----------------------|---------------|----------------------|---------------|
|              | Revenue              | Change in EPS | Sh Price | Revenue              | Change in EPS | Sh Price | Revenue              | Change in EPS | Revenue              | Change in EPS |
| Anglo        |                      |               |          | 3%                   | 82%           | 17%      | 22%                  | 27%           | 41%                  | 25%           |
| BHP Billiton | 73%                  | 252%          | 174%     | 146%                 | 195%          | 98%      | 25%                  | 18%           | 59%                  | 55%           |
| Glencore     |                      |               |          | 99%                  | 46%           |          | 6%                   | 95%           | 32%                  | 106%          |
| Rio Tinto    | 133%                 | 258%          | 184%     | 208%                 | 124%          | 42%      | 22%                  | 29%           | 35%                  | 46%           |
| Xstrata      |                      |               |          | 99%                  | -17%          | 42%      | 34%                  | 88%           | 43%                  | 87%           |
| Vale         |                      |               |          | 359%                 | 294%          | 109%     | 2%                   | -22%          | 0%                   | 0%            |

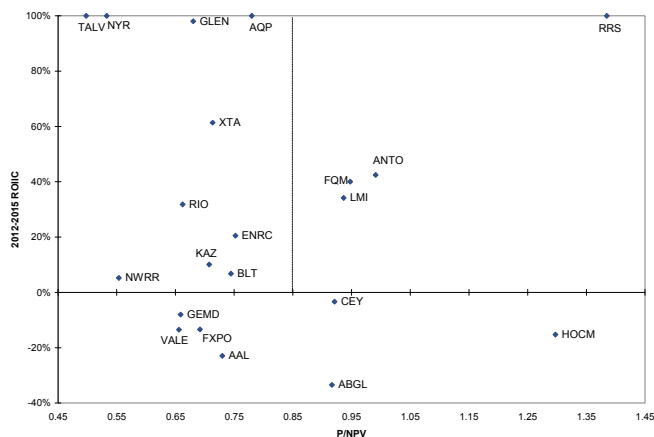
  

|              | 1996-2005 (Period A) |          |       | 2006-2011 (Period B) |          |       | 2012-2015 (Period c) |       | 2012-2020 (Period C) |       |
|--------------|----------------------|----------|-------|----------------------|----------|-------|----------------------|-------|----------------------|-------|
|              | EPS Conversion       | Sh Price | ROIIC | EPS Conversion       | Sh Price | ROIIC | EPS Conversion       | ROIIC | EPS Conversion       | ROIIC |
| Anglo        |                      |          |       | 25.75                | 17%      | 58%   | 1.19                 | -23%  | 0.60                 | -11%  |
| BHP Billiton | 3.46                 | 174%     |       | 1.33                 | 98%      | 32%   | 0.74                 | 7%    | 0.94                 | 17%   |
| Glencore     |                      |          |       | 0.47                 |          | 10%   | 15.78                | 98%   | 3.34                 | 58%   |
| Rio Tinto    | 1.94                 | 184%     | 16%   | 0.60                 | 42%      | 16%   | 1.28                 | 32%   | 1.34                 | 34%   |
| Xstrata      |                      |          |       | -0.18                | 42%      | 6%    | 2.60                 | 61%   | 2.01                 | 34%   |
| Vale         |                      |          |       | 0.82                 | 109%     | 23%   | -10.56               | -13%  |                      |       |

Source: Company Data, Citi Investment Research and Analysis

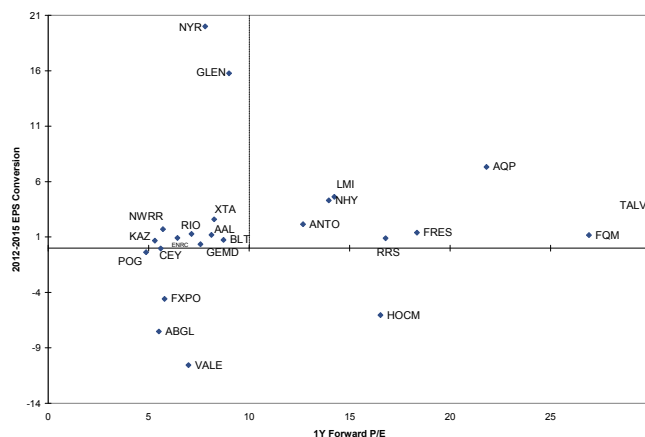
**What is priced in:** We have compared the EPS conversion and Incremental ROIC versus what the company share prices are currently discounting. The standouts are highlighted below ie low PE and high conversion

Figure 7. 2012-2015E ROIC\* vs P/NPV



Source: Citi Investment Research and Analysis, \*Return on Incremental Invested Capital Note: ROIC capped at 100% on positive side

Figure 8. EPS Conversion\* vs 1Y Forward P/E Ratio



Source: Citi Investment Research and Analysis, \*Change in EPS/Change in Revenue capped at 20 on positive side, Note: P/E capped at 30

Figure 9. EPS Conversion\* vs Share Price Performance and ROIC<sup>A</sup>

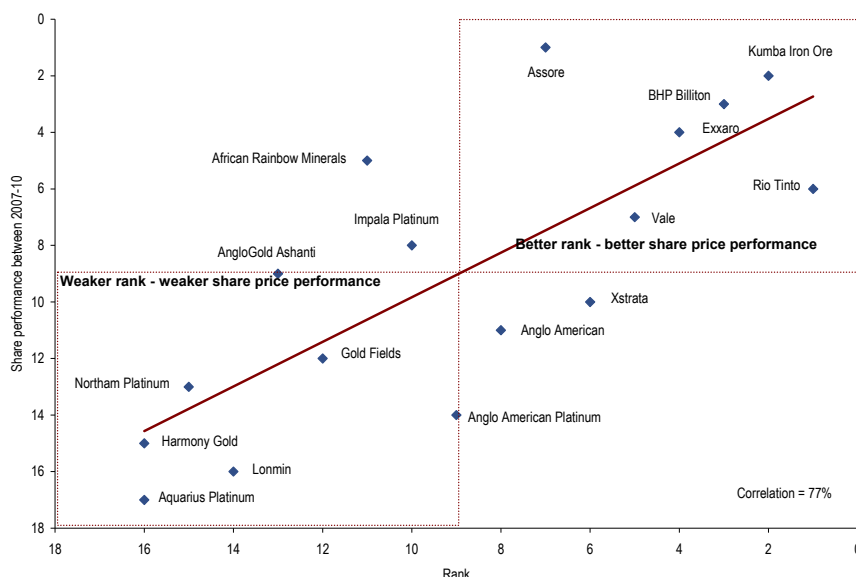
|                      | 2006-2011 (Period B) |          |      | 2012-2015 (Period C) |        | 2012-2020 (Period C) |       |
|----------------------|----------------------|----------|------|----------------------|--------|----------------------|-------|
|                      | EPS Conv             | Sh Price | ROIC | EPS Conv             | ROIC   | EPS Conv             | ROIC  |
| <b>Diversified</b>   |                      |          |      |                      |        |                      |       |
| Anglo                | 25.75                | 17%      | 58%  | 1.19                 | -23%   | 0.60                 | -11%  |
| BHP Billiton         | 1.33                 | 98%      | 32%  | 0.74                 | 7%     | 0.94                 | 17%   |
| ENRC                 | -                    | -        | -    | 0.92                 | 20%    | 1.02                 | 5%    |
| Glencore             | 0.47                 | -        | -    | 15.78                | 98%    | 3.34                 | 58%   |
| Rio Tinto            | 0.60                 | 42%      | 16%  | 1.28                 | 32%    | 1.34                 | 34%   |
| Vale                 | 0.82                 | 109%     | 23%  | -10.56               | -13%   | -                    | -     |
| Xstrata              | -0.18                | 42%      | 6%   | 2.60                 | 61%    | 2.01                 | 34%   |
| <b>Bulks</b>         |                      |          |      |                      |        |                      |       |
| Ferrexpo             | -                    | -        | -    | -4.58                | -13%   | 5.28                 | -46%  |
| NWR                  | -                    | -        | -    | 1.70                 | 5%     | 2.10                 | 30%   |
| Zanaga               | -                    | -        | -    | -                    | -      | -                    | -     |
| <b>Base</b>          |                      |          |      |                      |        |                      |       |
| Antofagasta          | 0.48                 | 225%     | 18%  | 2.16                 | 42%    | -0.01                | -36%  |
| First Quantum        | -0.10                | 228%     | 14%  | 1.18                 | 40%    | 1.14                 | 35%   |
| Kazakhmys            | 3.77                 | 20%      | 23%  | 0.67                 | 10%    | -0.16                | 14%   |
| Nyrstar              | -                    | -        | -    | 29.39                | 36399% | 17.14                | 338%  |
| Talvivaara           | -                    | -        | -    | 4.08                 | 822%   | 4.30                 | 870%  |
| <b>Aluminium</b>     |                      |          |      |                      |        |                      |       |
| Norsk Hydro          | 1.80                 | -33%     | nm   | 4.31                 | nm     | 5.13                 | 12%   |
| <b>Precious</b>      |                      |          |      |                      |        |                      |       |
| African Barrick Gold | -                    | -        | -    | -7.52                | -33%   | 1.50                 | -370% |
| Aquarius Platinum    | -0.32                | 6%       | -2%  | 7.32                 | 164%   | -9.39                | 30%   |
| Centamin Egypt       | -                    | 243%     | -    | -0.04                | -3%    | 0.02                 | 2%    |
| European Gold Field  | 0.01                 | 557%     | 1%   | 1.32                 | 50%    | 2.53                 | 79%   |
| Fresnillo            | 1.37                 | -        | 83%  | 1.40                 | nm     | 1.45                 | nm    |
| Gem Diamonds         | -                    | -        | -    | 0.35                 | -8%    | -0.05                | -36%  |
| Hochschild           | 0.56                 | -        | 48%  | -6.04                | -15%   | 4.29                 | -276% |
| Lonmin PLC           | -0.71                | -36%     | -6%  | 4.62                 | 34%    | 4.56                 | -     |
| Petropavlovsk        | 0.65                 | -33%     | 11%  | -0.38                | nm     | 23.55                | nm    |
| Randgold             | 0.73                 | 610%     | 25%  | 0.89                 | 441%   | 1.27                 | 39%   |

Source: Citi Investment Research and Analysis

## Efficient miners generally performed well

Miners that performed strongly in our analysis have generally shown good relative share price performance over the period.

Figure 10. Relationship between miners performance ranking\* and 2007-10 share performance\*



\* 1 = best; 17 = worst

Source: DataStream, Citi Investment Research and Analysis

Figure 11. Share price performance, 2007-10

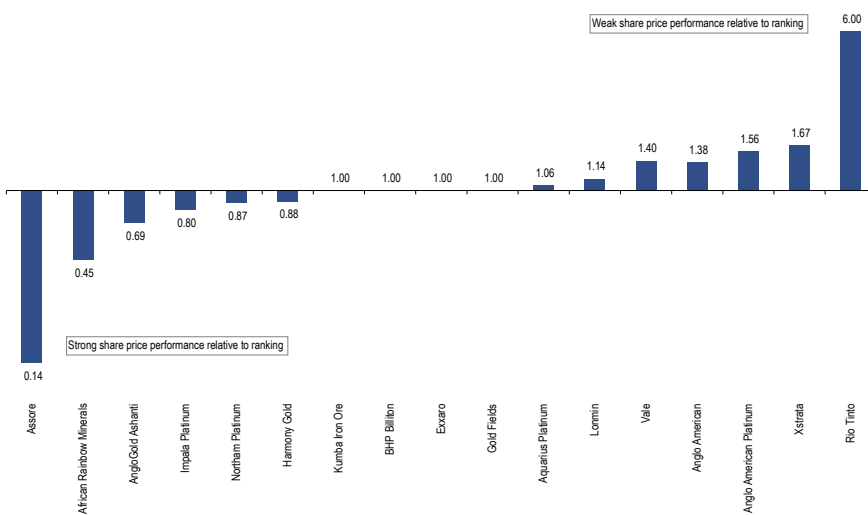
| Company                  | Rank | Price on 1st Jan'07 | Price Currency | Price on 31st Dec'10 | % Change |
|--------------------------|------|---------------------|----------------|----------------------|----------|
| Assore                   | 1    | 31                  | ZAR            | 189                  | 510%     |
| Kumba Iron Ore           | 2    | 111                 | ZAR            | 425                  | 282%     |
| BHP Billiton             | 3    | 935                 | GBp            | 2,551                | 173%     |
| Exxaro                   | 4    | 56                  | ZAR            | 136                  | 143%     |
| African Rainbow Minerals | 5    | 101                 | ZAR            | 210                  | 108%     |
| Rio Tinto                | 6    | 2,245               | GBp            | 4,487                | 100%     |
| Vale                     | 7    | 27                  | BRL            | 49                   | 79%      |
| Impala Platinum          | 8    | 184                 | ZAR            | 233                  | 27%      |
| AngloGold Ashanti        | 9    | 309                 | ZAR            | 327                  | 6%       |
| Xstrata                  | 10   | 1,444               | GBp            | 1,506                | 4%       |
| Anglo American           | 11   | 352                 | ZAR            | 343                  | -3%      |
| Gold Fields              | 12   | 133                 | ZAR            | 121                  | -9%      |
| Northam Platinum         | 13   | 51                  | ZAR            | 45                   | -12%     |
| Anglo American Platinum  | 14   | 832                 | ZAR            | 694                  | -17%     |
| Harmony Gold             | 15   | 111                 | ZAR            | 83                   | -25%     |
| Lonmin                   | 16   | 2,872               | GBp            | 1,966                | -32%     |
| Aquarius Platinum        | 17   | 9                   | AUD            | 5                    | -40%     |

Source: DataStream, Citi Investment Research and Analysis

### The outliers

Assore, ARM and AngloGold Ashanti posted better share price performance than their ranking suggests, while Rio Tinto, Xstrata, Anglo Platinum and Anglo American achieved disappointing share price performance relative to our rankings (Figure 12). Relative commodity price performance likely caused this discrepancy, in our view.

Figure 12. Share price performance relative to Citi performance ranking (log scale)



\*Share price ranking (1=best) divided by Citi performance ranking (1 = best)

Source: Citi Investment Research and Analysis



## Analysing real performance

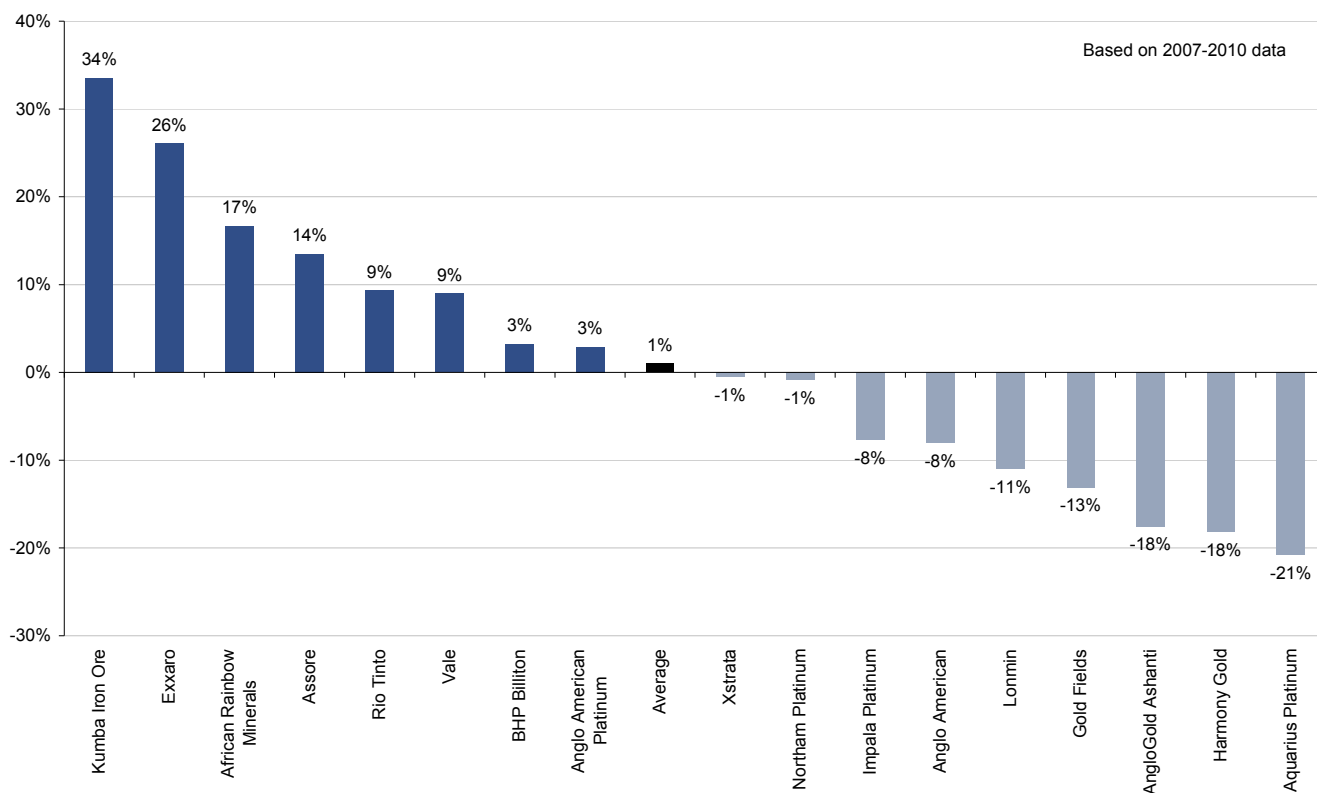
### 1. Production growth

Throughout this report, we calculated copper equivalent units using our long-term normalised commodity prices (see page 35), to equalize revenue generating units among companies. For example, 10 million tonnes of export thermal coal is equal to 188 000 tonnes of copper ( $10\,000\,000 \times \$109/t / \$5\,800/t$ ).

Mining companies grew production only 1% on average over the past three years. Kumba (+34%), Exxaro (+26%) and ARM (+17%) were outperformers. Rio Tinto increased production 9%, beating major London listed peers.

Platinum and Gold miners performed poorly, with production declines in all cases, except for Anglo American Platinum.

Figure 13. Cumulative production growth since 2007\*



\* Measured in copper equivalent units, only core divisions included. As per financial year.

Source: Company Reports and CIRA Estimates

**Figure 14. Growth in Copper equivalent production ranking carried forward (for period 2007-10)**

| Company                  | % change | Rank |
|--------------------------|----------|------|
| Kumba Iron Ore           | 33.5%    | 1    |
| Exxaro                   | 26.1%    | 2    |
| African Rainbow Minerals | 16.7%    | 3    |
| Assore                   | 13.5%    | 4    |
| Rio Tinto                | 9.4%     | 5    |
| Vale                     | 9.0%     | 6    |
| BHP Billiton             | 3.2%     | 7    |
| Anglo American Platinum  | 2.9%     | 8    |
| Xstrata                  | -0.5%    | 9    |
| Northam Platinum         | -0.9%    | 10   |
| Impala Platinum          | -7.8%    | 11   |
| Anglo American           | -8.0%    | 12   |
| Lonmin                   | -11.0%   | 13   |
| Gold Fields              | -13.1%   | 14   |
| AngloGold Ashanti        | -17.6%   | 15   |
| Harmony Gold             | -18.2%   | 16   |
| Aquarius Platinum        | -20.8%   | 17   |

Source: Company reports, Citi Investment Research and Analysis

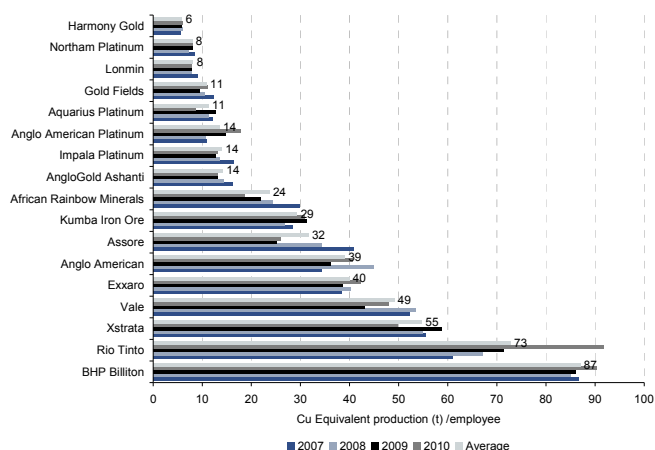
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## 2. Labour productivity

Figure 15 shows miners' production per employee measured in annual copper equivalent units.

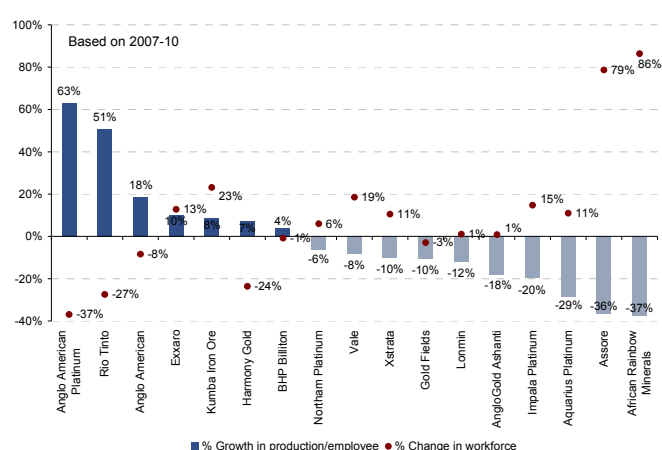
- Productivity, as measured by normalized revenue per employee, varies widely between different industries. Superior shareholder value generation therefore starts with the correct strategy. Companies need to invest in industries with strong fundamentals, and preferably in large scale assets which maximize revenue per employee. Opencast mining, which lends itself to mechanization appears to boost productivity relative to underground mining.
- Larger miners (BHP, RIO, Xstrata, Vale) are more productive than smaller miners (ARM, Kumba), pointing to scale benefits.
- BHP's workforce appears to be most productive, boosted by its petroleum division, its large scale and the bulk and mechanized nature of its mineral operations.
- Deep-level precious metal miners are least productive.
- Anglo American Platinum posted the biggest efficiency improvement over the three-year period (+63%) as it reduced its workforce by 37% and implemented a major restructuring (closing of high cost shafts). Rio Tinto (+51%) and Anglo American (+18%) performed best among the major London listed miners, partly due to a 27% and 8% reduction in workforce respectively.
- Assore and ARM's efficiency dwindled by 36% and 37%, respectively, due partly to a weakening in manganese demand impacting volumes, but mostly due to a significant jump in workforce (79% and 86% respectively).

Figure 15. Annual production per employee\*, 2007-10



\* Copper equivalent tonnes per employee (including contractors) per annum  
Source: Company reports, Citi Investment Research and Analysis

Figure 16. Growth in production per employee and workforce, 2007-10



Source: Company reports, Citi Investment Research and Analysis

**Figure 17. Avg. Copper eq. production/employee ranking carried forward (for period 2007-10)**

| <b>Company</b>           | <b>Avg. production<br/>Rank</b> | <b>Production<br/>Improv'mt Rank</b> | <b>Combined<br/>Score</b> | <b>Combined<br/>Rank</b> |
|--------------------------|---------------------------------|--------------------------------------|---------------------------|--------------------------|
| Rio Tinto                | 2                               | 2                                    | 4                         | 1                        |
| BHP Billiton             | 1                               | 7                                    | 8                         | 2                        |
| Exxaro                   | 5                               | 4                                    | 9                         | 3                        |
| Anglo American           | 6                               | 3                                    | 9                         | 3                        |
| Kumba Iron Ore           | 8                               | 5                                    | 13                        | 5                        |
| Xstrata                  | 3                               | 10                                   | 13                        | 5                        |
| Vale                     | 4                               | 9                                    | 13                        | 5                        |
| Anglo American Platinum  | 12                              | 1                                    | 13                        | 5                        |
| Harmony Gold             | 17                              | 6                                    | 23                        | 9                        |
| Assore                   | 7                               | 16                                   | 23                        | 9                        |
| AngloGold Ashanti        | 10                              | 13                                   | 23                        | 9                        |
| Northam Platinum         | 16                              | 8                                    | 24                        | 12                       |
| Gold Fields              | 14                              | 11                                   | 25                        | 13                       |
| Impala Platinum          | 11                              | 14                                   | 25                        | 13                       |
| African Rainbow Minerals | 9                               | 17                                   | 26                        | 15                       |
| Lonmin                   | 15                              | 12                                   | 27                        | 16                       |
| Aquarius Platinum        | 13                              | 15                                   | 28                        | 17                       |

Source: Company reports, Citi Investment Research and Analysis

### 3. Cost control

Head office, marketing, exploration, royalties, SGA and other costs are often not captured in a normal cash costs analysis for miners. Thus whilst a mine may look profitable, its true profitability may not be as rosy.

To assess true cash costs (as well as compare costs across commodity types) we have looked at total costs at the corporate level. Costs are thus represented as the difference between sales and EBITDA.

To convert these into unit costs we have divided total costs by copper equivalent production. In turn copper equivalent production was calculated by dividing 2010 revenue by the 2010 average copper price (for this exercise only). The chart below provides a walk through example of the calculations.

**Figure 18. Calculating copper equivalent cash costs (2010)**

| Item  | Unit   | Anglo  | BHP    | RIO    | Xstrata |
|---|--------|--------|--------|--------|---------|
| A Sales                                     | US\$m  | 32,929 | 52,798 | 60,323 | 30,499  |
| B EBITDA                                    | US\$m  | 11,983 | 24,478 | 24,808 | 10,386  |
| C EBITDA Margin (B ÷ A)                     | %      | 36%    | 46%    | 41%    | 34%     |
| D Costs (A - B)                             | US\$m  | 20,946 | 28,320 | 35,515 | 20,113  |
| E Copper price                              | US\$/t | 7540   | 7540   | 7540   | 7541    |
| F Copper price                              | USc/lb | 342    | 342    | 342    | 342     |
| G Copper production units<br>(A ÷ E x 1000) | kt     | 4,367  | 7,002  | 8,000  | 4,044   |
| H Cash cost (D ÷ G x 1000)                  | US\$/t | 4,796  | 4,044  | 4,439  | 4,973   |
| I Cash cost (H ÷ 2204 x 100)                | USc/lb | 218    | 183    | 201    | 226     |

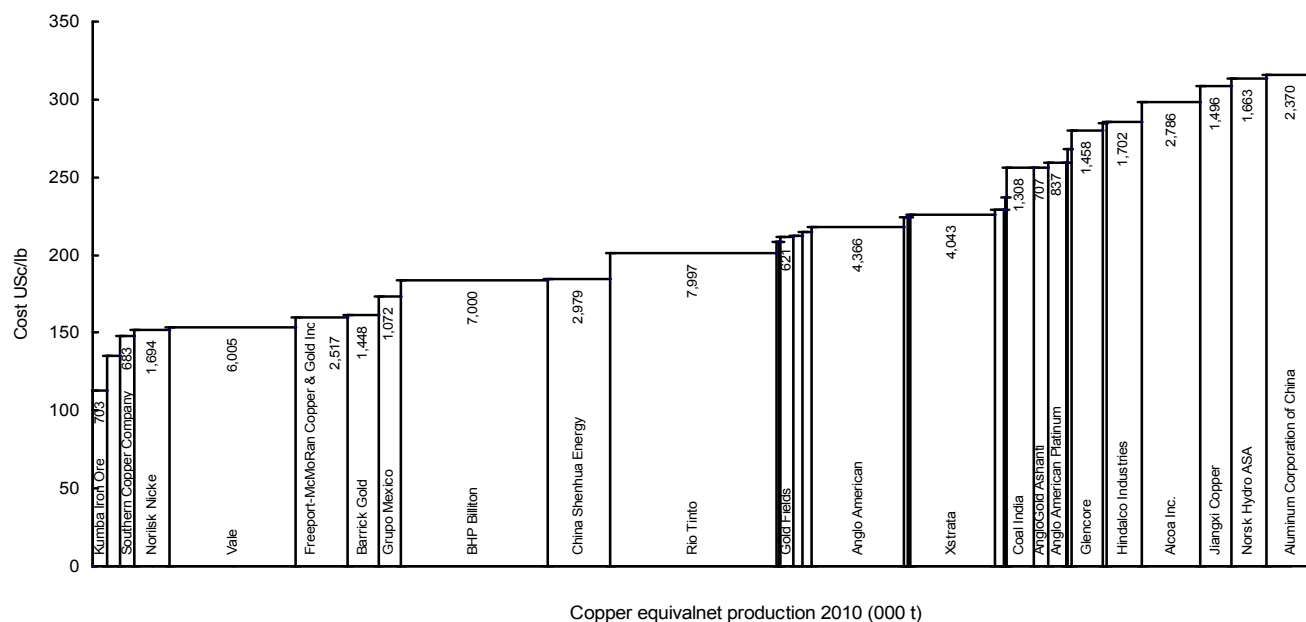
Source: Company reports, Citi Investment Research and Analysis

With the calculation of copper equivalent production, and an associated copper equivalent cash cost figure, we can plot a cost curve for the mining industry under our coverage universe.

Whilst it is a crude analysis, it provides a simple snapshot of the cash cost position of companies across the mining industry. Figure 19 and Figure 20 below represent cost curves of the major mining companies in Citi's global coverage universe. A full breakdown of these companies' cash costs is in Appendix 1.

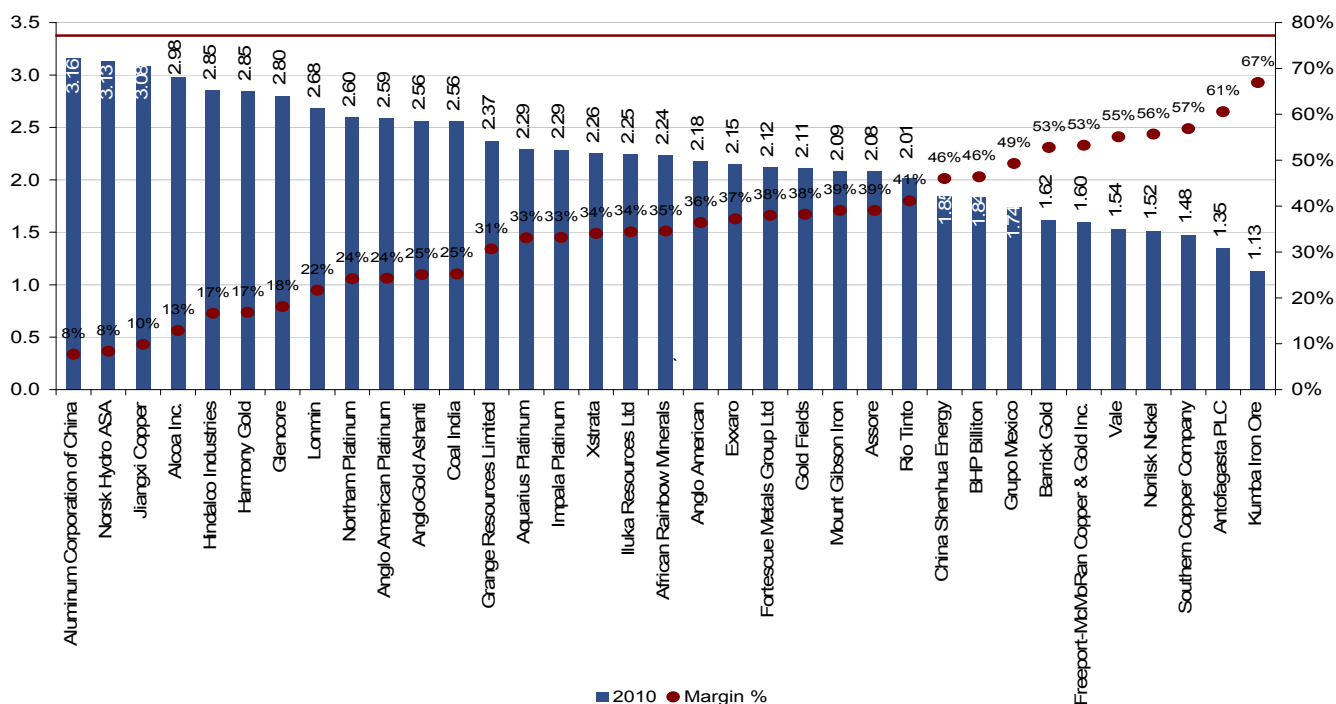
Note that AngloGold Ashanti's costs include the negative impact of 1) its gold hedge book which is now eliminated as well as 2) the accelerated buy-back of its hedge book during the period.

Figure 19. Industry cash cost curve (showing copper equivalent units)



Source: Company data and Citi Investment Research and Analysis

Figure 20. Industry cash cost curve (with EBITDA margin)



Source: Company data and Citi Investment Research and Analysis

Strategy determines cost curve position

A company's strategy will largely determine its position on the global cost curve. Strategy should determine 1) attractiveness of the industry and 2) competitiveness relative to peers within same industry (driven by mining complexity, grades, scale and infrastructure).

High-margin industries share a number of important characteristics:

- Steep cost curve (iron ore, copper)
- Strong trend demand growth (Chinese infrastructure related like iron ore)
- High barriers to entry (platinum, coking coal, copper, iron ore)
- Low barriers to exit (in contrast to steel, aluminium sectors)
- Substantial capital investment (platinum, iron ore)
- Consolidated industry structure (diamonds, iron ore, coking coal, platinum and manganese)
- Low market risk

**Discipline and operational efficiencies  
required to maintain competitiveness**

Once a company is invested in the desired asset, as determined by its strategy the cost curve position can be maintained or improved through operational efficiencies and discipline. Badly run companies are likely to become less competitive, even if they own good assets.

Figure 21 focuses on the 18 miners in our analysis and shows 2010 EBITDA margins and position on the copper equivalent unit cost curve.

Average unit cash cost inflation for these miners from 2007 to 2010 was 43% in US dollar terms. The escalation in cash costs has been driven by a combination of factors, but the major drivers have been:

- currency appreciation;
- increasing labour and electricity costs;
- fuel and consumable costs;
- falling grades; and
- deeper, older mines with higher strip ratios;

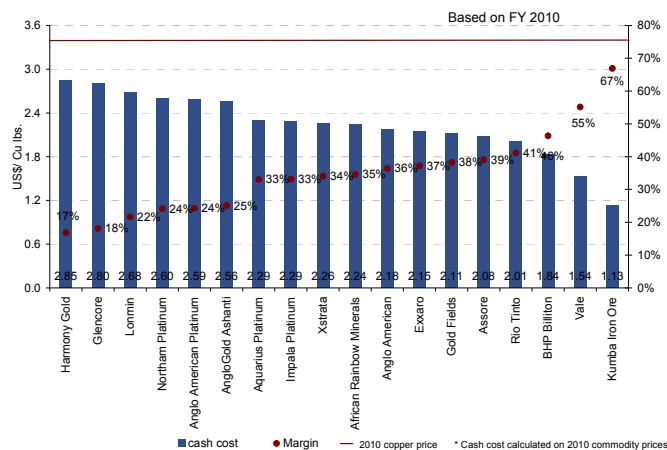
South African deep-level underground precious-metal miners are generally the highest cost miners. Glencore also doesn't screen well on this measure, with cash costs of \$2.80/Cu equivalent unit.

Impala Platinum and Vale showed the best cost containment, with inflation of only 4% and 11%, respectively, over the three years (Glencore 2007 data not available).

Goldfields' and ARM's costs went up most, rising 100% and 94% over these three years.

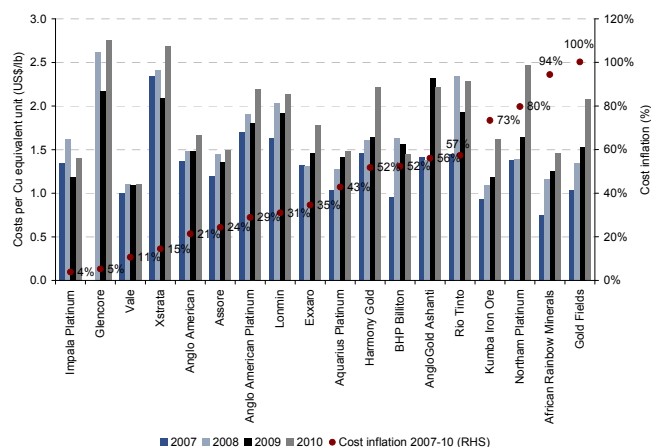


Figure 21. Cash cost per Cu unit



Source: Company reports, Citi Investment Research and Analysis

Figure 22. Cash cost per Cu eq unit\*(LHS) and 3yr. inflation(RHS)



Source: Company reports, Citi Investment Research and Analysis

\* Per financial year; calculated using long term normalized commodity prices

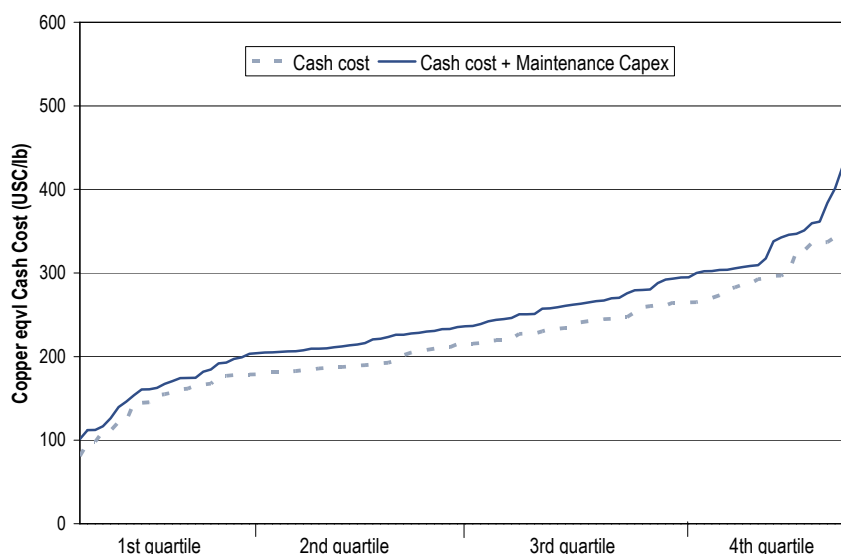
## Cash margin after capital expenditure

### Maintenance capex – the hidden cost

The other area of hidden costs is the capital cost requirements the companies face to stay in business each year. Maintenance costs of a mine (mill repairs, development work to keep faces open, re-habilitation works, etc) are all costs, but do not fit the 'C1' cash cost analysis. To assess the all in cash commitment a miner faces in its operations we add our expectations of maintenance capex onto our calculations of all in cash costs (sales less EBITDA).

On average the maintenance capex requirements add in an extra US\$0.16/lb (7%) on to group cash costs.

Figure 23. Disparity between cash costs and total costs including SIB capex



Source: Citi Investment Research and Analysis

Several companies have significantly different all in costs versus their reported C1 cash costs. This may occur for several reasons such as mine development work being allocated as capex rather than cash costs or old mine that require considerable maintenance capital spent on them to keep mining faces and regions open. The table below looks at the companies in our coverage universe where the all in cash cost (C1 + SIB capex + head office costs) is more than 20% above the reported C1 cost. These companies may look good on a straight cost curve, but their P/L and/or cash flow position will not be as robust as the straight C1 mine site costs would indicate.

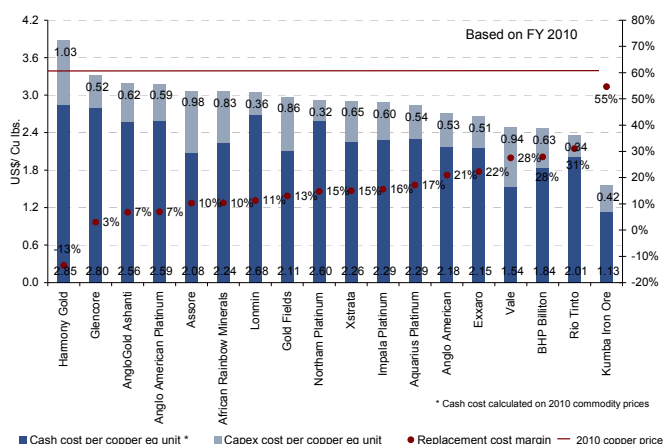
Figure 24. Disparity between cash costs and total costs including SIB capex

|                                   | RIC     | Total cash cost + calculated cash cost (US\$/lb) | Total cash cost + Maintenance Capex (US\$/lb) | Increase in Total calculated cash cost (US\$/lb) | % Increase |
|-----------------------------------|---------|--|---|--|------------|
| <b>Australia</b>                  |         |  |   |  |            |
| Buenaventura SAA                  | BUEV.LM | 188  | 295   | 107  | 57%        |
| Energy Resources Of Australia Ltd | ERA.AX  | 261  | 401   | 140  | 54%        |
| Hochschild Mining Plc             | HOCM.L  | 157  | 230   | 73   | 46%        |
| Cockatoo Coal Limited             | COK.AX  | 297  | 428   | 131  | 44%        |
| St Barbara Limited                | SBM.AX  | 193  | 262   | 69   | 36%        |
| Gold Fields Ltd                   | GFIJ.J  | 183  | 231   | 48   | 26%        |
| Western Areas NL                  | WSA.AX  | 167  | 210   | 43   | 26%        |
| Southern Copper Company           | SCCO.N  | 177  | 221   | 45   | 25%        |
| Fresnillo Plc                     | FRES.L  | 81   | 101   | 20   | 25%        |
| Exxaro Resources Limited          | EXXJ.J  | 243  | 300   | 57   | 24%        |
| Kazakhmys Plc                     | KAZ.L   | 181  | 221   | 39   | 22%        |
| African Rainbow Minerals          | ARIJ.J  | 215  | 259   | 44   | 20%        |
| Mirabela Nickel Ltd               | MBN.AX  | 265  | 318   | 53   | 20%        |
| Raspadskaya                       | RASP.MM | 122  | 146   | 24   | 20%        |
| New World Resources               | NWRR.L  | 230  | 276   | 46   | 20%        |
| Harmony Gold Mining Co. Ltd       | HARJ.J  | 241  | 288   | 47   | 20%        |

Source: Citi Investment Research and Analysis

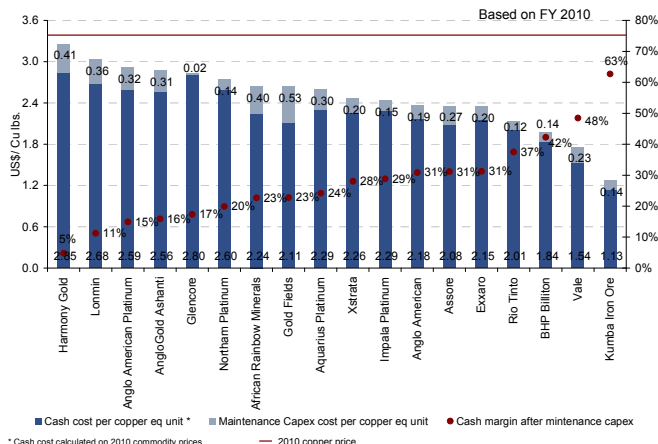
Figure 25 and Figure 26 show miners' 2010 cash costs plus total and maintenance (Figure 26) capex relative to the average 2010 copper price.

Figure 25. Cash cost and total capital expenditure per Cu unit\*



Source: Company reports, Citi Investment Research and Analysis

Figure 26. Cash cost and maintenance capital expenditure per Cu unit\*



Source: Company reports, Citi Investment Research and Analysis

## Labour costs under the spotlight

Labour is one of the most significant cost drivers, contributing up to 50% of miners' cash cost. Successful miners need to achieve the following two objectives:

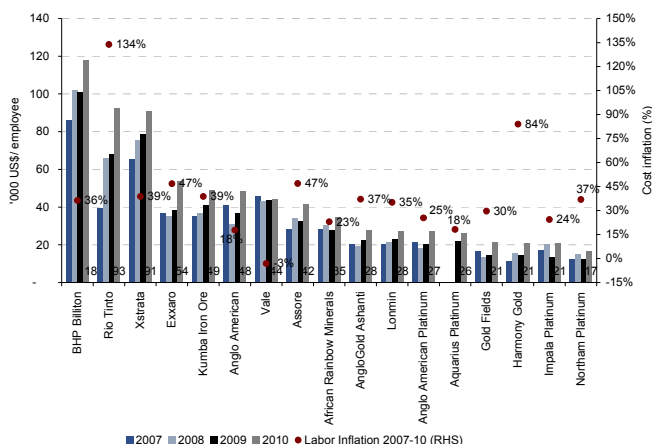
- minimise labour cost inflation; and
- maximise productivity per employee.

Miners that most successfully control labour cost inflation will likely achieve good relative cost control.

The level of mining companies' average salary per employee is less important than productivity achieved for each rand of labour cost paid.

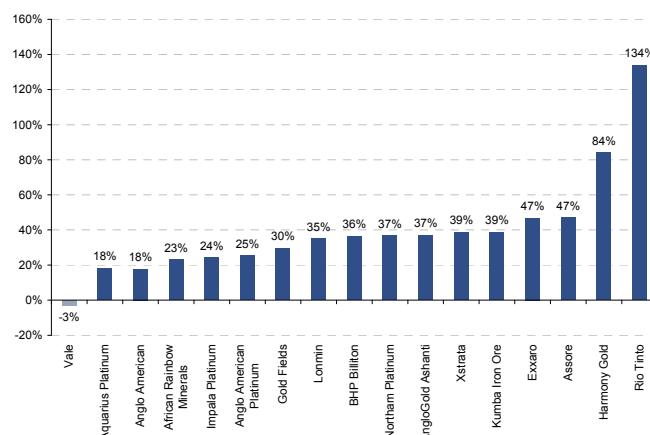
Anglo American contained average labour cost inflation to only 22% over the past three years, significantly better than the sector average 41%. This largely explains Anglo's superior cost containment performance in Figure 27. Exxaro (52%) and Kumba's (44%) high labour inflation contributed to significant unit cost increases.

Figure 27. Avg. employee cost 2007-10 (LHS) and 3yr. inflation (RHS)



Source: Company reports, Citi Investment Research and Analysis

Figure 28. Average wage inflation, 2007-10



Source: Company reports, Citi Investment Research and Analysis

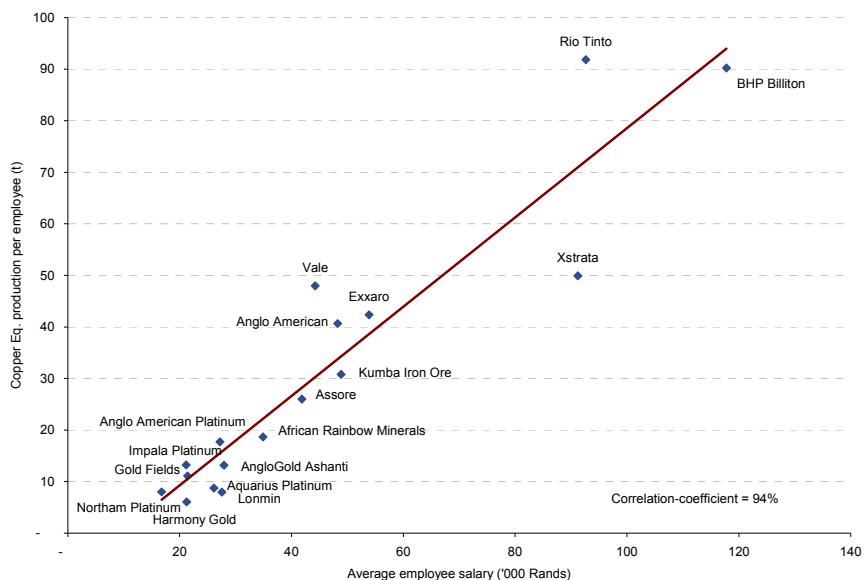
## Productivity essential – you get what you pay for

Our analysis indicates that there is a 94% correlation between employee cost and productivity (Figure 29).

BHP Billiton's average employee cost of \$118 000 (Figure 27) is far higher than peers', but it also generates far more revenue per employee (Figure 36). It uses more skilled labour, contractors and mechanization to achieve higher output.

By contrast, Northam's average employee cost is the lowest among its peers (\$17 000), but it also achieved the second lowest output (Figure 15).

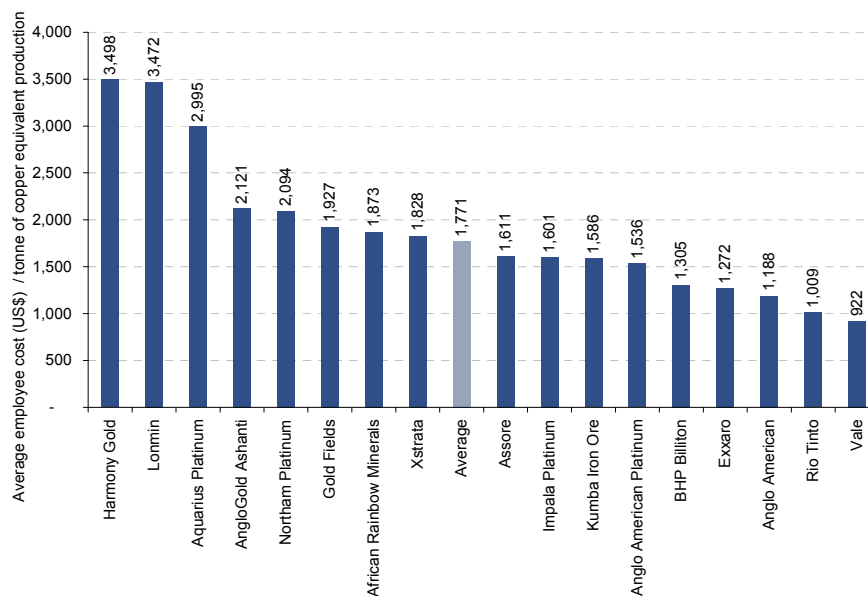
Figure 29. Correlation between employee cost and productivity, 2010



Source: Company reports, Citi Investment Research and Analysis

Harmony Gold, Lonmin and Aquarius Platinum pay more labour than average (\$1 771/t) for each tonne of Cu equivalent product, while Vale, Rio Tinto and Anglo American are outperformers. The challenge for miners with higher than average labour cost per unit of revenue is that productivity needs to increase more than real labour inflation to improve its position.

Figure 30. Labour cost per Cu equivalent production tonne, 2010



Source: Company reports, Citi Investment Research and Analysis

**Figure 31. Change in copper equivalent cash cost ranking carried forward (for period 2007-10)**

| Company                  | % change in cost | Rank |
|--------------------------|------------------|------|
| Impala Platinum          | 3.9%             | 1    |
| Glencore                 | 5.2%             | 2    |
| Vale                     | 10.7%            | 3    |
| Xstrata                  | 14.5%            | 4    |
| Anglo American           | 21.4%            | 5    |
| Assore                   | 24.3%            | 6    |
| Anglo American Platinum  | 28.9%            | 7    |
| Lonmin                   | 31.0%            | 8    |
| Exxaro                   | 34.6%            | 9    |
| Aquarius Platinum        | 42.8%            | 10   |
| Harmony Gold             | 51.8%            | 11   |
| BHP Billiton             | 52.4%            | 12   |
| AngloGold Ashanti        | 56.1%            | 13   |
| Rio Tinto                | 57.4%            | 14   |
| Kumba Iron Ore           | 73.4%            | 15   |
| Northam Platinum         | 79.7%            | 16   |
| African Rainbow Minerals | 94.5%            | 17   |
| Gold Fields              | 100.2%           | 18   |

Source: Company reports, Citi Investment Research and Analysis

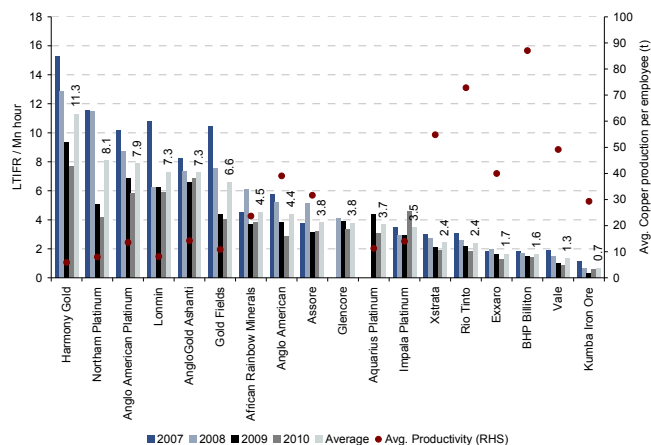
## 4. Safety performance

Fewer safety incidents mean increased productivity and efficiency. Figure 32 clearly shows that safest miners are more productive (red dots).

Our analysis of mining companies' safety track record over the past four years (Figure 32 and Figure 33) highlights the following:

- Deep-level precious metal miners perform far worse than opencast bulk and base metal producers. Average Lost time injury frequency rate (LTIFR) for precious miners stood at 7.2 per million man hours, about three times higher than base metal and diversified peers.
- Encouragingly, almost all miners made considerable progress in terms of enhancing safety over the past three years. Miners that saw considerable progress (LTIFR reduced by 50% or more) are Northam Platinum (64%), Gold Fields (61%), Vale (53%) and Anglo American (50%). The average LTIFR improvement over the period was 34%.
- Impala Platinum, African Rainbow Minerals and AngloGold Ashanti has made the least progress in terms of their safety record over the three years.
- Kumba, Vale, BHP Billiton and Exxaro are the safest miners, while underground gold and platinum miners have most safety incidents.
- African Rainbow Minerals and Anglo American achieved the worst average safety record among diversified peers over the period, but Anglo American has improved its safety by 50%.

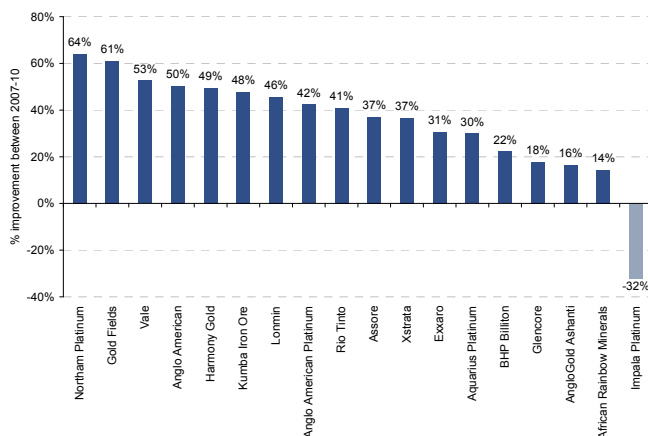
Figure 32. Miners' LTIFR\*, 2007-10



\* Per million man hours

Source: Company reports, Citi Investment Research and Analysis

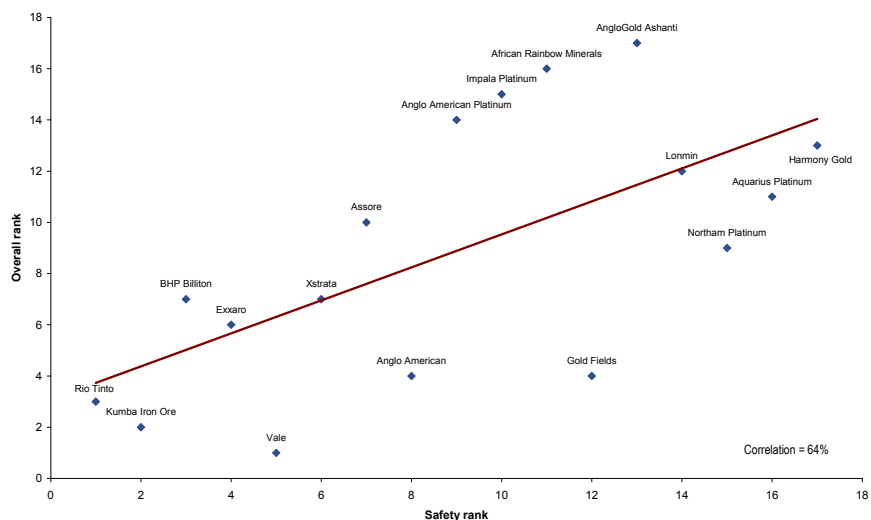
Figure 33. % reduction (increase) in LTIFR, 2007-10



Source: Company reports, Citi Investment Research and Analysis

Safe miners are productive and efficient miners. Figure 34 shows a positive correlation between miners' safety performance and their overall ranking (see Figure 5) in terms of our analysis in this report.

Figure 34. Correlation between safety and overall productivity and efficiency ranking



Source: Citi Investment Research and Analysis

Figure 35. Safety ranking (for period 2007-10)

| Company                  | Avg. LTIFR Rank | Improvement in LTIFR Rank | Combined Score | Combined Rank |
|--------------------------|-----------------|---------------------------|----------------|---------------|
| Anglo American           | 11              | 4                         | 15             | 4             |
| BHP Billiton             | 3               | 14                        | 17             | 7             |
| African Rainbow Minerals | 12              | 17                        | 29             | 16            |
| Exxaro                   | 4               | 12                        | 16             | 6             |
| Kumba Iron Ore           | 1               | 6                         | 7              | 2             |
| Assore                   | 10              | 10                        | 20             | 10            |
| AngloGold Ashanti        | 14              | 16                        | 30             | 17            |
| Gold Fields              | 13              | 2                         | 15             | 4             |
| Lonmin                   | 15              | 7                         | 22             | 12            |
| Harmony Gold             | 18              | 5                         | 23             | 13            |
| Anglo American Platinum  | 16              | 8                         | 24             | 14            |
| Impala Platinum          | 7               | 18                        | 25             | 15            |
| Northam Platinum         | 17              | 1                         | 18             | 9             |
| Aquarius Platinum        | 8               | 13                        | 21             | 11            |
| Rio Tinto                | 5               | 9                         | 14             | 3             |
| Xstrata                  | 6               | 11                        | 17             | 7             |
| Vale                     | 2               | 3                         | 5              | 1             |

Source: Citi Investment Research and Analysis

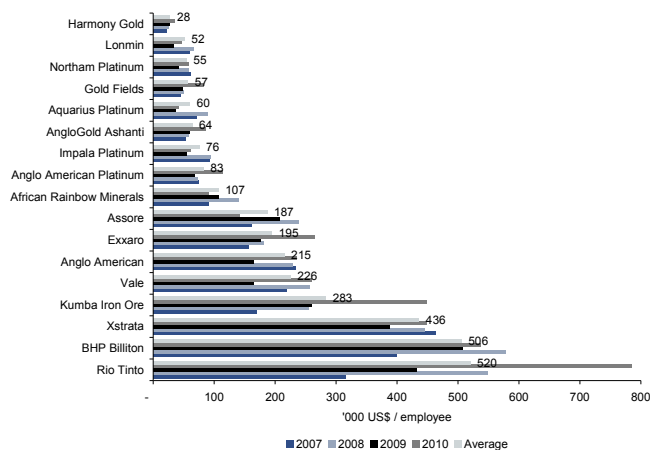
## 5. Revenue per employee

Revenue per employee combines labour productivity with the impact of commodity prices.

Our analysis in Figure 36 and Figure 37 highlight the following:

- Rio Tinto (\$520 000 per employee) and BHP Billiton (\$506 000) generated far more revenues per employee than peers. Performance was driven largely by superior productivity (Figure 15), and both miners benefited from high iron ore prices.
- Harmony Gold came out bottom of the pile and significantly worse than Goldfields and AngloGold Ashanti, mainly due to its poor productivity (Figure 15).
- Kumba, Rio Tinto and Goldfields posted the biggest improvement in revenue per employee over the three years, due mainly to rising prices for iron ore and gold. Kumba and Rio Tinto also benefited from improved labour productivity over the period (Figure 16).
- Aquarius and Impala showed the biggest decline in revenue per employee due to disappointing PGM price performance and an increase in workforce of 11% and 15% respectively.

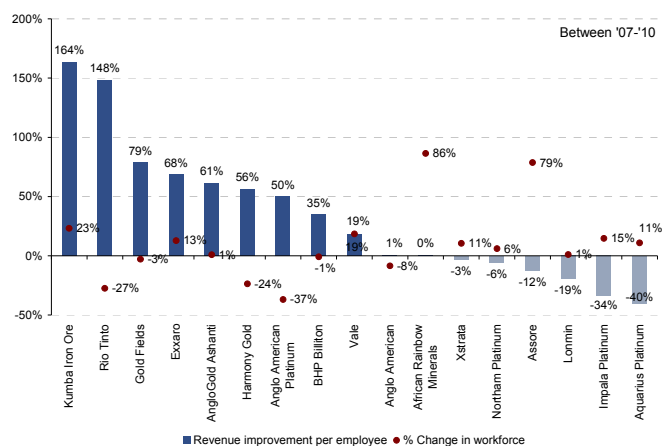
Figure 36. Revenue per employee\*, 2007-10



\* Including contractors

Source: Company reports, Citi Investment Research and Analysis

Figure 37. Improvement in revenue per employee, 2007-10



Source: Company reports, Citi Investment Research and Analysis



**Figure 38. Average Revenue / Employee ranking methodology (for period 2007-10)**

| Company                  | (000 US\$ /Emp) | Rank |
|--------------------------|-----------------|------|
| Rio Tinto                | 520.34          | 1    |
| BHP Billiton             | 505.84          | 2    |
| Xstrata                  | 436.36          | 3    |
| Kumba Iron Ore           | 283.39          | 4    |
| Vale                     | 225.64          | 5    |
| Anglo American           | 215.40          | 6    |
| Exxaro                   | 195.08          | 7    |
| Assore                   | 187.22          | 8    |
| African Rainbow Minerals | 107.20          | 9    |
| Anglo American Platinum  | 82.69           | 10   |
| Impala Platinum          | 75.80           | 11   |
| AngloGold Ashanti        | 64.07           | 12   |
| Aquarius Platinum        | 60.32           | 13   |
| Gold Fields              | 56.94           | 14   |
| Northam Platinum         | 54.95           | 15   |
| Lonmin                   | 51.56           | 16   |
| Harmony Gold             | 27.97           | 17   |

Source: Citi Investment Research and Analysis

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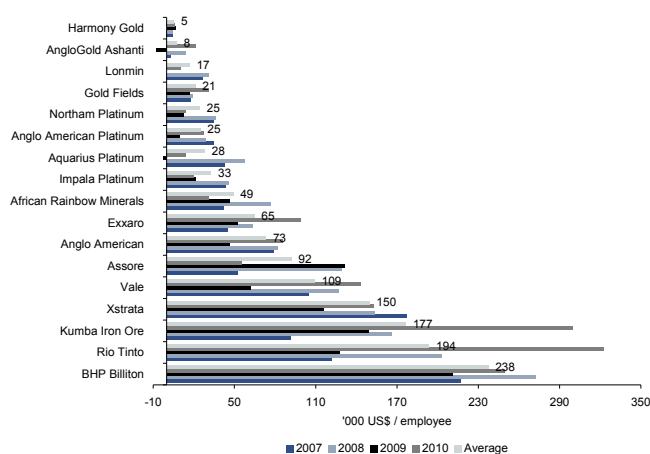
## 6. EBITDA per employee

EBITDA per employee considers the combined impact of commodity exposure, cost management and volume benefits.

Key observations:

- Miners with high iron ore exposure outperformed due to elevated and rising prices.
- BHP squeezed most EBITDA per capita out of its workforce, due to superior productivity, competitive cost positioning and a favourable commodity mix. It generated average EBITDA per employee of \$238 000 from 2007 to 2010.
- SA Gold miners underperformed, given labour intensive nature of underground mining (low productivity), declining production and high and rapidly rising costs.

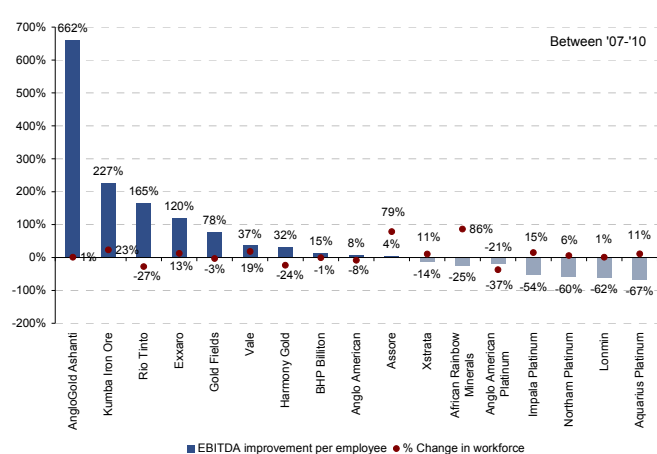
Figure 39. EBITDA per employee\*, 2007-10



\* Including contractors

Source: Company reports, Citi Investment Research and Analysis

Figure 40. Improvement in EBITDA per employee, 2007-10



Source: Company reports, Citi Investment Research and Analysis

**Figure 41. Average EBITDA / Employee ranking methodology (for period 2007-10)**

| Company                  | (000 US\$ /Emp) | Rank |
|--------------------------|-----------------|------|
| BHP Billiton             | 237.55          | 1    |
| Rio Tinto                | 193.87          | 2    |
| Kumba Iron Ore           | 176.68          | 3    |
| Xstrata                  | 149.79          | 4    |
| Vale                     | 109.41          | 5    |
| Assore                   | 92.21           | 6    |
| Anglo American           | 73.34           | 7    |
| Exxaro                   | 64.93           | 8    |
| African Rainbow Minerals | 49.28           | 9    |
| Impala Platinum          | 32.81           | 10   |
| Aquarius Platinum        | 28.22           | 11   |
| Anglo American Platinum  | 25.06           | 12   |
| Northam Platinum         | 24.62           | 13   |
| Gold Fields              | 21.37           | 14   |
| Lonmin                   | 17.07           | 15   |
| AngloGold Ashanti        | 7.64            | 16   |
| Harmony Gold             | 5.46            | 17   |

Source: Citi Investment Research and Analysis

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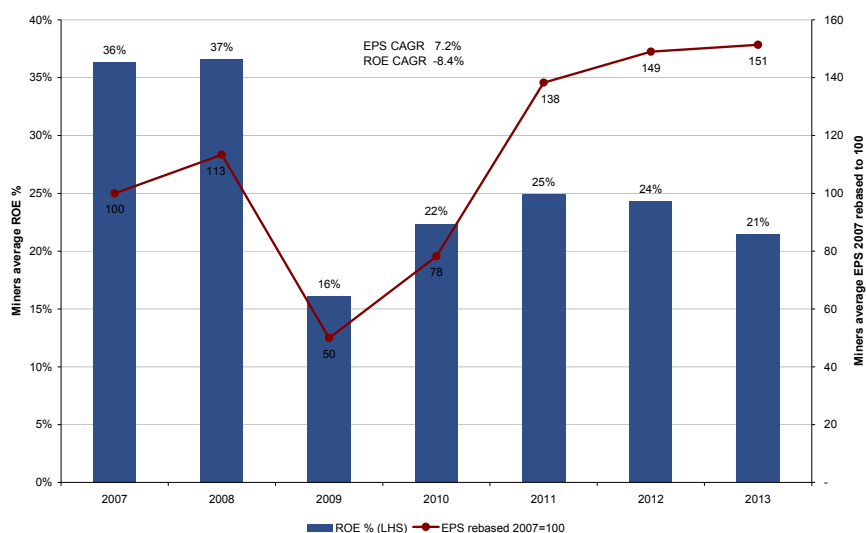
## 7. Capital allocation and asset efficiency

We highlight poor capital allocation as a key risk to mining company valuations, particularly in an environment of healthy cash generation and limited organic growth opportunities.

Capital allocation and efficient use of assets are as important in generating shareholder returns as earnings.

In some cases returns have already peaked three years ago despite the possibility of record profits in 2011. This is largely due to high capital expenditure (including acquisitions) over the past four years, which is still unproductive in many cases.

Figure 42. Miners' EPS (2007 = 100) and ROE\*



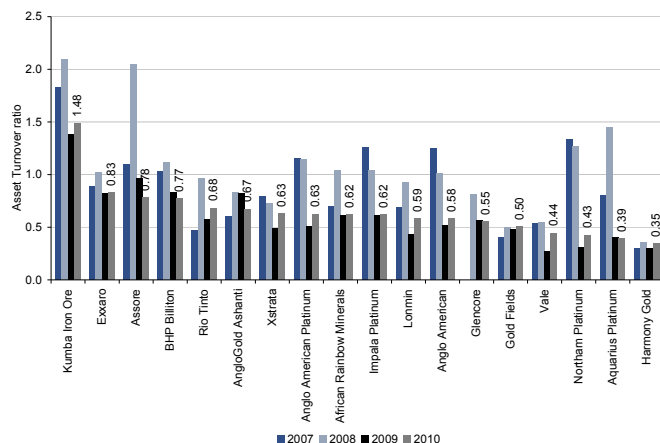
\* Simple average of the 17 miners covered (excluding Glencore)

Source: Company Reports and CIRA Estimates

Below we analyse miners' asset turnover as a measure of efficient use of assets.

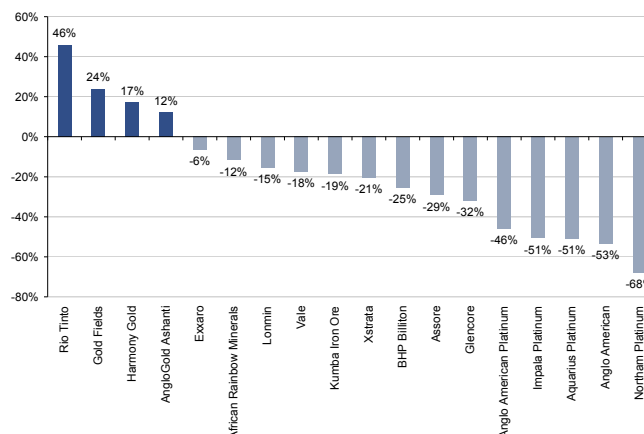
- Kumba, Exxaro and Assore and BHP Billiton have the highest asset turnover among peers.
- Harmony, Aquarius and Northam show the lowest asset turnover.
- Biggest improvements were seen at Rio Tinto (partly due to impairments), Goldfields, Harmony and AngloGold Ashanti.
- Anglo American's asset turnover deteriorated significantly after the acquisition of Minas Rio (expensive acquisition and unproductive capital).
- The PGM miners Northam, Aquarius and Impala also saw significant deterioration in asset turnover. This is partly due to the capital intensive nature of PGM operations and partly due to underperforming PGM prices.

Figure 43. Asset turnover ratio, 2007-10



Source: Company reports, Citi Investment Research and Analysis

Figure 44. Improvement in asset turnover between 2007 and 2010



Source: Company reports, Citi Investment Research and Analysis

Figure 45. Average asset turnover (ATO) ranking methodology (for period 2007-10)

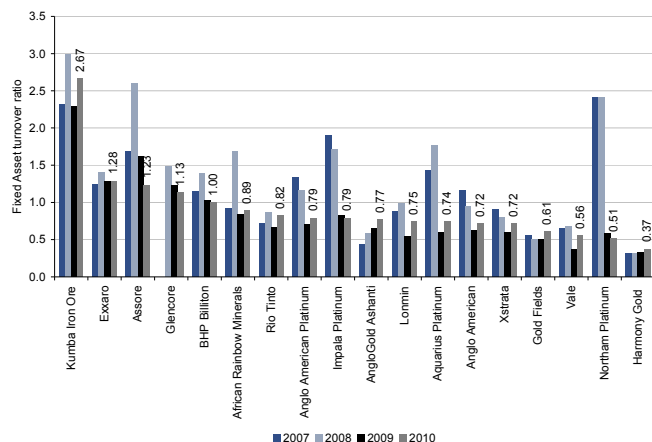
| Company                  | Average ATO Rank | Improvement in ATO Rank | Combined Score | Combined Rank |
|--------------------------|------------------|-------------------------|----------------|---------------|
| Kumba Iron Ore           | 1                | 9                       | 10             | 2             |
| Exxaro                   | 4                | 5                       | 9              | 1             |
| Assore                   | 2                | 12                      | 14             | 4             |
| BHP Billiton             | 3                | 11                      | 14             | 4             |
| Rio Tinto                | 12               | 1                       | 13             | 3             |
| AngloGold Ashanti        | 11               | 4                       | 15             | 6             |
| Xstrata                  | 13               | 10                      | 23             | 13            |
| Anglo American Platinum  | 6                | 14                      | 20             | 9             |
| African Rainbow Minerals | 10               | 6                       | 16             | 7             |
| Impala Platinum          | 5                | 15                      | 20             | 9             |
| Lonmin                   | 14               | 7                       | 21             | 11            |
| Anglo American           | 7                | 17                      | 24             | 14            |
| Gold Fields              | 16               | 2                       | 18             | 8             |
| Vale                     | 17               | 8                       | 25             | 15            |
| Northam Platinum         | 8                | 18                      | 26             | 17            |
| Aquarius Platinum        | 9                | 16                      | 25             | 15            |
| Harmony Gold             | 18               | 3                       | 21             | 11            |

Source: Company reports, Citi Investment Research and Analysis

Below we expand on asset efficiency and capital allocation.

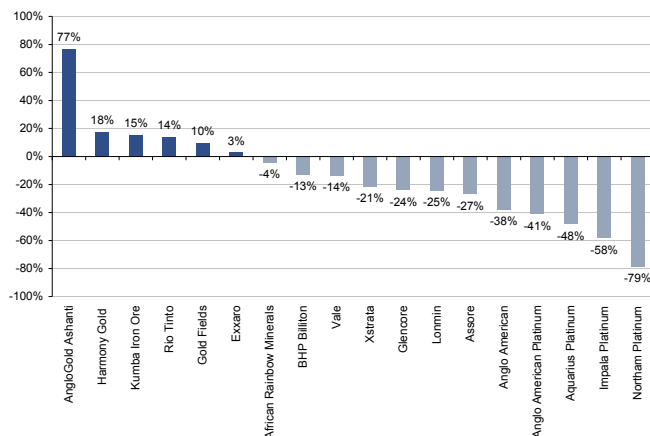
We split asset turnover into two main subsections below: 1) Fixed asset turnover and 2) working capital days.

Figure 46. Fixed asset turnover ratio, 2007-10



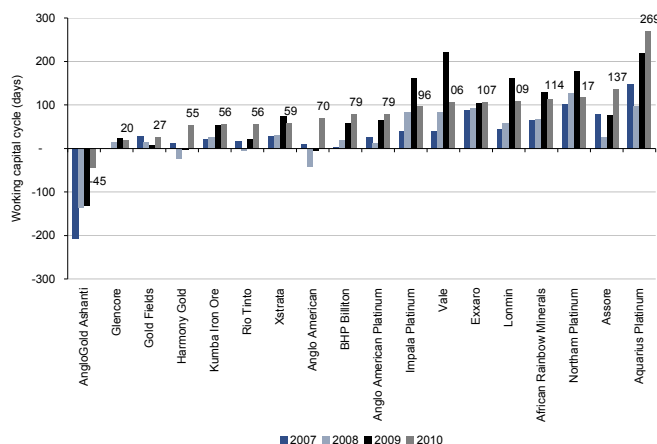
Source: Company reports, Citi Investment Research and Analysis

Figure 47. Improvement in fixed asset turnover between 2007 and 2010



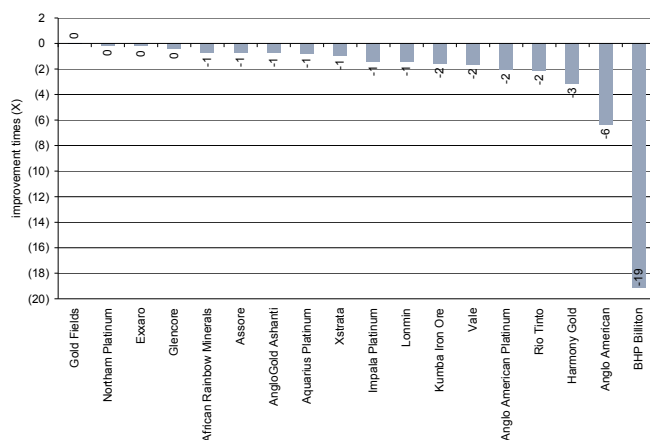
Source: Company reports, Citi Investment Research and Analysis

Figure 48. Working capital cycle (days)



Source: Company reports, Citi Investment Research and Analysis

Figure 49. Improvement in working capital cycle between 2007 and 2010



Source: Company reports, Citi Investment Research and Analysis

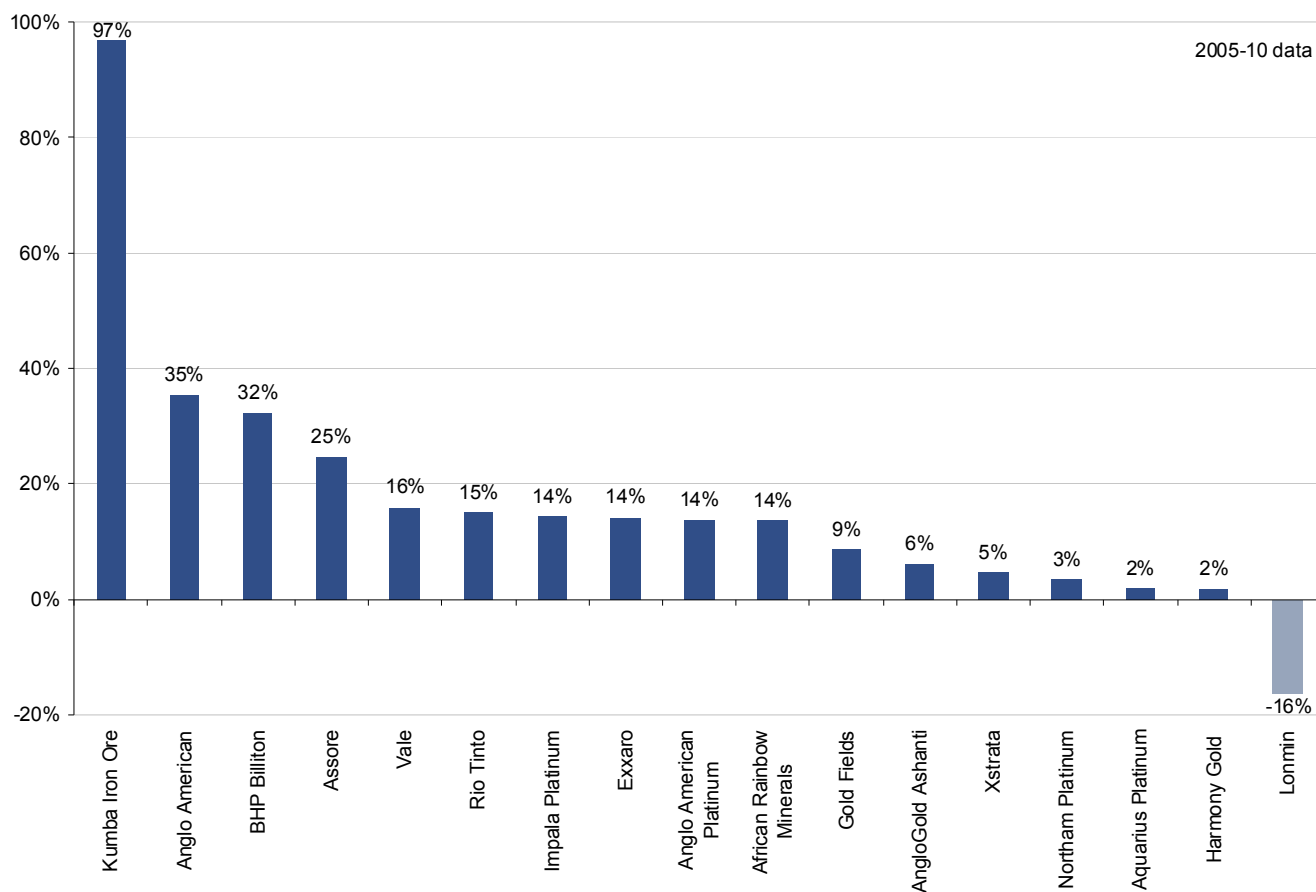
Figure 50 shows miners' returns on incremental invested capital for the period 2005-2010. For this calculation we divided miners' change in NOPAT by change in invested capital over the period.

- South African precious metal miners again dominate the unfavourable side of the chart, but Impala (14%) and Angloplat (14%) put in decent performances.
- Kumba delivered the strongest performance due to 1) attractive high margin iron ore exposure and 2) successful project delivery (Sishen jig plant).
- Anglo American put in a strong performance (35%), mainly due to its streamlining and divestments of Mondi and AngloGold Ashanti, which reduced its capital base.

On a divisional level copper (30%) and Iron ore and manganese (22%) showed the biggest returns.

- BHP Billiton performed strongly as well with Carbon Steel (21%) and Petroleum (17%) divisions posting healthy incremental returns.
- Rio Tinto would have been a very strong performer on this metric if it wasn't for the expensive Alcan acquisition. Its iron ore division posted ROIIC of 125% over the period, while its copper (30%) and energy coal (4%) divisions were also very strong.

Figure 50. Return on incremental invested capital (2005-2010)\*



\* Change in NOPAT/Change in invested capital (2005-2010)

Source: Citi Investment Research and Analysis

Figure 51 shows Citi's estimates for planned and actual IRR's for a selection of mining projects.

- Actual IRR's are in most cases below planned IRR due to cost and time overruns
- However, most major projects for these miners still look value accretive
- Anglo's Minas Rio acquisition was the biggest value destroyer according to our calculations with an expected IRR of only 2%. We work on the assumption that phase 2 is not built and include acquisition cost of ~\$7bn.
- Coal, copper and iron ore projects generally offer healthy IRR's at Citi's long term commodity prices, while nickel projects look relatively unattractive.

Figure 51. Planned vs. actual IRR for mining projects

| Company                  | Project                            | Commodity | Planned IRR | Actual IRR | Time over run   |
|--------------------------|------------------------------------|-----------|-------------|------------|-----------------|
| Anglo American           | Minas-Rio (incl acquisition price) | Iron Ore  | 8%          | 2%         | 36 months       |
| Anglo American           | Los Bronces                        | Copper    | 19%         | 12%        | 6 months        |
| Kumba Iron Ore           | Kolomela                           | Iron Ore  | 36%         | 15%        | 12 months       |
| African Rainbow Minerals | Khumani Mine                       | Iron Ore  | 32%         | 29%        | On Time         |
| BHP Billiton             | Spence                             | Copper    | 37%         | 32%        | 6 months        |
| BHP Billiton             | RGP5                               | Iron Ore  | 19%         | 19%        | On Time         |
| Xstrata                  | Mangoola                           | Coal      | 19%         | 22%        | 3 months before |
| Xstrata                  | Antapaccay                         | Copper    | 25%         | 21%        | On Time         |
| Rio Tinto                | Brockman 4                         | Iron Ore  | 27%         | 25%        | 3 months        |
| Rio Tinto                | Clermont                           | Coal      | 34%         | 22%        | On Time         |
| Vale                     | Goro                               | Nickel    | 9%          | 6%         | 30 months       |
| Vale                     | Moatize                            | Met Coal  | 29%         | 22%        | 6 months        |
| <b>Average</b>           |                                    |           | <b>26%</b>  | <b>21%</b> |                 |

Source: Company Reports, Citi Investment Research and Analysis



## Downside risks to our forecasts and valuation

Our profit forecasts and valuations are based on input assumptions detailed in this report. Our forecasts are subject to risks that include:

- **Poor capital allocation:** Value-destroying projects or acquisitions could negatively impact our earnings forecasts and valuations.
- **Resource nationalism:** The continued rise in commodity prices and miners' profitability, coupled with struggling economies of many resource-rich countries, are resulting in increased pressure for resource nationalism. Threats of nationalisation, higher mining taxes and royalties, and pressure on miners to spend more on community development are becoming popular as a political platform. We do not see this theme disappearing and believe the risk is firmly to the upside for royalties, taxation and community development spend of resource companies. Over the past year, Australia, Brazil, China, Peru and Russia (to name a few) have all looked to increase the tax burden on miners. South African politicians are debating the merits of nationalisation, which could come at a cost to shareholders.
- **Commodity price risk:** A collapse in commodity demand could lead to much lower commodity prices than our base-case forecasts, which would negatively impact our earnings forecasts and valuations.
- **Currency risk:** Stronger-than-forecast currencies for resource-producing countries would negatively impact earnings and valuations.
- **Downside risk to sales volumes:** If commodity demand unexpectedly contracts, our sales volume forecasts could face downside.
- **Infrastructure constraints** could limit or delay volume growth or increase cost inflation more than we anticipate. In particular, South African manganese ore and coal exports may not reach our five-year targets due to rail and port constraints.
- **Government actions** in countries where the miners operate, such as controls on imports, exports and prices and increased government regulation, could squeeze profitability.
- **Higher-than-forecast inflation** in the mining sector could drive up costs, especially if rapidly growing demand puts pressure on scarce skills and resources.
- **Skills, electricity and water shortages** may impact production and mining inflation more than we anticipate.
- **Over-estimation of mineral reserves or failure to discover new resources** or expand existing resources could lead to earnings downgrades.

## Upside risks and catalysts for outperformance

- **Economic stabilisation in the Euro Area.**
- **A policy response** in Europe, the US and China could provide upside for metals and mining equities.
- **An end to the ongoing destocking** in China could also act as a catalyst for outperformance by mining equities in the first half of 2012
- **Stronger for longer commodity prices:** Our base-case forecasts are for commodity prices to decline to marginal cost of production over the next decade. However, if commodity prices remain higher for longer, there could be upside risk to our earnings forecasts and valuations. Potentially higher commodity prices than our forecasts over the medium term also pose an upside risk.
- **Supply-side challenges support higher prices:** Falling grades, increasing mining complexity, permitting delays, skills and equipment shortages, weather-related disruptions and labour issues continue to weigh on miners' production. Overpromising and under-delivering on new projects has become a trend in mining. A confidence crisis could potentially lead to further project delays or even cancellations, which could sow the seeds for the next commodity bull market.
- **Share buybacks:** Strong free cash flow generation by miners should result in surplus cash. We have not factored share buybacks into our forecasts, but these could lead to share price outperformance.
- **M&A activity:** Excess cash generation could lead to M&A in the mining sector. This could boost target companies' share prices beyond our target prices.
- **A pick-up in US housing starts and infrastructure rebuild:** An eventual pick-up in US housing starts or fiscal stimulus, which may include infrastructure rebuild, could support commodity demand.
- **Cheap money:** Low interest rates in advanced economies could stimulate growth (industrial demand) and investment demand for commodities more than we anticipate. In addition, low interest rates could eventually support asset prices, which could lead to share prices exceeding our target prices.

## Commodity price and exchange rate forecasts

The forecasts below represent Citi's house forecasts.

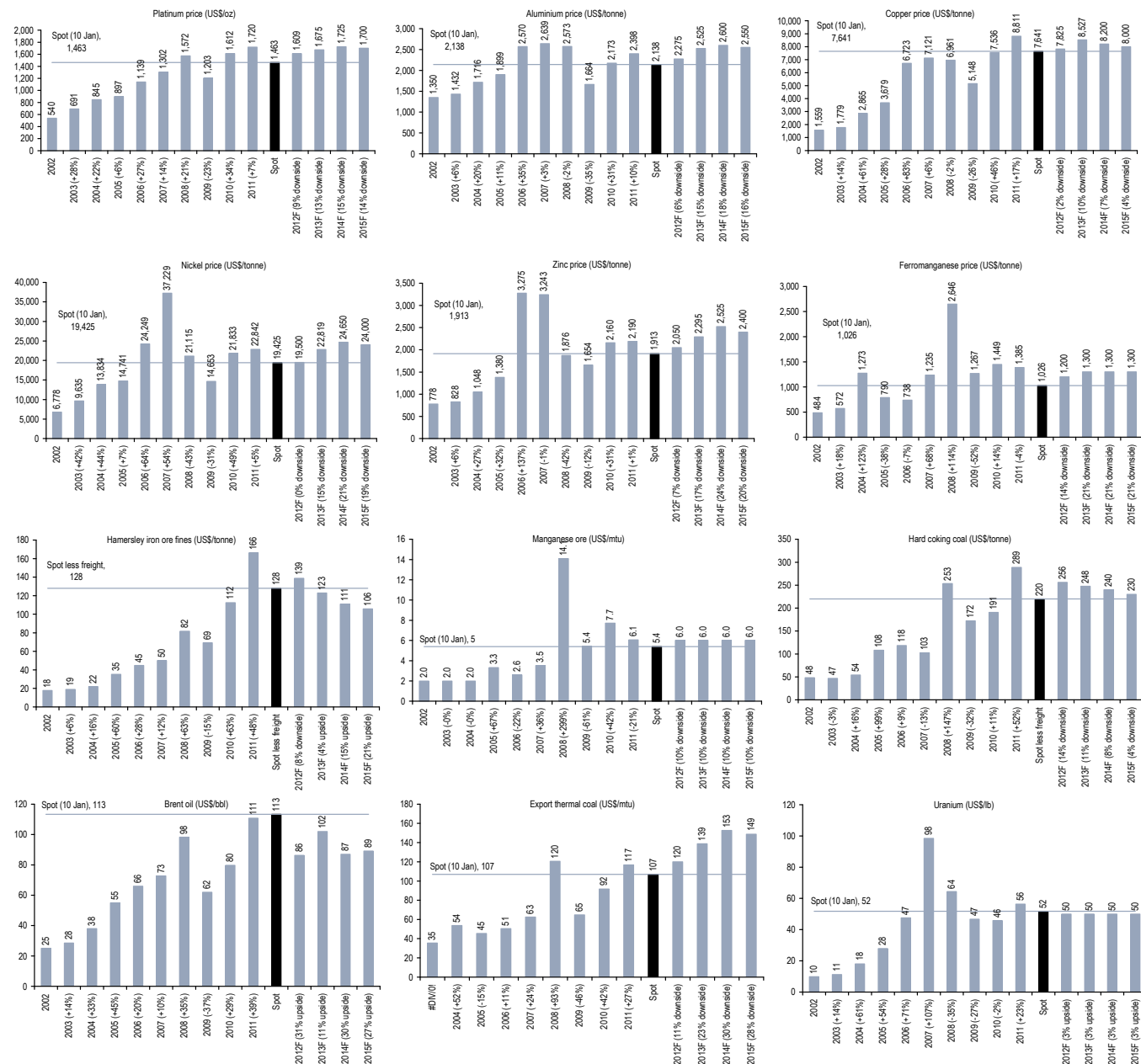
Figure 52. Citi's commodity price and exchange rate forecasts

| Average per calendar year                | 2009   | 2010   | 2011   | 2012F  | 2013F  | 2014F  | 2015F  | 2016F  | 2017F  | 2018F  | 2019F  | 2020F  | LT<br>(Real) |
|--|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------------|
| <b>Precious commodities</b>              |        |        |        |        |        |        |        |        |        |        |        |        |              |
| Gold (US\$/oz)                           | 973    | 1,225  | 1,571  | 1,900  | 1,744  | 1,350  | 1,250  | 1,177  | 1,206  | 1,237  | 1,268  | 1,299  | 1,050        |
| Silver (US\$/oz)                         | 14.80  | 20.72  | 36.02  | 29.75  | 27.13  | 24.13  | 21.13  | 18.13  | 17.00  | 17.26  | 17.67  | 18.10  | 15.00        |
| Platinum (US\$/oz)                       | 1,203  | 1,612  | 1,720  | 1,609  | 1,675  | 1,725  | 1,700  | 1,738  | 1,781  | 1,826  | 1,871  | 1,918  | 1,550        |
| Palladium (US\$/oz)                      | 263    | 526    | 733    | 775    | 925    | 900    | 850    | 695    | 712    | 730    | 748    | 767    | 620          |
| Rhodium (US\$/oz)                        | 1,594  | 2,455  | 2,014  | 1,650  | 1,850  | 2,500  | 3,000  | 3,475  | 3,562  | 3,651  | 3,742  | 3,836  | 3,100        |
| 3PGM basket (US\$/oz) (63%Pt,30%Pd,7%Rh) | 948    | 1,345  | 1,444  | 1,362  | 1,462  | 1,532  | 1,536  | 1,546  | 1,585  | 1,625  | 1,665  | 1,707  | 1,380        |
| <b>Base metals</b>                       |        |        |        |        |        |        |        |        |        |        |        |        |              |
| Aluminium (US\$/tonne)                   | 1,664  | 2,173  | 2,398  | 2,275  | 2,525  | 2,600  | 2,550  | 2,522  | 2,585  | 2,650  | 2,716  | 2,784  | 2,250        |
| Aluminium (US cents/lb)                  | 75     | 99     | 109    | 103    | 115    | 118    | 116    | 114    | 117    | 120    | 123    | 126    | 102          |
| Copper (US\$/tonne)                      | 5,148  | 7,536  | 8,811  | 7,825  | 8,527  | 8,200  | 8,000  | 6,950  | 7,124  | 7,302  | 7,485  | 7,672  | 6,200        |
| Copper (US cents/lb)                     | 234    | 342    | 400    | 355    | 387    | 372    | 363    | 315    | 323    | 331    | 339    | 348    | 281          |
| Nickel (US\$/tonne)                      | 14,653 | 21,833 | 22,842 | 19,500 | 22,819 | 24,650 | 24,000 | 22,420 | 22,980 | 23,555 | 24,144 | 24,747 | 20,000       |
| Nickel (US cents/lb)                     | 665    | 990    | 1,036  | 885    | 1,035  | 1,118  | 1,089  | 1,017  | 1,042  | 1,068  | 1,095  | 1,123  | 907          |
| Zinc (US\$/tonne)                        | 1,654  | 2,160  | 2,190  | 2,050  | 2,295  | 2,525  | 2,400  | 2,354  | 2,413  | 2,473  | 2,535  | 2,598  | 2,100        |
| Zinc (US cents/lb)                       | 75     | 98     | 99     | 93     | 104    | 115    | 109    | 107    | 109    | 112    | 115    | 118    | 95           |
| Lead (US\$/tonne)                        | 1,720  | 2,148  | 2,397  | 2,150  | 2,400  | 2,600  | 2,500  | 2,466  | 2,528  | 2,591  | 2,656  | 2,722  | 2,200        |
| Lead (US cents/lb)                       | 78     | 97     | 109    | 98     | 109    | 118    | 113    | 112    | 115    | 118    | 120    | 123    | 100          |
| Uranium (US\$/lb)                        | 47     | 46     | 56     | 50     | 50     | 50     | 50     | 56     | 57     | 59     | 60     | 62     | 50           |
| <b>Steelmaking materials</b>             |        |        |        |        |        |        |        |        |        |        |        |        |              |
| Iron ore spot (CIF China) (US\$/t)       | 85     | 152    | 175    | 149    | 135    | 125    | 120    | 115    | 110    | 108    | 105    | 105    | 81           |
| Iron ore fines (FOB) (US\$/dmu)          | 109    | 177    | 262    | 219    | 194    | 175    | 167    | 156    | 148    | 144    | 140    | 140    | 111          |
| Iron ore fines (FOB) (USD/tonne)         | 69     | 112    | 166    | 139    | 123    | 111    | 106    | 99     | 94     | 91     | 89     | 89     | 71           |
| Iron ore lump (FOB) (US\$/dmu)           | 134    | 196    | 288    | 241    | 213    | 192    | 183    | 171    | 162    | 158    | 154    | 154    | 120          |
| Iron ore lump (FOB) (USD/tonne)          | 85     | 125    | 183    | 153    | 135    | 122    | 116    | 109    | 103    | 100    | 98     | 98     | 76           |
| Hard coking coal (US\$/tonne)            | 172    | 191    | 289    | 256    | 248    | 240    | 230    | 215    | 222    | 226    | 231    | 235    | 200          |
| Semi soft benchmark (US\$/tonne)         | 116    | 139    | 210    | 173    | 168    | 168    | 159    | 146    | 151    | 154    | 157    | 160    | 150          |
| Manganese ore - CIF (US\$/mtu)           | 5.43   | 7.71   | 6.07   | 6.00   | 6.00   | 6.00   | 6.00   | 5.83   | 5.96   | 6.08   | 6.20   | 6.32   | 5.20         |
| Ferro manganese - CIF (US\$/tonne)       | 1,267  | 1,449  | 1,385  | 1,200  | 1,300  | 1,300  | 1,300  | 1,457  | 1,489  | 1,519  | 1,550  | 1,581  | 1,300        |
| Ferrochrome (US\$/lb)                    | 0.93   | 1.24   | 1.26   | 1.25   | 1.00   | 1.00   | 1.00   | 1.12   | 1.15   | 1.17   | 1.19   | 1.22   | 1.00         |
| <b>Energy</b>                            |        |        |        |        |        |        |        |        |        |        |        |        |              |
| Brent crude oil (US\$/bbl)               | 62     | 80     | 111    | 86     | 102    | 87     | 89     | 95     | 97     | 99     | 101    | 103    | 81           |
| Richards Bay thermal coal (US\$/tonne)   | 65     | 92     | 117    | 120    | 139    | 153    | 149    | 144    | 145    | 148    | 151    | 154    | 109          |
| <b>Heavy minerals</b>                    |        |        |        |        |        |        |        |        |        |        |        |        |              |
| Rutile (US\$/tonne)                      | 535    | 538    | 839    | 2,525  | 2,600  | 2,600  | 2,600  | 617    | 630    | 643    | 656    | 669    | 550          |
| Zircon (US\$/tonne)                      | 947    | 942    | 1,880  | 2,500  | 2,600  | 2,600  | 2,600  | 953    | 974    | 993    | 1,013  | 1,034  | 850          |
| Synrutile (US\$/t)                       | 438    | 441    | 687    | 2,050  | 2,100  | 2,100  | 2,100  | 561    | 536    | 546    | 557    | 569    | 500          |
| Titanium Slag (US\$/tonne)               | 307    | 333    | 574    | 1,502  | 1,538  | 1,538  | 1,538  | 359    | 367    | 374    | 382    | 389    | 320          |
| Ilmenite (US\$/tonne)                    | 87     | 75     | 129    | 250    | 250    | 250    | 250    | 135    | 137    | 140    | 143    | 146    | 120          |
| <b>Currency exchange rates</b>           |        |        |        |        |        |        |        |        |        |        |        |        |              |
| US\$/ZAR                                 | 8.40   | 7.30   | 7.25   | 8.35   | 8.72   | 9.08   | 9.47   | 10.00  | 10.22  | 10.58  | 10.96  | 11.35  | 10.00        |
| US\$/AUD                                 | 0.79   | 0.92   | 1.03   | 1.03   | 0.96   | 0.92   | 0.89   | 0.90   | 0.89   | 0.87   | 0.85   | 0.84   | 0.90         |
| US\$/EUR                                 | 1.39   | 1.33   | 1.39   | 1.38   | 1.37   | 1.37   | 1.36   | 1.30   | 1.30   | 1.29   | 1.29   | 1.28   | 1.30         |
| US\$/CHP                                 | 559    | 502    | 482    | 524    | 547    | 570    | 594    | 613    | 646    | 680    | 716    | 754    | 613          |
| US\$/BRL                                 | 2.00   | 1.76   | 1.67   | 1.86   | 1.94   | 2.02   | 2.10   | 2.17   | 2.29   | 2.41   | 2.54   | 2.67   | 2.17         |
| US\$/COP                                 | 2,156  | 1,898  | 1,848  | 1,982  | 2,070  | 2,155  | 2,246  | 2,320  | 2,443  | 2,573  | 2,709  | 2,853  | 2,320        |
| <b>Inflation</b>                         |        |        |        |        |        |        |        |        |        |        |        |        |              |
| US CPI index                             | 215    | 218    | 225    | 230    | 234    | 239    | 244    | 249    | 254    | 259    | 264    | 269    |              |
| US Inflation                             | 0%     | 2%     | 3%     | 2%     | 2%     | 2%     | 2%     | 2%     | 2%     | 2%     | 2%     | 2%     |              |

Source: I-Net, Bloomberg, DataCentral, CIRA

## Commodity price forecasts vs. spot

Figure 53. Citi's commodity price forecasts relative to spot



Source: Bloomberg, I-Net, CIRA estimates

## Peer comparison

Figure 54. Mining company peer comparison (calendarised)\*

|                                       | Citi's  | Price  | Historic P/E |           | Forward P/E |             | EV/ EBITDA |            | FCF yield  |           | Div Yld   |           | P/B        |            | ROE        |            | Perf % (USD) |            |
|---------------------------------------|---------|--------|--------------|-----------|-------------|-------------|------------|------------|------------|-----------|-----------|-----------|------------|------------|------------|------------|--------------|------------|
|                                       | Rating  | (US\$) | 2009         | 2010      | 2011        | 2012        | 2011       | 2012       | 2011       | 2012      | 2011      | 2012      | 2011       | 2012       | 2011       | 2012       | Weekly       | YTD        |
| FTSE ALL SHARE (GBP)                  |         |        | 19           | 22        | 11.7        | 10.6        | 6.9        | 7.1        | 6%         | 6%        | 4%        | 4%        | 2.8        | 2.5        | 27%        | 24%        | 0%           | 1%         |
| FTSE/JSE ALL SHARE (ZAR)              |         |        | 17           | 15        | 12.2        | 11.5        | 7.4        | 7.0        | 7%         | 7%        | 4%        | 4%        | 3.6        | 3.3        | 32%        | 30%        | 3%           | 4%         |
| <b>Major diversified miners</b>       |         |        |              |           |             |             |            |            |            |           |           |           |            |            |            |            |              |            |
| BHP Billiton                          | Buy     | 31.5   | 15           | 10        | 8.3         | 8.7         | 5.2        | 5.3        | 8%         | 5%        | 3%        | 4%        | 3.0        | 2.7        | 39%        | 32%        | 4%           | 8%         |
| Rio Tinto                             | Buy     | 54.4   | 15           | 8         | 6.6         | 7.1         | 3.1        | 3.0        | 10%        | 9%        | 2%        | 3%        | 1.5        | 1.2        | 24%        | 18%        | 6%           | 12%        |
| Anglo American                        | Buy     | 39.2   | 19           | 10        | 8.6         | 8.1         | 4.5        | 3.9        | 17%        | 9%        | 2%        | 2%        | 1.1        | 1.0        | 25%        | 13%        | 3%           | 6%         |
| Xstrata                               | Buy     | 16.4   | 16           | 9         | 8.5         | 8.3         | 5.1        | 5.0        | 1%         | 4%        | 2%        | 2%        | 1.0        | 0.9        | 13%        | 12%        | 4%           | 8%         |
| Vale                                  | Buy     | 23.3   | 23           | 7         | 5.6         | 7.0         | 3.9        | 4.5        | 7%         | 2%        | 2%        | 1%        | 1.5        | 1.2        | 29%        | 20%        | 2%           | 9%         |
| Glencore                              | Buy     | 6.1    | 16           | 10        | 9.8         | 9.0         | 9.7        | 6.8        | 2%         | 6%        | 2%        | 2%        | 1.3        | 1.2        | 17%        | 15%        | 0%           | 1%         |
| <b>Average</b>                        |         |        | <b>17</b>    | <b>9</b>  | <b>7.9</b>  | <b>8.0</b>  | <b>5.3</b> | <b>4.7</b> | <b>7%</b>  | <b>6%</b> | <b>2%</b> | <b>2%</b> | <b>1.6</b> | <b>1.4</b> | <b>25%</b> | <b>19%</b> | <b>3%</b>    | <b>7%</b>  |
| <b>South African mid-cap miners</b>   |         |        |              |           |             |             |            |            |            |           |           |           |            |            |            |            |              |            |
| Kumba - Attributable (74%)            | Sell    | 66.0   | 24           | 12        | 9.6         | 8.9         | 6.8        | 6.4        | 9%         | 10%       | 8%        | 9%        | 9.3        | 7.3        | 109%       | 92%        | 4%           | 6%         |
| Exxaro - proportionately consolidated | Buy     | 21.6   | 25           | 12        | 7.7         | 5.1         | 4.7        | 3.3        | 5%         | 10%       | 4%        | 7%        | 2.6        | 1.9        | 40%        | 45%        | 1%           | 4%         |
| ARM                                   | Buy     | 21.9   | 19           | 15        | 11.3        | 9.5         | 5.0        | 4.2        | 3%         | 6%        | 3%        | 4%        | 1.7        | 1.5        | 16%        | 17%        | 3%           | 3%         |
| Assore                                | Buy     | 27.3   | 11           | 11        | 8.1         | 7.6         | 5.4        | 4.9        | 6%         | 10%       | 3%        | 4%        | 2.2        | 1.8        | 30%        | 26%        | 5%           | 5%         |
| <b>Average</b>                        |         |        | <b>20</b>    | <b>13</b> | <b>9.2</b>  | <b>7.8</b>  | <b>5.5</b> | <b>4.7</b> | <b>6%</b>  | <b>9%</b> | <b>4%</b> | <b>6%</b> | <b>3.9</b> | <b>3.1</b> | <b>49%</b> | <b>45%</b> | <b>3%</b>    | <b>5%</b>  |
| <b>Copper</b>                         |         |        |              |           |             |             |            |            |            |           |           |           |            |            |            |            |              |            |
| Freeport McMoran                      | Neutral | 42.5   | 14           | 9         | 8.8         | 11.3        | 4.4        | 4.8        | 11%        | 5%        | 4%        | 2%        | 2.6        | 2.2        | 32%        | 21%        | 8%           | 15%        |
| Southern Copper Corp                  | Neutral | 33.4   | 30           | 18        | 12.6        | 17.0        | 7.7        | 9.1        | 7%         | 4%        | 6%        | 3%        | 6.9        | 5.7        | 56%        | 37%        | 7%           | 11%        |
| Antofagasta                           | Sell    | 20.1   | 30           | 20        | 16.3        | 12.7        | 5.7        | 4.9        | 9%         | 10%       | 5%        | 5%        | 3.2        | 2.9        | 20%        | 24%        | 3%           | 6%         |
| Kazakhmys                             | Buy     | 16.1   | 14           | 6         | 4.9         | 5.3         | 1.7        | 1.5        | 6%         | 1%        | 2%        | 3%        | 0.9        | 0.8        | 14%        | 16%        | 6%           | 12%        |
| Jiangxi Copper                        | Buy     | 2.3    | 19           | 9         | 8.3         | 7.3         | 6.0        | 4.9        | 13%        | 14%       | 2%        | 2%        | 1.3        | 1.1        | 17%        | 16%        | 6%           | 7%         |
| FST Quantum Minerals                  | Neutral | 22.1   | 17           | 12        | 17.4        | 26.9        | 7.9        | 9.5        | -6%        | -10%      | 0%        | 0%        | 2.7        | 2.2        | 17%        | 9%         | 4%           | 18%        |
| Grupo Mexico                          | Neutral | 2.9    | 26           | 14        | 9.8         | 13.5        | 5.1        | 6.1        | 8%         | 7%        | 5%        | 4%        | 3.3        | 2.8        | 36%        | 23%        | 9%           | 11%        |
| <b>Average</b>                        |         |        | <b>21</b>    | <b>13</b> | <b>11.2</b> | <b>13.4</b> | <b>5.5</b> | <b>6.8</b> | <b>7%</b>  | <b>4%</b> | <b>3%</b> | <b>3%</b> | <b>3.0</b> | <b>2.5</b> | <b>27%</b> | <b>21%</b> | <b>7%</b>    | <b>11%</b> |
| <b>Ferrous</b>                        |         |        |              |           |             |             |            |            |            |           |           |           |            |            |            |            |              |            |
| Siderurgica Naci                      | Neutral | 9.3    | 10           | 10        | 5.0         | 12.4        | 5.2        | 5.7        | 5%         | -4%       | 4%        | 2%        | 3.3        | 2.8        | 65%        | 25%        | 8%           | 16%        |
| Mt Gibson Iron                        | Neutral | 1.3    | 17           | 8         | 4.7         | 3.7         | 2.2        | 1.3        | 18%        | 29%       | 7%        | 11%       | 1.1        | 0.9        | 26%        | 27%        | 7%           | 11%        |
| Atlas Iron                            | Buy     | 3.2    | -            | 27        | 10.9        | 9.1         | 7.4        | 4.7        | 10%        | 6%        | 1%        | 2%        | 1.5        | 1.3        | 16%        | 15%        | 10%          | 15%        |
| ENRC                                  | Buy     | 11.3   | 14           | 7         | 6.6         | 6.4         | 3.8        | 3.9        | 3%         | -3%       | 3%        | 3%        | 1.2        | 1.1        | 21%        | 18%        | 5%           | 15%        |
| Fortescue Metals                      | Buy     | 4.9    | 33           | 13        | 8.1         | 7.8         | 5.6        | 5.9        | -7%        | -16%      | 2%        | 2%        | 4.8        | 3.3        | 62%        | 51%        | 4%           | 10%        |
| Cliffs Natural                        | Buy     | 71.4   | -            | 11        | 6.2         | 6.1         | 4.4        | 4.6        | 8%         | 13%       | 1%        | 2%        | 1.7        | 1.4        | 35%        | 25%        | 8%           | 14%        |
| <b>Average</b>                        |         |        | <b>20</b>    | <b>11</b> | <b>6.4</b>  | <b>6.9</b>  | <b>4.3</b> | <b>3.9</b> | <b>7%</b>  | <b>7%</b> | <b>3%</b> | <b>3%</b> | <b>2.1</b> | <b>1.7</b> | <b>37%</b> | <b>27%</b> | <b>8%</b>    | <b>14%</b> |
| <b>Coal</b>                           |         |        |              |           |             |             |            |            |            |           |           |           |            |            |            |            |              |            |
| New Hope                              | Neutral | 5.8    | 20           | 28        | 25.7        | 19.9        | 23.3       | 15.8       | 2%         | -4%       | 4%        | 3%        | 2.0        | 2.0        | 17%        | 10%        | 0%           | 2%         |
| Whitehaven Coal                       | Buy     | 5.9    | 38           | 44        | 31.5        | 14.1        | 15.8       | 8.1        | -2%        | 7%        | 2%        | 3%        | 2.6        | 2.2        | 6%         | 17%        | 1%           | 6%         |
| Adaro Energy                          | Buy     | 0.2    | 15           | 24        | 13.1        | 6.2         | 4.8        | 3.8        | 5%         | 15%       | 1%        | 3%        | 2.4        | 1.9        | 20%        | 34%        | 1%           | 1%         |
| China Coal                            | Buy     | 1.2    | 14           | 14        | 10.3        | 8.3         | 5.7        | 5.0        | -20%       | -2%       | 3%        | 3%        | 1.3        | 1.1        | 13%        | 14%        | 8%           | 11%        |
| China Shenhua                         | Buy     | 4.4    | 17           | 14        | 12.5        | 10.7        | 7.0        | 5.9        | 5%         | 8%        | 3%        | 3%        | 2.4        | 2.1        | 21%        | 21%        | 1%           | 3%         |
| Arch Coal                             | Buy     | 15.7   | 42           | 16        | 12.6        | 5.2         | 6.6        | 4.5        | 6%         | 17%       | 3%        | 3%        | 0.9        | 0.8        | 6%         | 17%        | 2%           | 8%         |
| Peabody Energy                        | Buy     | 37.2   | 19           | 12        | 9.2         | 6.4         | 5.2        | 3.3        | 9%         | 13%       | 1%        | 1%        | 1.8        | 1.4        | 21%        | 25%        | 2%           | 12%        |
| <b>Average</b>                        |         |        | <b>22</b>    | <b>20</b> | <b>15.7</b> | <b>10.4</b> | <b>9.5</b> | <b>6.4</b> | <b>1%</b>  | <b>8%</b> | <b>2%</b> | <b>2%</b> | <b>1.7</b> | <b>1.5</b> | <b>13%</b> | <b>18%</b> | <b>2%</b>    | <b>7%</b>  |
| <b>Nickel &amp; Zinc</b>              |         |        |              |           |             |             |            |            |            |           |           |           |            |            |            |            |              |            |
| Sterlite Industries                   | Buy     | 2.0    | 9            | 7         | 6.0         | 5.6         | 2.8        | 2.5        | 3%         | 8%        | 1%        | 1%        | 0.8        | 0.7        | 14%        | 13%        | 11%          | 17%        |
| Norilsk                               | Neutral | 157.5  | 11           | 5         | 5.6         | 6.4         | 3.5        | 3.7        | 13%        | 9%        | 4%        | 4%        | 1.4        | 1.2        | 27%        | 20%        | -1%          | -1%        |
| <b>Average</b>                        |         |        | <b>12</b>    | <b>8</b>  | <b>7.6</b>  | <b>7.8</b>  | <b>4.1</b> | <b>3.9</b> | <b>7%</b>  | <b>8%</b> | <b>2%</b> | <b>2%</b> | <b>1.4</b> | <b>1.2</b> | <b>20%</b> | <b>17%</b> | <b>5%</b>    | <b>8%</b>  |
| Iluka Resources                       | Buy     | 16.9   | -79          | 189       | 13.1        | 4.9         | 7.2        | 2.8        | 9%         | 23%       | 4%        | 10%       | 5.4        | 3.4        | 44%        | 85%        | 8%           | 9%         |
| <b>Average excl. precious</b>         |         |        | <b>5</b>     | <b>38</b> | <b>10.2</b> | <b>8.5</b>  | <b>5.9</b> | <b>4.6</b> | <b>6%</b>  | <b>9%</b> | <b>3%</b> | <b>4%</b> | <b>2.7</b> | <b>2.1</b> | <b>31%</b> | <b>33%</b> | <b>5%</b>    | <b>9%</b>  |
| <b>PGM</b>                            |         |        |              |           |             |             |            |            |            |           |           |           |            |            |            |            |              |            |
| Aquarius Platinum                     | Neutral | 2.7    | 129          | 16        | 19.6        | 21.7        | 7.8        | 8.5        | -4%        | 3%        | 2%        | 1%        | 1.5        | 1.4        | 1%         | 6%         | 6%           | 10%        |
| Anglo American Platinum               | Sell    | 69.4   | 187          | 29        | 25.3        | 21.4        | 12.1       | 9.7        | 2%         | 2%        | 2%        | 2%        | 2.6        | 2.4        | 10%        | 12%        | 5%           | 5%         |
| Impala Platinum                       | Buy     | 21.3   | 19           | 18        | 15.0        | 12.9        | 7.7        | 6.7        | 3%         | 4%        | 3%        | 4%        | 2.2        | 2.0        | 14%        | 16%        | 2%           | 3%         |
| Northam Platinum                      | Buy     | 3.8    | 18           | 23        | 25.8        | 15.1        | 15.4       | 9.5        | -11%       | -11%      | 1%        | 2%        | 1.1        | 1.0        | 4%         | 7%         | 1%           | 3%         |
| Lonmin                                | Neutral | 15.1   | -60          | 19        | 14.2        | 14.2        | 5.3        | 4.9        | -3%        | 7%        | 2%        | 2%        | 1.0        | 1.0        | 8%         | 7%         | 0%           | -1%        |
| <b>Average</b>                        |         |        | <b>59</b>    | <b>21</b> | <b>20.0</b> | <b>17.1</b> | <b>9.7</b> | <b>7.8</b> | <b>-3%</b> | <b>1%</b> | <b>2%</b> | <b>2%</b> | <b>1.7</b> | <b>1.6</b> | <b>7%</b>  | <b>9%</b>  | <b>3%</b>    | <b>4%</b>  |
| <b>Gold/Precious</b>                  |         |        |              |           |             |             |            |            |            |           |           |           |            |            |            |            |              |            |
| AngloGold Ashanti                     | Neutral | 43.8   | -309         | -9        | 12.2        | 10.6        | 6.1        | 5.2        | 7%         | 7%        | 1%        | 1%        | 3.2        | 2.5        | 35%        | 27%        | 2%           | 3%         |
| Gold fields                           | Sell    | 15.7   | 32           | 20        | 10.9        | 9.0         | 4.5        | 4.0        | 10%        | 12%       | 3%        | 3%        | 1.9        | 1.6        | 16%        | 19%        | 3%           | 2%         |
| Harmony Gold Mng                      | Sell    | 12.1   | 57           | 74        | 26.3        | 18.4        | 9.9        | 6.2        | 2%         | 7%        | 0%        | 0%        | 1.2        | 1.2        | 4%         | 7%         | 3%           | 3%         |
| Barrick Gold                          | Buy     | 48.8   | 25           | 15        | 10.1        | 9.3         | 6.3        | 5.9        | -1%        | 6%        | 1%        | 1%        | 1.6        | 1.4        | 19%        | 16%        | 2%           | 8%         |
| Newmont Mining                        | Buy     | 64.0   | 24           | 14        | 13.7        | 13.0        | 6.1        | 6.1        | 5%         | 3%        | 2%        | 2%        | 2.1        | 2.1        | 16%        | 16%        | 3%           | 7%         |
| Newcrest Mining                       | Buy     | 33.5   | 22           | 20        | 21.5        | 16.3        | 11.8       | 9.0        | -2%        | 1%        | 1%        | 2%        | 1.7        | 1.7        | 9%         | 11%        | 8%           | 11%        |
| <b>Average</b>                        |         |        | <b>-25</b>   | <b>22</b> | <b>15.8</b> | <b>12.8</b> | <b>7.4</b> | <b>6.1</b> | <b>4%</b>  | <b>6%</b> | <b>1%</b> | <b>2%</b> | <b>1.9</b> | <b>1.7</b> | <b>17%</b> | <b>16%</b> | <b>3%</b>    | <b>6%</b>  |
| <b>Average - all miners</b>           |         |        | <b>13</b>    | <b>27</b> | <b>15.3</b> | <b>12.8</b> | <b>7.7</b> | <b>6.2</b> | <b>2%</b>  | <b>5%</b> | <b>2%</b> | <b>3%</b> | <b>2.1</b> | <b>1.8</b> | <b>18%</b> | <b>19%</b> | <b>4%</b>    | <b>6%</b>  |

Source: Powered by dataCentral \* Priced on 13 January 2012



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## Appendix 1 – Cash costs

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## Unit cash cost by company

**Figure 55. Citi calculated copper equivalent unit cash costs by company**

| Company                             | Copper Equivalent<br>Production (kt) | C1 cash cost (Usc/lb) |
|-------------------------------------|--------------------------------------|-----------------------|
| Aluminum Corporation of China       | 2,370                                | 316                   |
| Norsk Hydro ASA                     | 1,663                                | 313                   |
| Jiangxi Copper                      | 1,496                                | 308                   |
| Alcoa Inc.                          | 2,786                                | 298                   |
| Hindalco Industries                 | 1,701                                | 285                   |
| Harmony Gold                        | 201                                  | 285                   |
| Glencore                            | 1,458                                | 280                   |
| Lonmin                              | 209                                  | 268                   |
| Northam Platinum                    | 69                                   | 260                   |
| Anglo American Platinum             | 837                                  | 259                   |
| AngloGold Ashanti                   | 707                                  | 256                   |
| Coal India                          | 1,308                                | 256                   |
| Grange Resources Limited            | 37                                   | 237                   |
| Aquarius Platinum                   | 63                                   | 229                   |
| Impala Platinum                     | 439                                  | 229                   |
| Xstrata                             | 4,043                                | 226                   |
| Iluka Resources Ltd                 | 108                                  | 225                   |
| African Rainbow Minerals            | 215                                  | 224                   |
| Anglo American                      | 4,365                                | 218                   |
| Exxaro                              | 453                                  | 215                   |
| Fortescue Metals Group Ltd          | 427                                  | 212                   |
| Gold Fields                         | 621                                  | 211                   |
| Mount Gibson Iron                   | 62                                   | 209                   |
| Assore                              | 124                                  | 208                   |
| Rio Tinto                           | 7,997                                | 201                   |
| China Shenhua Energy                | 2,979                                | 185                   |
| BHP Billiton                        | 7,000                                | 184                   |
| Grupo Mexico                        | 1,072                                | 174                   |
| Barrick Gold                        | 1,448                                | 162                   |
| Freeport-McMoRan Copper & Gold Inc. | 2,516                                | 160                   |
| Vale                                | 6,005                                | 154                   |
| Norilsk Nickel                      | 1,694                                | 152                   |
| Southern Copper Company             | 683                                  | 148                   |
| Antofagasta PLC                     | 607                                  | 135                   |
| Kumba Iron Ore                      | 703                                  | 113                   |

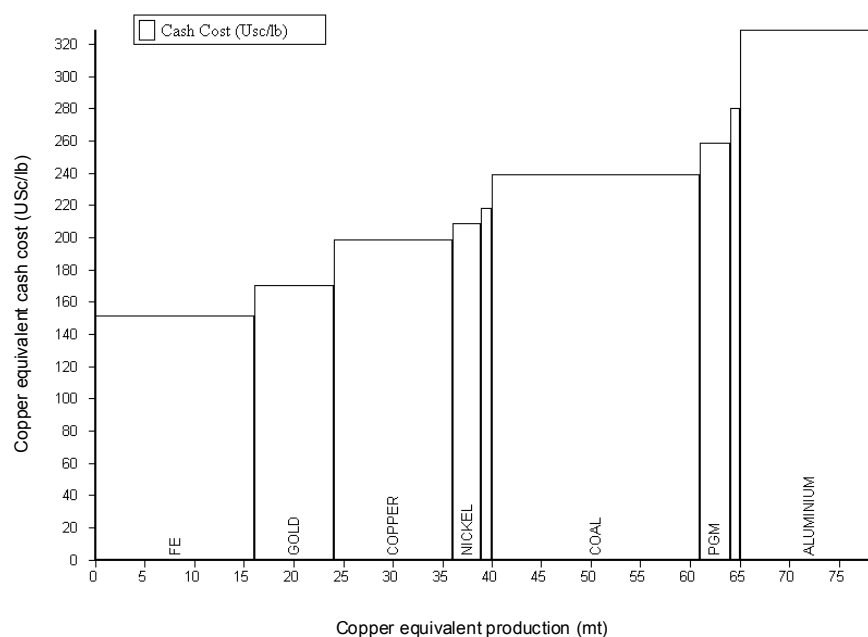
Source: Company reports, Citi Investment Research and Analysis

## Cash cost by commodity

The re-basing of production and cost into copper equivalent units allows for a comparison of the cost curve across commodities. Effectively it is similar to looking at the commodities on a relative EBITDA margin basis. For the multi-commodity producers we have split the companies' assets into their various commodities. And where we don't model the non-mine costs on a commodity by commodity basis we have allocated those costs on a proportional basis.



Figure 56. Copper equivalent cost curve by commodity



Source: Company data and Citi Investment Research and Analysis

Not surprisingly iron ore has the best cash cost with an effective US\$1.50/lb copper equivalent cash cost. Gold and copper make up the bottom half of the curve with PGM's, uranium and aluminium all in the top quartile of cash costs by commodity.

Our forecast of the cash cost for copper of US\$1.99/lb compares to the Brook Hunt C1 cash cost of US\$1.32/lb. Our data set only captures c12mt of mine production which equates to c75% of global mine supply. Thus on the large data set, we believe that the large difference between C1 cash costs and those costs that encompass the corporate costs is representative of the industry.

## Cash costs defined

There are 3 primary methods of unit cost measurement in the mining industry, referred to as C1, C2 and C3. The most commonly used measure of unit cost to compare the competitiveness of operations globally is C1 costs in US\$. Wood Mackenzie defines the various costs as follows:

$C1 = \text{Direct Costs} = \text{Cost to concentrate} + \text{Freight} + \text{TC/RC} - \text{By-Product Credits}$

$C2 = C1 + \text{Depreciation}$

$C3 = C2 + \text{all other indirect costs (eg. royalties)} + \text{interest on financing (initial and expansion)}$

$\text{Total Cash Cost} = C1 + \text{Royalty} + \text{Other Indirect Costs (most common for gold)}$

## Cost progression

- **Cost becoming a big issue:** Our analysis of global cash costs indicate that cost have been running at over 10% CAGR for the past decade and rates in the mid-teens over the past 5 years. Coal, copper and iron ore have suffered the highest increase in average industry costs, likely due to the strong demand and high prices for the metals as well as currency impacts. With commodity prices stabilising around current levels, costs increase could become a major downside risk to earnings
- **All parts of the curve have been impacted:** Whilst higher commodity prices have drawn higher cost supply in to the market, all quartiles of the cost curve have been suffering almost equal levels of inflation indicating that the cost pressures are an industry wide phenomenon rather than an issue of development of higher cost mines. It is only in the coal complex where we have seen a steepening of the cost curve
- **Risk is commodity price momentum stops, but cost momentum continues:** There is a clear correlation between rising commodity prices and rising costs. The big risk to earnings is if we see a slowdown in commodity price momentum (which we forecast) and a continuation of cost momentum. Lifting royalty rates around the world along with other 'costs' such as carbon tax are likely to see that cost pressures continue.
- **What is forecast:** Looking at industry cost curves from third party providers, cost inflation from 2010-2015 is expected to run at 2-3%pa (i.e in line with inflation). Our own modeling assumes cost increases from -5% to +12% pa over the period of time. Given the historical trends, we are starting to believe that our cost inflation forecasts are too low and represent a significant risk to future earnings and valuation of the industry.
- **Downside risk to earnings & valuation:** If we assume historical industry cost inflation rather than our explicit forecasts, earnings for the companies could drop by c3-6% pa. And for each year that costs continue to escalate at historical levels, a c3-5% reduction in our NPV occurs.

Figure 57. Average annual cash cost moves by commodity

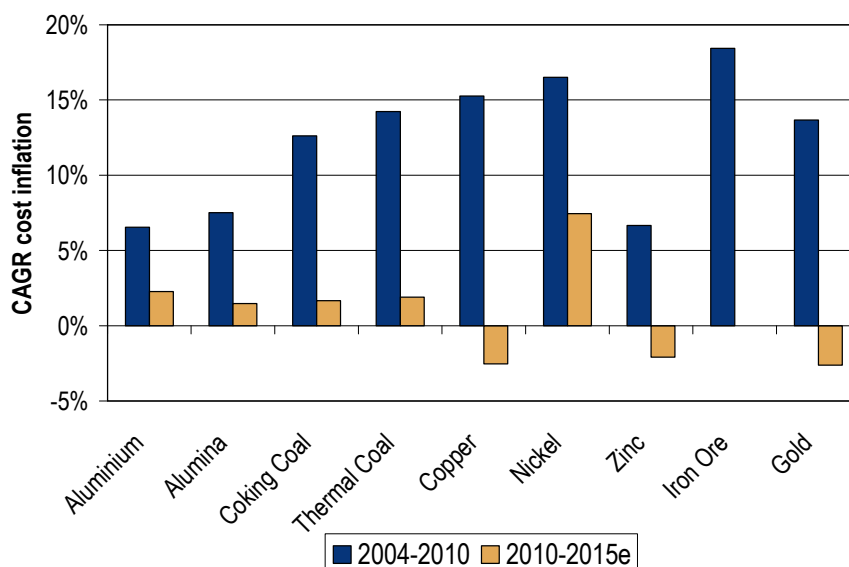
|              | CAGR 2001-2010 | CAGR 2004-2010 | CAGR 2010-2015e |
|--------------|----------------|----------------|-----------------|
| Aluminium    | 6%             | 7%             | 2%              |
| Alumina      | 6%             | 8%             | 1%              |
| Coking Coal  | 14%            | 13%            | 2%              |
| Thermal Coal | 12%            | 14%            | 2%              |
| Copper       | 10%            | 15%            | -3%             |
| Nickel       | 15%            | 17%            | 7%              |
| Zinc         | 3%             | 7%             | -2%             |
| Iron Ore     | 17%            | 18%            | n/a             |
| Gold         | 12%            | 14%            | -3%             |

Source: Brook Hunt

## Costs in the future

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 58. Historical and forecast cash cost inflation



Source: Citi Investment Research and Analysis

Clearly in the current climate it is unlikely that we will see the level of cost reduction forecast.

## What we forecast

Despite the clear trend of double digit cost increases our forecast cost increase on a company by company basis are significantly lower than this. The table below looks at our assumption of future unit cost movement for a selection of our coverage universe. The stocks below are the companies that have the same asset production profile over the time frame and as such the cash costs are not distorted by the addition or closure of mines.

Looking at the data, the coal sector is the one area where cost inflation is in line with historic trends. In other areas such as copper and iron ore; and to a lesser degree gold, our unit cost inflation forecasts are running well below historical trends.

Figure 59. Forecast unit cost inflation (in dollar terms)

|            |        | CAGR       |      |        | CAGR       |
|------------|--------|------------|------|--------|------------|
|            | RIC    | 2010-2013E |      | RIC    | 2010-2013E |
| XTA        | XTA.L  | -4%        | AAL  | AAL.L  | 4%         |
| GLEN       | GLEN.L | -4%        | BHP  | BLT.L  | 4%         |
| OZL        | OZL.AX | -3%        | CNA  | CNA.AX | 5%         |
| NCM        | NCM.AX | -3%        | EXX  | EXXJ.J | 5%         |
| NHM        | NHMJ.J | -1%        | GFI  | GFIJ.J | 6%         |
| RIO        | RIO.L  | 0%         | PNA  | PNA.AX | 7%         |
| AMS        | AMSJ.J | 0%         | KCN  | KCN.AX | 7%         |
| ANG        | ANGJ.J | 1%         | AQG  | AQG.AX | 7%         |
| KIO        | KIOJ.J | 2%         | ARI  | ARIJ.J | 8%         |
| IMP        | IMPJ.J | 2%         | ASR  | ASRJ.J | 8%         |
| BHP Coking | BLT.L  | 2%         | VALE | VALE.N | 9%         |
| GBG        | GBG.AX | 3%         | WHC  | WHC.AX | 10%        |
| BHP Fe     | BLT.L  | 3%         | HAR  | HARJ.J | 12%        |
| RIO Fe     | RIO.L  | 3%         | MCC  | MCC.AX | 12%        |
| FMG        | FMG.AX | 4%         | MML  | MML.AX | 22%        |

Source: Citi Investment Research and Analysis

In some instances our models assume a falling US\$ cost environment due to our falling commodity price forecasts. The falling unit costs are modeled to maintain EBITDA margins rather than see margins being compressed by high costs and falling prices. But this is the clear risk to our forecasts that we do indeed see a stable or falling commodity price environment, but a rising cost environment.

## Companies Mentioned

Table on Following page

Figure 60. Companies mentioned

| Company                            | Ticker      | Listing<br>Currency | Rating | Prices as at<br>12-Jan-12 | Target<br>price | Upside | Div.<br>yield | ETR    |
|------------------------------------|-------------|---------------------|--------|---------------------------|-----------------|--------|---------------|--------|
| Adaro Energy                       | ADRO.JK     | IDR                 | 1      | 1810.00                   | 2650.00         | 46.4%  | 2.3%          | 48.7%  |
| African Barrick Gold               | ABGL.L      | GBP                 | 1      | 4.63                      | 6.55            | 41.5%  | 0.0%          | 41.5%  |
| African Rainbow                    | ARIJ.J      | ZAR                 | 1      | 174.18                    | 230.00          | 32.0%  | 3.4%          | 35.5%  |
| Alacer Gold                        | AQG.AX      | AUD                 | 1      | 10.63                     | 13.00           | 22.3%  | 0.0%          | 22.3%  |
| Anglo American Platinum Ltd        | AMSJ.J      | ZAR                 | 3      | 549.62                    | 550.00          | 0.1%   | 2.2%          | 2.3%   |
| Anglo American PLC                 | AAL.L       | GBP                 | 1      | 25.94                     | 33.00           | 27.2%  | 2.3%          | 29.5%  |
| AngloGold Ashanti Ltd              | ANGJ.J      | ZAR                 | 2      | 351.43                    | 360.00          | 2.4%   | 1.5%          | 4.0%   |
| Antofagasta                        | ANTO.L      | GBP                 | 3      | 13.21                     | 10.60           | -19.8% | 3.9%          | -15.8% |
| Aquarius Platinum Ltd              | AQP.L       | GBP                 | 2      | 1.75                      | 1.89            | 8.2%   | 2.9%          | 11.0%  |
| Arch Coal                          | ACLN        | USD                 | 1      | 14.90                     | 23.00           | 54.4%  | 3.0%          | 57.3%  |
| Assore                             | ASRJ.J      | ZAR                 | 1      | 211.65                    | 280.00          | 32.3%  | 3.3%          | 35.6%  |
| Atlas Iron Ltd                     | AGO.AX      | AUD                 | 1      | 3.09                      | 4.00            | 29.4%  | 1.9%          | 31.4%  |
| Barrick Gold                       | ABX.N       | USD                 | 1      | 48.18                     | 78.00           | 61.9%  | 0.8%          | 62.7%  |
| BHP Billiton PLC                   | BLT.L       | GBP                 | 1      | 20.68                     | 23.00           | 11.2%  | 2.9%          | 14.1%  |
| Buenaventura SAA                   | BVN.N       | USD                 | 1      | 40.48                     | 50.00           | 23.5%  | 3.7%          | 27.2%  |
| Centamin                           | CEY.L       | GBP                 | 1      | 0.90                      | 1.04            | 15.6%  | 0.0%          | 15.6%  |
| China Coal Energy                  | 1898.HK     | HKD                 | 1      | 9.56                      | 10.30           | 7.7%   | 2.2%          | 9.9%   |
| China Shenhua Energy               | 1088.HK     | HKD                 | 1      | 34.15                     | 43.00           | 25.9%  | 2.2%          | 28.1%  |
| Cliffs Natural Resources Inc.      | CLF.N       | USD                 | 1      | 70.66                     | 97.00           | 37.3%  | 1.6%          | 38.9%  |
| Cockatoo Coal Limited              | COK.AX      | AUD                 | 1H     | 0.37                      | 0.65            | 75.7%  | 0.0%          | 75.7%  |
| Companhia Siderurgica Nacional     | CSNA3.SA    | BRL                 | 2      | 16.40                     | 18.00           | 9.8%   | 3.8%          | 13.6%  |
| Energy Resources Of Australia Ltd  | ERA.AX      | AUD                 | 2H     | 1.33                      | 1.50            | 12.8%  | 0.0%          | 12.8%  |
| ENRC                               | ENRC.L      | GBP                 | 1      | 7.39                      | 9.30            | 25.8%  | 2.7%          | 28.6%  |
| European Goldfields                | EGUq.L      | GBP                 | 1      | 7.70                      | 9.92            | 28.8%  | 0.0%          | 28.8%  |
| Exaro                              | EXXJ.J      | ZAR                 | 1      | 174.76                    | 215.00          | 23.0%  | 7.4%          | 30.5%  |
| Ferrexpo                           | FXPO.L      | GBP                 | 1      | 3.20                      | 4.45            | 39.0%  | 1.3%          | 40.3%  |
| First Quantum Minerals Ltd         | FQM.L       | GBP                 | 2      | 14.44                     | 14.40           | -0.2%  | 0.3%          | 0.1%   |
| Fortescue Metals Group Ltd         | FMG.AX      | AUD                 | 1      | 4.75                      | 6.50            | 36.8%  | 1.9%          | 38.7%  |
| Freeport-McMoRan Copper & Gold Inc | FCX.N       | USD                 | 2      | 42.09                     | 38.00           | -9.7%  | 2.4%          | -7.3%  |
| Fresnillo PLC                      | FRES.L      | GBP                 | 2      | 16.90                     | 16.68           | -1.3%  | 1.1%          | -0.2%  |
| Gem Diamonds                       | GEMD.L      | GBP                 | 1      | 1.87                      | 2.61            | 39.3%  | 0.0%          | 39.3%  |
| Gindalbie Metals Ltd               | GBG.AX      | AUD                 | 1H     | 0.58                      | 0.80            | 37.9%  | 0.0%          | 37.9%  |
| Glencore                           | GLEN.L      | GBP                 | 1      | 4.00                      | 5.50            | 37.7%  | 2.3%          | 40.0%  |
| Gold Fields Ltd                    | GFIJ.J      | ZAR                 | 3      | 126.34                    | 115.00          | -9.0%  | 3.5%          | -5.4%  |
| Grupo Mexico                       | GMEXICOB.MX | MXN                 | 2      | 39.10                     | 37.90           | -3.1%  | 1.5%          | -1.5%  |
| Harmony Gold Mining Co. Ltd        | HARJ.J      | ZAR                 | 3      | 96.71                     | 85.00           | -12.1% | 0.0%          | -12.1% |
| Hochschild Mining PLC              | HOCML       | GBP                 | 2      | 4.51                      | 4.75            | 5.4%   | 0.9%          | 6.3%   |
| Iluka Resources Ltd                | ILU.AX      | AUD                 | 1      | 16.32                     | 25.00           | 53.2%  | 8.0%          | 61.2%  |
| Impala Platinum                    | IMPJ.J      | ZAR                 | 1      | 166.93                    | 220.00          | 31.8%  | 4.0%          | 35.8%  |
| Kazakhmys PLC                      | KAZ.L       | GBP                 | 1      | 10.74                     | 15.60           | 45.3%  | 6.0%          | 51.2%  |
| Kingsgate Consolidated Limited     | KCN.AX      | AUD                 | 2      | 6.32                      | 7.00            | 10.8%  | 2.4%          | 13.1%  |
| Kumba Iron Ore Ltd                 | KIOJ.J      | ZAR                 | 3      | 524.50                    | 450.00          | -14.2% | 8.6%          | -5.6%  |
| Lonmin PLC                         | LML.L       | GBP                 | 2      | 9.84                      | 11.05           | 12.4%  | 0.0%          | 12.4%  |
| Medusa Mining Ltd                  | MLL.AX      | AUD                 | 1H     | 5.52                      | 8.50            | 54.0%  | 1.8%          | 55.8%  |
| Mirabela Nickel Ltd                | MBN.AX      | AUD                 | 1      | 1.32                      | 2.80            | 112.1% | 0.0%          | 112.1% |
| New Hope Corp Ltd                  | NHC.AX      | AUD                 | 2      | 5.64                      | 5.65            | 0.2%   | 3.5%          | 3.7%   |
| New World Resources                | NWRR.L      | GBP                 | 1      | 4.67                      | 7.20            | 54.0%  | 8.8%          | 62.8%  |
| Newcrest Mining Ltd                | NCMA.AX     | AUD                 | 1      | 32.42                     | 38.00           | 17.2%  | 1.5%          | 18.8%  |
| Newmont Mining                     | NEM.N       | USD                 | 1      | 63.50                     | 80.00           | 26.0%  | 0.6%          | 26.6%  |
| Norilsk Nickel                     | GMKN.RTS    | USD                 | 2      | 157.50                    | 225.00          | 42.9%  | 3.8%          | 46.7%  |
| Norsk Hydro ASA                    | NHY.OL      | NOK                 | 2      | 29.70                     | 31.00           | 4.4%   | 3.5%          | 7.9%   |
| Northam Platinum                   | NHMJ.J      | ZAR                 | 1      | 30.71                     | 45.00           | 46.5%  | 1.7%          | 48.2%  |
| Nyrstar NV                         | NYR.BR      | EUR                 | 1      | 6.84                      | 9.10            | 33.1%  | 1.5%          | 34.5%  |
| OZ Minerals Ltd                    | OZL.AX      | AUD                 | 1      | 10.49                     | 13.00           | 23.9%  | 4.3%          | 28.2%  |
| PanAust Limited                    | PNA.AX      | AUD                 | 1H     | 3.53                      | 4.20            | 19.0%  | 0.0%          | 19.0%  |
| Peabody Energy                     | BTU.N       | USD                 | 1      | 36.32                     | 60.00           | 65.2%  | 0.9%          | 66.1%  |
| Petropavlovsk                      | POGL        | GBP                 | 1      | 6.87                      | 8.34            | 21.4%  | 0.0%          | 21.4%  |
| Randgold Resources Ltd             | RRS.L       | GBP                 | 1      | 71.70                     | 84.16           | 17.4%  | 0.3%          | 17.6%  |
| Raspads kaya                       | RASP.RTS    | USD                 | 1      | 3.40                      | 6.00            | 76.5%  | 0.0%          | 76.5%  |
| Rio Tinto PLC                      | RIOL        | GBP                 | 1      | 35.98                     | 49.00           | 36.2%  | 2.0%          | 38.2%  |
| Southern Copper Company            | SCCO.N      | USD                 | 2      | 32.88                     | 32.00           | -2.7%  | 4.6%          | 1.9%   |
| St Barbara Limited                 | SBMAX       | AUD                 | 2H     | 2.01                      | 2.25            | 11.9%  | 0.0%          | 11.9%  |
| Sterlite Industries (India)        | STRL.BO     | INR                 | 1      | 103.40                    | 165.00          | 59.6%  | 1.4%          | 60.9%  |
| Talvivaara                         | TALV.L      | GBP                 | 2      | 3.05                      | 3.00            | -1.7%  | 0.0%          | -1.7%  |
| Vale                               | VALE.N      | USD                 | 1      | 22.55                     | 33.00           | 46.3%  | 6.7%          | 53.0%  |
| Western Areas NL                   | WSA.AX      | AUD                 | 1      | 5.29                      | 6.10            | 15.3%  | 3.2%          | 18.5%  |
| Whitehaven Coal Ltd                | WHC.AX      | AUD                 | 1      | 5.72                      | 6.50            | 13.6%  | 2.8%          | 16.4%  |
| Xstrata PLC                        | XTAL        | GBP                 | 1      | 10.84                     | 13.50           | 24.5%  | 3.0%          | 27.5%  |
| Zanaga Iron Ore Co                 | ZIOC.L      | GBP                 | 1H     | 0.98                      | 1.50            | 53.1%  | 0.0%          | 53.1%  |

Source: Citi Investment Research and Analysis



## Appendix A-1

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Pradeep Mahtani, Analyst, holds a long position in the securities of Sterlite Industries (India).

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