Chrome: Recent Market Developments

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Industry data is sourced from ICDA, Metal Bulletin, FerroalloyNet, OANDA (2017), Heinz H. Pariser (2016).

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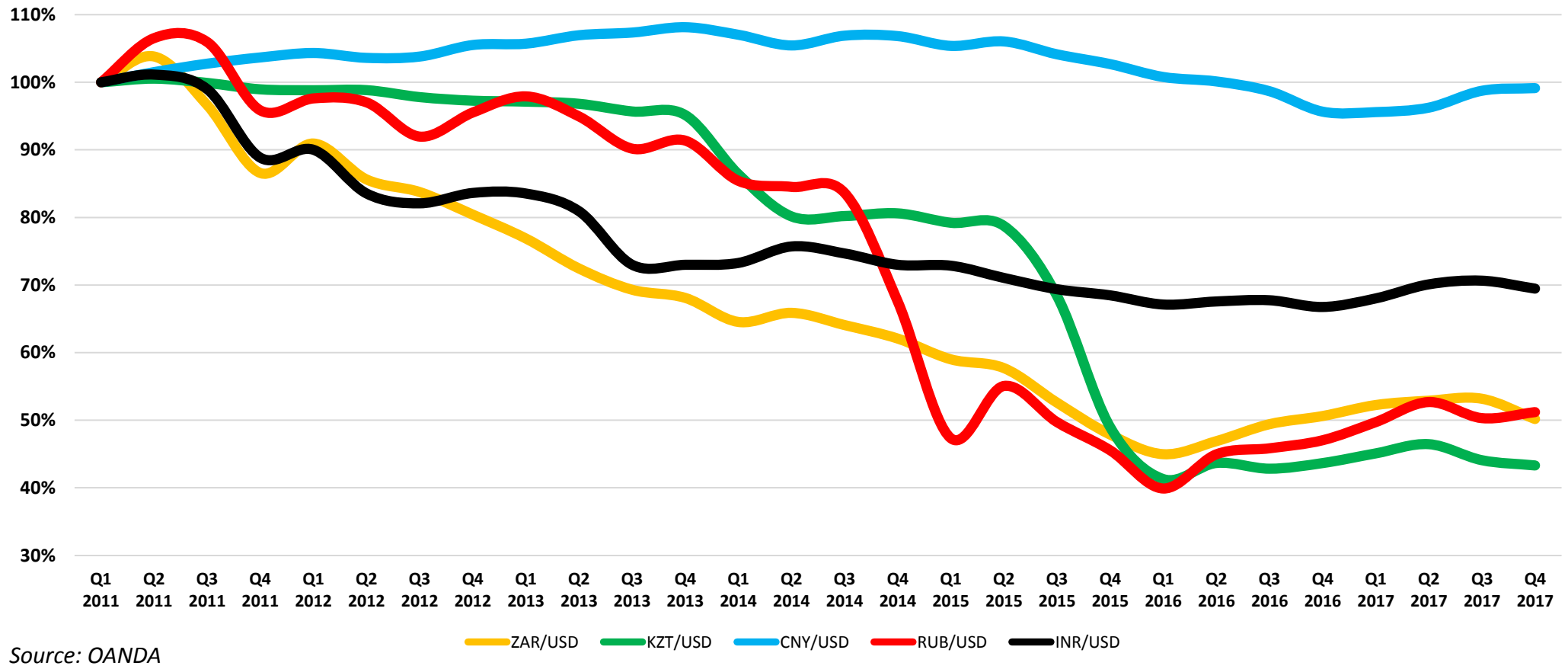
Currencies of Chrome producing countries



Source: OANDA
Indexed at Q1 2011 (100%)

Price dynamics: base and spot prices in Europe, USA and spot prices in China

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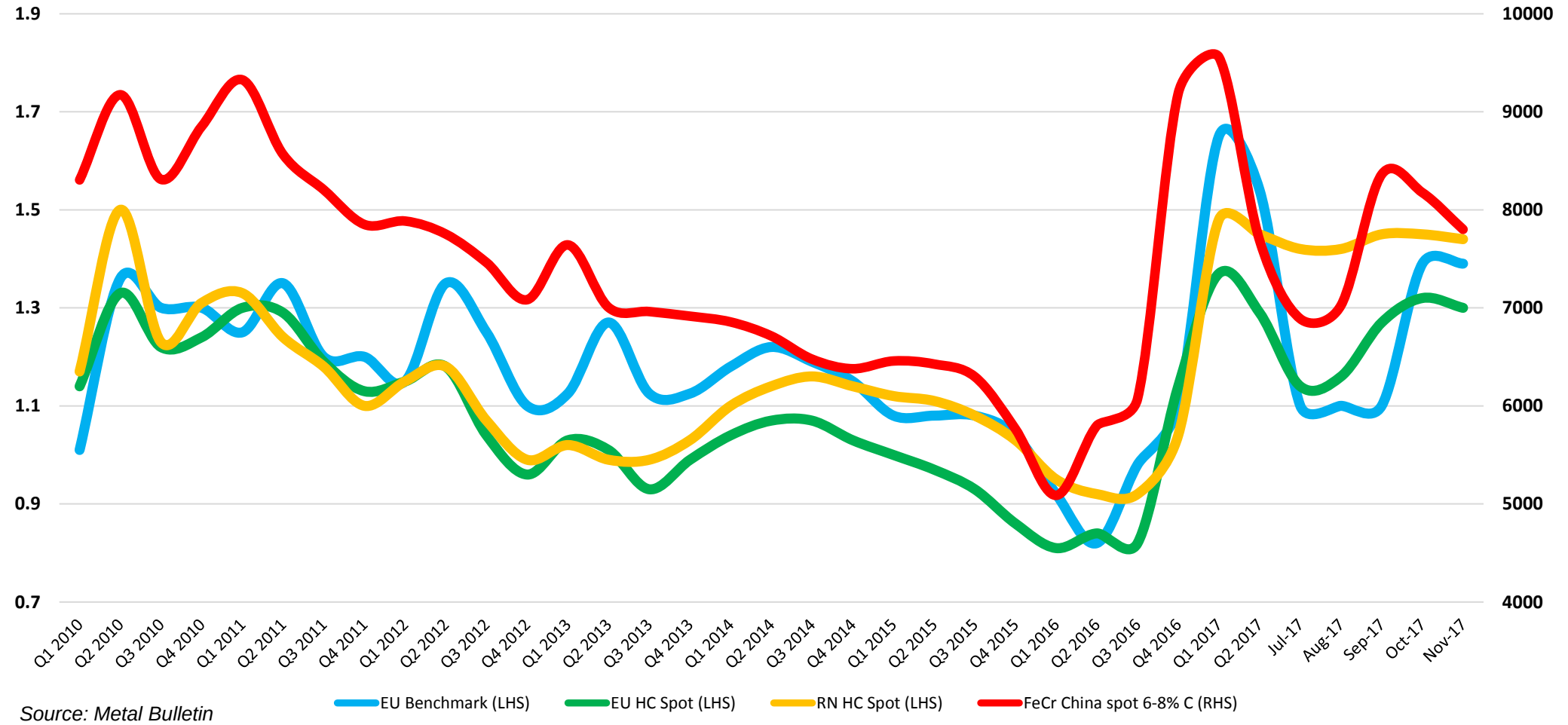

Source: Metal Bulletin

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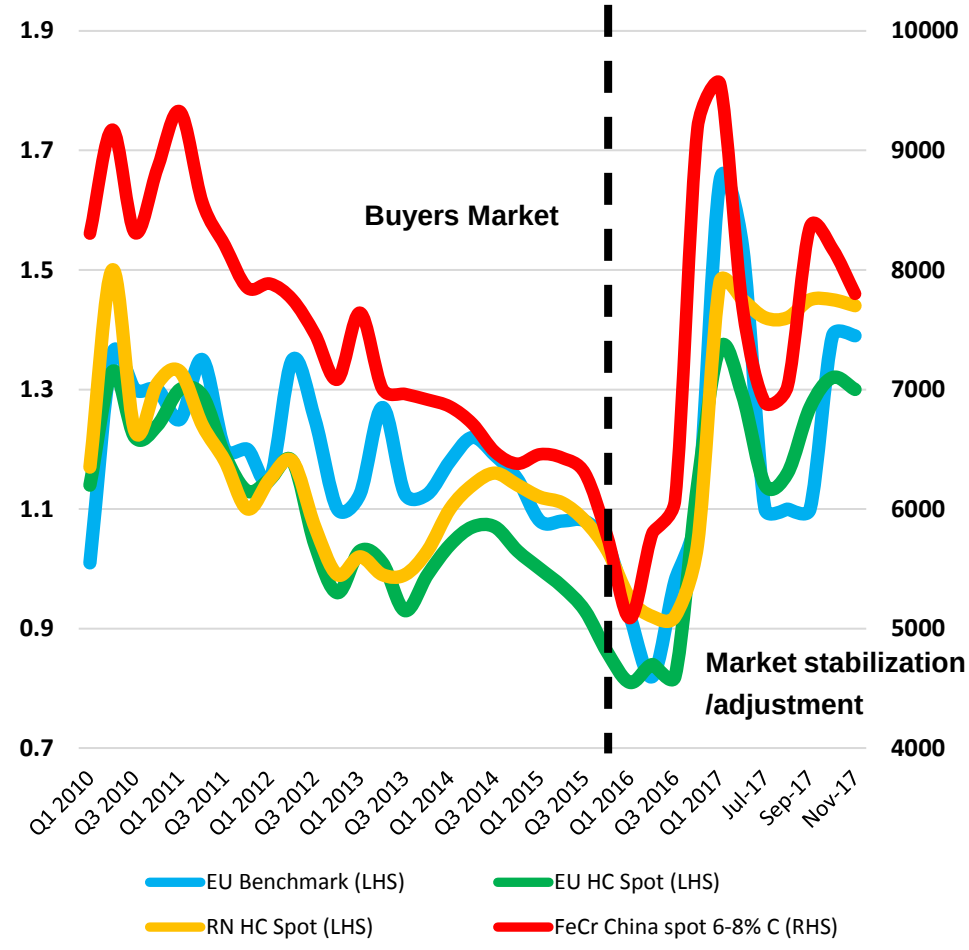
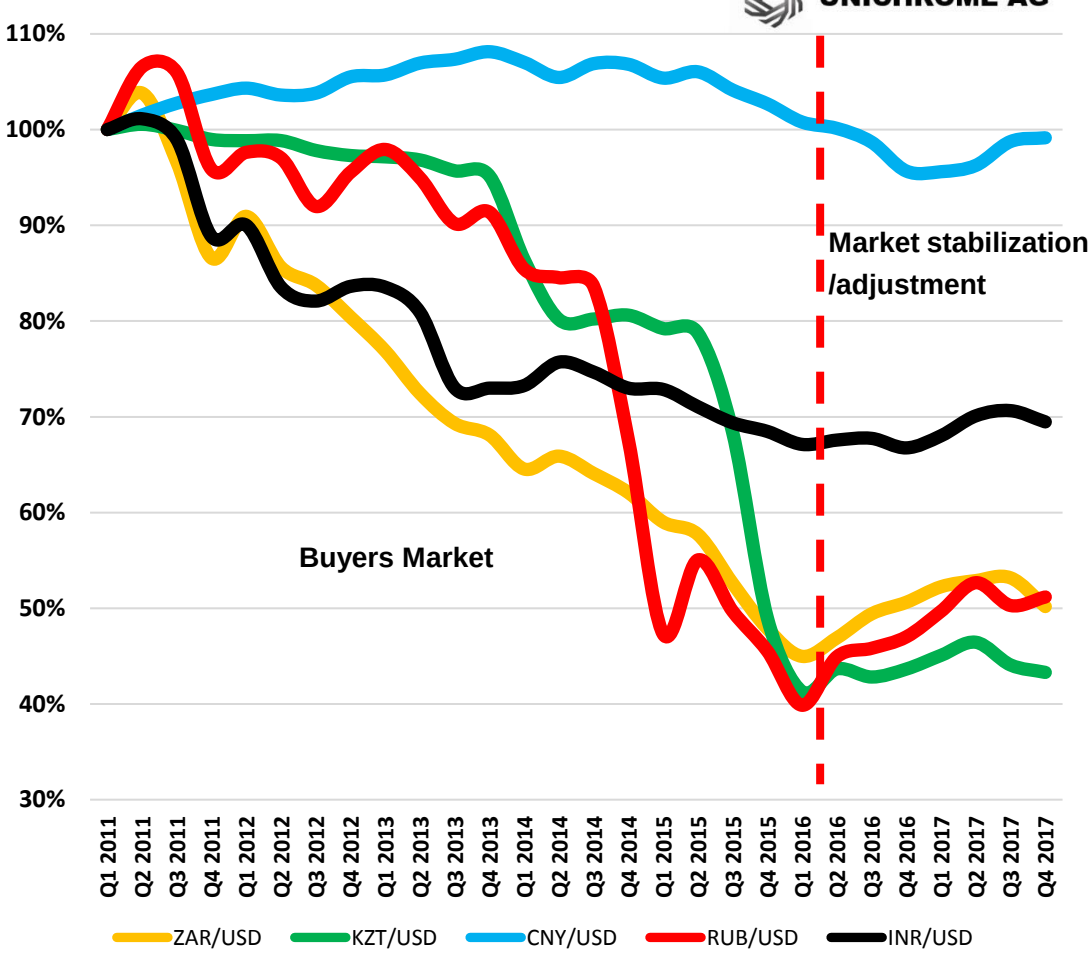


Currencies of Chrome producing countries



Source: Metal Bulletin

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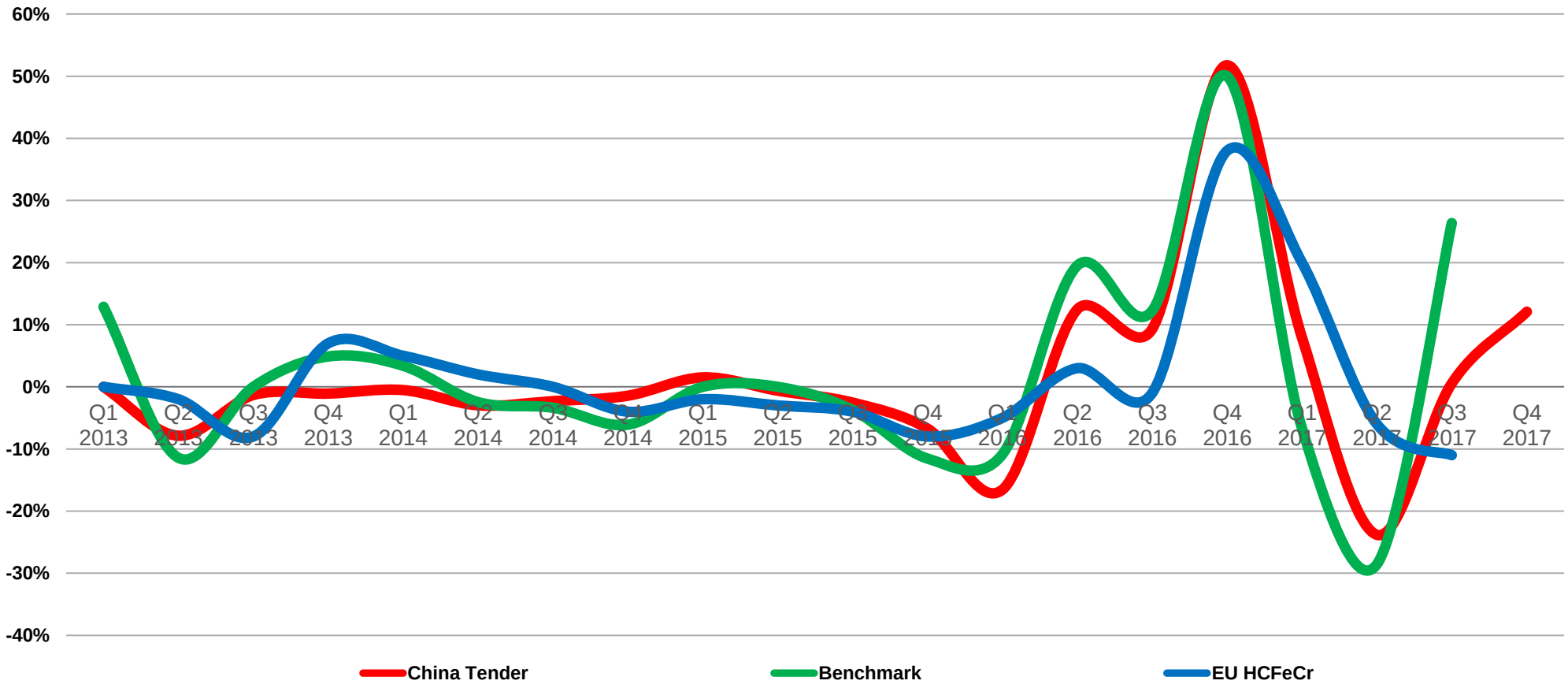
EU Benchmark vs China Tender and EU Benchmark vs EU HCFeCr spot price



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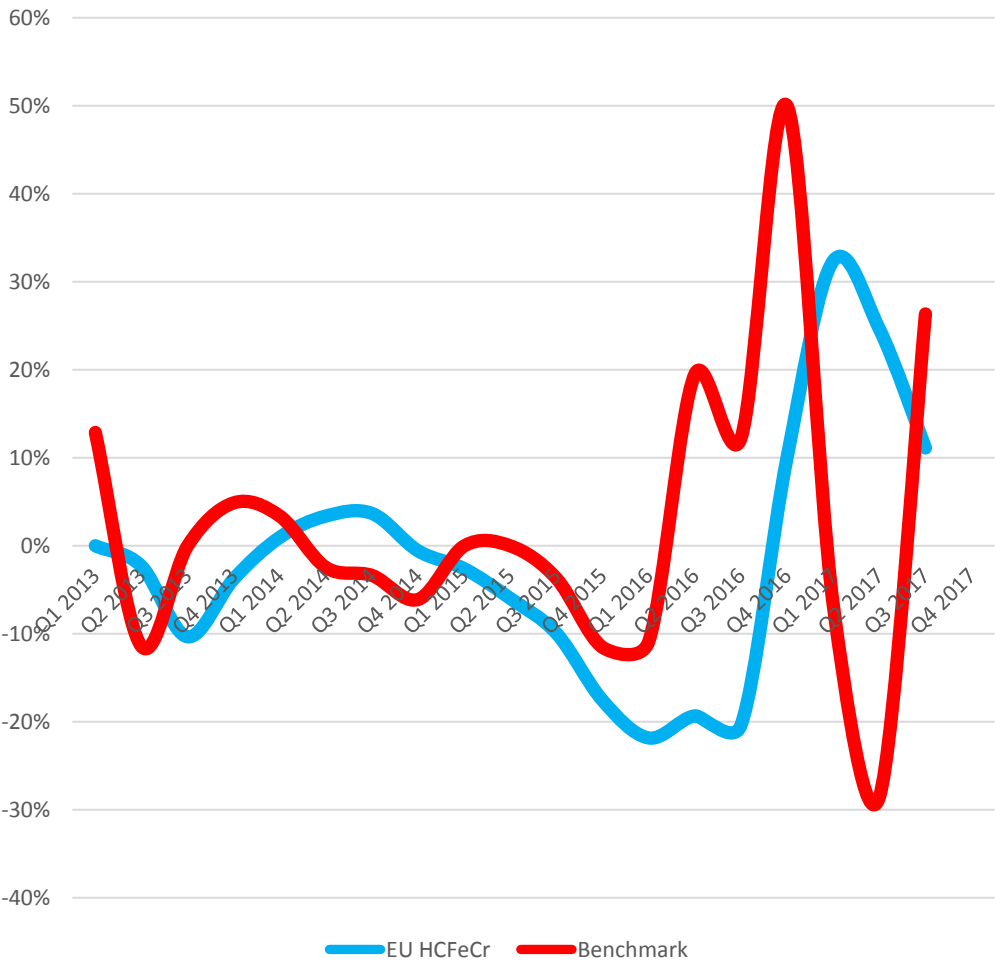
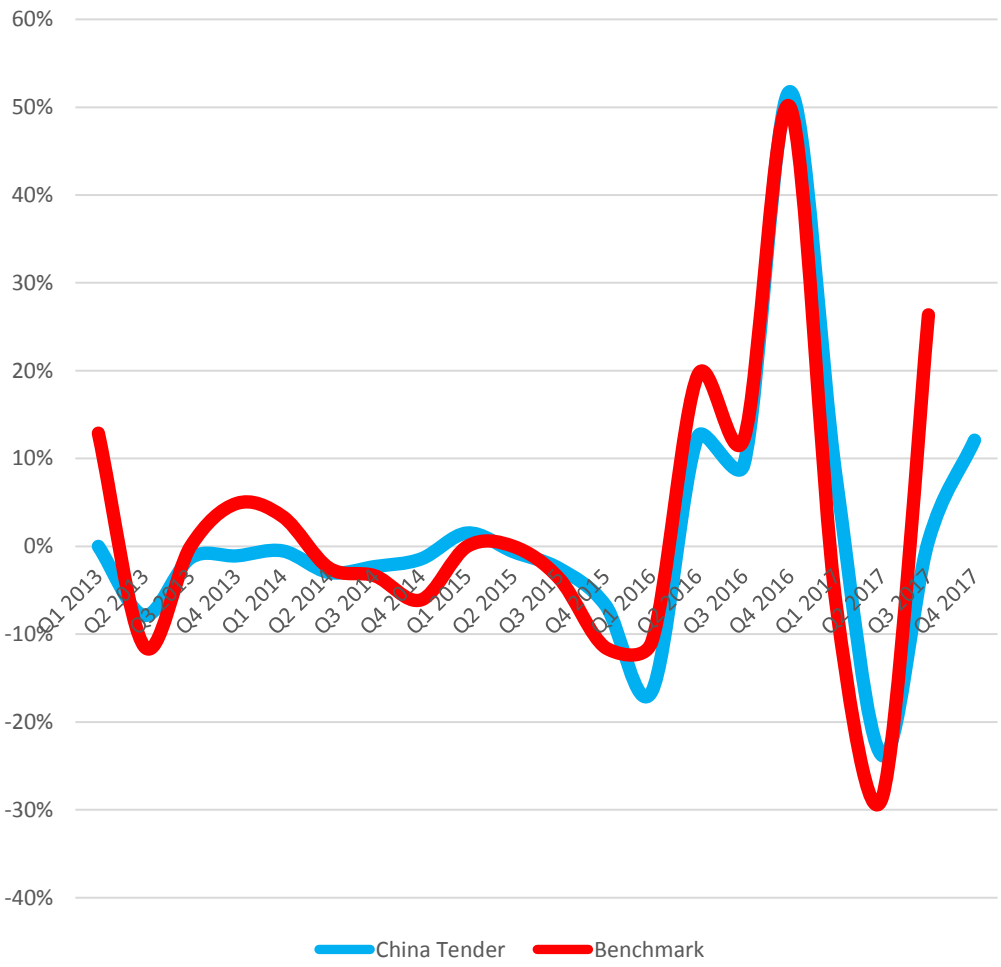
EU Benchmark vs EU HC FeCr Spot



EU Benchmark vs China Tender



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- **Over the years benchmark has been the driving force behind pricing models for Ferrochrome and Ferroalloys globally**
- **Yet in the current time the situation has started to take a drastic turn, with more and more contracts being based on the spot prices or China tender prices**
- **In the past China tender prices were following the benchmark increases and decreases**
- **However lately the situation switched, now benchmark is following China tender pricing, with the correlation being more and more linear**
- **European HC FeCr prices decoupled from benchmark since spot pricing is driven by its own supply/demand**
- **It only follows general trend that benchmark and tender prices establish**
- **Yet it differs from both of them more than benchmark from tender**

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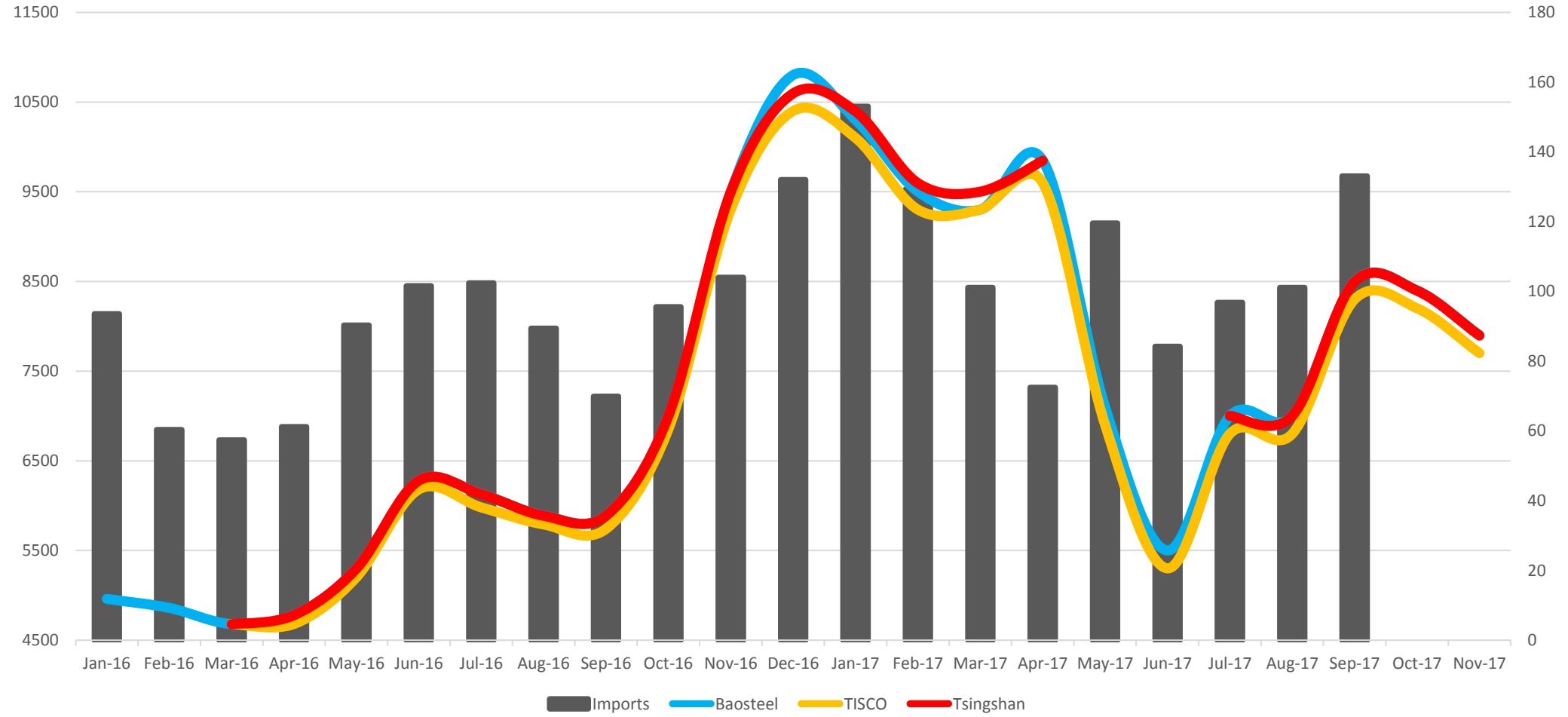
China Tender Prices vs Imports of Chromium Ore (10,000 tons)



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Chromium quality=Ferrochrome quality

- **Chromium ore is divided into two types: stratiform deposits (low quality) and podiform deposits (high quality)**
- **The majority of the deposits are stratiform, used mainly for production of charge chrome and low quality ferrochrome**
- **Podiform deposits are used mainly in production of high quality high carbon ferrochrome and refined ferrochrome**
- **From the graphs you can see that production levels of podiform deposits are much higher than stratiform based on the percentage of the total resources**
- **In the long run, such disproportion will lead to shortage of high quality ferrochrome, thus driving the prices for chromium ore and ferrochrome up**

Charge & HC FeCr classification

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High Grade High Carbon, Market Share 19%	**Cr: 65 – 72%** **C: max 10%** **Si: max 2.5%** **2016 Production: 2,083,710**	**Albania** **Kazakhstan** KazChrome **Russia** **Sweden** **Turkey**	AlbCHROME Tikhvin, Serov, CHEMK Vargön (since 2008 only HC) Etikrom, Eti Metallurgij
Low Grade High Carbon Market Share 48%	**Cr: 57 – 65%** **C: max 10%** **Si: up to 4.0%** **2016 Production: 5,283,946**	**China** **India** **Iran** **Zimbabwe** **Vietnam**	various IMFA, Facor, FAL, Balasore, Rohit, Tata. etc Faryab Mining Zimasco, Zimbabwe Alloys, Maranatha Nam Viet Ferrochrome
Charge Chrome Market Share 33%	**Cr: 45 – 57%** **C: 4.0 – 8.0%** **Si: 2.5 – 7.0%** **2016 Production: 3,731,593**	**Brazil** **Finland** **Sweden** **Romania** **South Africa**	Ferbasa Outokumpu Cr Oy Vargön (until'08 Charge + HC) SC Feral Xstrata/Merafe, Samancor, Hernic, ASA, IFML, Assmang, Ruukki , Tata

Source: Heinz H. Pariser, ICDA 2016 Data

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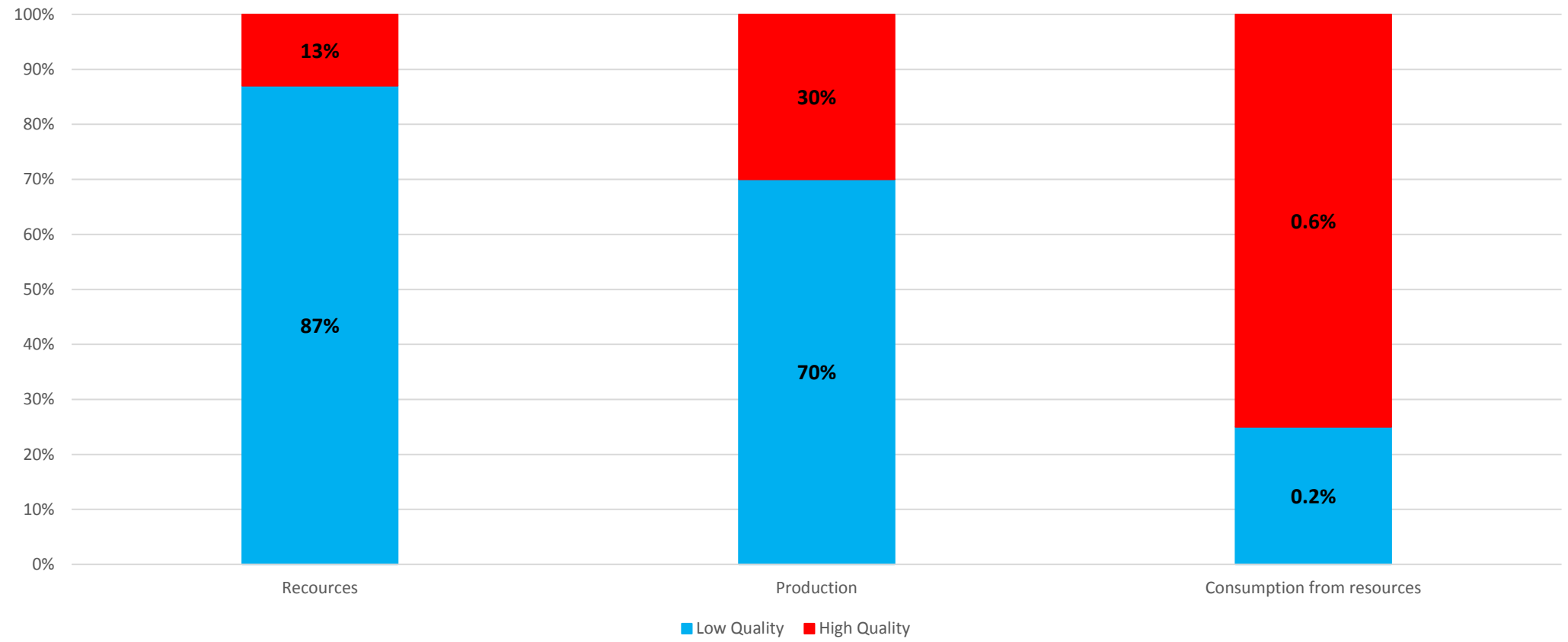
Cr ore production and reserves vs consumption



- **First column is the percentage of the total resources split by High Quality and Low Quality Ores**
- **Second column is the split of percentage of High Quality and Low Quality Ores produced annually**
- **Third column is the total percentage of the known resources used in production annualy**

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Worldwide Challenges

- **China tightening ecological norms and control:**
  - The continuous tightening of the environmental controls in China so far has not affected FeCr industry on the large scale
  - Yet, there is a strong possibility that in the near future China will have to close older ferrochrome smelters and steel factories, that would obviously have an affect on the demand for FeCr
  - These controls also will have an implication on the use of scrap, which in turn will also decrease the demand for FeCr
  - Still the major question remains as to which industry will be affected the most, stainless steel or ferrochrome?
- **Mining rules in RSA:**
  - With the court date set in December, the mining industry is hoping for a negotiations that will satisfy both sides
  - Yet with a possibility of the new law being passed, that will potentially have a negative impact on South African chrome and ferrochrome industry, because future investors will be more cautious in investing, since they will have less controlling power
- **LCFeCr anti-dumping probe in EU:**
  - So far the case has been put on hold, due to other anti-dumping issues between China and EU currently taking place
  - Simple supply/demand in EU shows that increase in production from countries not involved in anti-dumping ruling wont be able to cover EU demand . That in turn will lead to price increase and as the result EU low carbon consumers will pay for the anti-dumping
  - As the history showed in 1990's when Europe implemented anti-dumping rules against Russian refined ferrochrome, Chinese producers took advantage of the situation, especially since Europe at that time didn't increase its production. That disproportion was in effect, until anti-dumping ruling was reversed.
- **Ferrochrome and chrome industries have been suffering from continued low demand, which in turn created price disadvantage for most suppliers, yet recent price volatility was not only affected by supply/demand, but also political constrains.**

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China Tender Prices vs Imports of HC Ferrochrome (10,000 tons)