Copper Market and Industry Outlook

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I. Introduction

II. Demand side
   • China
   • The dollar
   • The oil price

III. Supply side
   • Market cap
   • Debts
   • Cost and production cuts
   • New supply
   • Preference for copper
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Copper’s super cycles

- Cyclic behavior as all commodities
- Steep rise in the early 2000s
- Increasing volatility
- Last peak in 2011

Evolution of the copper price
1935-2016, real

Source: Plusmining based on data from Cochilco
Main drivers of the last upward supercycle

**Headwind:** Europe

- Unregulated financial markets fostering growth
- Low interest rate
- Falling dollar

**Emerging economies**

- Long and steady GDP growth led to historical higher income

**China**

- Peak of growth based on „Old Normal“

**USA**

- Financial markets “in love” with commodities

**Supply**

- Difficulties to increase production

Source: Plusmining
What has changed?

**Emerging economies**
- Structural weaknesses emerge, particularly large imbalances generated during the booming period

**Tail wind:**
- Lower oil price

**Headwind:**
- Cost deflation
- Financial markets abandon commodities

**China**
- “New Normal”
- Less commodities as collateral

**USA**
- Modest economic growth
- Rise in interest rate – Turning point?

**Supply**
- Rising production
- Little production cuts

Source: Plusmining
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Chinese demand pattern is changing

- Declining demand growth rate
- Still increasing demand

Additional copper demand (in ‘000 tons) for every 1% increase in copper consumption

<table>
<thead>
<tr>
<th></th>
<th>1960</th>
<th>1990</th>
<th>2010</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>United States</td>
<td>12.2</td>
<td>21.5</td>
<td>17.7</td>
<td>17.8</td>
</tr>
<tr>
<td>China</td>
<td>0.8</td>
<td>5.8</td>
<td>73.9</td>
<td>109.9</td>
</tr>
<tr>
<td>India</td>
<td>0.6</td>
<td>1.3</td>
<td>4.1</td>
<td>4.4</td>
</tr>
</tbody>
</table>

Source: Plusmining based on ICSG
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Relationship between the US dollar and the copper price

Dollar index and copper Price, 1973-2016

Inverse relationship

Strong US growth

Higher interest rates

Stronger dollar

More capital inflow in US

Less capital inflow in emerging economies which account for most commodity demand growth

Falling commodity prices

Source: Plusmining based on data from the Federal Reserve and LME
The dollar’s performance

- The turning point of the last bear market occurred in 2011
- The dollar bull market accelerated around mid-2014 and seems to be coming to an end nowadays
- A dollar bear market still not to be expected, rather stabilization over the next two years

Dollar index vs. copper price
(May 2015 to date)
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Relationship between the oil and the copper price

• Oil price were plummeting because of record production
• Oil price usually drags other commodity prices along

Source: Plusmining
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Mining companies’ market value has been affected

- Since the peak of the boom in 2011, major mining companies have lost up to 86% (Vale) of their market value.
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Will we see a wave of defaults in the mining industry?

- Debt maturity peaks in 2018 for most major mining companies (except Glencore and BHP)
- In case prices do not recover within the next 2-3 years, some mining companies may be under pressure in 2018

Debt Maturity Profile of major mining companies, accumulated

<table>
<thead>
<tr>
<th>Year</th>
<th>Anglo American</th>
<th>Rio Tinto</th>
<th>Freeport</th>
<th>BHP*</th>
<th>Vale</th>
<th>Codelco</th>
</tr>
</thead>
<tbody>
<tr>
<td>2016</td>
<td>$2,000</td>
<td>$3,000</td>
<td>$3,800</td>
<td>$2,000</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2017</td>
<td>$2,000</td>
<td>$1,900</td>
<td>$3,800</td>
<td>$1,900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>$1,330</td>
<td>$3,100</td>
<td>$3,400</td>
<td>$2,800</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2019</td>
<td>$4,832</td>
<td>$1,800</td>
<td>$2,100</td>
<td>$1,983</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2020</td>
<td>$3,945</td>
<td>$3,100</td>
<td>$3,643</td>
<td>$2,900</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2021</td>
<td>$1,610</td>
<td>$3,100</td>
<td>$1,900</td>
<td>$3,600</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2022</td>
<td>$1,256</td>
<td>$3,100</td>
<td>$1,900</td>
<td>$1,100</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Debt Maturity Profile of major mining companies, individual

* BHP’s debt maturity is estimated for each year. There are no data for Vale for the year 2022

Source: Plusmining based on information from the respective companies
Debt in the mining industry

- Large investments during boom generated some cases of highly indebted companies
- Major mining companies divided into two groups

Source: Plusmining based on Bloomberg and the respective companies' financial reports
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Cost evolution in copper mining

- Cash cost rose sharply during the last boom
- First effects of cost reductions to be seen

Source: Cochilco and Wood Mackenzie
Measurements to preserve cash

- So far, measurements to preserve cash in the copper industry mainly consist in cost reduction plans
- Low oil price and strong dollar helped

Cost reduction plans

Operational cost

Investments

Dividends

Renegotiation of contracts, layoffs, optimization plans

Investment plans under scrutiny, Capex reductions

Reductions or cancellations
Measurements to preserve cash [cont.]

Copper production cut backs as of February 2016

<table>
<thead>
<tr>
<th>Country</th>
<th>Mine</th>
<th>Operator/Process</th>
<th>Prod. (kzt Cu)</th>
<th>Announced date</th>
<th>Action</th>
<th>Duration (company reports)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Australia</td>
<td>Mt. Leyli</td>
<td>Vedanta</td>
<td>0/0</td>
<td>Nov-15</td>
<td>Deferred decision to restart mine due to low copper prices (C&amp;M since Jan 2014)</td>
<td>NA</td>
</tr>
<tr>
<td>Botswana</td>
<td>Mowana</td>
<td>African Copper</td>
<td>10/5</td>
<td>Mar-15</td>
<td>C&amp;M and in Nov liquidation</td>
<td>NA</td>
</tr>
<tr>
<td>Botswana</td>
<td>Boseto</td>
<td>Livewire Metals</td>
<td>22/3</td>
<td>1G15</td>
<td>Cunic bought assets to develop new mine by 2018</td>
<td>NA</td>
</tr>
<tr>
<td>Canada</td>
<td>Huckleberry</td>
<td>Imperial Metals</td>
<td>16/20</td>
<td>Jan-18</td>
<td>To suspend operations when milling of stockpile ends Aug 2016</td>
<td>Until improvement in the copper price</td>
</tr>
<tr>
<td>Canada</td>
<td>Minto</td>
<td>Capstone Mining</td>
<td>10/16</td>
<td>Jan-18</td>
<td>Underground mining will be paused in Q1 2016. Surface mining ends Aug 2016 and one process continues till mid 2017</td>
<td>Depends on a number of factors, most notably the Copper market</td>
</tr>
<tr>
<td>Canada</td>
<td>Wolverine</td>
<td>Yukon Zinc</td>
<td>5/0</td>
<td>Jan-15</td>
<td>C&amp;M</td>
<td>NA</td>
</tr>
<tr>
<td>Chile</td>
<td>El Abra</td>
<td>Freeport/Codelco</td>
<td>186/147</td>
<td>end Aug 15</td>
<td>60% reduction of mining and stacking rates</td>
<td>Additional adjustments may be made as market conditions warrant</td>
</tr>
<tr>
<td>Chile</td>
<td>Collahuasi</td>
<td>Anglo American/Glenore</td>
<td>25/22</td>
<td>end Sep 15</td>
<td>Cut in SX-EW production only (not concs.)</td>
<td>NA</td>
</tr>
<tr>
<td>Congo</td>
<td>Kamoto</td>
<td>Glencore</td>
<td>158/114</td>
<td>Sep-15</td>
<td>Suspension of operations</td>
<td>18 month</td>
</tr>
<tr>
<td>Mexico</td>
<td>Aranzazu</td>
<td>Aura Minerals</td>
<td>7/1</td>
<td>Jan-15</td>
<td>C&amp;M</td>
<td>Remains on C&amp;M in 2016</td>
</tr>
<tr>
<td>Namibia</td>
<td>Ojijahse/Matchless</td>
<td>Weatherly</td>
<td>5/3</td>
<td>Sep-15</td>
<td>To be reviewed when market conditions improve</td>
<td></td>
</tr>
<tr>
<td>Spain</td>
<td>Aquabianca</td>
<td>Lundin Mining</td>
<td>7/0</td>
<td>Oct-15</td>
<td>C&amp;M</td>
<td>Until permits received and improved market conditions</td>
</tr>
<tr>
<td>USA</td>
<td>Miami</td>
<td>Freeport</td>
<td>28/20</td>
<td>end Aug 15</td>
<td>Suspension of mining operations</td>
<td>Additional adjustments may be made as market conditions warrant</td>
</tr>
<tr>
<td>USA</td>
<td>Tyrone</td>
<td>Freeport</td>
<td>43/38</td>
<td>end Aug 15</td>
<td>60% reduction in mining rates</td>
<td>Additional adjustments may be made as market conditions warrant</td>
</tr>
<tr>
<td>USA</td>
<td>Ray</td>
<td>Asarco</td>
<td>83/20</td>
<td>end Aug 15</td>
<td>40% cut in output (indefinite shutdown of concentrator/reduction in stripping for each) Prod reduced by approx. 39kzt Cu</td>
<td>Adjustments may be made as market conditions warrant.</td>
</tr>
<tr>
<td>USA</td>
<td>Sienta</td>
<td>Freeport</td>
<td>66/96</td>
<td>Dec-15</td>
<td>50% reduction in operating rates announced in Sep 15. In Dec announced planned full shutdown</td>
<td>Planned shutdown</td>
</tr>
<tr>
<td>USA</td>
<td>Tmy</td>
<td>Heda Mining</td>
<td>2/0</td>
<td>Feb-15</td>
<td>C&amp;M</td>
<td>NA</td>
</tr>
<tr>
<td>Zambia</td>
<td>Mogal</td>
<td>Glenore</td>
<td>110/92</td>
<td>Sep-15</td>
<td>Suspension of operations</td>
<td>18 month</td>
</tr>
<tr>
<td>Zambia</td>
<td>Baluba</td>
<td>CNMC</td>
<td>17/10</td>
<td>Sep-15</td>
<td>C&amp;M</td>
<td>NA</td>
</tr>
</tbody>
</table>

- Copper production cuts so far only represent 4% of market size
- Reason: Very costly to shut down mines
- Hence preference for cost reductions

Supply cuts as a proportion of market size

Source: ICSG at Metall Bulletin conference; Macquarie
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Peru’s copper production is increasing rapidly

- The production growth in the Peruvian mining industry nowadays is comparable to that of Chile in the 90s

**Chile’s copper production in the 90s**

<table>
<thead>
<tr>
<th>Year</th>
<th>Copper Production (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
<td>1,933</td>
</tr>
<tr>
<td>1993</td>
<td>2,055</td>
</tr>
<tr>
<td>1994</td>
<td>2,220</td>
</tr>
<tr>
<td>1995</td>
<td>2,489</td>
</tr>
<tr>
<td>1996</td>
<td>3,116</td>
</tr>
<tr>
<td>1997</td>
<td>3,392</td>
</tr>
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<td>1998</td>
<td>3,687</td>
</tr>
<tr>
<td>1999</td>
<td>4,391</td>
</tr>
<tr>
<td>2000</td>
<td>4,602</td>
</tr>
</tbody>
</table>

**Peru’s current and near-term future copper production**

<table>
<thead>
<tr>
<th>Year</th>
<th>Copper Production (tons)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>1,247</td>
</tr>
<tr>
<td>2011</td>
<td>1,236</td>
</tr>
<tr>
<td>2012</td>
<td>1,299</td>
</tr>
<tr>
<td>2013</td>
<td>1,376</td>
</tr>
<tr>
<td>2014</td>
<td>1,380</td>
</tr>
<tr>
<td>2015</td>
<td>1,701</td>
</tr>
<tr>
<td>2016</td>
<td>1,900</td>
</tr>
<tr>
<td>2017</td>
<td>2,300</td>
</tr>
<tr>
<td>2018</td>
<td>2,500</td>
</tr>
</tbody>
</table>

Source: Plusmining based Cochilco and Banco Central de Reserva de Perú
Peru's copper production is increasing rapidly [cont.]

- Such sharp increases by major producers may momentaneously influence the global copper price

### Chile’s copper production in the 90s

<table>
<thead>
<tr>
<th>Year</th>
<th>Production (Mtc)</th>
<th>Copper Price (US cents/lb)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1992</td>
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<td>2,300</td>
<td></td>
</tr>
<tr>
<td>2018</td>
<td>2,500</td>
<td></td>
</tr>
</tbody>
</table>

Source: Plusmining, based on Cochilco, Banco Central de Reserva de Perú and Macquarie
Greenfield, Brownfield and expansion projects in copper mining

Projects initiating operations: Status January 2015
(Projects with planned capacity >100kt/y)

- Many difficulties with new projects
- Investment programs revisions led to the delay or cancellation of many projects

Projects initiating operations: Status March 2016
(Projects with planned capacity >100kt/y)

14 Months later

Source: Cochilco
Copper projects in Chile

Net changes of the portfolio of projects
(Projects within the next 10 years)

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Number of projects</strong></td>
<td>+4 projects</td>
<td>-11 projects</td>
<td>-7 projects</td>
</tr>
</tbody>
</table>

The number of copper projects was reduced from 31 to only 23. Apart from copper projects, there are currently 7 gold projects (+1 since 2015) and 5 iron ore projects in the Chilean project portfolio.

Source: Plusmining based on Cochilco
Copper supply and demand - outlook

- Deficit to be expected from 2019 onwards
- Together with other influencing factors such as USD cycle, will have a positive (upward) impact on price

### Copper market balance forecast

(Supply – demand)

- **2016**: 100 thousand tons
- **2017**: 150 thousand tons
- **2018**: 50 thousand tons
- **2019**: -100 thousand tons
- **2020**: -150 thousand tons

Source: Plusmining
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Major mining companies’ preference for copper

- Mining companies giving up diversification strategies
- Many decided to focus or to prioritize on copper
- Confirms the advantageous market situation to be expected for copper producers in the medium and long term
- Economy driven more and more by energy and less by fossil fuels