Volatility of factor costs (incl. CO$_2$) and implications for the steel industry

Presentation document
May 23, 2013
Contents

- Volatility of factor costs (incl. CO₂)
  - Why volatility matters
  - What can be done to manage risk and capture upside
With the exception of energy in the 70s, volatility is at an all time high across all commodity classes\(^3\)

Ave annual change in real price\(^1\)

One standard deviation\(^2\)

1 Calculated as the arithmetic average of the annual change in prices across that timeframe

2 Calculated as the standard deviation of the commodity sub-index divided by the average of the sub-index over the timeframe

3 Data for 2013 are calculated as an average for the first 3 months of 2013

SOURCE: Grilli and Yang, 1988; Pfaffenzeller et al, 2007; World Bank Commodity Price Data; IMF primary commodity prices; OECD statistics; FAOstat; UN Comtrade; MGI Analysis
Steelmaking commodity prices are highly volatile and declined significantly over the last 2 years
USD/metric ton, CIF Europe

1 Contract FOB prices + dry bulk oceanic freight
2 Spot prices European domestic

SOURCE: McKinsey, SBB, AMM, EEX
High commodity prices have aggravated effect of volatility
USD/metric ton, CIF Europe

Yearly volatility\(^1\) Percent per year

Raw material basket price

1 Calculate as (standard deviation)/(average)

SOURCE: McKinsey, SBB, AMM, EEX
Carbon prices have fallen due to over allocation of allowances, the economic slowdown and lack of policy intervention …

1 European Union Allowance, the tradable carbon allowance in the European Union Emission Trading Scheme (EU ETS)

SOURCE: Point Carbon
... and volatility has typically been in line with Brent Oil prices but started deviating as of 2012

21-day historical volatility in Percent¹

- EUA prices 21-day historical volatility since January 2008 is not higher than Brent
- However, regulatory and economical shocks have changed the dynamics since July 2011 – Energy efficiency Directive proposal, Greek crisis, Euro recession

¹ Calculated based on the standard deviation of the daily price change for a period of 21 days

SOURCE: Point Carbon; Bloomberg (Bloomberg European Brent Blend Crude Oil Spot Price; Ticker: EUCRBREN Index)
Contents

- Volatility of factor costs (incl. CO₂)
- Why volatility matters
- What can be done to manage risk and capture upside
Economic uncertainties, variability of market prices, uncertainties in sales volumes combined with existing usages leads to EBITDA uncertainty.

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<thead>
<tr>
<th>Purchasing</th>
<th>Operations</th>
<th>Sales</th>
</tr>
</thead>
<tbody>
<tr>
<td>Iron ore</td>
<td>▪ Misalignments between sales and purchase contracts</td>
<td>▪ Storage and production management</td>
</tr>
<tr>
<td></td>
<td>▪ Timing</td>
<td>▪ Uncertainties in future sales volumes</td>
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<td></td>
<td>▪ Duration</td>
<td>▪ Pricing mechanism</td>
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<td>▪ Inception</td>
<td>▪ Timing</td>
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<td>▪ Pricing mechanism</td>
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<tr>
<td>Coking coal</td>
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<tr>
<td>Scrap</td>
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<tr>
<td>Merchant coke</td>
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<td>PCI coal</td>
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<td>El. power</td>
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<tr>
<td>FX</td>
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<tr>
<td>CO2</td>
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</tr>
</tbody>
</table>

EBITDA variability can lead to:
- Periods with unexpectedly large profits
- Periods with critical bottom-line
- Higher volatility of overall P&L (budget/actuals)

SOURCE: McKinsey
Steel production: Misalignment between purchasing and sales creates an exposure ...

Exposure to raw material volatility

Operations

<table>
<thead>
<tr>
<th>T=0</th>
<th>T+3</th>
<th>T+5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Raw material order</td>
<td>Raw material delivery &amp; Steel order</td>
<td>Steel delivery</td>
</tr>
</tbody>
</table>

Quarterly RM contract

1.5 month

Average 1.5 month

Average 2 months

Raw material basket prices (dependant on contract type) + Constant transformation & fixed cost (205 USD/t) + Constant operating margin (140 USD/t) = Steel price

1. Costs plus margin: prices based on actual production costs plus constant margin
   - No exposure, as steel price defined according to the actual raw material prices
   - 3 months exposure, as steel price defined based on RM prices agreed 3 months earlier
   - 5 months exposure, as steel price defined based on RM prices agreed 5 months earlier

2. Locked-in prices: prices agreed at time of contract signature

3. Spot: Prices agreed at time of steel delivery

Exposure to raw material price volatility will:
- Increase EBITDA if raw material prices go up
- Decrease EBITDA if raw material prices go down

SOURCE: McKinsey analysis
... that can be estimated at ~6 USD/ton EBITDA at risk per ton of steel produced if raw materials basket price decreases by 10% (example)

Simulation, EBITDA/t exposure, USD per ton

<table>
<thead>
<tr>
<th>Potential sales contract designs</th>
<th>Description</th>
<th>Resulting risk exposure EBITDA at risk, USD per ton</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Costs plus margin</td>
<td>Steel sold at actual commodity costs plus fixed transformation costs and constant margin</td>
<td>0</td>
</tr>
<tr>
<td>2 Locked-in prices</td>
<td>Steel sold at commodity costs at the time of the contract plus fixed transformation costs and constant margin, for a 6 month period</td>
<td>2</td>
</tr>
<tr>
<td>3 Spot</td>
<td>Steel sold at commodity costs at the time of delivery plus fixed transformation costs and constant margin</td>
<td>16</td>
</tr>
</tbody>
</table>
| 4 Mix of contracts              | 10% of cost plus contracts (e.g. internal sales)  
60% locked-in contracts (e.g. direct sales)  
30% spot contracts (e.g. through distribution) | 6  
Equivalent to 9% of 2010 EBITDA (70 USD/ton) |

SOURCE: McKinsey
Contents

- Volatility of factor costs (incl. CO₂)
- Why volatility matters
- What can be done to manage risk and capture upside
How to manage risks from volatility

**Levers applicable to raw materials and CO₂**

1. **Take value-chain perspective**
   - Create transparency on exposure
   - Define risk/return trade-offs along the value chain (incl. aligning purchasing and sales activities)

2. **Reduce CO₂ emissions**
   - Optimize operations to minimize GHG emissions and, potentially, monetize abatement

3. **Develop CO₂ regulatory strategy**
   - Engage in constructive dialogue with the regulator
   - Increase share of funding for breakthrough technologies

**CO₂-specific levers**
Optimize risk/return trade-offs along the value chain

- Stock reduction
- Proactive stocking/destocking
- Freight hedging
- Carbon credit inventory

- Asset base flexibility
  - Flexible production
  - Optimal VIU of Raw Materials

NOT EXHAUSTIVE

Steelmaker

- Procurement
- Warehousing, transport & distribution
- Production
- Sales

Market transactions

- Pooled sourcing
- Upstream integration
- RM and CO2 market intelligence

- Centralized hedging
  - Trading (incl. CO2)

- Purchasing and sales alignment
  - Contract design (CO2 cost transfer)
  - Contract performance measurement

- Contract portfolio management
  - FX hedging

- Value-added services
  - Demand planning

SOURCE: McKinsey
### Understanding true volatility risk exposure and maximizing value from mismatch of purchasing and commercial contracts

<table>
<thead>
<tr>
<th>Supply contract properties</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
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<tbody>
<tr>
<td>Scrap – mainly 1 - 3 months’ price surcharge</td>
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<td>Alloys – long plus short-term</td>
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<td>Electricity – more long-term</td>
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<tr>
<td>CO2 – typically long term</td>
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<thead>
<tr>
<th>Client contract properties</th>
<th>Jan</th>
<th>Feb</th>
<th>Mar</th>
<th>Apr</th>
<th>May</th>
<th>Jun</th>
<th>Jul</th>
<th>Aug</th>
<th>Sep</th>
<th>Oct</th>
<th>Nov</th>
<th>Dec</th>
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<tbody>
<tr>
<td>Automotive – mainly yearly contracts</td>
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<td>Appliance – mainly yearly contracts</td>
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<td>Packaging – mainly yearly contracts</td>
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<td>Shipbuilding – yearly or longer</td>
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<td>Construction/engineering – quarterly/monthly or shorter</td>
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</tbody>
</table>

**Misalignment between purchasing and sales contracts**

**SOURCE:** McKinsey
In practice, risk book approach is implemented through an integrated software tool. The tool includes:

**Inputs**
- Contract structure optimization tool
- Procurement contracts
- Sales contracts
- Process economics
- Historical commodity price data
- Simulation engine

**Outputs**
- Cash margin development
  - Historical analysis
  - Forward-looking analysis
  - Alternative contract structures
  - Predefined sensitivity and exposure reports

Including interface to market data (downloadable)
Contract management and hedging can be measures to ensure sustainable operating cash flows.

- **Reshape to ensure strategically "healthy" EBIT distribution**
  - Structural changes in business
  - Contract management
  - Hedging

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**Contract Management and Hedging**

<table>
<thead>
<tr>
<th>Probability</th>
<th>Hurdle</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cash Needs</td>
<td>USD</td>
</tr>
<tr>
<td>Interest &amp; Principal</td>
<td>Dividends</td>
</tr>
</tbody>
</table>

- Operating cash flow distribution

---

SOURCE: McKinsey
Contract management – in contract design a variety of dimensions should be considered

**Contract parameters**

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Sample types</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Term</td>
<td>Spot</td>
<td>▪ Duration of contract</td>
</tr>
<tr>
<td></td>
<td>1 month</td>
<td>▪ Cycle times for renegotiation</td>
</tr>
<tr>
<td></td>
<td>2 years</td>
<td></td>
</tr>
<tr>
<td>Lag</td>
<td>Zero</td>
<td>▪ Time lags between commodity price point in index of sales and procurement contracts</td>
</tr>
<tr>
<td></td>
<td>...</td>
<td>▪ Time lag between procurement of raw material and delivery (e.g., to account for lead times)</td>
</tr>
<tr>
<td></td>
<td>Three</td>
<td></td>
</tr>
<tr>
<td>Index</td>
<td>Index</td>
<td>▪ Prices indexed to single commodities or raw material baskets</td>
</tr>
<tr>
<td></td>
<td>Freight</td>
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<td></td>
<td>HRC</td>
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<td></td>
<td>CO2</td>
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<td></td>
<td>...</td>
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<tr>
<td>Currency</td>
<td>USD</td>
<td>▪ Different denominations (currencies) for procurement, but particularly sales contracts</td>
</tr>
<tr>
<td></td>
<td>EUR</td>
<td></td>
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<td></td>
<td>RUB</td>
<td></td>
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<tr>
<td>Volume flexibility</td>
<td>Fixed volume</td>
<td>▪ Flexible volume structures that allow customers to adjust volumes within pre-defined boundary conditions</td>
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<tr>
<td></td>
<td>Take or pay</td>
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<tr>
<td></td>
<td>50%</td>
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</tr>
<tr>
<td></td>
<td>90%</td>
<td></td>
</tr>
</tbody>
</table>

**NOT EXHAUSTIVE**

SOURCE: McKinsey
Steel sector is responsible for 8.0% of global GHG emissions if indirect emissions are also taken into account.

Percent, 2010e

### Global CO₂e emissions
100% = 49.4 GtCO₂e per year

- Agriculture: 13.3
- Forestry: 15.0
- Waste: 2.9
- Building: 6.8
- Transport: 12.1
- Power: 24.4
- Chemicals: 3.0
- Cement: 3.9
- Other industry: 3.0
- Petroleum and gas: 5.0

### Steel CO₂e emissions
100% = 4.0 GtCO₂e per year

- Ferro-alloys\(^2\): 70
- Power: 9
- Mining\(^1\): 17
- Steel (Power): 0.7
- Steel (Direct): 5.6
- Steel (mining\(^1\) and ferro-alloys\(^2\)): 5.5

1 Includes mining and beneficiation of iron ore, coal, limestone, and ferro-alloy ores
2 Production of Ni, FeCr, FeSi, FeMn, SiMn and Al consumed during steel production

SOURCE: McKinsey steel CO2 model; Global McKinsey carbon cost curve 2.1
Close to half of the abatement potential in the steel industry has a negative abatement cost

2007

Abatement cost
EUR per tCO₂e

- Top gas recovery turbine (TRT)
- Increased use of pellets
- Dry coke quenching

Abatement potential
MtCO₂e per year

- CCS attractive location
- CCS unattractive location

Five broad categories of abatement levers
- Energy efficiency (30%)
- Process change (20%)
- Carbon capture and storage (20%)
- Levers around raw materials (15%)
- Credits (15%)

SOURCE: McKinsey
Example energy efficiency levers: Steel industry can achieve 10-15% energy cost saving with <2 years pay-back.

An integrated steelmaker in North America

Energy saving with payback < 2 years and implementation < 18 months
USD millions

- Energy cost baseline: 400
- Initiatives with no capex: 25
- Initiatives with capex <2 mn: 20
- Initiatives with capex >2 mn: 15
- Improvement target: -15%

Improvement: -15% from 400 to 340

Saving 6% energy cost with no capex, and another 5% with limited capex.

Subsidiary of a leading Chinese steelmaker

Energy saving with payback < 2 years and implementation < 12 months
% in energy cost

- Energy cost baseline: 100%
- Initiatives with no capex: 5%
- Initiatives with capex < RMB 3.5 mn: 2%
- Other improvement levers: 10%
- Improvement target: -17%

Improvement: -17% from 100% to 84%

Saving 5% energy cost with no capex, and another 2% with limited capex.

SOURCE: McKinsey
### Example raw material levers: Iron ore linked abatement opportunities

| A Raw material preparation | • Avoidance of sintering saves ~ 60 kg of coke breeze consumption per ton of sinter  
|                           | • Avoidance of pelletization saves ~ 0.7 GJ/ton of pellets  
|                           | • Higher sinter strength (higher RDI, mainly driven by Al2O3) reduces fraction of return fines, lowering coke breeze consumption |
| B1 Blast furnace - fuel rate | • Higher Fe grade reduces slag generation (SiO2 and Al2O3), and fuel rate  
|                           | • Lower fraction of volatile impurities (Alkali’s, Zn and Pb), reduces total fuel rate  
|                           | • Lower fraction of reducable impurities (Mn, S and P) reduces the total fuel rate  
|                           | • Lower moisture content reduces the total fuel rate |
| B2 Blast furnace - coke replacement (e.g., burden permeability) | • Higher permeability of the blast furnace burden allows for replacement of coke by PCI/natural gas/oils/coke oven gas (permeability of Pellets > Sinter > Lump)  
|                           | • Higher sinter strength (higher RDI - mainly low Al2O3), reduces the coke rate |
| C Steelmaking | • Lower impurities (mainly Mn, S and P) reducing CO2 emissions during steelmaking (e.g., desulphurization requiring CaC2, dephosphorization requiring additional lime, removing Mn leads to additional oxygen consumption) |

SOURCE: McKinsey
**External financing is available for breakthrough climate change initiatives**

<table>
<thead>
<tr>
<th>Research and development programs</th>
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</thead>
<tbody>
<tr>
<td>Regional/country funding of public private partnerships aiming at developing a range of breakthrough steelmaking technologies e.g.,</td>
</tr>
<tr>
<td>- ULCOS (Europe)</td>
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<td>- COURSE50 (Japan)</td>
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<tr>
<td>- The Technology Roadmap (TRP) (US)</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Funding of carbon capture and storage</th>
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</thead>
<tbody>
<tr>
<td>Regional/country subsidies for demonstration of carbon capture and storage plants (CCS) and innovative technologies. E.g.,</td>
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<tr>
<td>- “NER300” (Europe)</td>
</tr>
<tr>
<td>- Australian Carbon Capture and Storage Institute (Australia)</td>
</tr>
<tr>
<td>- Fossil Energy’s Carbon Sequestration program (Department of Energy; US)</td>
</tr>
</tbody>
</table>

SOURCE: McKinsey
Questions

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Mobile: +32/477 480.165