Where do we go from here?

The Market Forces Changing Mining Outlook for Key Commodities




EXPOSIBRAM
Belo Horizonte September 2017

McKinsey&Company

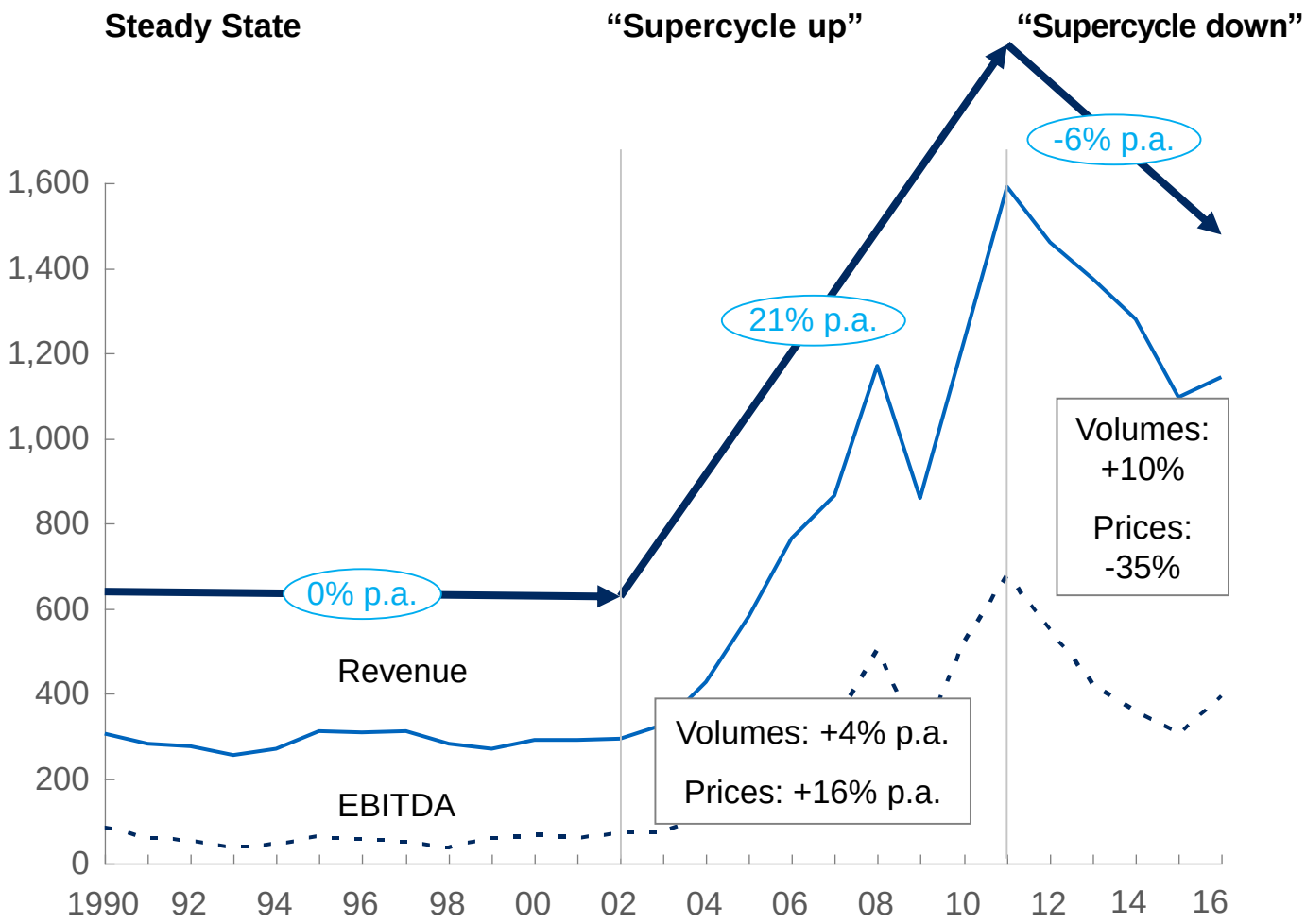
The Boom & Bust cycle is here to stay

Since 2005, the mining sector went through 5 massive price swings (boom & bust)

- Conventional wisdom often tries to describes these events as “demand driven”
- Real commodity demand however is **robust**, and X-rates, oil prices,.. have far bigger impact on prices as they create swings in marginal cost structures of +/- 25%. These price swings induce supply shifts, (sometimes also demand shifts), which will feed the next price correction
- **Price bands are very wide.** The 85% confidence interval (for historic prices over a 15 yr cycle), goes from X to 2X for primary commodities, and from X to 4X for by-product commodities**.** In other words**, a gold price outlook could be 1100 to 2200 USD/oz, silver could be 10 to 40 USD/oz.**
- **Average prices over a cycle do not respond to a price regime or archetype.** They are neither cash cost, nor incentive prices. They are typically 30% (20%-40%) above cash cost (e.g., floor prices). Floor prices (and hence the price bands) **inflate with average productivity declines** in the industry when measured over longer periods in time (10 years). Until 1995, the opposite was true, prices declined in line with historic productivity gains.
- Pricing regimes for most **commodities are now improving**. In absence of demand catalysts, price recoveries are supported by differentiated supply stories (China cuts and/or depletion and grade erosion). We favor “exploration” dependent commodities, but beware of the next hype (Lithium, Co,..)

The mining sector has been fundamentally reshaped, but has also become more volatile, and more vulnerable

REVENUES AND EBITDA OF THE GLOBAL MINING INDUSTRY
USD billions (nominal)



SUPERCYCLE UP

50% volume growth (75% of this from China demand)

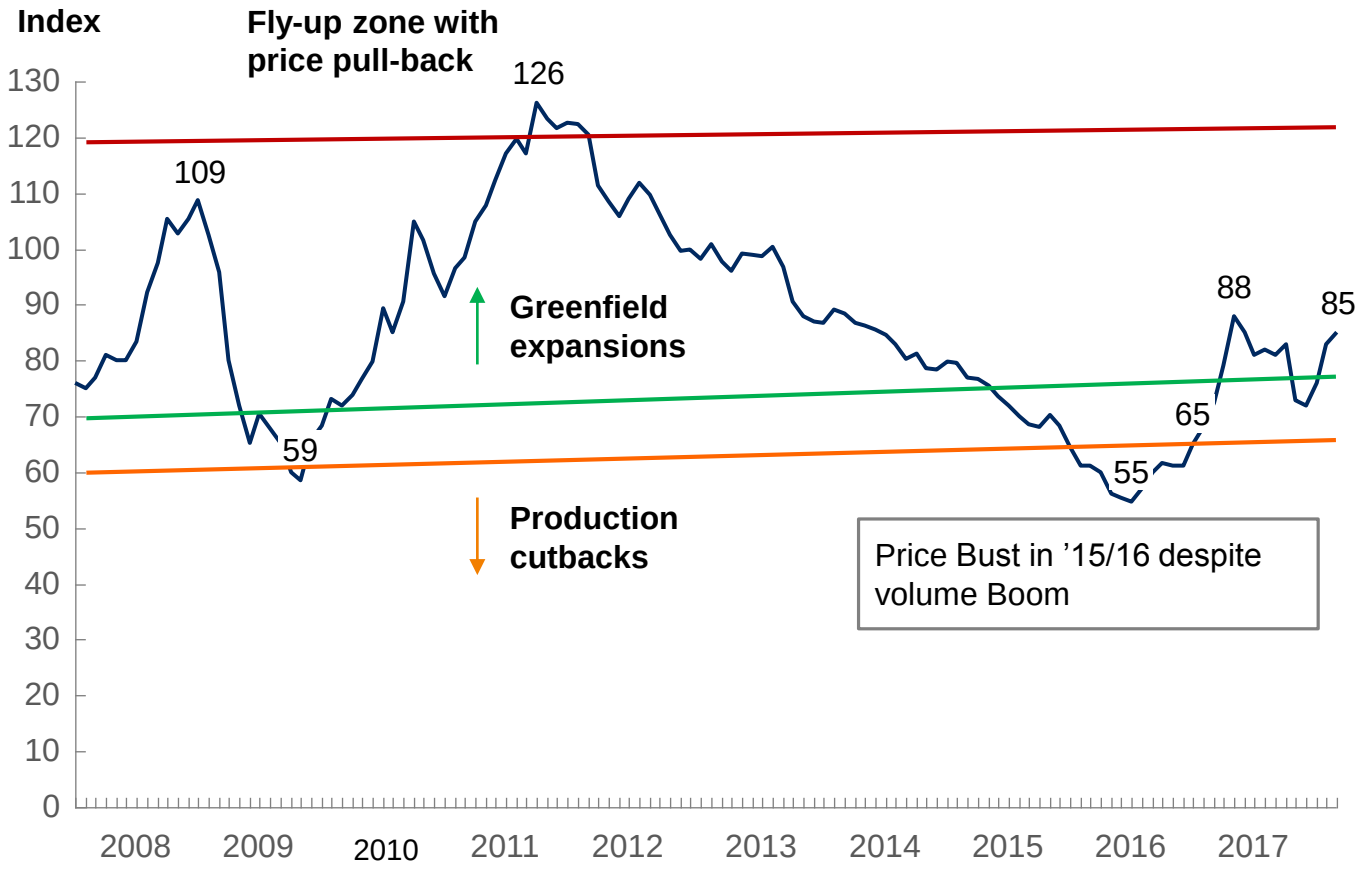
50% drop in mining productivity

Mega-swings in Forex/oil prices

SOURCE: McKinsey Mining Model

Extreme volatility is here to stay

MONTHLY PRICE-INDEX FOR THE GLOBAL MINING INDUSTRY
1 MPI = 1 USD billion/month revenue

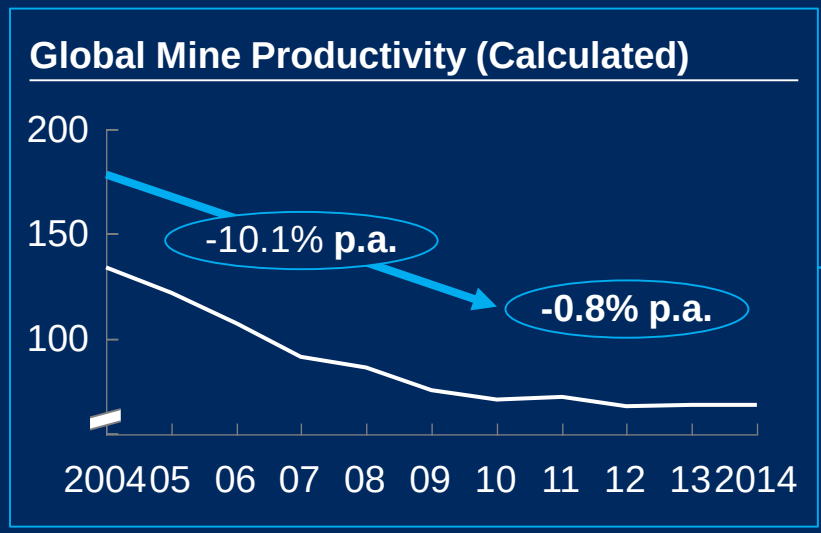


High volatility

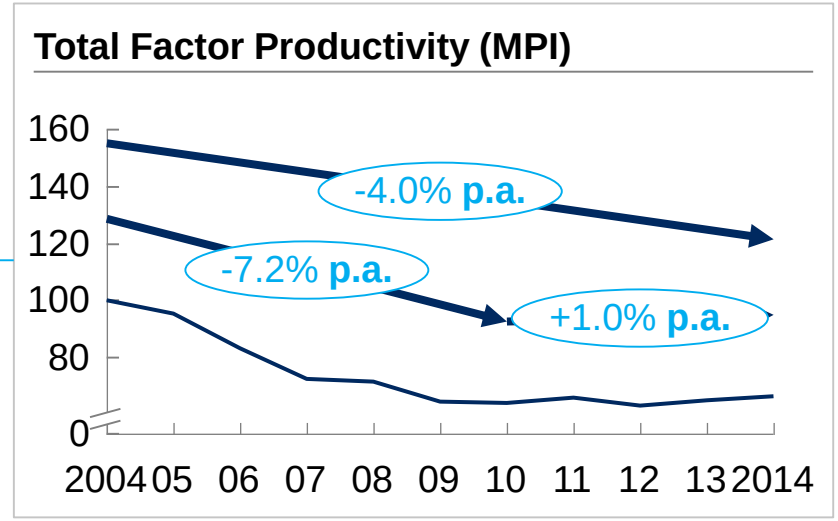
- **Since 2011, drop of 71 MPI points, versus 50 in 2008/09**
- **Stagnating demand in 2015 and strengthening USD in 2014/15 leading to 2009 pricing or worse**
- **Commodities priced below cash cost in 2015**
- **MPI of 55 (absolute bottom; “zero EBITDA”) reached in Dec ‘15/Jan ‘16**
- **Low price levels start triggering production cutbacks (1H’16)**
- **Back to normal in ’17?**

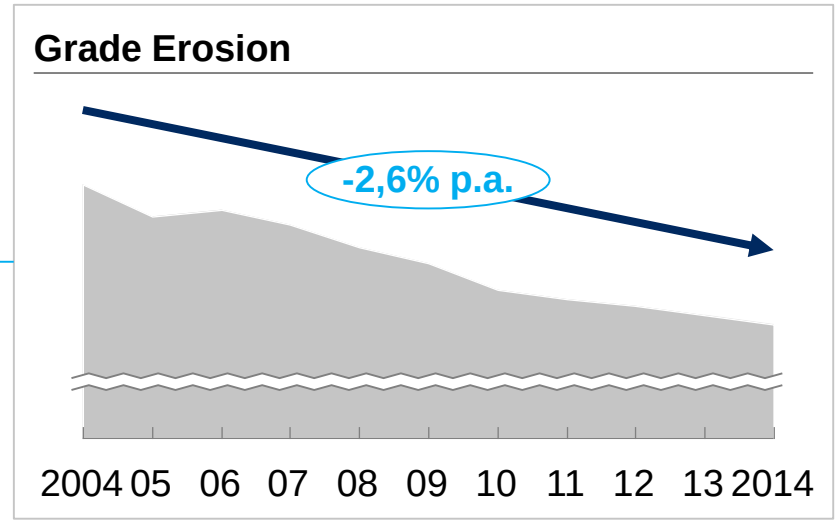
SOURCE: McKinsey Mining Model

Mining productivity (total factor productivity and geological factors) is a key driver of price performance and revenue development



Typical productivity growth in manufacturing sector of 2-3% p.a.



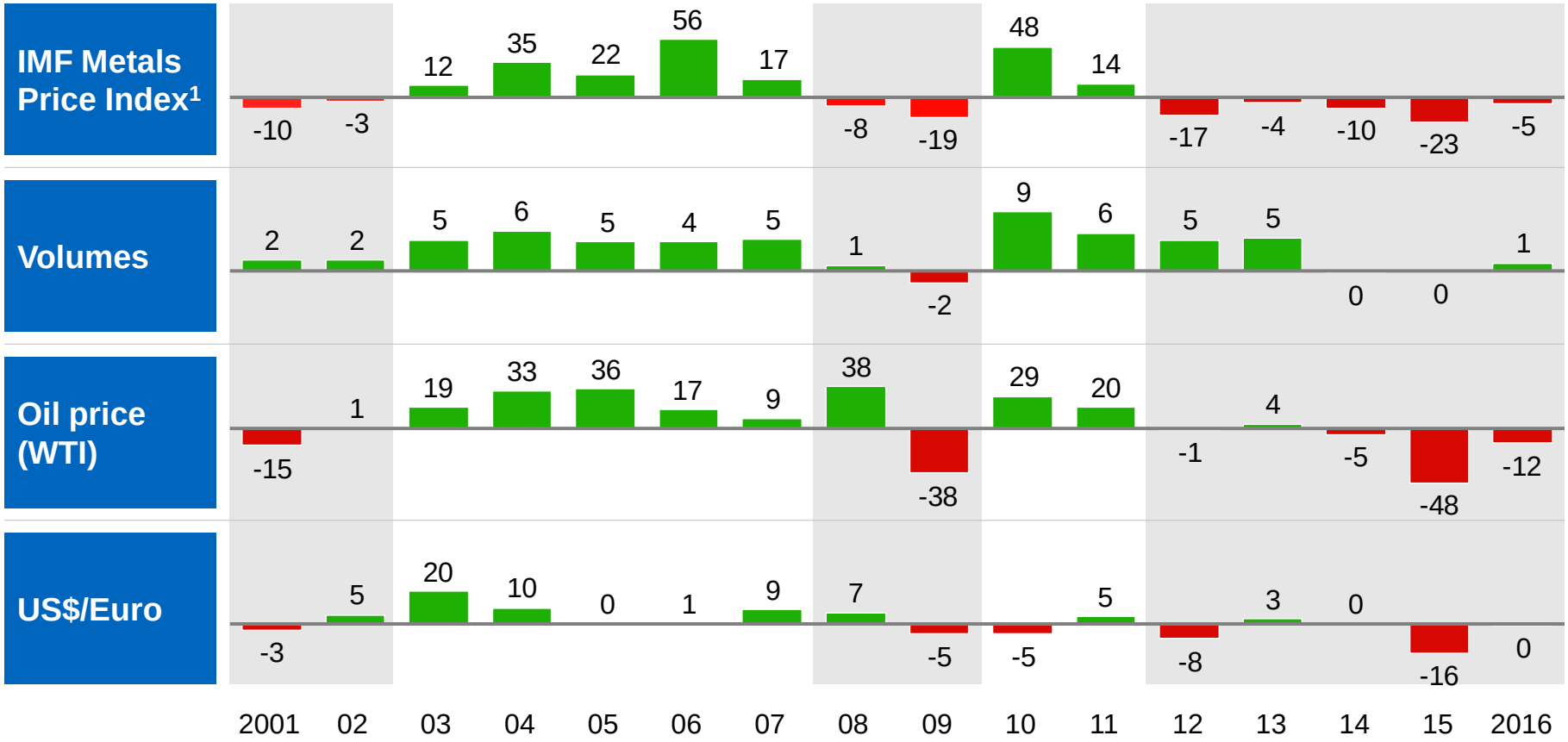


SOURCE: McKinsey Basic Materials Institute (BMI Mining Model); MPI study 2015

Contrary to common belief, the boom/bust cycle was not shaped by demand — forex, oil prices and growing (over) supply contributed significantly

Comparison of price drivers

Year on year change, percentage

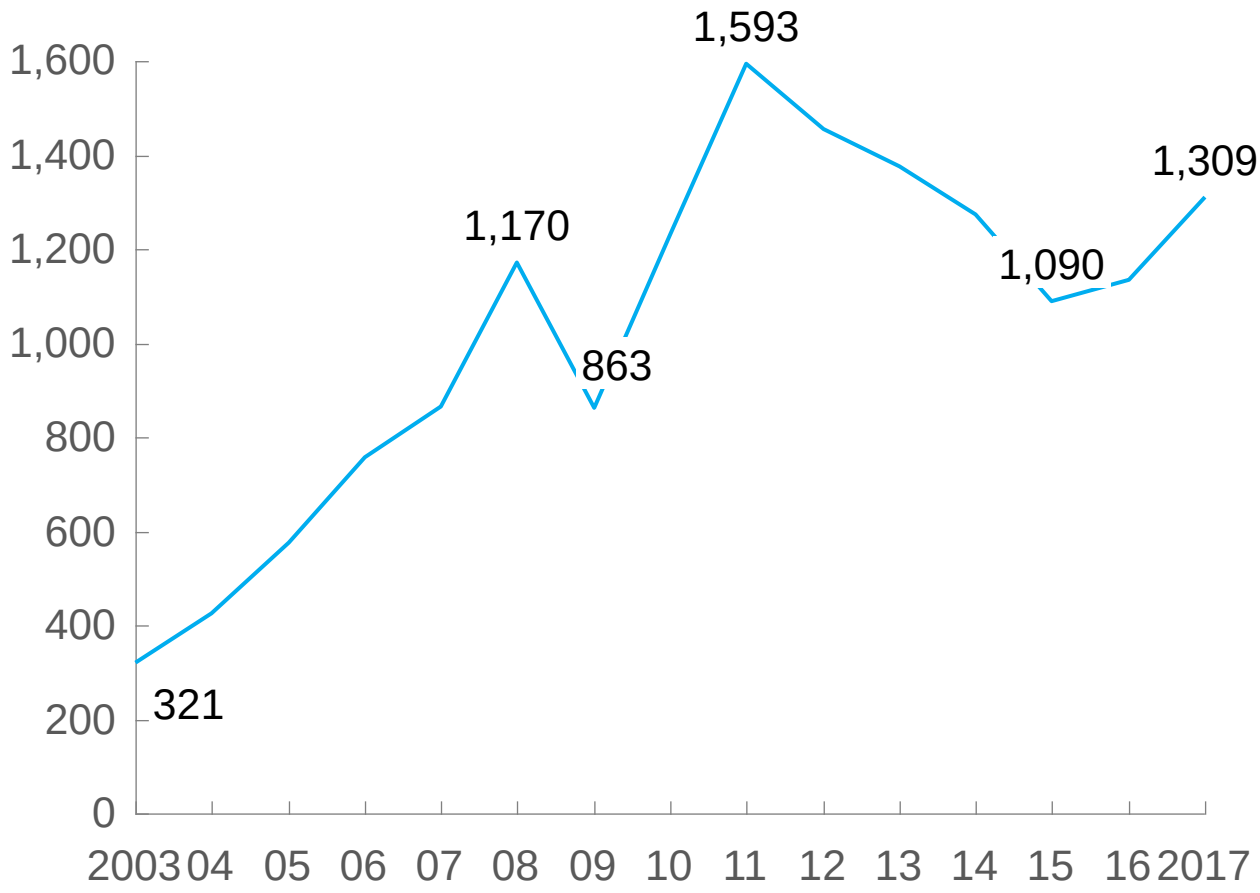


1 Includes copper, aluminum, iron ore, tin, nickel, zinc, lead, and uranium price indices

SOURCE: IMF, McKinsey Global Institute, McKinsey Basic Materials Institute

Global Mining Revenue

Nominal Currency (USD)

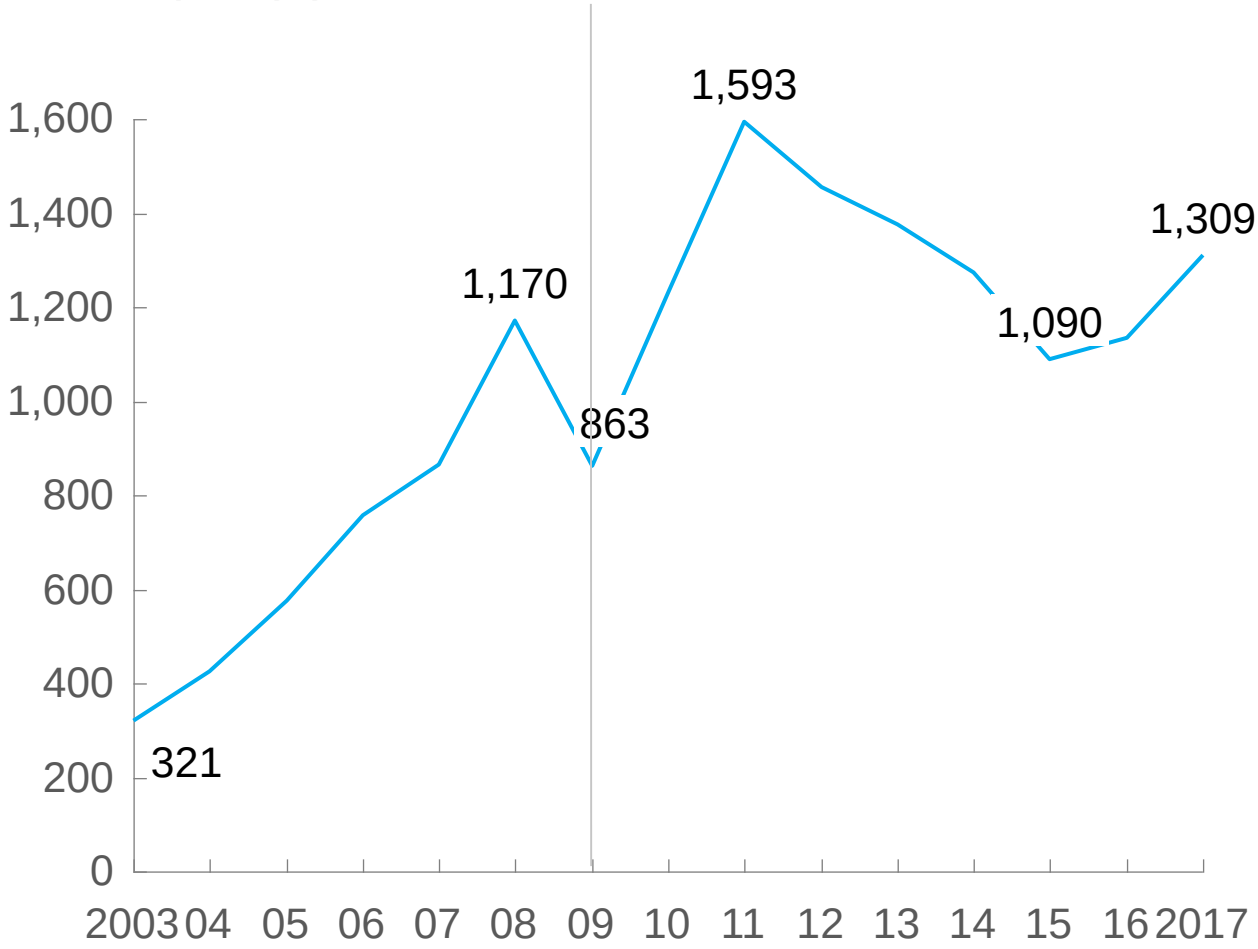


SOURCE: McKinsey Mining Model

Global Mining Revenue

Nominal Currency (USD)

- **Demand boom (4% pa)**
- **Productivity decline (-10% pa)**

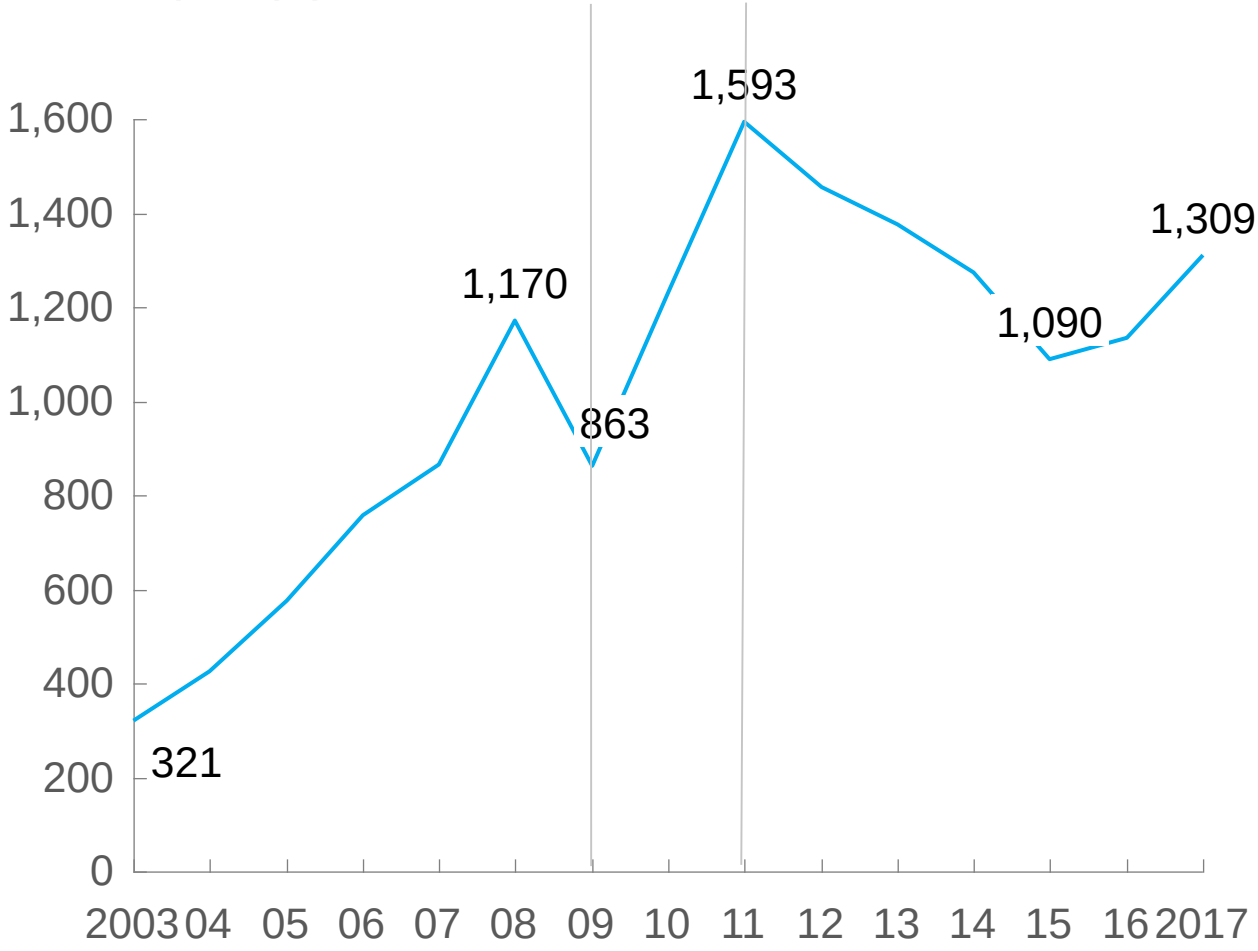


SOURCE: McKinsey Mining Model

Global Mining Revenue

Nominal Currency (USD)

- **Demand boom (4% pa)**
- **Productivity decline (-10% pa)**
- **Week USD**
- **Peak oil**

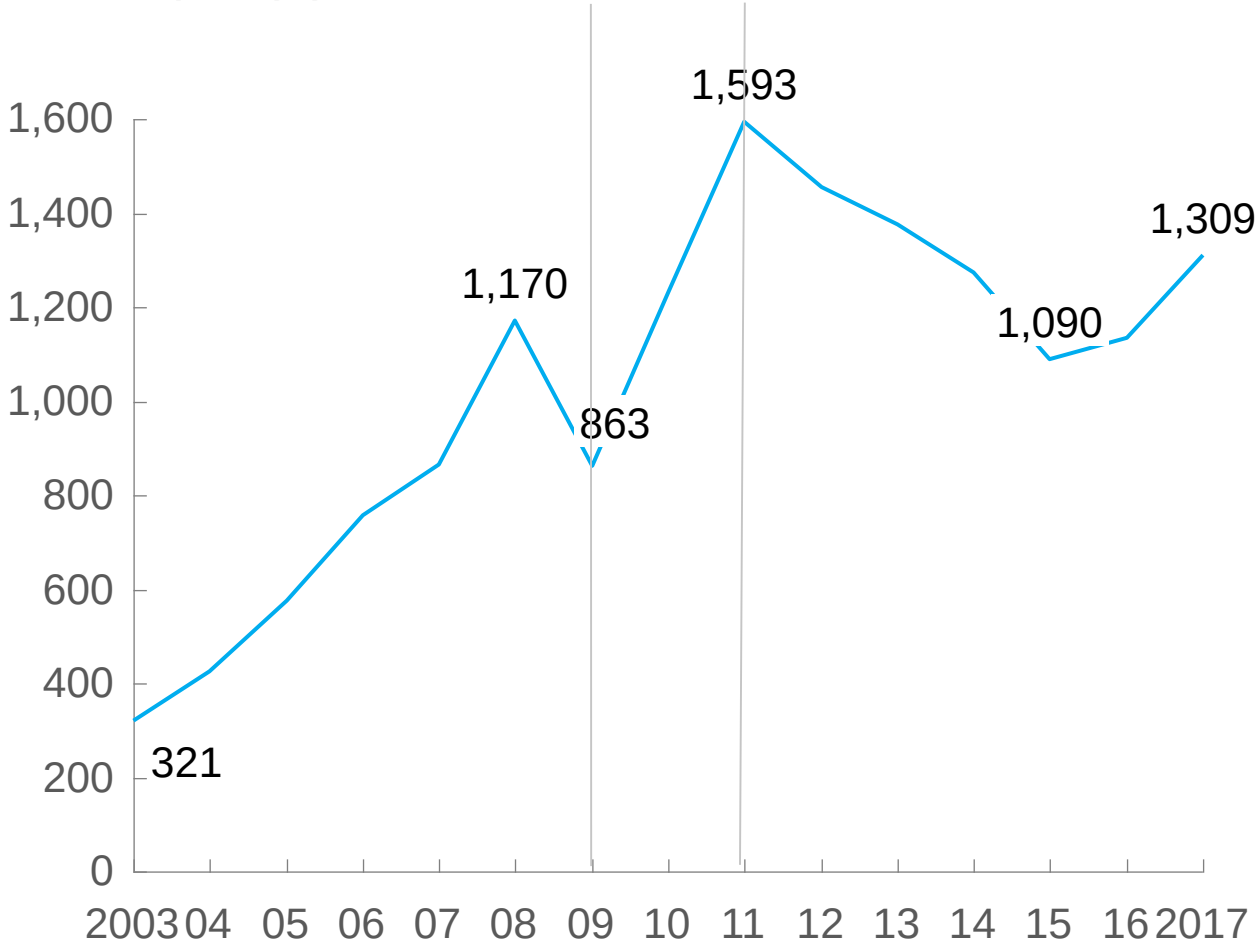


SOURCE: McKinsey Mining Model

Global Mining Revenue

Nominal Currency (USD)

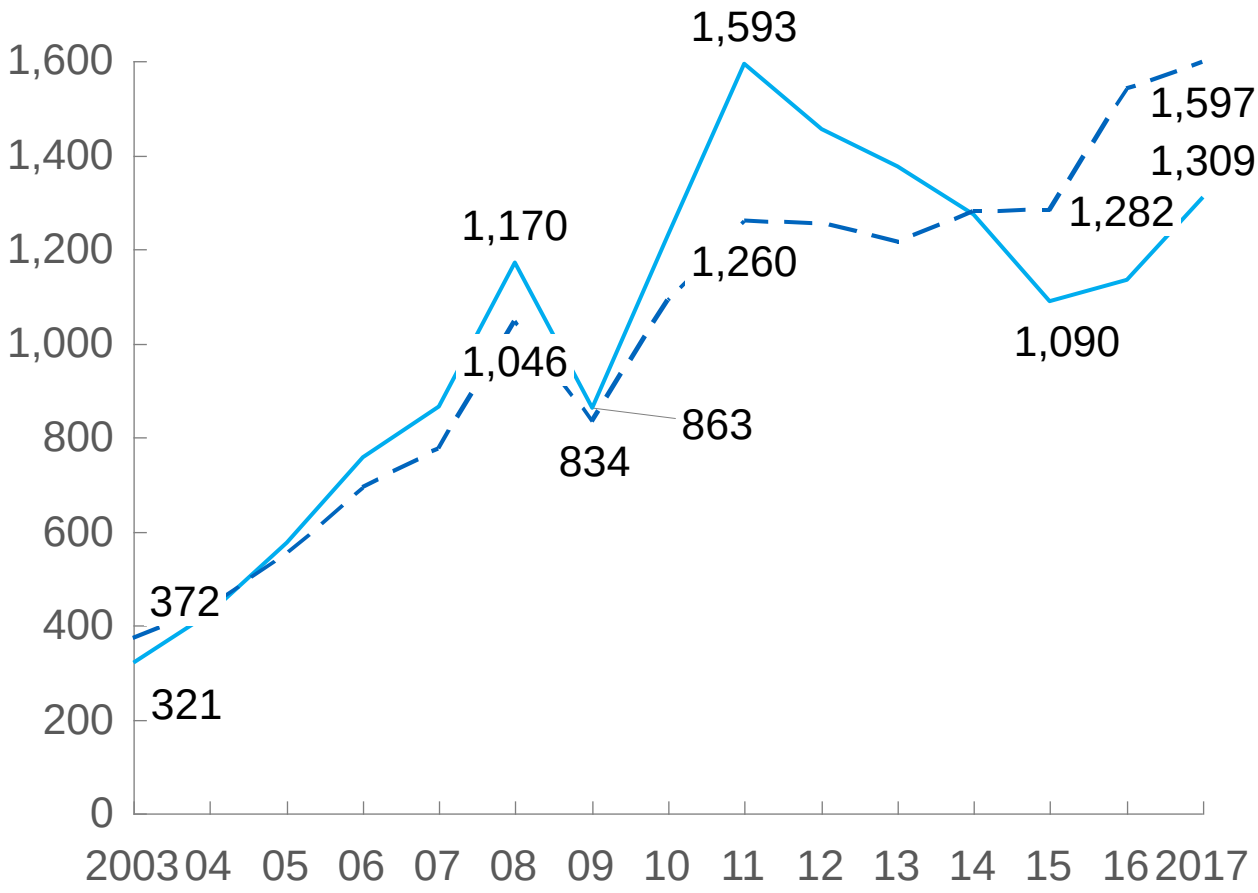
- **Demand boom (4% pa)**
- **Productivity decline (-10% pa)**
- **Weak USD**
- **Peak oil**
- **Strong USD**
- **Weakening Oil**



SOURCE: McKinsey Mining Model

Global Mining Revenue Revisited

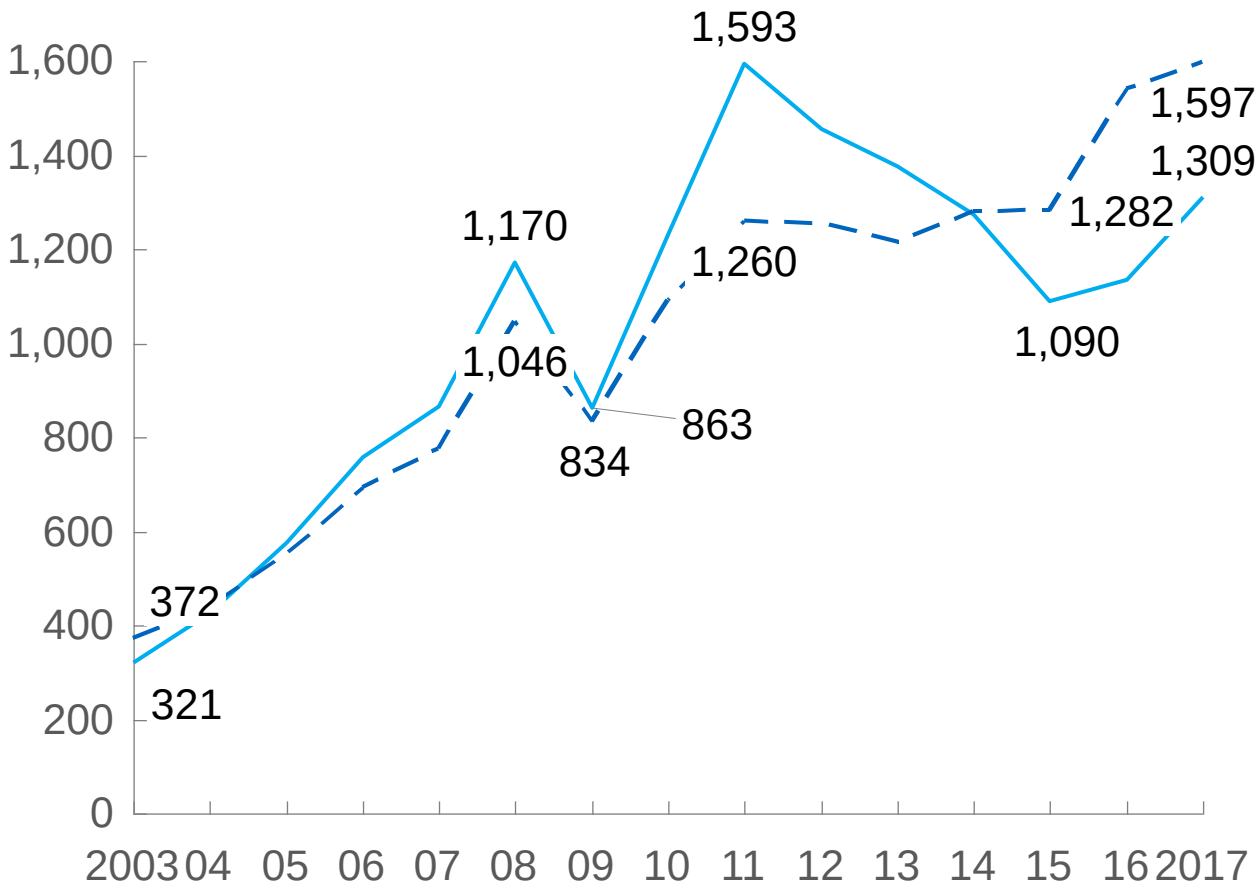
Nominal Currency (USD; GMU)



SOURCE: McKinsey Mining Model

Global Mining Revenue Revisited

Nominal Currency (USD; GMU)

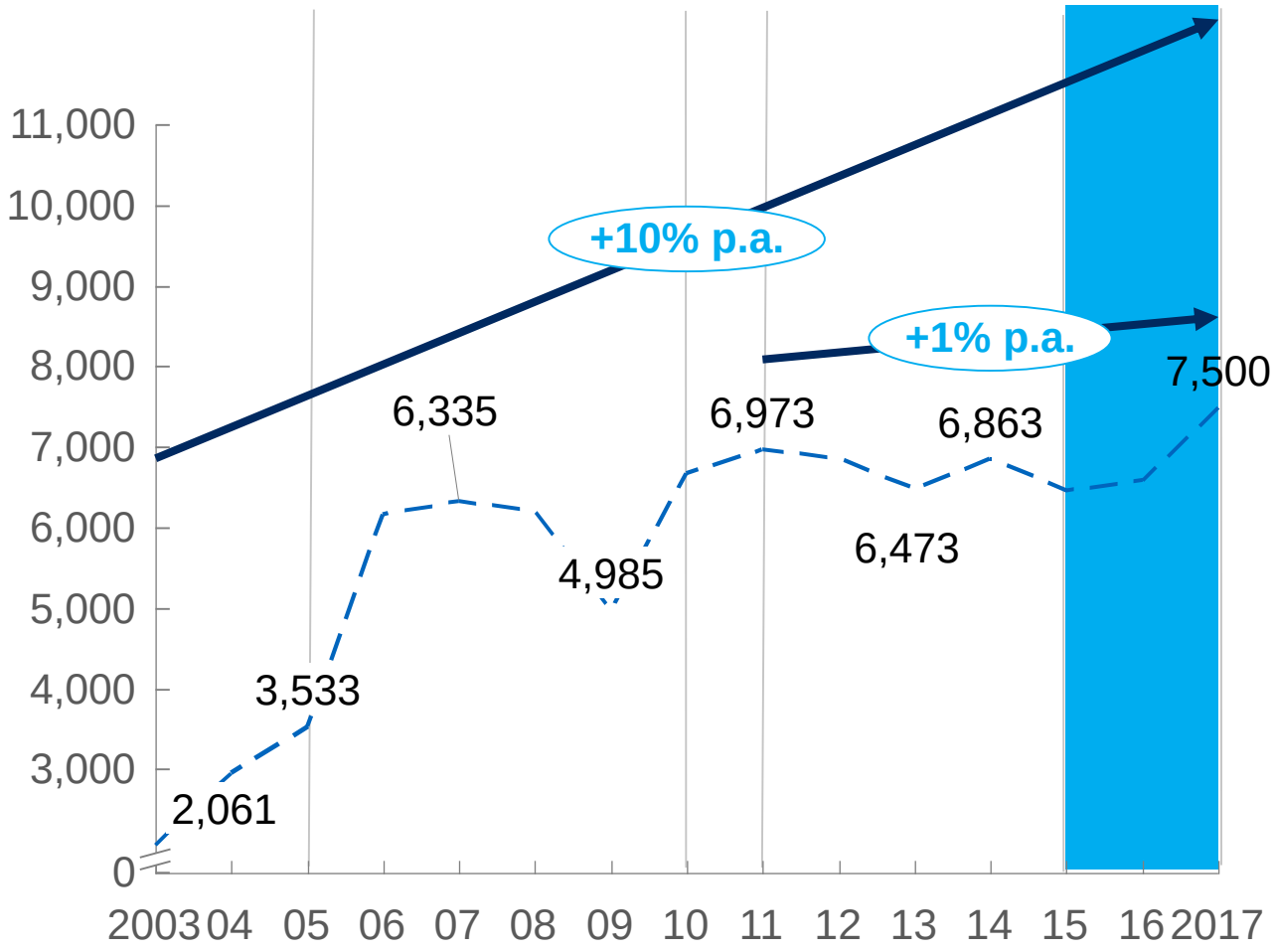


- The Global Mining Unit is a currency basket made up from major "commodity" currencies, proportional to their share in the global mining revenue
- In GMU-terms, neither the peaks of 2011/12, nor the crisis of 2015/16 appear. These were largely due to USD volatility since 2009.

SOURCE: McKinsey Mining Model

Copper Price Development

Nominal Global Mining Units per ton (and not USD)



- Medium volume growth
- Sharp productivity and grade decline
- Early “resetting of the cost curve”
- Oil price increase

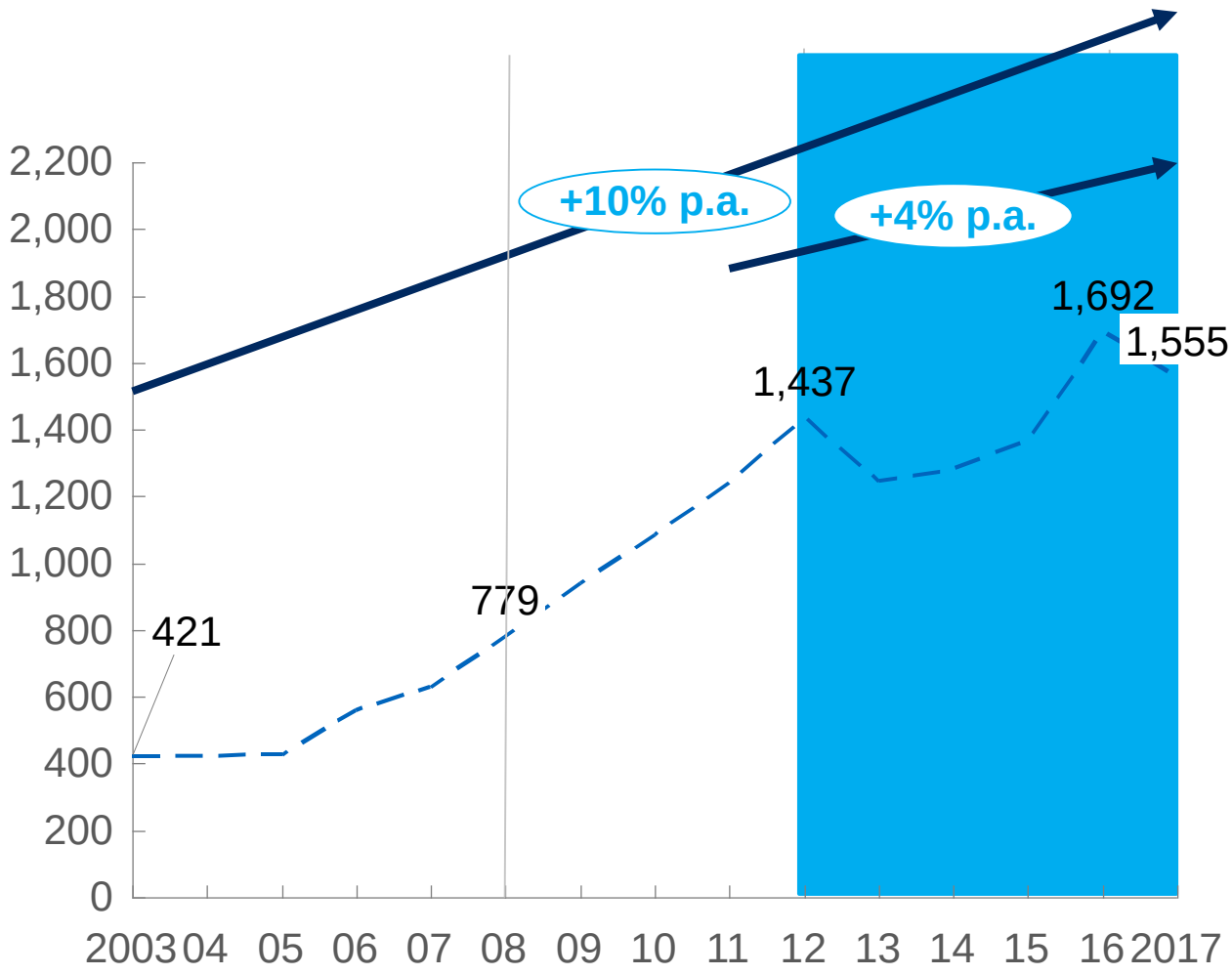
- Modest volume growth Modest productivity declines
- Oil price decline
- Modest oversupply (high-grading)

- Easing over-supply

SOURCE: McKinsey Mining Model

Gold Price Development

Nominal Global Mining Units per Ounce (and not USD)



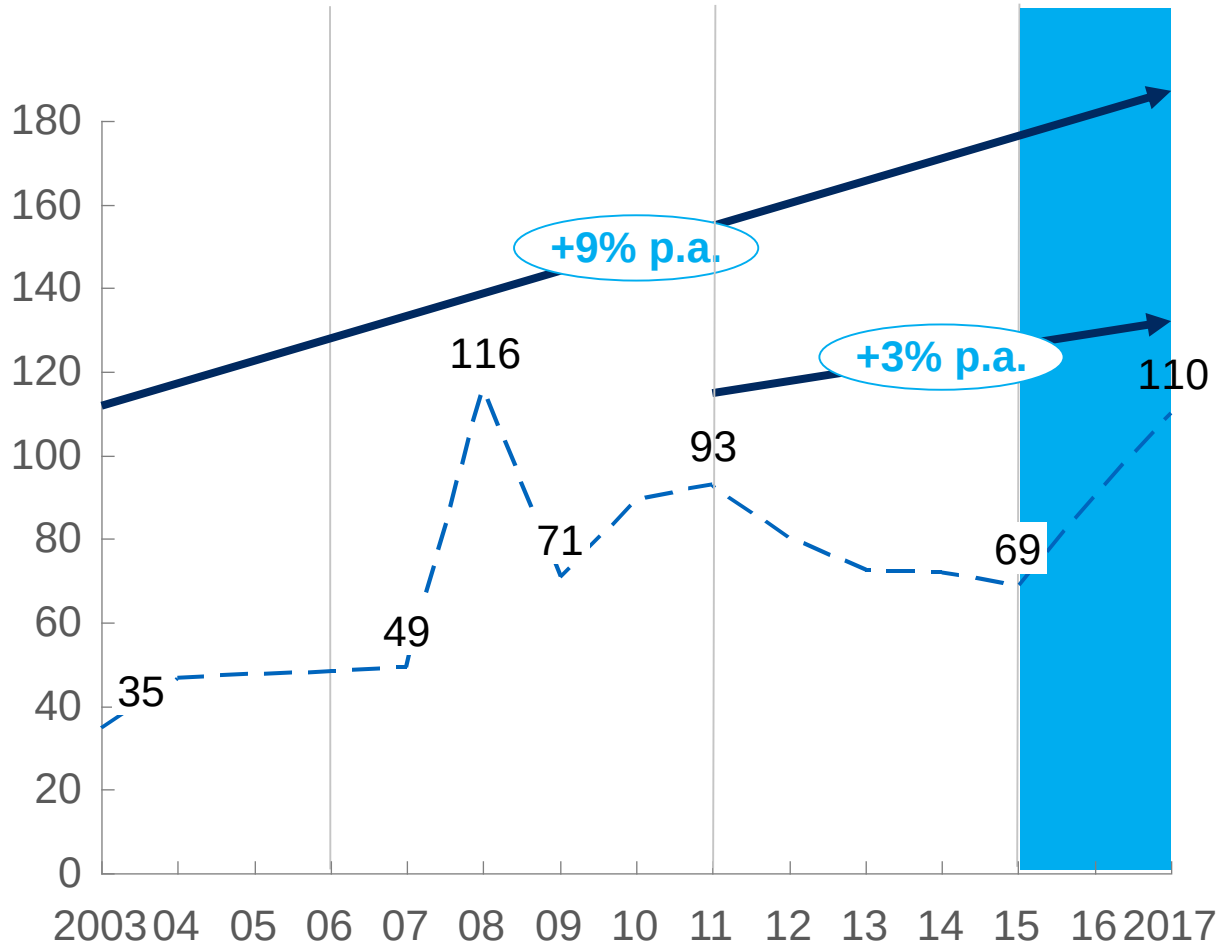
- Large productivity loss
- Gradual “resetting the cost curve”
- Speculative bubble
- Oil price increase

- Demand curve shift
- Changing investor sentiment (worsening, more recently improving)
- Oil price decline

SOURCE: McKinsey Mining Model

Thermal Coal FOB Export Price Development

Nominal Global Mining Units per ton (and not USD)

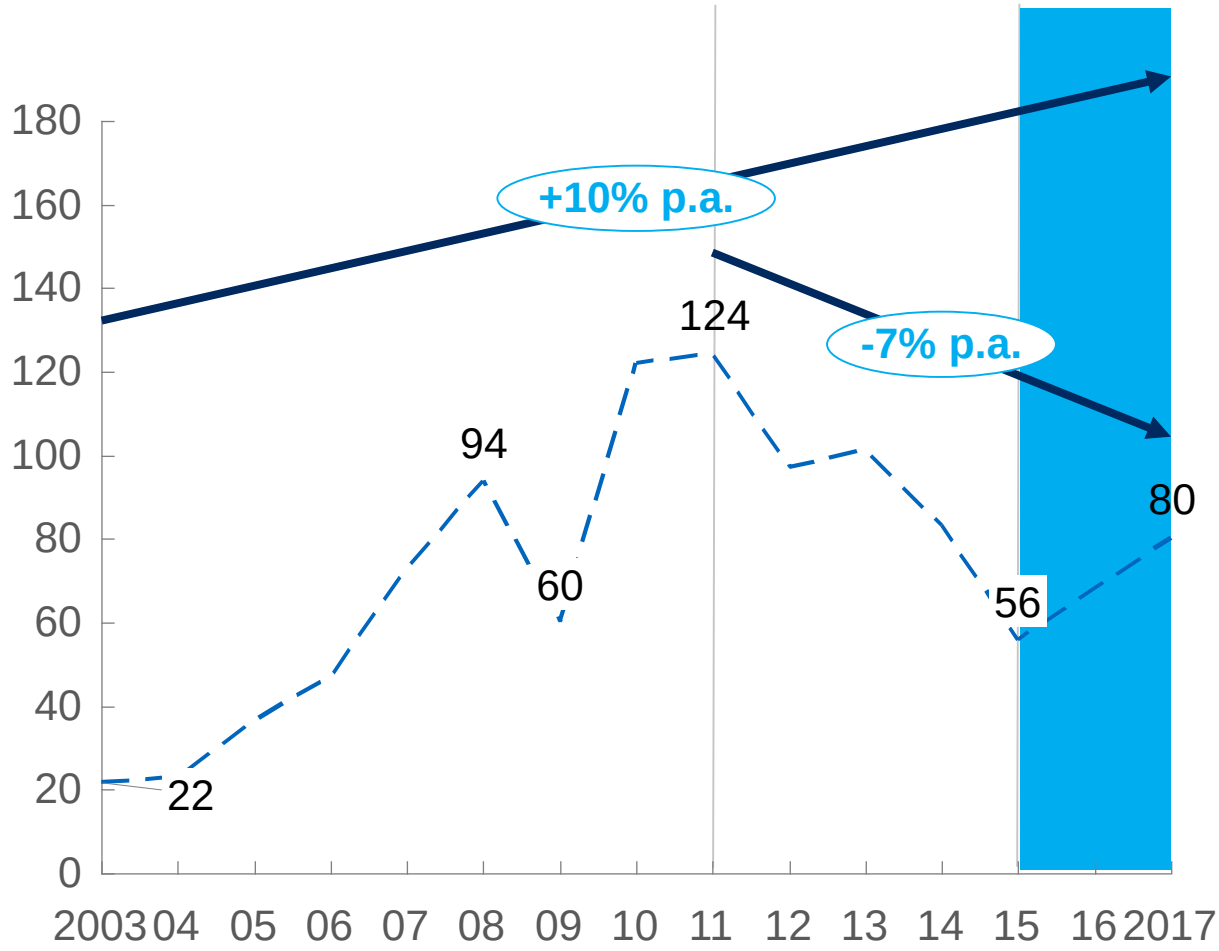


- Oil price increase impacting supply curve & demand curve
- Oil and gas price decline, again impacting supply & demand curve
- Easing over-supply (China,..) for now?

SOURCE: McKinsey Mining Model

Iron Ore FOB Price Development

Nominal Global Mining Units per ton (and not USD)



- Demand boom and dropping productivity (resetting supply curve & demand curve)

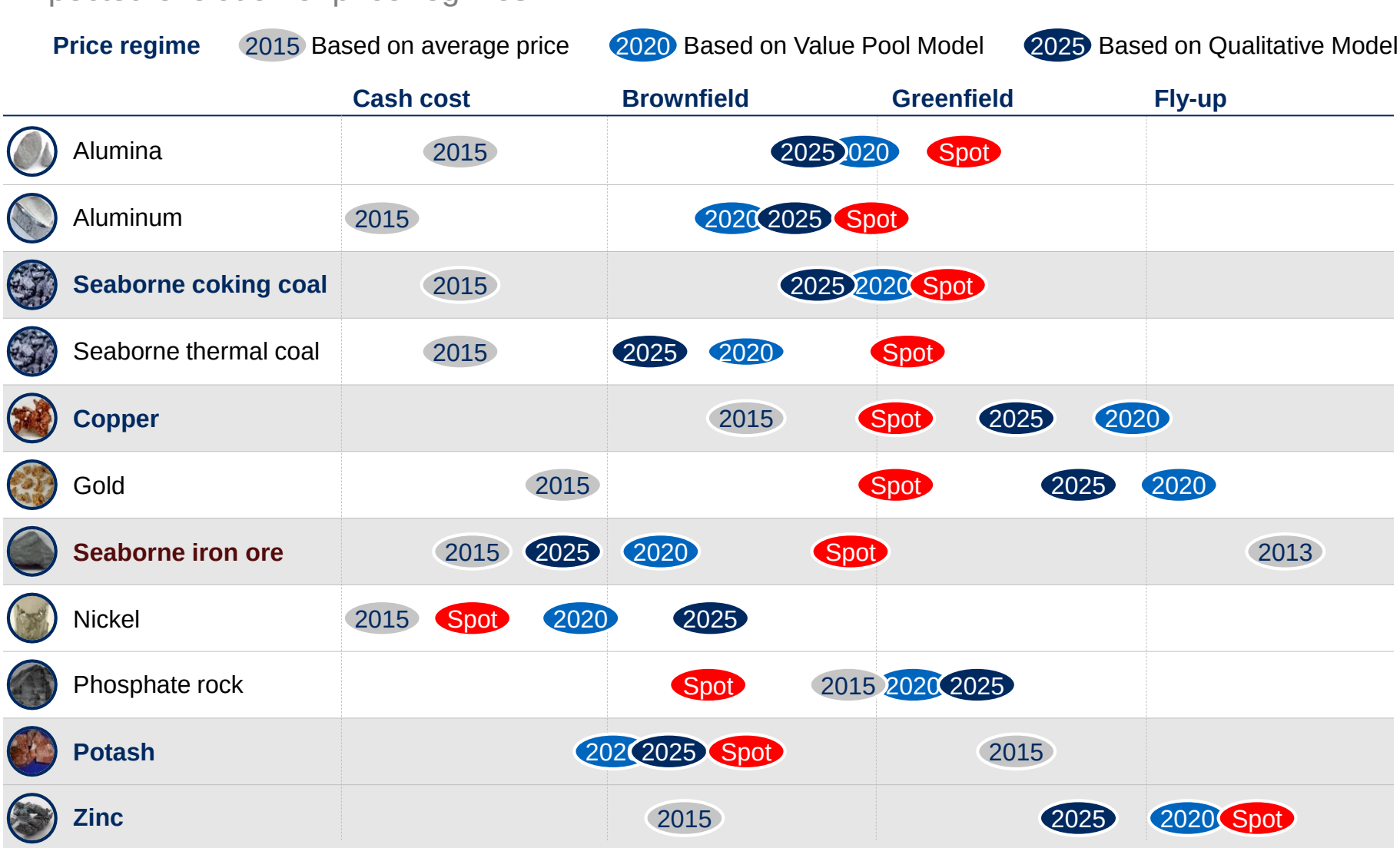
- New supply flattening the cost curve
- Productivity gains by majors

- Easing hi-grade over-supply (China,..) for now

SOURCE: McKinsey Mining Model

Divergent expectation for each commodity's price regime in the short/long run, mostly due to supply factors

Expected evolution of price regimes

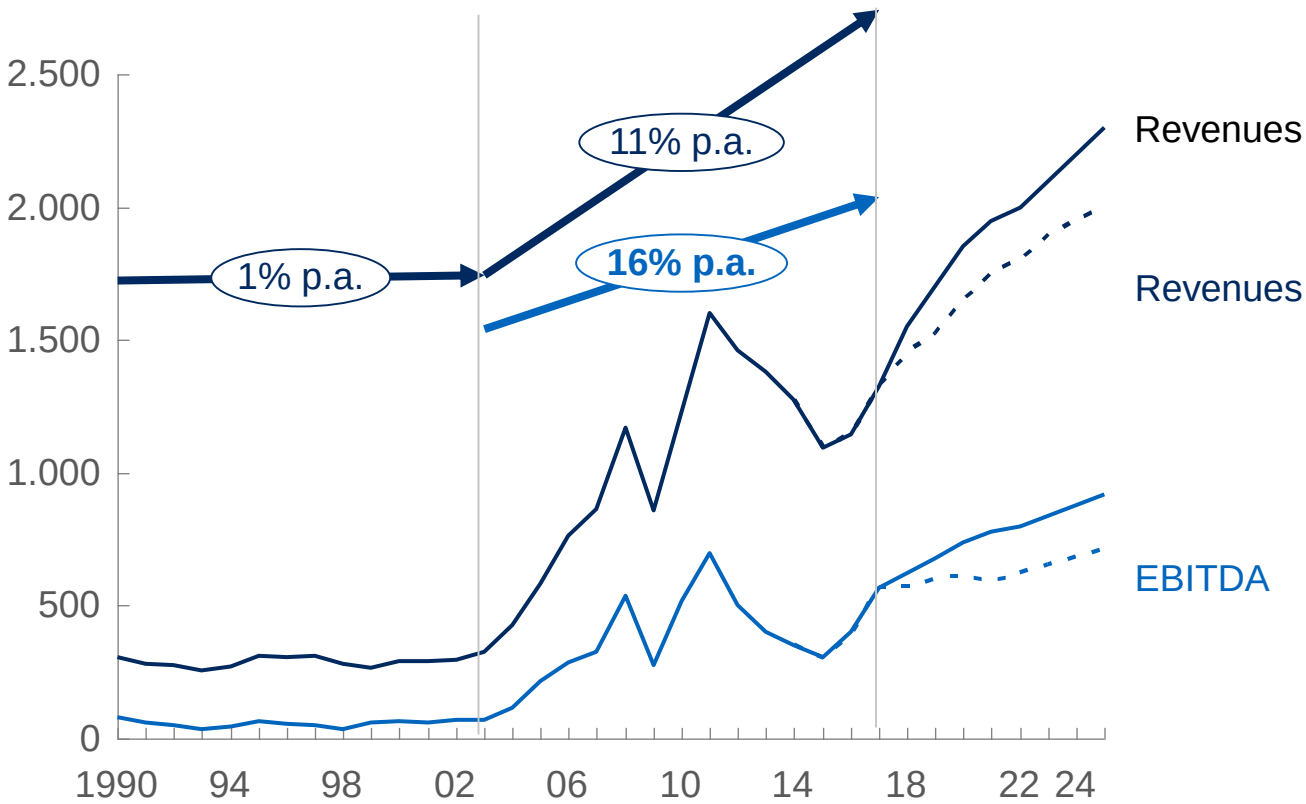


SOURCE: McKinsey Mining Model

Robust price & volume recovery ahead, potentially with some margin pressure

Weakening $ — — — Strong $

REVENUES AND EBITDA OF THE GLOBAL MINING INDUSTRY
USD billion (real as of 2017)



- **"Middle class" consumers underpinning demand**
- **Revenue growth of around 5-6% in next cycle (2018 - 25)**
- **Robust EBITDA, aided by "cheap" oil and price recovery**
- **Significant volatility risk (+/- $250 b) from USD AND China: *"the $ is trying to ride a Chinese tiger"***

SOURCE: McKinsey Mining Model