GFMS COPPER SURVEY 2016

THOMSON REUTERS

THE GFMS COPPER SURVEY 2016 HAS BEEN KINDLY SUPPORTED BY THE FOLLOWING COMPANIES

CESCO

CENTRO DE ESTUDIOS
DEL COBRE Y LA MINERÍA

Cesco is an independent and plural non-profit organization based in Santiago, Chile, whose main purpose is to contribute to increasing knowledge, social legitimacy and trust in mining and its crucial support to the country's development.

It considers the continuous growth and progress of the sector essentials in order to keep its international leadership and to renew the dialogue between people from the field and civil society to continue fostering development, innovation and sustainability.

Thus, it follows up and contributes with information and quality analysis in original formats, supports other activities and encourages the disclosure of mining information.

It also organizes well known events distinguished by its high quality and call such as Cesco Week in Santiago and Asia Copper Week in Shanghai.

El Centro de Estudios del Cobre y la Minería, CESCO, es un espacio independiente y pluralista con sede en Santiago, cuyo propósito es contribuir al conocimiento, la legitimidad social y la confianza del país en su minería y su aporte crucial al desarrollo nacional. Para ello, consideramos indispensable que la minería siga creciendo y progresando para que Chile mantenga su liderazgo internacional. Promovemos la renovación de su relación con las comunidades y con el país, para que continúe siendo motor de desarrollo y ejemplo de innovación y sustentabilidad.

Con este fin, monitoreamos y aportamos información y análisis de calidad en formatos novedosos, apoyamos las actividades que otros impulsan y fomentamos el pensamiento y dialogo entre los integrantes del mundo minero y la sociedad civil. También impulsamos un conjunto de eventos nacionales e internacionales reconocidos por su alta calidad y convocatoria: Cesco Week en Santiago y Asia Copper Week en Shanghai.

KGHM

KGHM is a globally operating mining company, with more than half a century of experience in the industry. It is the world's leading copper and silver producer, with the offered range of products also including molybdenum, gold, nickel, rhenium, lead and platinum group metals. KGHM has a broad portfolio of producing, development and exploration projects, as well as technologically advanced smelters, spanning the globe in jurisdictions which are politically and economically stable.

The company's main producing assets in Poland are based on a world-class and long-lived orebody, while its premier low-cost operation in Chile at Sierra Gorda has a mine life of over 20 years and the potential for further increases in resources and mine life. Both open-pit and underground operations located on three continents (Poland, Canada, the USA and Chile), alongside with the experienced management, guarantee an increase in shareholder value in the coming decades.

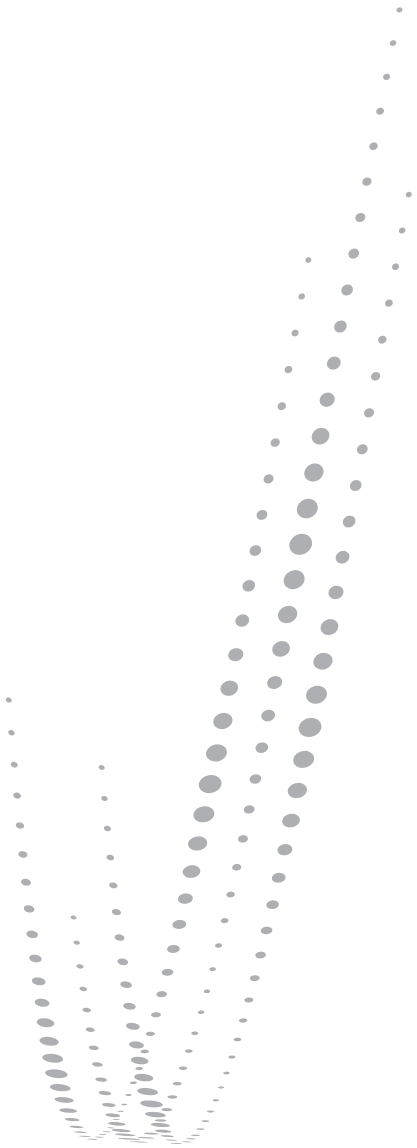
THOMSON REUTERS

GFMS COPPER SURVEY 2016

BY:

Rhona O'Connell, Head of Metals Research and Forecasts
Bruce Alway, Manager - Base Metals Mining
Bernd Sischka, Metals Proposition Manager
Karen Norton, Senior Analyst
Wenyu Yao, Senior Analyst
Ling Wong, **CFA** Senior Analyst
Vicky Bakourou, Analyst
Beverley Salmon, Customer Relationship Manager

DESIGN AND LAYOUT:
Clive George, Production Manager
Nita Webb, Assistant Manager
Gavin White, Senior Production Executive



PUBLISHED APRIL 2016 BY THOMSON REUTERS

The Thomson Reuters Building, 30 South Colonnade
London, E14 5EP, UK
E-mail: gfms@thomsonreuters.com
Web: http://financial.thomsonreuters.com/en/products/tools-applications/trading-investment-tools/eikon-trading-software/metal-trading.html

© THOMSON REUTERS 2016.
All content provided in this publication is owned by Thomson Reuters and/or its affiliates (the "Thomson Reuters Content") and protected by United States and international copyright laws. Thomson Reuters retains all proprietary rights to the Thomson Reuters Content. The Thomson Reuters Content may not be reproduced, copied, manipulated, transmitted, distributed or otherwise exploited for any commercial purpose without the express written consent of Thomson Reuters. All rights are expressly reserved.

TRADEMARKS
"Thomson Reuters" and the Thomson Reuters logo are trademarks of Thomson Reuters and its affiliated companies. The third party trademarks, service marks, trade names and logos featured in this publication are owned by the relevant third parties or their affiliates. No use of such mark, names or logos is permitted without the express written consent of the owner.

DISCLAIMER OF WARRANTIES AND NO RELIANCE
This publication is provided by Thomson Reuters on an "as is" and "as available" basis. Thomson Reuters makes no representations or warranties of any kind, express or implied, as to the accuracy or completeness of the Thomson Reuters Content. Thomson Reuters is an aggregator and provider of information for general information purposes only and does not provide financial or other professional advice. Thomson Reuters is not responsible for any loss or damage resulting from any decisions made in reliance on the Thomson Reuters Content, including decisions relating to the sale and purchase of instruments, or risk management decisions.

ISSN: 2055-1770 (Print)
ISSN: 2055-1789 (Online)

FORTHCOMING RELEASES

• GFMS GOLD SURVEY 2016: Q1 UPDATE AND OUTLOOK	26th April 2016
• WORLD SILVER SURVEY 2016	5th May 2016
• GFMS PLATINUM AND PALLADIUM SURVEY 2016	12th May 2016
• GFMS GOLD SURVEY 2016: Q2 UPDATE AND OUTLOOK	26th July 2016
• GFMS BASE METALS 2016: REVIEW AND OUTLOOK	October 2016
• GFMS GOLD SURVEY 2016: Q3 UPDATE AND OUTLOOK	27th October 2016
• GFMS GOLD SURVEY 2016: Q4 UPDATE AND OUTLOOK	January 2017

TABLE OF CONTENTS

1. SUMMARY AND INTRODUCTION 5

2. MACROECONOMIC AND SCENARIO ANALYSIS 7

3. PRICE AND EXCHANGE ACTIVITY 17

4. MINE PRODUCTION, COSTS AND INCENTIVE PRICING 23

5. CORPORATE ACTIVITY AND MINE ECONOMICS 33

6. REFINED & CONCENTRATES 43

7. CONSUMPTION 51

NOTES

UNITS USED

Throughout the Copper Survey, "tonne(s)" refer(s) to "metric tonne(s)", being equal to 1,000 kilogrammes. Where conversions to and from figures quoted in pounds (lb), the following was used:

1 tonne = 2,204.62 lb

- Figures throughout the report are rounded to the nearest thousand tonnes, except where further accuracy is required.
- Throughout the tables, totals may not add due to independent rounding.

PRICES

Unless otherwise stated, US dollar prices and their equivalents refer to LME 3-month prices.

TERMINOLOGY

"-"	Not available or not applicable.
"0.0"	Zero or less than 0.05.
"dollar"	US dollar unless otherwise stated.

End use consumption definitions:

"Building Construction"	Building Wire; Plumbing & Heating; Air Conditioning & Commercial Refrigeration; Builders Hardware; Architectural.
"Electrical & Electronic Products"	Power Utilities; Telecommunications; Business Electronics; Lighting & Wiring Devices.
"Transportation Equipment"	Automobile, Truck & Bus; Railroad; Marine; Aircraft & Aerospace.
"Consumer & General Products"	Appliances; Cord Sets; Military & Commercial Ordnance; Consumer. Electronics; Fasteners & Closures; Coinage; Utensils & Cutlery; Miscellaneous.
"Industrial Machinery & Equipment"	In-Plant Equipment; Industrial Valves & Fittings; Non-Electrical Instruments; Off-Road Vehicles; Heat Exchangers.

1. SUMMARY AND INTRODUCTION

Just as the collapse in copper prices late last year reinforced the bleak, so too the bounce at the start of this year has seen fear levels recede. After all, China is slowing, not imploding and the U.S. economy might continue to muddle along, rather than tip into recession. But how long can this last? The copper market's present holding pattern could presage a leap into the abyss or the first tentative baby steps on the road to recovery. We believe that the lows of this cycle have yet to be seen.

Prices have recovered from the near seven-year low of $4,318/tonne recorded in mid-January, but there is clearly a lack of conviction that a significant move higher is justified. Our Global Chief Technical Analyst informs that copper has been forming an inverted head and shoulders pattern. This medium-term bullish move would only be jeopardised, basis COMEX, by closes below the exponential 21-day moving average and the nearby 23.6% Fibonacci retracement at 2.1782 ($4,802/tonne). Ironically, from a fundamental perspective, the present lull above the earlier lows may ultimately help to set copper prices on their next leg down, as producers feel less need to act.

We expect the LME 3-month copper price to average $4,850/tonne, the nadir of the cycle as another year of surplus (150,000 tonnes) weighs. Insufficient production cutbacks, higher output from the progeny of the last mine supply boom and lower Chinese demand growth as it transitions to a more consumer-based economy will combine for a fifth consecutive year of price decline in 2016. A surplus

WORLD COPPER SUPPLY AND DEMAND (000 TONNES)

Refined Production	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**
Primary from Concentrate	12,426	12,604	12,746	13,344	14,270	14,804
Primary SX-EW	3,309	3,529	3,664	3,797	3,898	3,906
Secondary	3,250	3,465	3,580	3,544	3,540	3,502
Total Refined Production	**18,985**	**19,598**	**19,990**	**20,685**	**21,708**	**22,212**
Refined Consumption						
of which Asia	11,637	12,092	12,433	13,289	14,025	14,503
China	7,320	7,932	8,312	8,967	9,560	9,942
India	405	466	456	455	440	462
Japan	1,060	1,003	978	988	1,064	1,015
South Korea	909	803	720	714	745	739
Taiwan	533	459	433	437	465	463
of which Europe	4,372	4,546	4,244	4,182	4,260	4,181
EU-28	3,495	3,364	3,100	3,027	3,137	3,212
Russia	449	712	660	664	630	460
of which North America	1,793	1,788	1,818	1,875	1,963	1,985
United States	1,650	1,642	1,663	1,715	1,800	1,820
Canada	143	146	155	159	163	165
Other	1,326	1,311	1,304	1,295	1,204	1,180
Total Refined Consumption	**19,127**	**19,736**	**19,799**	**20,640**	**21,450**	**21,849**
Surplus/(Deficit)	**-142**	**-138**	**191**	**45**	**257**	**363**
Exchange Stock Change	-120	-24	45	-83	-200	175
Implied Off-Exchange Stock Change	-22	-115	146	128	457	188
3-Month Price ($/tonne)	**7,558**	**8,821**	**7,945**	**7,345**	**6,827**	**5,493**
Cash Price ($/tonne)	**7,539**	**8,811**	**7,950**	**7,322**	**6,861**	**5,503**

Totals may not sum due to rounding

Source: GFMS, Thomson Reuters, ICSG, LME

of similar magnitude is forecast for 2017 with improving demand growth countered by a pick-up in mine and refined production.

CUTBACKS IN FOCUS

As the copper price has slumped, cash margins have narrowed and remedial action at structurally high cost mines has increased. To define 'structurally high cost' mines we take a look at operations which have featured in at least eight of the last 16 quarters at, or above, the 90th percentile of the cost curve. This allows the exclusion of operations that are facing shorter term cost challenges. Starting with closures and suspensions, in January 2016 Lundin announced it had brought forward the closure of Aguablanca mine by two years, operations were completed at KGHM's McCreedy West mine last October and Antofagasta placed its Michilla mine on care and maintenance at end-2015. Lastly, Glencore suspended production at Katanga in September 2015 and also announced a partial suspension at Mopani. Crucially, both mines are to come back on line on the completion of expansionary and upgrade projects by 2017.

Asset sales and reviews have also featured, but sales do not necessarily equate to cuts. Anglo American's Mantoverde and Mantos Blancos mines were sold to a consortium of investors last August but production in 2015 actually increased by 2% year-on-year. Glencore's high cost Cobar and/or Lomas Bayas assets are also up for sale. A review at Lubambe (African Rainbow and Vale), meanwhile, sounds ominous as the company looks to "reduce cash funding and preserve resources at the mine". High cost mines can also be preserved by company cross-subsidies. Codelco's Salvador mine, for instance, is protected by policy commitments. In February 2010 the board agreed to "continue mining operations at the division until 2016 and if market and operating conditions are maintained, until 2021".

All told, the reaction by the industry at the top end of the cost curve in our mine economics coverage has been limited with annualised cutbacks of around 200,000 tonnes, and the bulk of that from the temporary suspension of Katanga and Mopani. The accelerated closure of mines operating for 40 to 50 years is hardly headline news. One explanation for the muted impact so far is that it was only in the third quarter of last year that the average copper price dipped below the 90th percentile.

DEMAND NO MARKET SAVIOUR

Global copper consumption growth shrank to 1.9% last year, with another year of sluggish growth seen in 2016. Chinese copper consumption, which, given all the negative press, held up better than expected last year is nevertheless still slowing. This year it is forecast to grow at around half the rate in 2014, and will moderate further to around 3% over the medium term. Offtake from the power sector will remain the key driving force, although some factors are at play which will limit potential, such as greater uptake of aluminium at copper's expense. The housing sector remains the Achilles' heel for Chinese copper demand. Massive housing inventories and risks closely related to China's banking system pose another challenge for the government.

Elsewhere, demand in EU-28 improved by 2.4%, reflecting a mixed picture across Europe. Germany remains the region's powerhouse while demand improved in more peripheral economies such as Italy and Spain. In the United States, copper demand increased moderately by 1.1% due to falling demand in some end-use markets, such as the oil and mining sectors. In Japan, Brazil and Russia copper consumption fell significantly while in India a 5% rise fell short of expectations. Longer term, the Indian government's announcement of many infrastructure projects has piqued interest.

DOOMSDAY OR BOOM?

While not part of our central thinking risks to our range of forecasts out to 2018, include a recession in the United States, a slowdown in global trade and China yuan devaluation as central bank liquidity reserves are drained. Assuming this doomsday scenario is averted the outlook for copper is not particularly inspiring over the medium term. We believe that the worst of the downturn will be behind us by late 2016. However, bearing in mind demand growth consistently below 3% compared with circa 4% as recently as 2014 the transition to a sustained deficit market will now extend beyond our three-year forecast horizon to around the turn of the decade. Even so, there is no doubting that the current low price environment is sowing the seeds for the next boom as projects are shelved, delayed, sold or abandoned completely.

2. MACROECONOMIC AND SCENARIO ANALYSIS

Base case forecast - copper market to remain in **surplus** to 2018

Global export growth stays negative after Aug 2015 **13.9 %** slump

Weak ISM raises US recession odds to **65%**

China Central Bank reserves outflows **$599bn** yr to Feb 2016

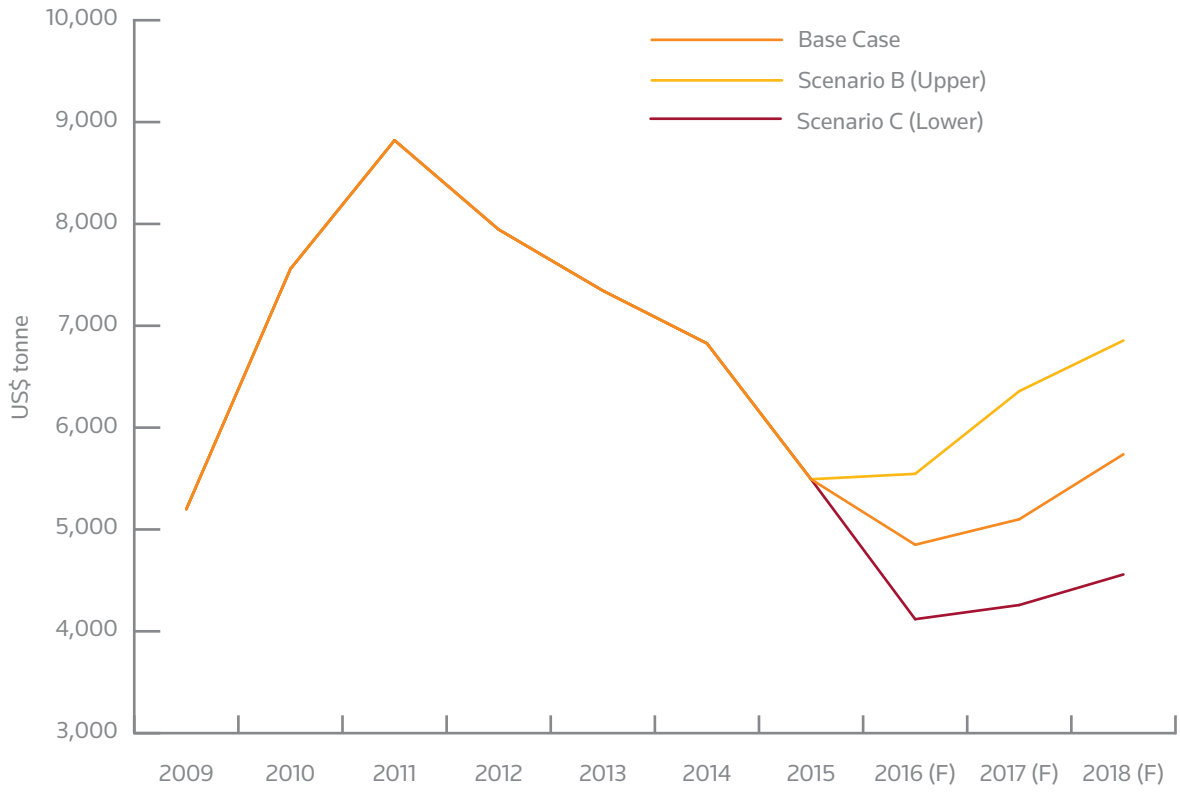
MACROECONOMIC AND SCENARIO ANALYSIS

We explore three paths for copper prices out to 2018 based on three different macroeconomic scenarios: base case, Scenario B (a faster growth, inflationary environment) and Scenario C (a lower growth environment coupled with disinflationary pressures). Basing our view on medium term structural trends shaping copper uptake, we incorporate macroeconomic indicators as inflators to refined consumption and to a certain extent, refined production. The macroeconomic drivers that underpin our forecasts for each scenario are detailed in the table on page 10.

In our **base case**, we expect mine production to grow in the next three years, albeit at a slower pace than in the recent past, as miners continue to deliver on investments made during the boom years. This will filter through to higher refined output, which we estimate will grow by an average of 2.1% in the next three years. With an estimated 400,000 tonnes per annum of smelting capacity ramped up towards the end of last year, we expect a further addition of smelting capacity to enter the markets this year. Our base case forecasts moderate global GDP growth of 2.7% on average in the next three years. Consumption continues to be heavily reliant on China, with a forecast global share of 46% in 2018, a touch higher than 45.5% in 2015. China's copper consumption growth however, is expected to slow down to an annual average of 3.2%. Power network investments in China will remain an important driver of growth, but weaker activity in the property construction sector will partly offset this. With production exceeding consumption throughout our forecast horizon, the copper market is expected to remain in a surplus, albeit at a declining rate with less than 60,000 tonnes by 2018. Total stocks, measured in terms of weeks' consumption, is estimated to reach 6.6 weeks' by the end of the forecast horizon.

In **Scenario B**, our high growth scenario, we project a more buoyant consumption profile,

ANNUAL AVERAGE PRICE OUTLOOK



Source: GFMS, Thomson Reuters, LME

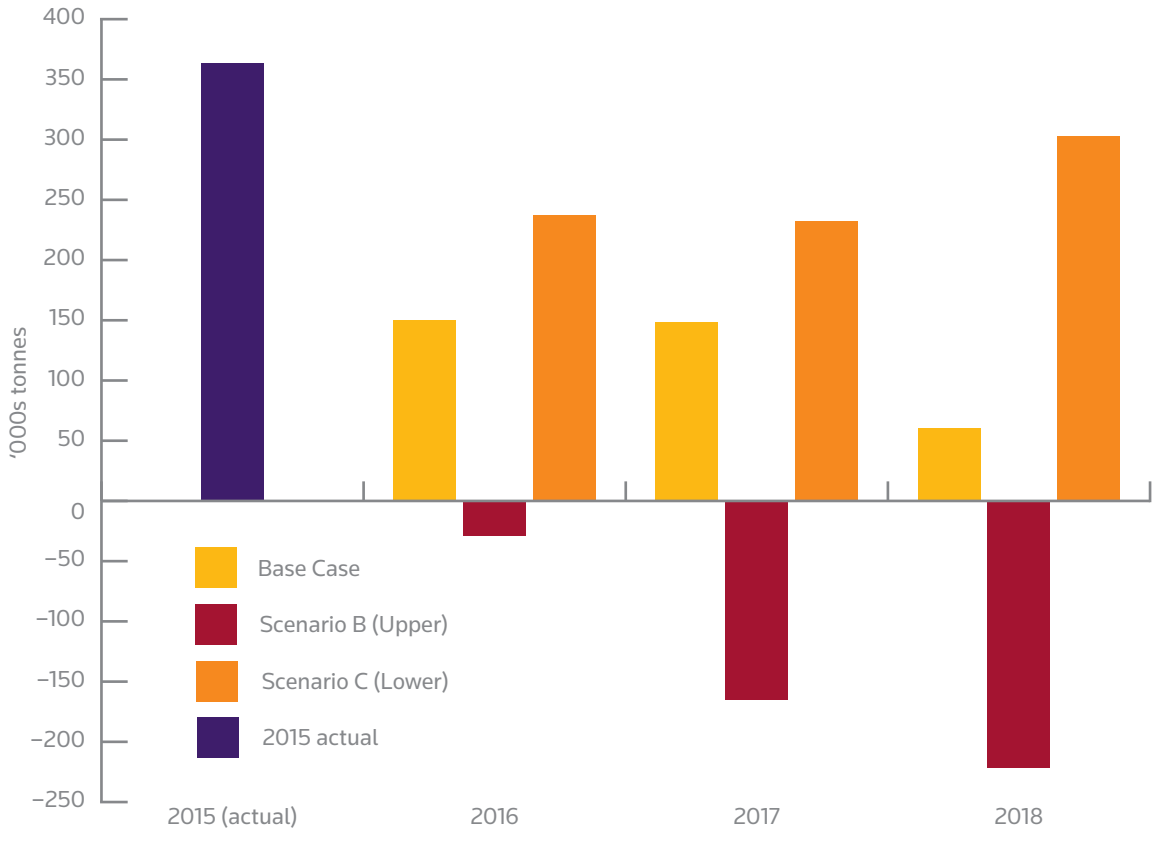
underpinned by a stronger global annual GDP growth forecast of 3.9%. In this scenario, China's IP growth is estimated to average 6.9% per annum as the government's infrastructure rollout is further complemented by higher uptake in the construction and automotive industry that comes together in a higher GDP growth environment. Aggregate consumption is also supported by robust demand from emerging countries, where they shake off recessionary conditions and benefit from a stronger China outlook. We allow for further cutbacks and closures that will restrict global refined output growth to 1.0% in 2016, but improving prices on the back of stronger demand growth prospects will encourage greater increases in refined production, bringing total production to 23.65 million tonnes by 2018, slightly higher than our base case. For scenario B we project a widening deficit, reaching 220,000 tonnes by 2018, the biggest since 2007. Total stocks under this scenario are expected to fall to five weeks' consumption.

Scenario C represents a much weaker copper market through to 2018. This view is predicated on weak global GDP growth forecast of 2.0%. China copper consumption is estimated to grow by a mere 1.3% per annum under this scenario, underpinned by weaker average IP growth forecast of 3.1%. Weakness in other emerging countries, continued stagnation in the euro zone and mild recession in the manufacturing sector in the United States will also contribute to the overall decline in global demand growth. We expect some production cutbacks, leading to less than 1% growth in production in 2016, before picking up slightly from 2017 as some shuttered operations restart. The refined copper market is expected to be mired in swelling surpluses under this scenario, reaching 303,000 tonnes by 2018, bringing total stocks to 7.7 weeks' consumption.

Copper prices, like other base metals, will also be shaped by other macroeconomic drivers, including the dollar, oil price, expected inflation and the industrial production outlook.

In our base case, we forecast the red metal to retreat in 2016 and see an average price of $4,850/tonne in nominal terms this year,

MARKET SURPLUS/DEFICIT ('000 TONNES)



Source: GFMS, Thomson Reuters, ICSG

MACROECONOMIC INDICATORS FOR BASE, UPPER AND LOWER CASE SCENARIOS

World GDP Growth		2016	2017	2018
Base Case	%	2.3	2.9	3.0
Scenario B (upper)	%	3.2	4.0	4.5
Scenario C (lower)	%	2.0	1.9	1.8
China IP Growth				
Base Case	%	5.2	4.6	4.7
Scenario B (upper)	%	7.3	7.0	6.5
Scenario C (lower)	%	3.5	3.0	2.7
US IP Growth				
Base Case	%	–0.6	3.0	2.6
Scenario B (upper)	%	3.5	5.0	5.5
Scenario C (lower)	%	–1.0	1.0	0.8
Eurozone IP Growth				
Base Case	%	1.2	2.4	1.9
Scenario B (upper)	%	2.7	3.5	4.0
Scenario C (lower)	%	0.7	0.7	0.5
EUR/USD				
Base Case	€/$	1.07	1.06	1.09
Scenario B (upper)	€/$	1.15	1.17	1.20
Scenario C (lower)	€/$	1.03	1.01	1.03
World CPI				
Base Case	%	2.9	3.1	2.6
Scenario B (upper)	%	3.1	3.5	3.7
Scenario C (lower)	%	2.2	2.0	1.8

Source: GFMS, Thomson Reuters, Oxford Economics

the lowest since 2005. Prices are forecast to improve from 2017 onwards as the global economy picks up some momentum, to gain by 5% year-on-year to reach $5,100/t. Coupled with shrinking surpluses, we expect prices to see a much stronger upswing of 12.5% in 2018 to reach $5,738/t. In real terms (2015 prices) however, we expect the price to remain below $5,000/t in 2016, and will only see a positive turn by 2018.

With marginal cash costs at approximately $4,800/tonne (Q4 2015), copper producers have already made some production curtailments including the suspension and the sale of high cost assets. Moreover, on a total cost basis (this includes depreciation, a proxy for sustaining capital) marginal costs are just above $5,900/tonne. So in theory, further closures should be on the cards. However, the scale of any new mine closures should not be overstated. First, disinflationary pressures from a weak crude price, weak inflation expectations, and a strong dollar could potentially shift the cost curve lower in the next three years. Furthermore, the cost of mine closures, including labour retrenchments, environmental liabilities, and the possible souring of relationships with governments, all offer resistance to companies in taking the ultimate decision of shutting a mine.

If the reaction from steady state copper assets risks being somewhat muted, the longer term impact of low copper prices could be more meaningful. A downbeat price outlook will hold back investments in mine projects and green field developments, and has already seen a shift in M&A activity from "buy and build" to

"spin out and sell", as producers focus scarce capital on their highest margin assets. Given the long lead time from mine development to production, any impact will naturally play out over a longer time horizon, but we are no doubt laying the foundations for a supply shortfall, an increased risk of market deficits and the associated move in copper prices.

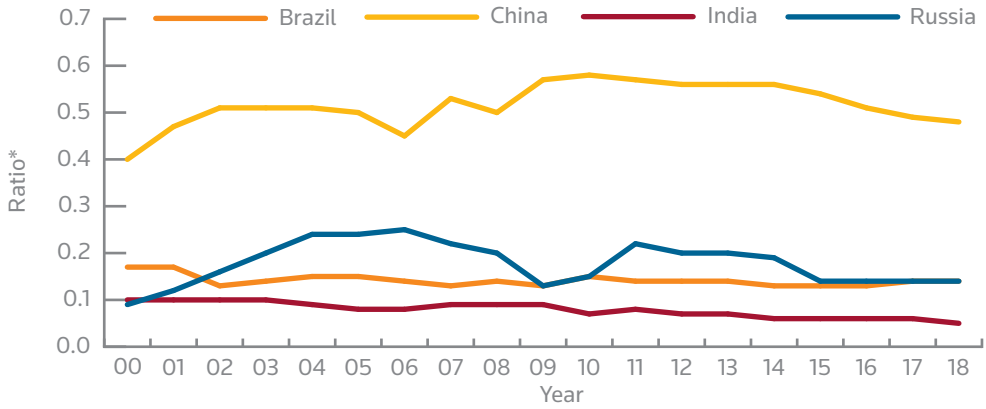
CHANGING PROFILES IN INTENSITY OF USE

The relative intensity of copper consumption as economies mature has, in the past, been used to model potential growth in copper demand across key developing economies. But so far, and to some disappointment, the figures appear to actually be in decline. The ratio is measured as tonnes of copper consumption per million dollars of GDP, and excluding China (which was the 'poster child' for predictions of explosive copper demand in Indian for example) the lesser developed economies tend to exhibit low levels of per capita copper consumption and, generally, a low intensity of use. This is due to their position on the economic development cycle (early stages-expansion) and a lack of semi-fabricated production capacity. Indeed, the BRICs, excluding China, accounted only for 8% of world copper fabrication capacity in 2015.

While perhaps not a surprise that forecast intensity of copper use in China is in decline, the projected falls for Russia and India are more of a concern. In Brazil, meanwhile, levels are expected to remain relatively flat.

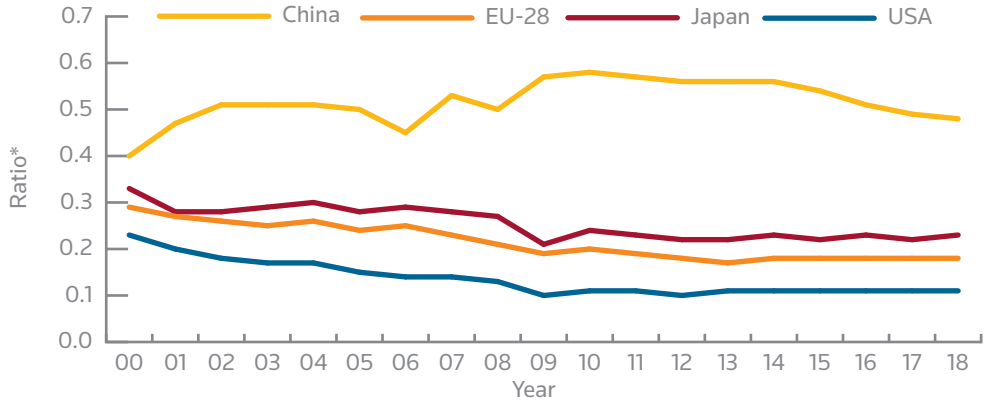
In China the economic slowdown, the switch to a consumer-based growth model and a peak in demand from end-use markets, chiefly explain the negative trend. In Brazil and India, on the other hand, slow reforms, weak economic performance

INTENSITY OF USE-BRICs



Source: GFMS, Thomson Reuters

INTENSITY OF USE-CHINA VS MATURE ECONOMIES



*Consumption per capita / GDP per capita PPP (constant 2011 international USD)
Source: GFMS, Thomson Reuters

and slow progress in implementing planned infrastructure and industrial projects have kept copper demand at much lower levels than expected.

Turning to developed countries, intensity of copper use is expected to remain broadly flat out to 2018. The broad decline from 2000 to 2008 is explained by a slowdown in infrastructure and manufacturing activities and competition from cost-effective emerging markets. In later years, the flatlining is explained by the maintenance of the broad fabrication capacity in Japan and EU-28.

MACRO THREATS - TRADE, RECESSION AND FX

Global markets have started 2016 with a sharp increase in volatility across foreign exchange, equity, bond and commodity markets. This highlights the increasingly difficult macro environment and threats to our central price scenarios are arguably increasing.

We have identified three macro themes which we think require a more thorough analysis of risk assessment. First, the slowdown in global trade; second recession in the United States; and last a yuan devaluation. To be clear, the following analysis outlines potential risks facing the global economy and is not part of our base, low or high case price scenarios.

SLOWDOWN IN GLOBAL TRADE

The global value of exports as reported by the IMF has been trending lower since the beginning of 2012. In August 2015 the value declined by 13.8% year-on-year, the second greatest fall since January 1958. The January 2016 reading has improved but still remains at a negative 7.2% with the overall trend remaining downwards. The chart below overlays the change in world GDP growth with exports which, not surprisingly, demonstrates a strong positive correlation.

Lower export growth and falling global GDP readings are synchronised with recessions in the United States. These events also, and rather obviously, direct monetary policy and in the bottom chart in the stack of three below we show the US fed funds rate since 1954 and an equal-weighted index of policy rates made up by the Bank of Japan, Bank of England, U.S. Federal Reserve and ECB (prior to the EU the data corresponds to the German Bundesbank rate). The weighted index has been easing since the 1980s and has now reached almost zero.

In the past, negative export and GDP growth have been relatively short lived as central banks were able to lower interest rates substantially in a recessionary period to drive economic growth and global trade. The concern this time around is that central bank policy rates are either close to zero percent or negative, such as in Japan and Europe and therefore, a lift-off from these depressed export levels will take either new measures, such as renewed QE or more negative interest rates to stimulate the global economy.

Our concern is that the U.S. economy will not be able to withstand the effects of slowing global GDP growth and global exports and that as a result the United States will ultimately move into a recession.

UNITED STATES RECESSION RISK

The business cycle theory provides a good starting point to analyse the current health of the economy in the United States, and charted below, we look at long-run GDP (year-on-year percentage change), ISM purchasing managers index and industrial production (year-on-year percentage change).

First, the year-on-year GDP change stands at 1.9% which on an historical basis indicates that a recession is imminent. A drop below 2.0% (the red line on the chart) has been a reliable 'recessionary trigger' for many decades. However, post-2010, the indicator has proven a false one, and the year-on-year change in GDP has dropped below 2.0% on three occasions without resulting in a recession. This can be

partly explained, in our view, by the Fed's QE programme launched in the wake of the global financial crisis. But that support has now been knocked away with the QE programme concluded in October 2014 and the first rate hike in December 2015 by 0.25%.

Secondly, the ISM Index has posted the fifth consecutive month below 50 in February, which indicates a contraction in the business cycle. Using data back to the 1950s we conclude that an ISM reading below 50 for three consecutive months raises the probability of a U.S. recession to over 65%.

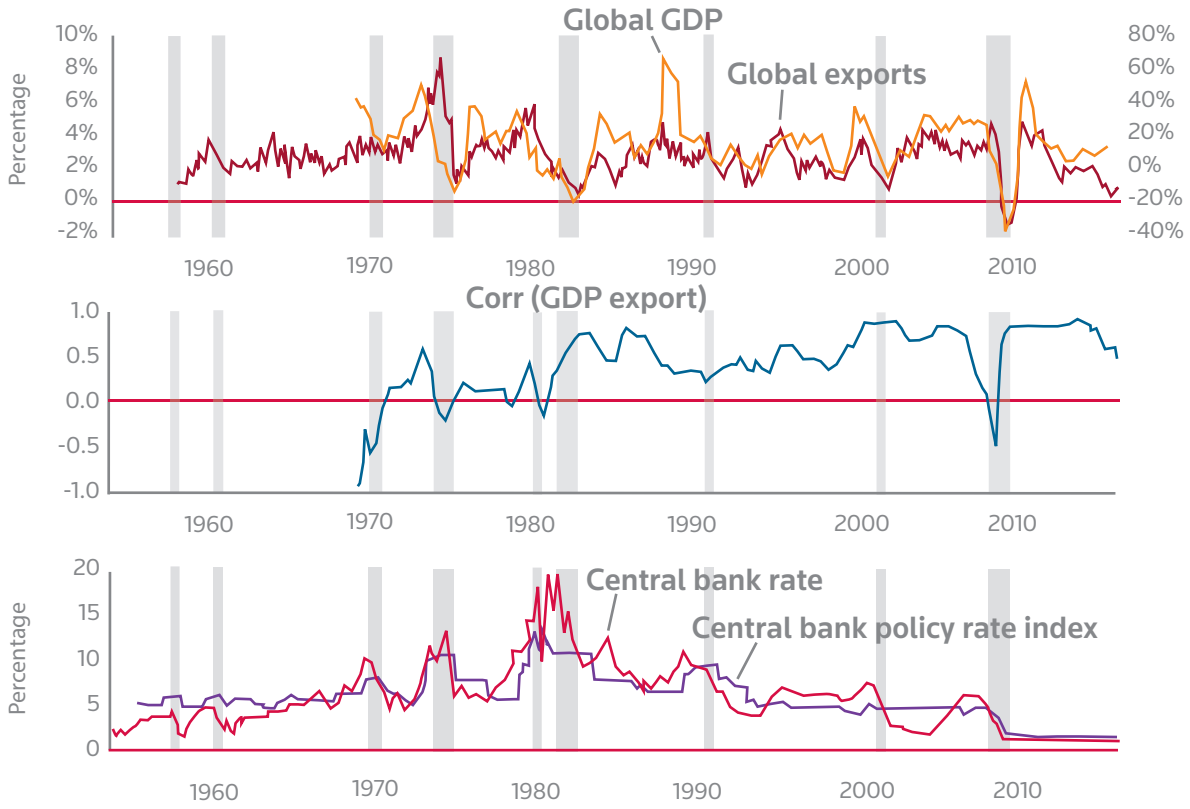
Thirdly, U.S. industrial production has declined by 0.70% year-on-year 2014-2015 and been declining over the past three months. Again, declining year-on-year U.S. industrial production has coincided with U.S. recession periods since the 1950s. Overall, and with all key business cycle indicators crossing below critical levels, the probability of a U.S. recession in 2016 has, in our view, increased.

In this context, copper's price performance during past recessionary periods is an important framework in estimating the red metal's potential downside. Perhaps not surprisingly, in all of the nine last recessions, the LME cash copper price dropped significantly (see table on page 14).

Copper prices have already fallen dramatically; down by 6% in 2013, 14% in 2014 and 28% in 2015, and that's without the assistance of recession in the United States. So how much further could prices decline if the country 'officially' goes into recession?

In the chart above, the steepest year-on-year price falls include a 58% drop in the 1975 recession and a 59.8% decline in the 2008 recession. Taking into account the price action to date, a worst case scenario implies a further 35% to 40% drop, or a target level of around $2,900-$3,150. Coincidentally, the 2008 low for copper prices during the global financial crisis was $2,825.

GLOBAL EXPORTS VS WORLD GDP WITH US RECESSION BANDS. HOW LOW CAN BANK RATES GO?



Source: Thomson Reuters Datastream

U.S. (NBER) RECESSION BANDS

U.S. Recession	Duration (months)	LME Cash Copper Price Performance	Biggest monthly % drop
Aug 1957-April 1958	9	-19%	-7%
Apr 1960-Feb 1961	11	-9%	-5%
Dec 1969-Nov 1970	12	-33%	-9%
Nov 1973-Mar 1975	17	-35%	-21%
Jan 1980-July 1980	7	-2%	-21%
July 1981-Nov 1982	17	-15%	-14%
Jul 1990-Mar 1991	9	-7%	-9%
Mar 2001-Nov 2001	9	-12%	-6%
Dec 2007-June 2009	19	-29%	-36%
Average of all recessions	**12**	**-18%**	**-14%**

Source: GFMS, Thomson Reuters, Oxford Economics

CHINESE YUAN DEVALUATION RISK

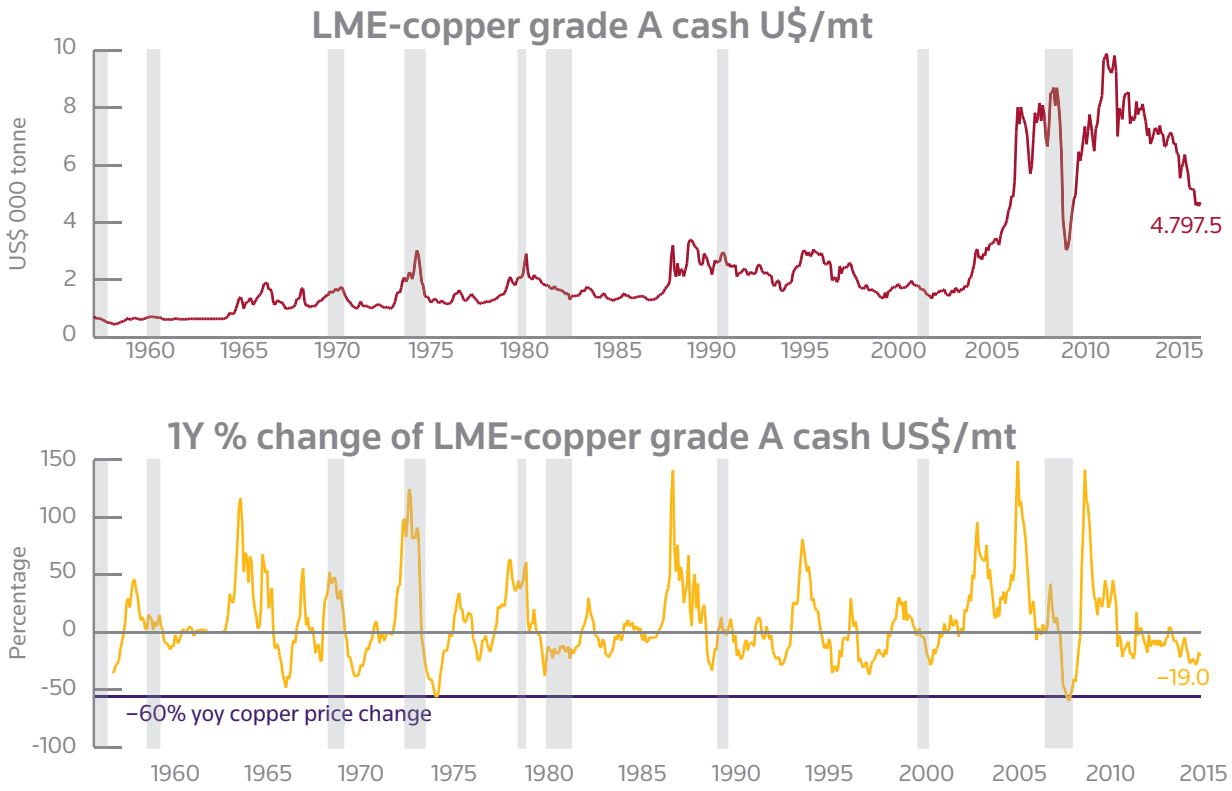
After the yuan devaluation by the PBOC in August 2015, risk of further devaluation is being priced in by the market. One such indicator (charted on page 16) is the one year expiry for 25 delta RMB put/USD call options. Since June 2015 the implied option volatility has been trading strongly upwards from 4.5% to now over 10% with the recent high at 13.5% at the beginning of February 2016.

The fundamental backdrop to this expectation has been the draining of central bank liquidity reserves in China over the past months. November 2015 saw $87 bn in outflows followed by $107 bn in December and $99 bn in January 2016. In all three months the CNH was devalued between 1-2% on a month-to-month basis.

KEY US BUSINESS CYCLE INDICATORS (GDP, ISM, INDUSTRIAL PRODUCTION) OVERLAYED WITH US RECESSION BANDS

Source: Thomson Reuters Datastream

LME CASH COPPER PRICE $/MT VS US (NBER) RECESSION BANDS



Source: Thomson Reuters Datastream

If the flight of capital cannot be slowed the PBOC's ability to defend the yuan is progressively weakened. China, of course, has a very large import-export balance and therefore requires liquid reserves to be able to handle the daily operations of its economy.

The IMF provides a simple equation to calculate the minimum central bank reserve requirements:

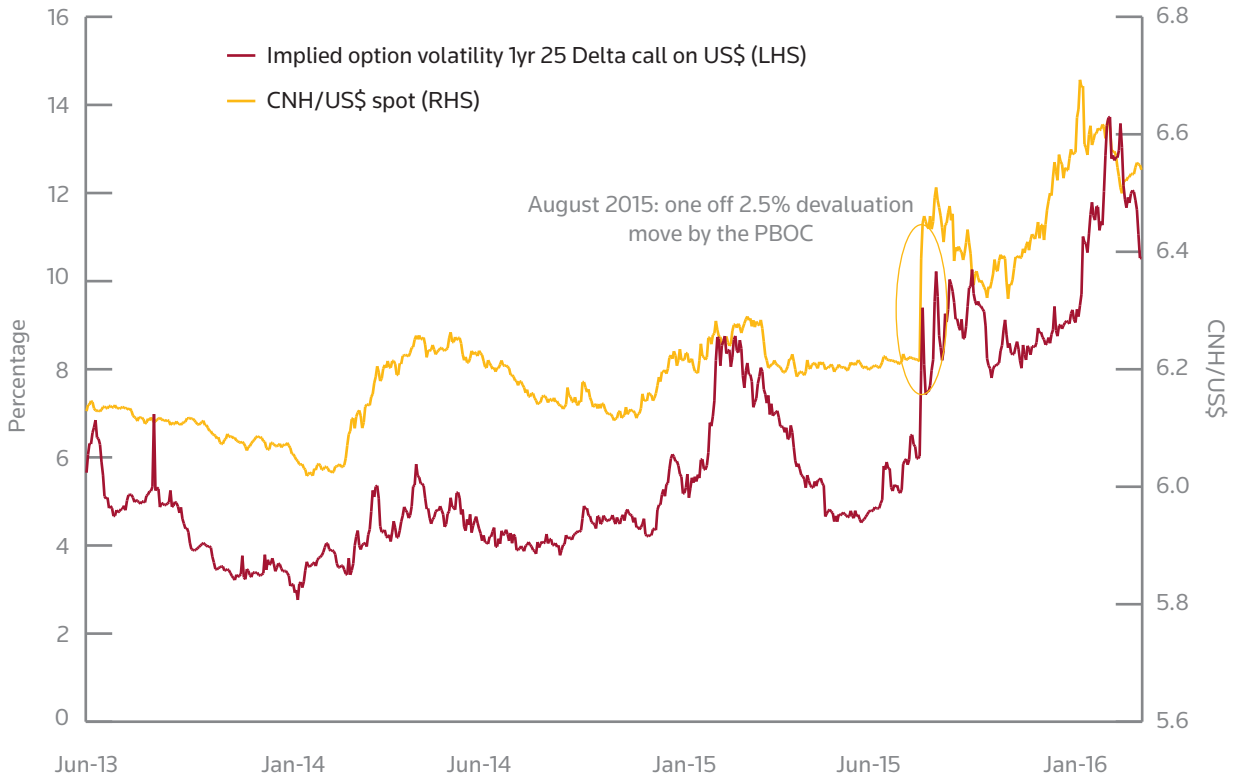
Minimum FX reserves = 10% of exports + 30% of short-term debt + 10% of M2

Using the latest available data for China we calculate the minimum FX reserves required at $2.49 trillion (basis exports at $1.7 trillion, short term debt of $1 trillion and M2 at RMB 141 trillion).

The current central bank assets of the PBOC as of end of January 2016 stood at $3.23 trillion. Therefore, the net reserves available to defend the currency would be $0.74 trillion ($3.23 trillion - $2.49 trillion). If the current reserve outflows continue at a rate of $100 bn per month the PBOC will run out of reserves in around seven months.

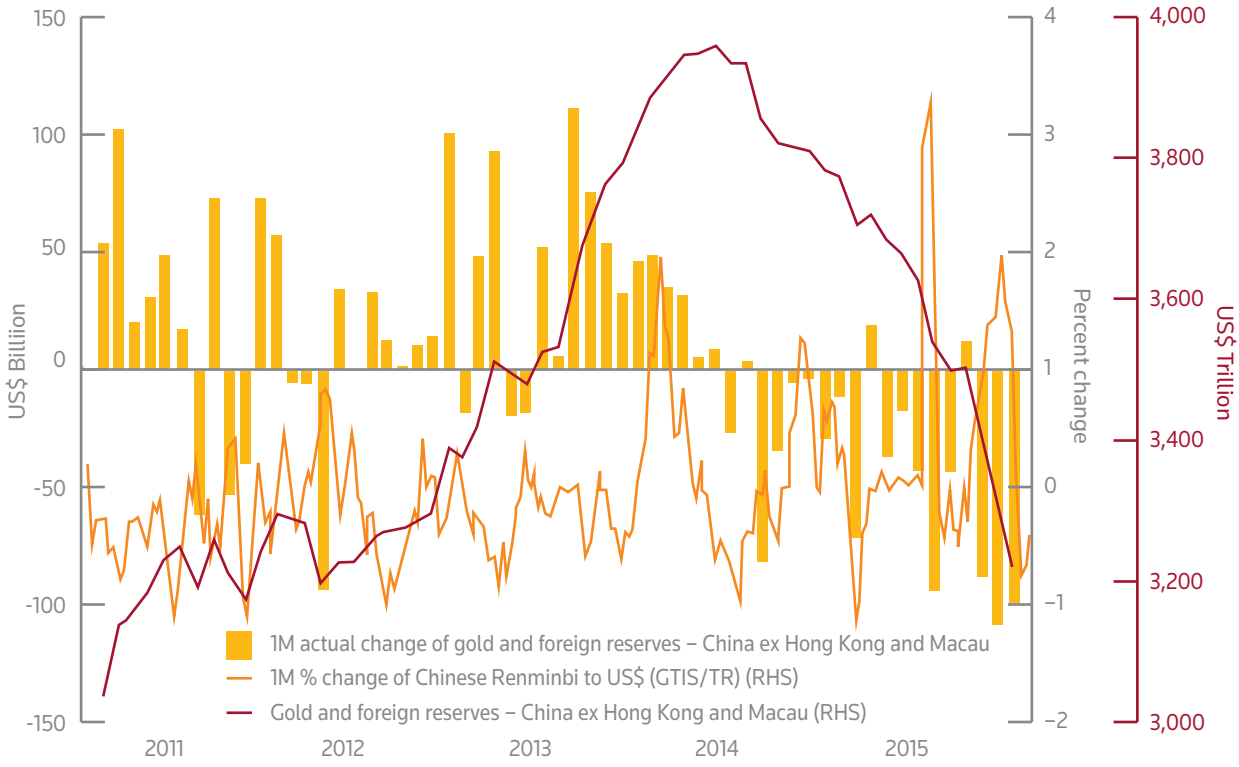
We are not currently aware of any plans to devalue the yuan. Indeed, at the recent G20 meeting a PBOC official stated that there would not be any further one-off devaluation of their currency. However, history tells us that conditions can change rapidly and that these new conditions require action by government. For instance, in May 1997 prior to the Asian crisis the prime minister of Thailand announced that he would not devalue the baht. In July 1997 the baht was devalued and the currency dropped by as much as 20%. Similarly, on 14th August 1998 Yeltsin declared that "there will be no devaluation" of the rouble. Three days later Russia announced devaluation by expanding the trading band from 5.3-7.1 RUB/USD to 6.0-9.5 RUB/USD.

CHINESE YUAN VS 25 DELTA YUAN PUT OPTION IMPLIED VOLATILITY



Source: GFMS, Thomson Reuters

MONTHLY CHANGE IN CHINESE RESERVES VS MONTHLY % CHANGE IN YUAN



Source: Thomson Reuters

3. PRICE AND EXCHANGE ACTIVITY

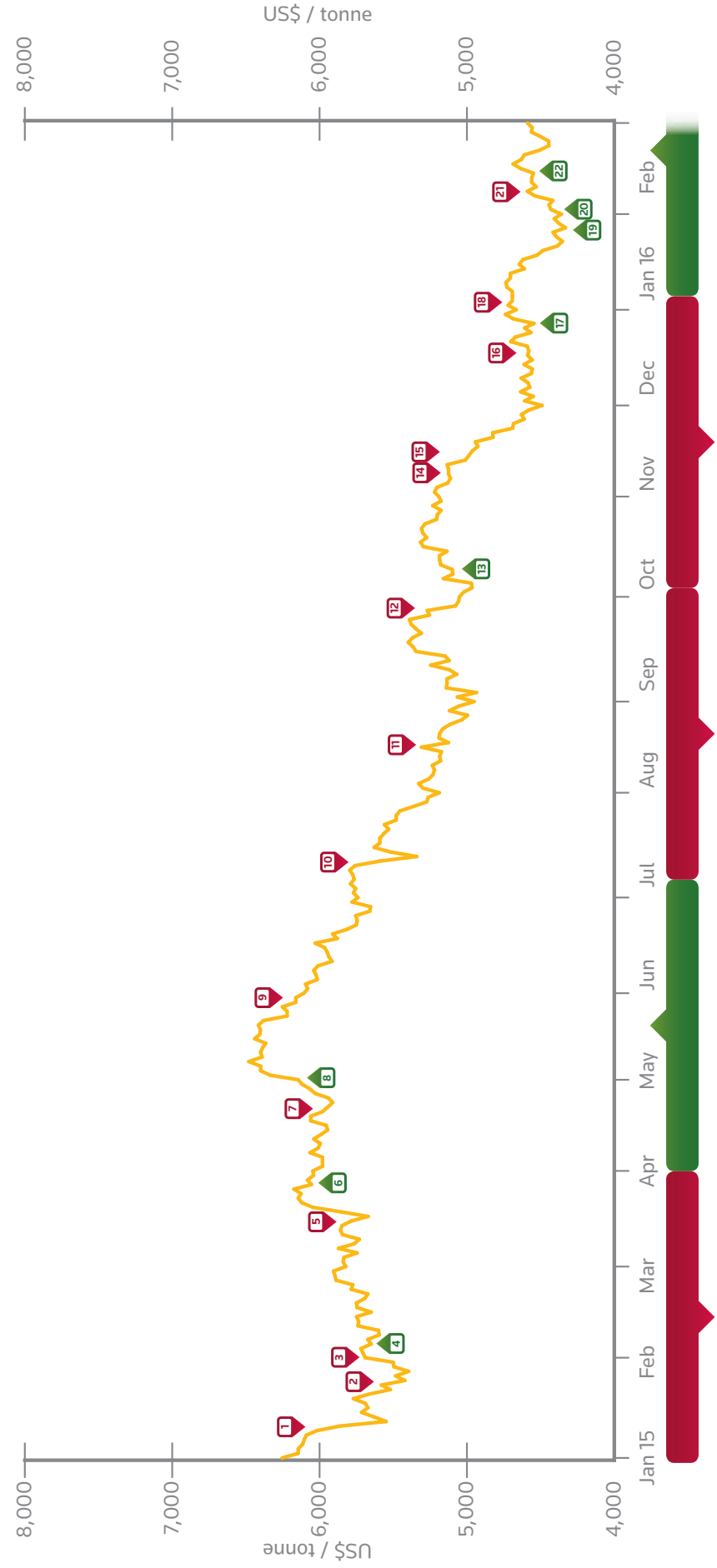
The **rise** and **fall** of the copper price

Large **SRB** intervention unlikely in 2016

LME share shrinks by **6%**

Exchange trading volumes up **9%** in 2015

LME COPPER PRICE EVENTS



Source: GFMS, Thomson Reuters

ACTIVITY ON COMMODITY EXCHANGES

Combined trading volume in copper across the London Metal Exchange (LME), COMEX and Shanghai Futures Exchange (SHFE) grew by more than 9% last year. Within this, however, it is clear that the growth in turnover on SHFE in particular came at the expense of the LME, which lost significant market share. It remains to be seen whether this is a trend which will continue in the longer term.

However, the LME is clearly not standing still. Earlier this year owner Hong Kong Exchanges and Clearing (HKEx) revealed its 2016-2018 Strategic Plan; its aim to create in mainland China physically deliverable spot commodity markets. HKEx said the plan was a way of getting LME warehousing expertise into China. So far, its aim of siting LME warehouses in China has met with opposition. Competitor SHFE is said to be one key opponent, no doubt concerned this would lead to a paring of its own trading volumes.

As part of its ongoing campaign to make inroads into China's mainland, in December 2014 the LME launched its LME HKEx Mini contracts in copper, as well as aluminium and zinc. The contracts are aimed at Chinese retail investors, largely wealthy individuals, who account for the bulk of trading on Chinese exchanges. Their launch has been followed a year later by the introduction of Mini Futures contracts for nickel, tin and lead.

These are among a growing number of RMB-denominated contracts as the Chinese government moves slowly towards full convertibility of the currency and are seen as part of China's long term goal as the world's largest consumer to have commodities such as oil, gold and copper priced in the RMB rather than the dollar. While these RMB mini contracts have seen only limited trading volumes, which dwindled further in copper's case in the second half of 2015, as part of the over-arching goal they are broadly viewed as a step in the right direction.

LME CEDES GROUND TO SHFE AND COMEX

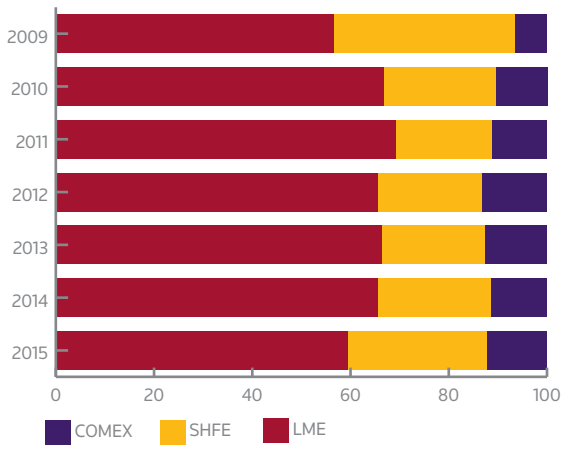
Minis aside, while the LME still continued to dominate the overall picture, accounting for 59.5% of total turnover in copper, this compared less favourably when viewed in the context of the 65.5% share recorded in 2014 and the close to 70% seen as recently as 2011. Total trading volumes on the LME shrank by more than 0.5% last year to 38.5 million contracts, or by six million tonnes to 962 million.

As LME volumes fell, those on SHFE conversely jumped by around one-third to 454 million tonnes, exceeding the previous peak level achieved in 2009. This also gave SHFE a 28.1% share of total exchange turnover, up from 23% last year. It should be noted that the original trading volume released by SHFE included both buy and sell positions, therefore we halved the data for cross-exchange comparison purposes.

Trading on SHFE jumped as investors looked for ways to bet against China's economy and boosted their short positions. The situation was exacerbated by the ban on short-selling in equities with trading on SHFE seen as an alternative to channel that bearish sentiment. Hedging by domestic smelters also featured last year as they tried to counter losses from the slump in copper prices.

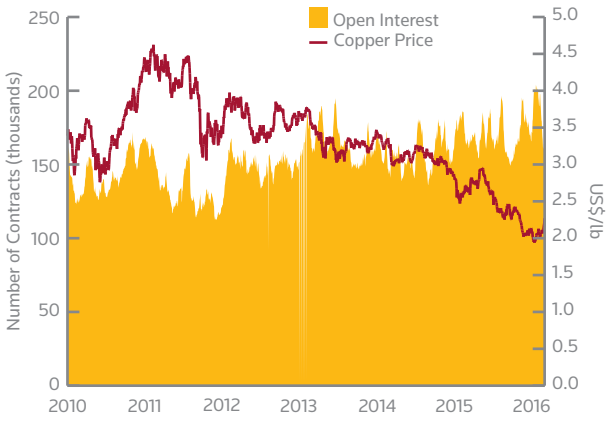
Open interest in copper futures on SHFE rose by 14% to 1.9 million tonnes by end-2015, a smaller gain than the 31% increase seen the previous year. As was the case in 2014, much of the increase in open interest over the period was attributed to short positions associated with concerns over China's demand prospects. By way of illustration, it surged early last year, reaching the equivalent of 2.4 million tonnes in late January, 40% higher than the end-2014 level. The sharp increase coincided with aggressive short selling by Chinese funds both on the LME and SHFE, which took prices to their lowest since July 2009. Similarly, as copper prices turned

EXCHANGE TURNOVER COMPARISON



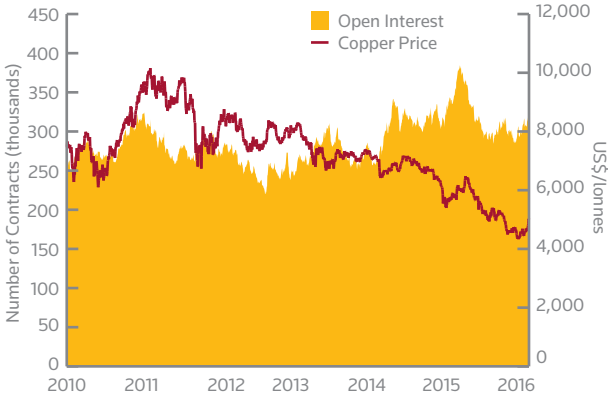
*Based on cumulative gross trading volume
Source: LME, SHFE, COMEX

COMEX COPPER FUTURES-OPEN INTEREST & PRICE



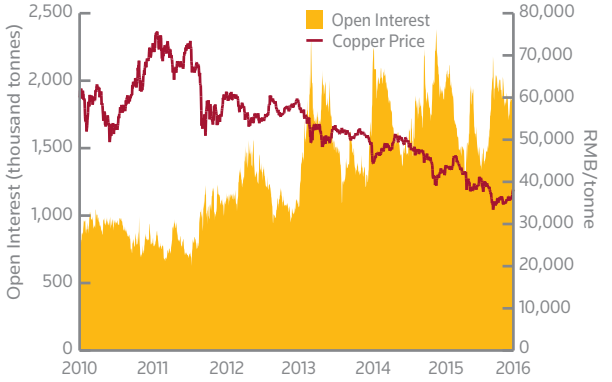
Source: Thomson Reuters; COMEX

LME COPPER EXCHANGE OPEN INTEREST



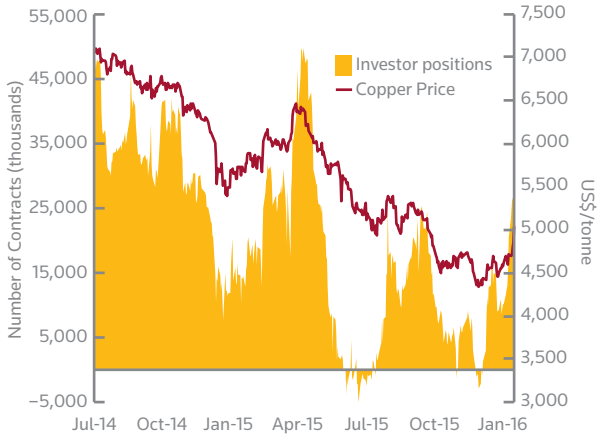
Source: Thomson Reuters; LME

SHFE COPPER FUTURES-OPEN INTEREST & PRICE



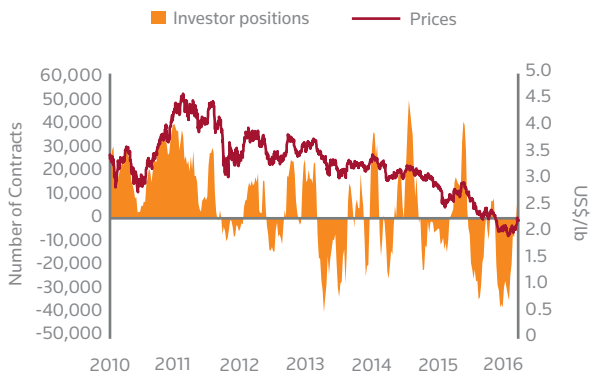
Source: Thomson Reuters; SHFE

NET INVESTOR POSITIONS IN LME



Source: Thomson Reuters

NET INVESTOR POSITIONS IN COMEX FUTURES



Source: GFMS, Thomson Reuters; CFTC

sharply lower in the final months of 2015, open interest increased towards the levels seen earlier in the year.

Somewhat surprisingly, perhaps, COMEX also boosted its share of total turnover last year by more than 18% to 200.6 million tonnes. Open interest ended the year at 165,643 contracts (1.86 million tonnes), up 3% from the previous year. Throughout the year, open interest ranged between around 150,000 and approaching 200,000 contracts (1.7 million to 2.2 million tonnes).

The year's peak of more than 196,000 contracts was reached in August, but came close to being matched again in mid-November against the backdrop of the accelerating downtrend in copper prices. Last year's peak in open interest has already been exceeded this year in late January, coinciding with a breach of the psychologically significant $2/lb level as fears about Chinese demand once again dominated market sentiment.

Taking a closer look at the breakdown of open interest on the exchange, weekly CFTC reports show that managed money positions were net short for much of last year. We focus on the managed money classification to gauge the activities of traders who manage and conduct organised futures trading on behalf of clients. In early 2015, a net short position carried over from 2014 on the previously noted China-related fears. They turned net short again, and in greater volume, from June 2015 with only brief respite through to the end of the year as players fixated on possible further deterioration in the metal's prospects.

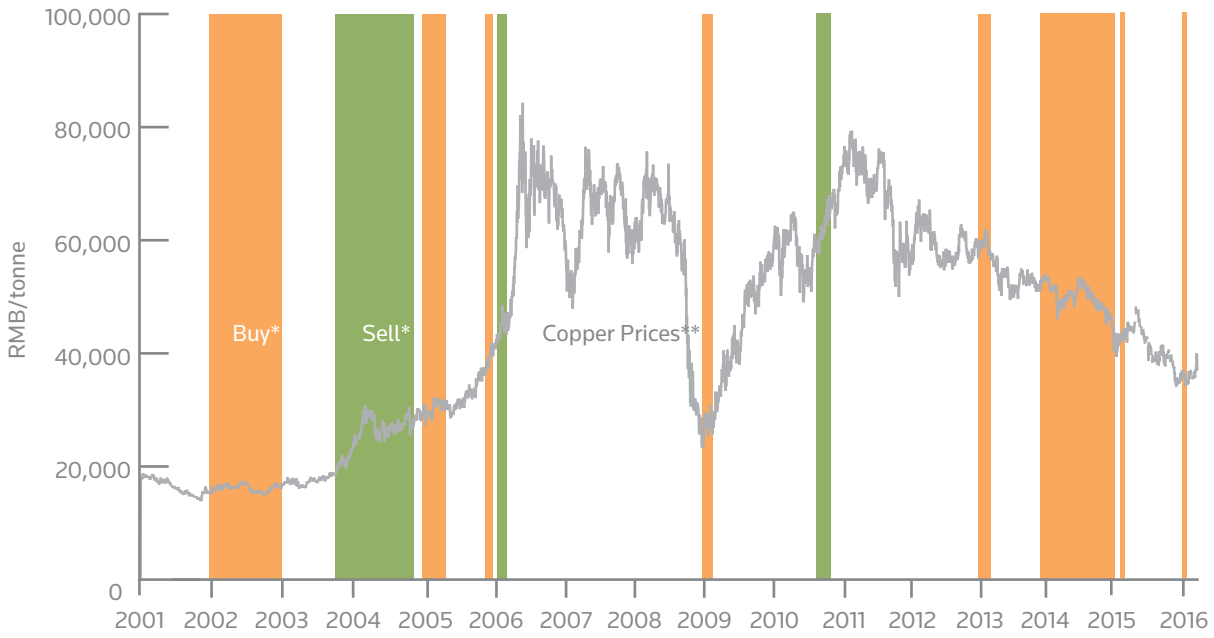
THE BUYING AND SELLING OF CHINA'S STRATEGIC RESERVE BUREAU

China's Strategic Reserve Bureau (SRB) brief is incredibly wide ranging. It is charged with 'stabilising the country's economy, enforcing macroeconomic control and securing strategic resources for safety, stability and security reasons'. It is also a means of managing the nation's fiscal investments (essentially the foreign currency reserve) when faced with resource scarcity and high volatility in both commodity availability and price.

Its role in the copper market is an important one as China is obviously a net importer of the metal, and arguably it can occasionally push the market into, or out of, surplus or deficit – if only for short periods of time. So while its actions can have an impact on both sentiment and price, its primary role is not to maximise profits, but rather to maintain the stability of supply and in so doing help grow the country's refining, manufacturing and consumer sectors. Measures undertaken by the SRB include purchase, storage, state reserve auction and stock rotation. Usually it also rotates the old stocks by auction, and replenishes with new stocks as soon as possible. Equally, the SRB needs to maintain and increase the value of state-owned assets.

The SRB first came to prominence in the copper market in 2002 with a 200,000 tonne purchase of metal. From September 2003 this metal was sold back to the market, with, according to media reports at the time, some 80,000 tonnes heading onto the SHFE. Sales continued into 2004 into rising LME prices (which had increased by 61% in 2003) as the SRB aimed to alleviate supply shortages in the market that were perceived to be harming the economic progress of the world's largest consumer. With regard to purchases in 2015, early last year, Reuters News reported that the SRB planned to buy at least 200,000 tonnes of copper, the bulk of which was pencilled in for the first half of the year. As the year unfolded and copper prices sank to six-and-a-half year lows, it was perhaps not surprising that updated estimates for full year purchases exceeded this by some 100,000-150,000 tonnes (although net purchases would be lower than this due to stock rotation). Understandably the modus operandi of SRB activity is secretive by design, so that the only visible market impact of these purchases was reflected in domestic cathode prices which at times traded at a premium to imports.

BUYING AND SELLING OF SRB



Note: *As reported by Reuters News
**Price converted from LME 3-month into RMB including VAT

The prospects for any large intervention by the SRB in 2016 look unlikely. At the end of November 2015, major copper smelters from China agreed to make production cuts of up to 350,000 tonnes. Other base metals smelters suggested similar action. At the time, smelters were reportedly appealing for the government to show some solidarity and support the market by committing to build-up state stockpiles. There was no official response at the time, but early in 2016 the SRB is reported to have confirmed a target (again) of 150,000 tonnes of copper purchases via public tender. This target, in our view, looks reasonable, and one that is not likely to be significantly breached. Consider that at end-2015 SRB copper stocks amounted to an estimated two million tonnes. Additionally significant stocks are sitting in SHFE sheds as well as in bonded warehouses. With substantial stocks and slowing domestic demand there appears to be little urge to "battle" for the red metal in 2016.

4. MINE PRODUCTION, COSTS AND INCENTIVE PRICING

World mine production up **3.5%** in 2015 vs **2.1%** in 2014

Strongest growth in **South America** and **Asia** (ex-China)

Cash costs **4%** lower, total costs down **2%** year-on-year

Incentive price for new supply around **$6,900/tonne**

MINE PRODUCTION, COSTS AND INCENTIVE PRICING

MINE PRODUCTION

World copper mine production last year increased by an estimated 3.5% year-on-year, or 652,000 tonnes, to reach 19.022 million tonnes. On a regional basis there were modest shifts in volumes in Africa, Oceania and Europe, the latter increasing slightly, versus declines in Africa and Oceania. The more important driver of global growth came from Asia, where we estimate an 8% or 289,000 tonne increase year-on-year, and the Americas, where volumes were up by an estimated 4% or 385,000 tonnes.

Peru was the star performer in the Americas region, posting a 23% increase in mine production for the year and boosting its share of world output from 7.3% to 8.7%. The strong result also saw the country jump above the United States in the global rankings, placing Peru as third largest copper producer in 2015, a position the country is likely to retain for some years to come.

In Asia, the year-on-year gains were mostly due to a return to normal operations in Indonesia, where production in 2014 was hampered by delays in export approvals. Honourable mentions should also go to Mongolia, up 23% or 60,000 tonnes, Brazil where production climbed by 50,000 tonnes, or 17%, and lastly Mexico, with reported gains of 36,000 tonnes, representing a 7% increase compared to 2014.

At the mine level the biggest year-on-year gain in tonnage terms was reported at Newmont's Batu Hijau in Indonesia due to higher ore grade mined, higher metal recovery and throughput, and as mentioned above, export delays experienced in 2014. Full year output amounted to 225,000 tonnes, more than three times the volume in 2014. At Freeport McMoRan's Morenci mine, the mill expansion that lifted daily ore throughput from 50,000 to 115,000 tonnes achieved full rates in the second quarter 2015. Copper production at the mine hit a record 485,000 tonnes, an increase of 113,000 tonnes on the prior year.

Mine starts in 2013 and 2014 also made a solid contribution to the year-on-year growth as these relatively new assets continued to ramp-up to design capacity. Chalco's Toromocho (Peru), Hudbay Minerals' Constancia (Peru), Codelco's Hales (Chile) and KGHM's Sierra Gorda (Chile) all delivered strong growth with combined production of 612,000 tonnes, or an extra 380,000 tonnes of copper production versus 2014.

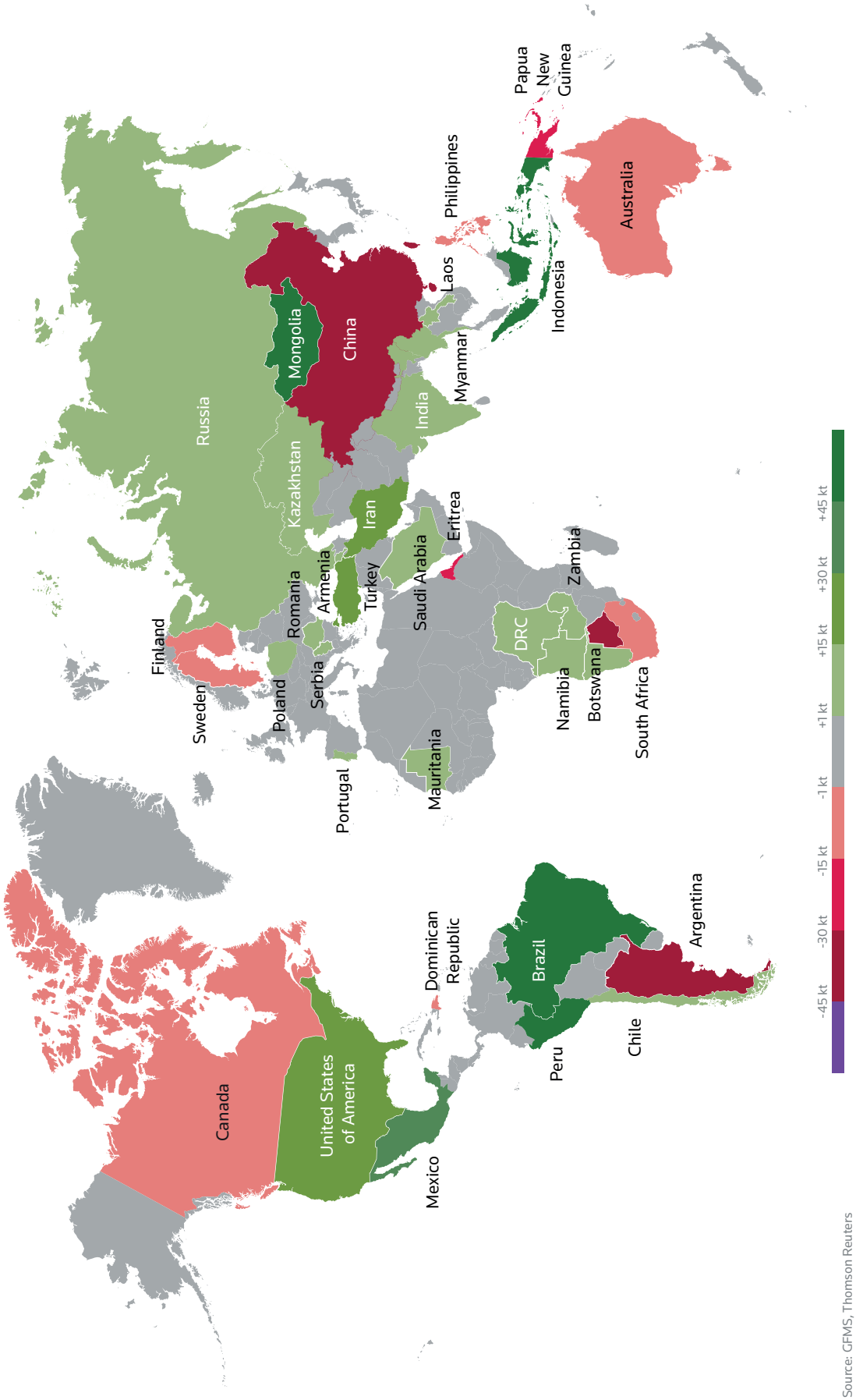
Turning to some of last year's declines, Rio Tinto's Bingham Canyon mine topped the group, with year-on-year losses of 112,000 tonnes. The result was in line with guidance as the group continued to focus on recovery work related to the "130 million-tonne landslide on the north-east wall of the mine which occurred in April 2013". Meanwhile, the suspension of processing operations at Glencore's Katanga mine left full year production at a reported 114,000 tonnes, or a 44,000 tonne decline year-on-year. Losses were also reported at the Alumbrera mine

MINE PRODUCTION BY REGION

	2010	2011	2012	2013	2014	2015
North America	1,895	2,141	2,221	2,359	2,606	2,656
South America	6,987	6,808	7,068	7,497	7,506	7,841
of which Chile	5,419	5,259	5,434	5,776	5,750	5,764
Europe	1,603	1,658	1,743	1,807	1,816	1,864
Asia	3,235	3,036	3,094	3,403	3,470	3,759
of which China	1,180	1,303	1,490	1,565	1,694	1,659
Africa	1,220	1,316	1,459	1,825	1,926	1,893
Oceania	1,029	1,090	1,048	1,103	1,045	1,008
Total	15,970	16,049	16,634	17,994	18,370	19,022
Year-on-year % chg.	0.6%	0.5%	3.6%	8.2%	2.1%	3.5%

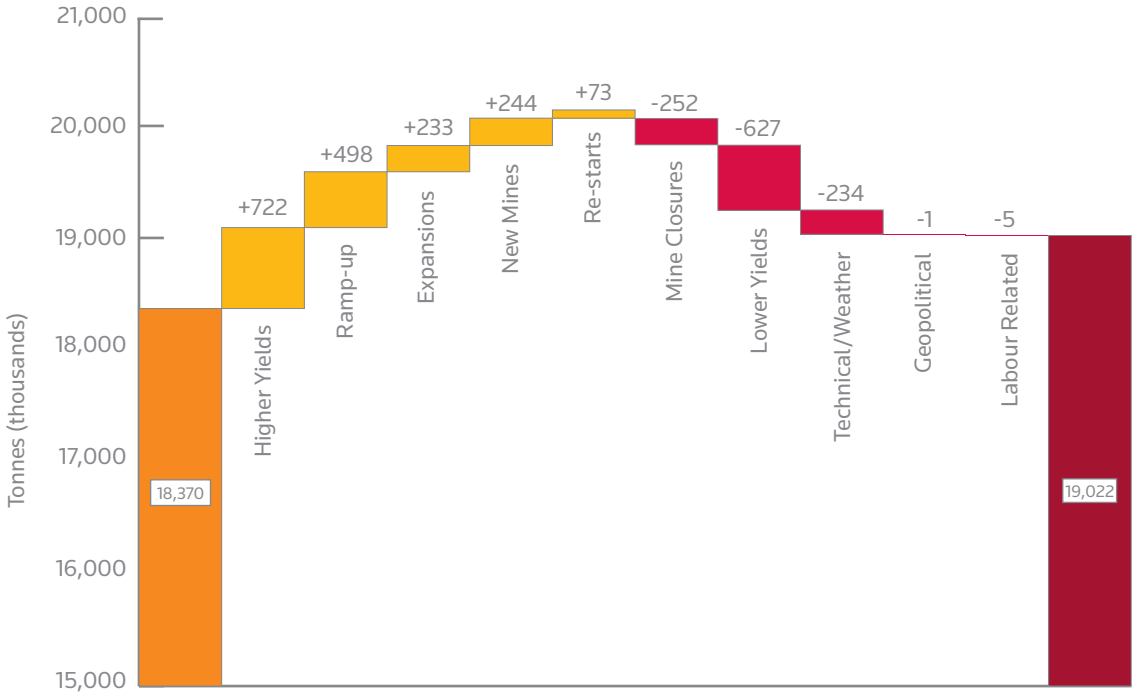
Source: GFMS, Thomson Reuters

MINE PRODUCTION WINNERS AND LOSERS, 2015 VERSUS 2014



Source: GFMS, Thomson Reuters

MINE PRODUCTION: VARIANCE ANALYSIS



Source: GFMS, Thomson Reuters

(Glencore 50%, Goldcorp 37.5%, and Yamana 12.5%), where output fell by just over 40,000 tonnes or 40%, reflecting expected lower production due to lower and more variable grades as it nears end of mine-life. Alumbrera is expected to begin decommissioning by the middle of 2017 and in its year-end financial statements Yamana commented that it had made a full write-down of its investment as the company does "not expect further profitability at current copper price levels". Lastly, production at one of Africa's largest copper mines, First Quantum's Kansanshi, fell by 36,000 tonnes to 227,000 tonnes. The 14% drop year-on-year was due to reduced throughput in the first half of the year, a combination of temporary power restrictions and the need to match acid consumption with smelter capacity as these operations built up to full commercial levels, achieved on 1st July 2015.

OPERATING COSTS

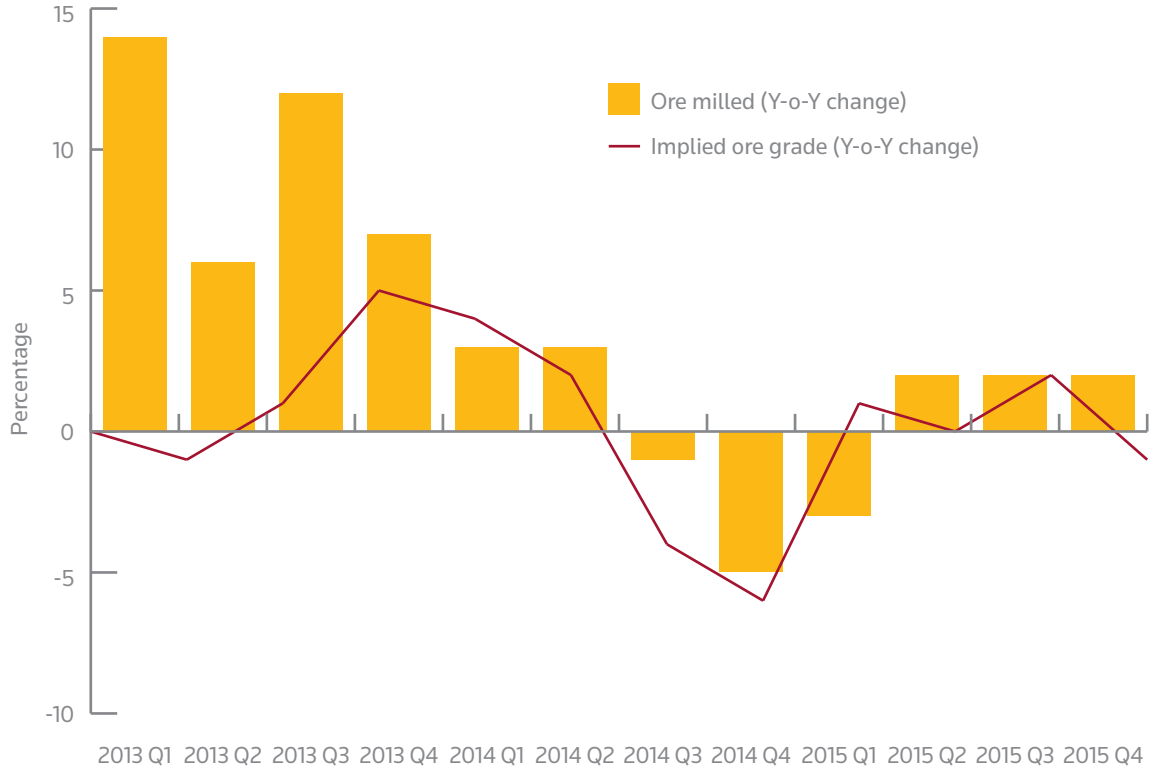
Net cash costs for full year 2015 stood at an estimated $3,586/tonne, a modest 4% or $160/tonne decline year-on-year. Depreciation costs, meanwhile, registered a $62/tonne increase which left total costs for the sector (net cash plus depreciation) at $4,626/tonne, a 2% decrease from levels in 2014. The much greater fall in the

WORLD COPPER COSTS

	2012	2013	2014	2015
Net Cash Costs	3,428	3,732	3,746	3,586
Year-on-Year change		9%	0%	-4%
Total Costs	4,189	4,629	4,724	4,626
Year-on-Year change		10%	2%	-2%
Cash Copper price ($/tonne)	7,948	7,322	6,835	5,503
Year-on-Year change		-8%	-7%	-19%
Cash cost margin (%)	57%	49%	45%	35%
Total cost margin (%)	47%	37%	31%	16%

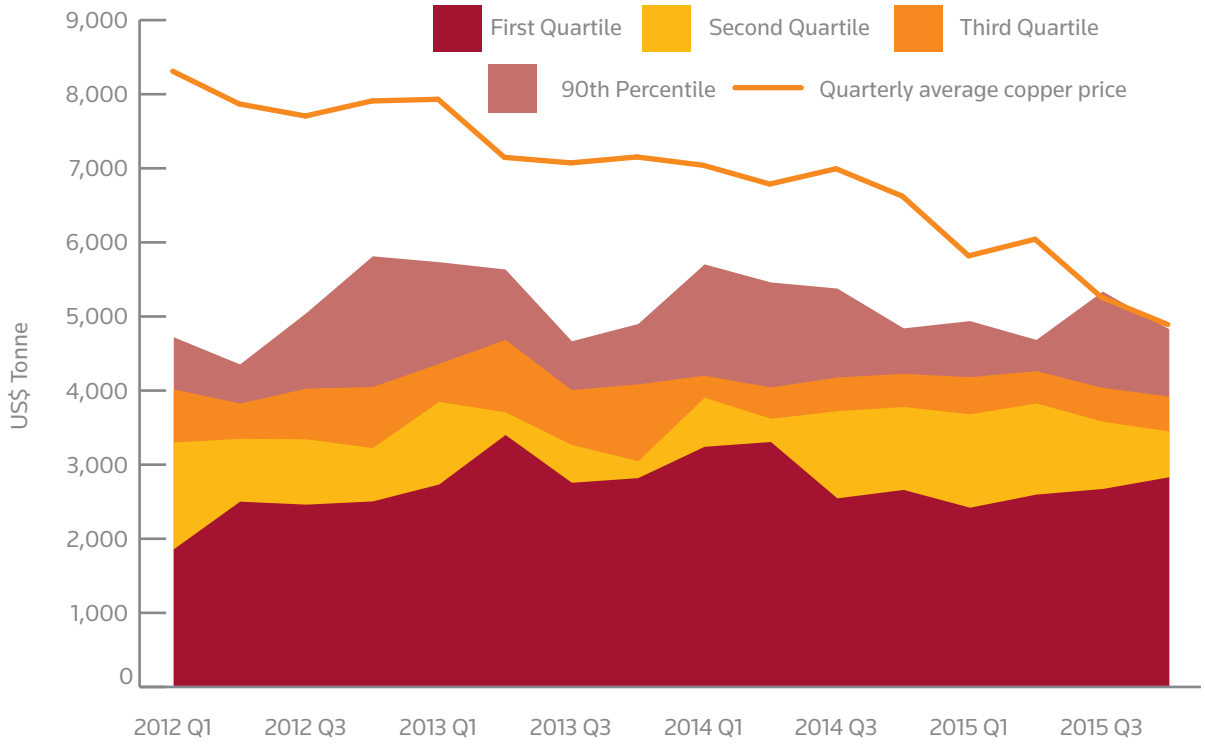
Source: GFMS, Thomson Reuters

TONNES OF ORE MILLED AND IMPLIED ORE GRADE (% CU)



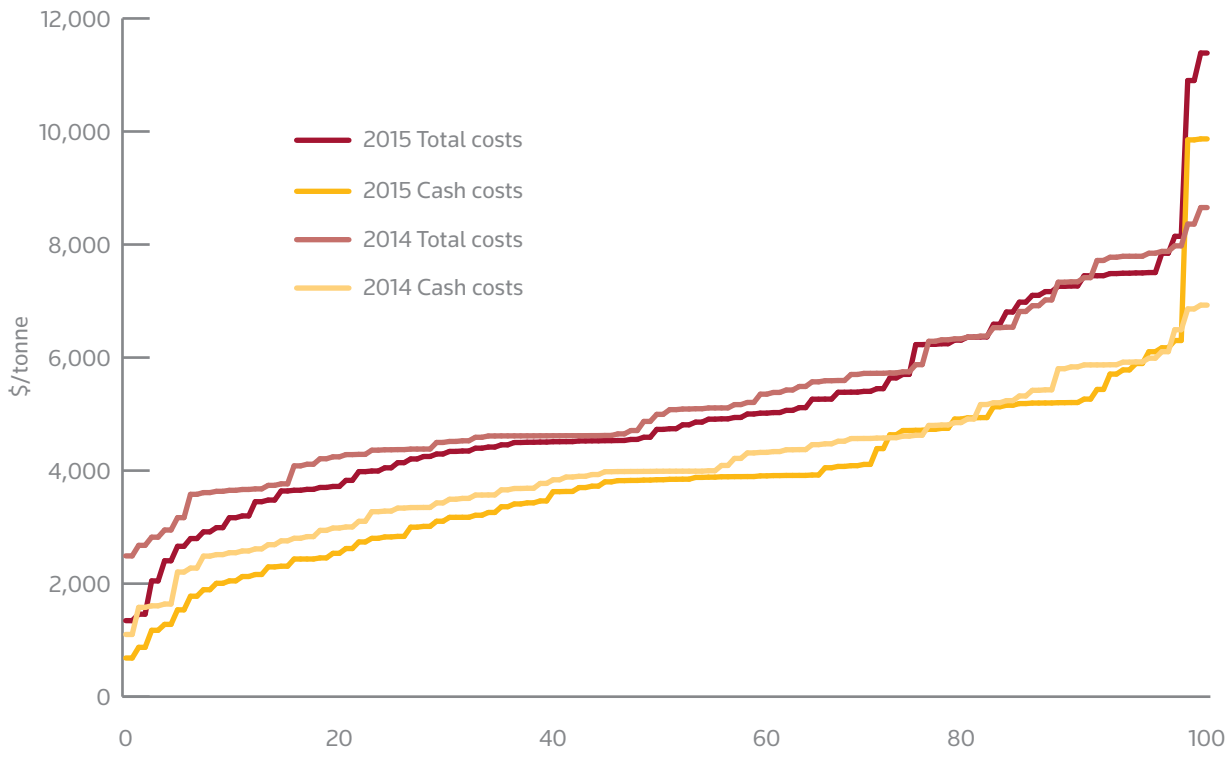
Source: GFMS, Thomson Reuters

COPPER INDUSTRY COST STRUCTURE - BY QUARTILE



Source: GFMS, Thomson Reuters

COST CURVES 2014 AND 2015



Source: GFMS, Thomson Reuters

copper price (cash LME), which registered a 19% decline year-on-year, resulted in cash margins deteriorating from 45% in 2014 to an estimated 35% in 2015. The total cost margin, meanwhile (copper price to total cash costs) declined from 31% to a modest 16%.

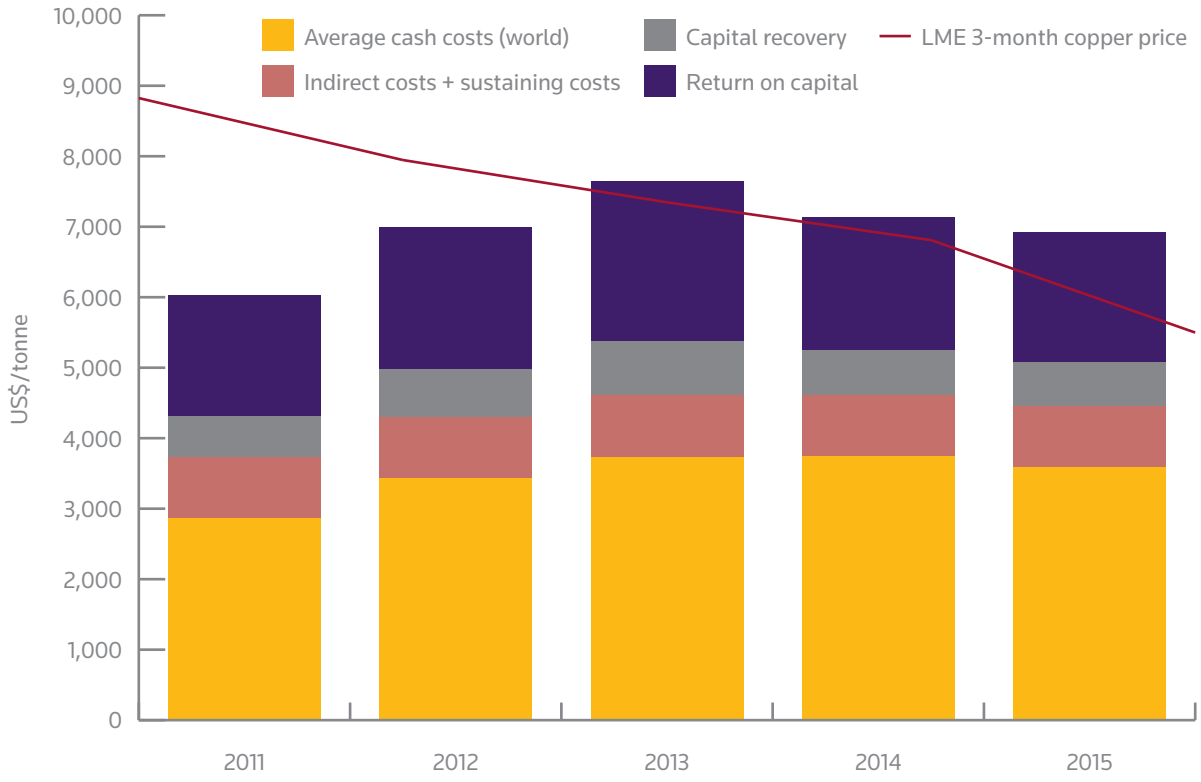
The shift in the underlying cost structure over time is best illustrated by a profile of the industry quartiles: 25%, 50%, 75% and the 90th percentile as a proxy for "marginal production". Over the last four years the marginal net cash cost of production has moved in a range of $4,400 to $5,800/tonne, with an average of $5,110/tonne. In the third quarter 2015, and for the first time in many years, the average copper price tracked below the marginal cost of production. To date we have only seen a handful of mine closures in reaction to depressed copper prices, but if the industry cannot make more meaningful cost savings, it seems likely that the pace of mine closures will pick up.

Of course the decision to close mines is not one taken lightly, and the cost of closure must be balanced against forecast accumulated losses, which are linked, among other parameters, to the owner's view on future copper prices. The time on the horizon where accumulated losses breach the cost of closure is the point where a mine should be closed. Where that point on the horizon is, of course, is a much harder question to answer, so that this balance of "unknowns" makes miners reluctant to close mines. Furthermore, there are social and socio-political issues involved in mine closure. State subsidies, or cross-company subsidies can keep mines operational for much longer than a marginal production analysis predicts.

INCENTIVE PRICES

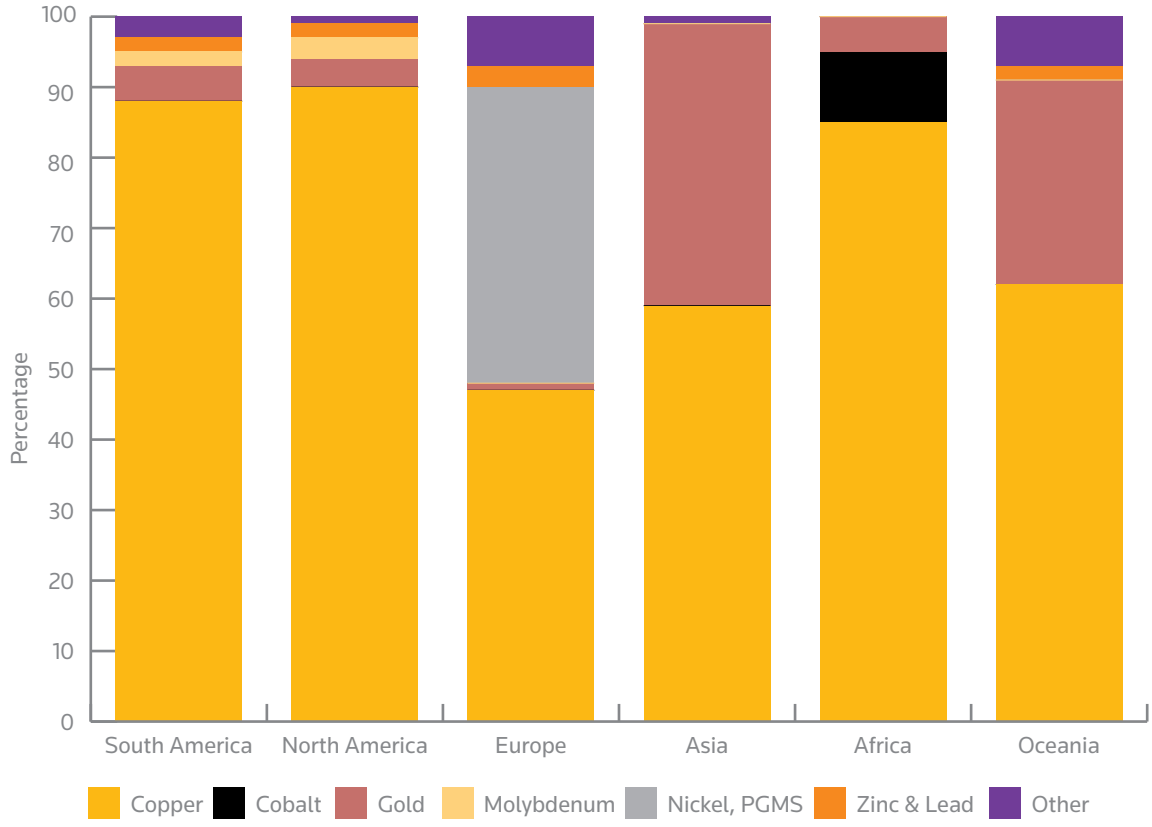
Our annual review of pipeline developments, capital costs and industry cash costs generates an incentive price for new copper projects for 2015 at $6,921/tonne. Looking at spot prices, new copper projects will not get built unless there is a substantial decline in capital intensity. This, however, seems unlikely as projects are becoming more rather than less complex, bearing in mind factors, to name but a few, such as location, mineralogy, services, water.

INCENTIVE PRICE



Source: Thomson Reuters

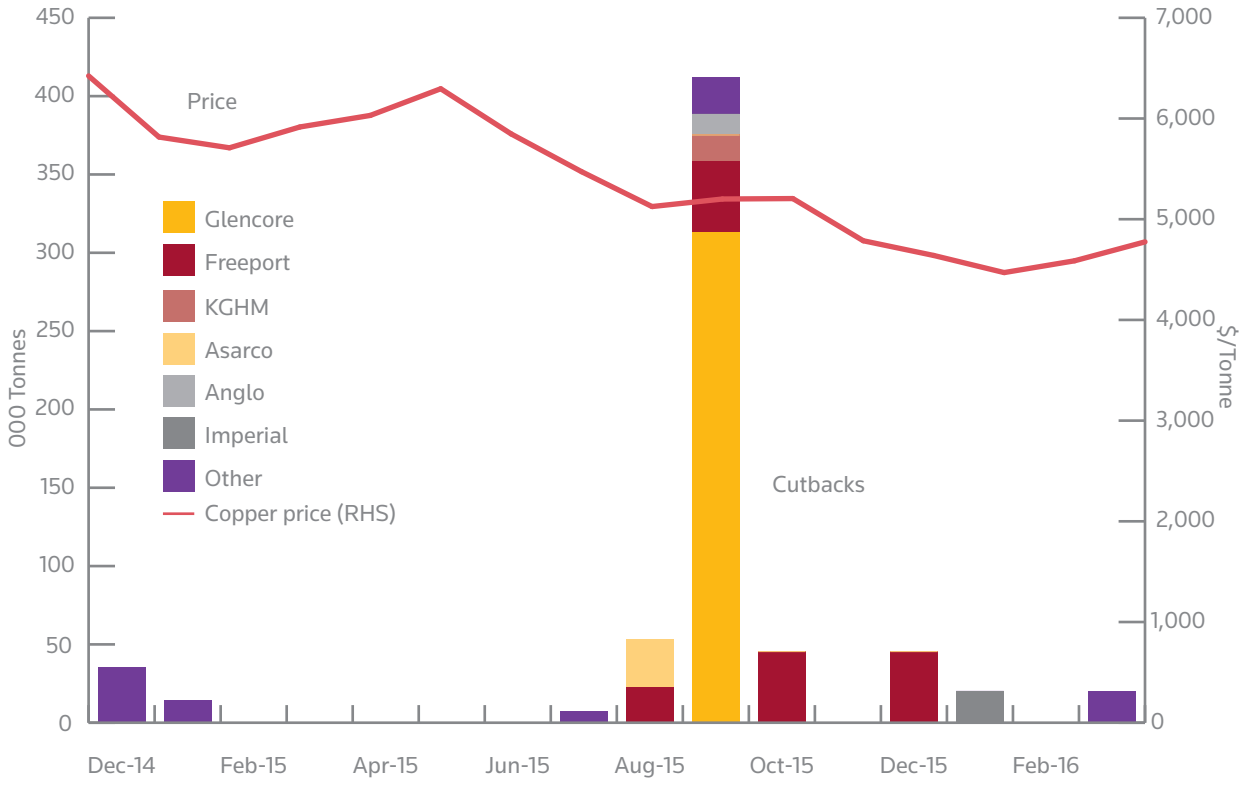
REVENUE BY REGION AND COMMODITY (BASIS Q4 2015)



Source: Thomson Reuters

Given the long lead time, delays today will have implications for supply tomorrow. Clearly a bullish argument for copper, but equally clear is that this is all about one's time horizon. In the short term, the next two to three years or so, the incentive price argument is just not topical. Consumption is slowing, while mines from the last boom are still ramping up. Furthermore, operations suspended, downscaled or mothballed may restart, some with expanded capacity to enable lower costs, so that the potential shortfalls in mine supply (as demand ratchets up) will not be so dramatic. Further out, towards 2020, the fundamental metal balance starts to look more interesting. The risk of ever greater deficits will loom, and copper prices should start to gain some upward momentum. The scramble to build additional mine capacity will no doubt evoke memories of the noughties mining boom, and just maybe, after such a long stretch of gloom, give the miners something to smile about.

COPPER PRICE AND CUTBACK ANNOUNCEMENTS



Source: Thomson Reuters

TOP-10 COPPER PRODUCING COUNTRIES

Rank			Production (000 t)	
2014	2015	Country	2014	2015
1	1	Chile	5,750	5,764
2	2	China	1,694	1,659
4	3	Peru	1,339	1,654
3	4	United States	1,391	1,408
5	5	Australia	969	960
6	6	DR Congo	915	918
7	7	Russia	740	741
9	8	Zambia	693	705
8	9	Canada	694	690
13	10	Indonesia	379	587

Source: GFMS, Thomson Reuters

TOP-10 COPPER MINE PRODUCERS*

Rank			Production (000 t)	
2014	2015	Company	2014	2015
1	1	Codelco	1,839	1,893
2	2	Freeport-McMoRan	1,470	1,547
3	3	Glencore	1,296	1,259
4	4	BHP Billiton	1,203	1,178
5	5	Southern Copper	665	745
7	6	KGHM Polska Miedz	506	562
6	7	Rio Tinto PLC	636	555
8	8	Anglo American	504	472
9	9	Antofagasta	455	400
10	10	First Quantum Minerals	380	366

*Attributable basis – totals may differ from company reports

Source: GFMS, Thomson Reuters

MAJOR COPPER PROJECTS

Project	Company	Location	Process	Type	Capacity	Capex*	Start Date
Ajax	KGHM	Canada	Conc	New Project	50	795	2019
Agua Rica	Yamana	Argentina	conc	New Project	150	2,122	2021?
Aktogay	KAZ Minerals	Kazakhstan	SX-EW/Conc	New Project	104	2,300	Q4 2015/17
Andina	Codelco	Chile	Conc	Expansion	na	1,400	2022
Aynak	MCC	Afghanistan	Conc	New Project	200	3,000	Post-2020
Bozshakol	KAZ Minerals	Kazakhstan	Conc	New Project	75	2,150	Q1 2016
Bytrinsky	Norilsk Nickel	Russia	Conc	New Project	66	1,700	End-2017
Carrapateena	Oz Minerals	Australia	Concs	New Project	40	555	2019
Carmacks	Copper North	Canada	SX-EW	New Project	14	225	Q2 2018
Chuquicamata UG	Codelco	Chile	Conc	Expansion	367	4,000	2018
Cobre de Panama	First Quantum	Panama	Conc	New Project	320	5,950	End-2017
Collahuasi	Anglo American/Glencore	Chile	Conc	Expansion	496	6,500	na
El Arco	Southern Copper	Mexico	Conc/SX-EW	New Project	190	2,600	2020
El Pachon	Glencore	Argentina	Conc	New Project	280	4,100	na
El Pilar	Southern Copper	Mexico	SX-EW	New Project	35	300	2018
El Teniente new mine level	Codelco	Chile	Conc	Expansion	432	5,100	2020/21
El Tesoro (Encuentro Oxidos)	Antofagasta	Chile	SX-EW	Expansion	50	636	Q4 2016
Esperanza (2nd concentrator)	Antofagasta	Chile	Conc	Expansion	140	2,700	Post-2019
Frieda River	Guangdong Rising Asset Mgmt	Papua New Guinea	Conc	New Project	125	1,700	na
Galore Creek	Teck/Novagold	Canada	Conc	New Project	154	na	na
Golpu (Stage 1)	Harmony (50%)	Papua New Guinea	Conc	New Project	80	2,600	2023
Haquira	First Quantum	Peru	Conc	New Project	190	na	na
Inca de Oro	Guangdong Rising Asset Mgmt/Codelco	Chile	Conc	New Project	50	na	na
Koksay	KAZ Minerals	Kazakhstan	Conc	New Project	80	na	na
Los Pelambres	Antofagasta	Chile	Conc	Expansion	95	1,600	Post-2019
Michiquillay	na	Peru	Conc	New Project	155	700	na
Olympic Dam	BHP Billiton	Australia	Conc/SX-EW	Expansion	225	na	2025
Oyu Tolgoi Underground	Rio Tinto	Mongolia	Conc	Expansion	250	4,400	2021
Project Corridor	Goldcorp/Teck	Chile	Conc	New Project	190	3,600	na
Pumpkin Hollow	Nevada Copper	United States	Conc	New Project	125	1,000	2019
Quebrada Blanca Phase II	Teck	Chile	Conc	Expansion	200	5,600	na
Quellaveco	Anglo American	Peru	Conc	New Project	225	na	na
Radomiro Tomic Sulphides	Codelco	Chile	Conc	Expansion	354	5,400	Post-2020
Roseby (Little Eva)	Sichuan R'way Invstmt/ Altona	Australia	Conc	New Project	39	232	2019
Rosemont	HudBay	United States	Conc	New Project	110	1,226	2020?
Schaft Creek	Teck/Copper Fox Metals	Canada	Canada	New Project	105	3,257	na
Sierra Gorda Phase II	KGHM/Sumitomo	Chile	Conc	Expansion	100	na	2020
Serrrote	Aura Minerals	Brazil	Conc	New Project	30	420	na
Taca Taca	First Quantum	Argentina	Conc	New Project	244	3,000	na
Tampakan	Indophil Resources	Philippines	Conc	New Project	375	5,900	na
Tia Maria	Southern Copper	Peru	SX-EW	New Project	120	1,400	na
Toquepala concentrator	Southern Copper	Peru	Conc	Expansion	100	1,200	Q1 2018
Toromocho	Chinalco	Peru	Conc	Expansion	75	1,320	na
Twin Metals	Antofagasta	United States	Conc	New Project	82	na	Post-2020
Victoria	KGHM	Canada	Conc	New Project	15	na	2021
Zafranal	Teck 50%/AQM Copper	Peru	Conc	New Project	54	na	na
Zone 5	Cupric Canyon Capital	Botswana	Conc	New Project	50	350	H1 2018

*Recent CAPEX figures not yet available for some operations.

Source: GFMS, Thomson Reuters

THOMSON REUTERS

EIKON™

MORE CONTACTS. BETTER OPPORTUNITIES.

Connect to more opportunity easily via the world's largest financial directory on Thomson Reuters Eikon™ Messenger. It's a secure, open and free instant messaging network.

Sign up for your free Instant Messaging account today.
thomsonreuters.com/messaging

© 2014 Thomson Reuters 1006439/4-14
Thomson Reuters and the Kinesis logo are trademarks of Thomson Reuters.

THOMSON REUTERS™

5. CORPORATE ACTIVITY AND MINE ECONOMICS

Metals & Mining M&A deal value down by **7%** to **$42.6bn**

315 transactions in 2015 vs **482** in 2014

Spinoffs and **divestments** dominate activity

$254bn capital raised, a **15%** fall year-on-year

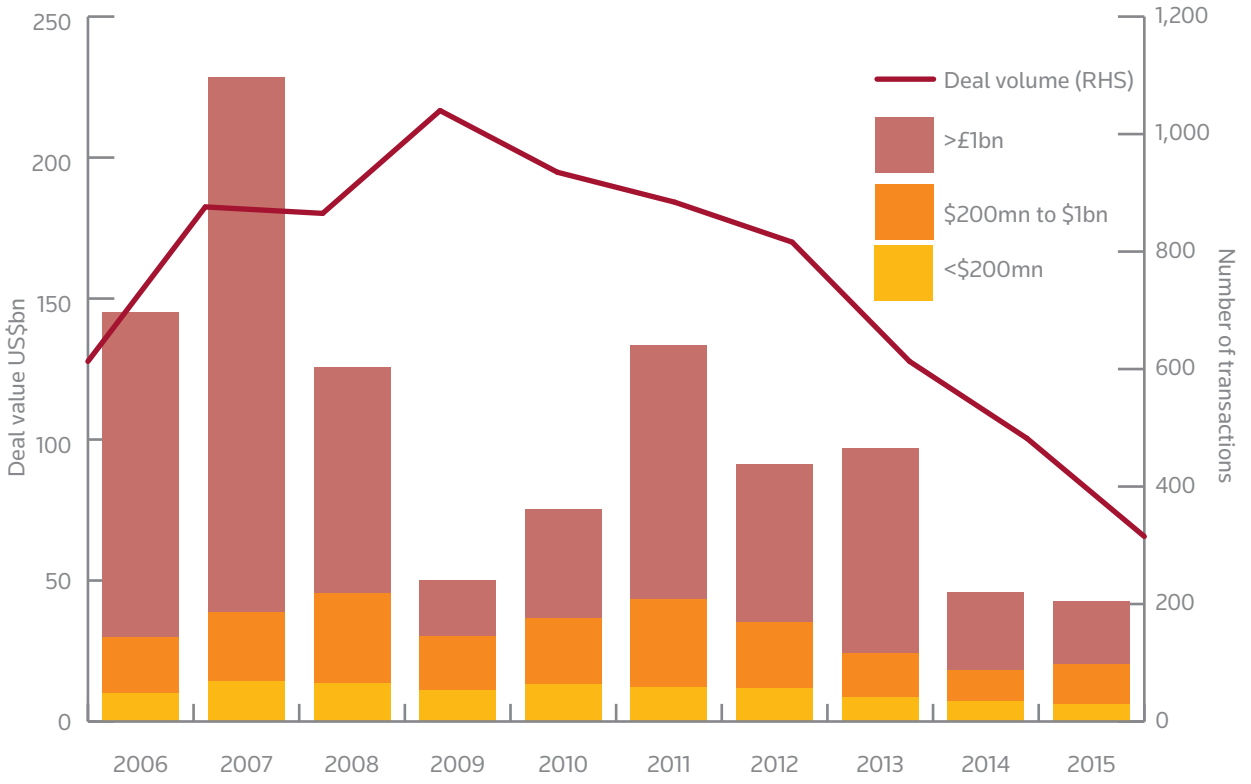
CORPORATE ACTIVITY AND MINE ECONOMICS

Deal activity in 2015 continued to trend lower with M&A transactions in the metals and mining space at a combined $42.6 billion, a 7% or $3.4 bn drop from the previous year. The number of transactions was, likewise, on the decline, with a total of 315 deals versus 482 in 2014. To be clear on methodology, we only include deals in which either the acquirer or the target are classified by Thomson Reuters in the "Metals and Mining" industry group. Metals and Mining is one of 52 industry groups defined within the M&A database. This group includes: Precious Metals, Steel, Aluminium and Mining/Mining-Speciality; the latter includes, among others, copper, lead, zinc, iron ore, diamonds and uranium.

Despite the fall year-on-year, intra-year there were some positive trends. Transaction numbers, for instance, on a quarterly basis, increased from a low of 68 in the first quarter to a high of 88 deals in the final quarter. Similarly, deal value increased from $3.8 bn in the first quarter 2015 to $14.4 bn in Q4 2015, a figure 30% above the two year quarterly average. The positive trend, in the main, however, was linked to an increase in spinoffs and divestments. Our analysis shows that these two categories accounted for a record 33% of total deal value in 2015, up from 25% in 2014, and significantly above the long term average of 16%. The rationale in the uptick over the last two years explained by a mix of focusing scarce capital and management resources in higher quality, higher margin assets and strengthening balance sheets. A further, perhaps not surprising trend has been the decline in value of M&A within the oil and gas sector. On our numbers, investment peaked in the sector in 2011 (at $20 bn), dropping over the next four years by just under $5.0 bn per annum, such that in 2015, deal value amounted to a modest $0.5 bn.

Moving away from oil and gas and looking at the broader range of target commodities (EIKON

VOLUME AND VALUE OF DEAL BY SIZE (2006-2015)



Source: Thomson Reuters

classifies 124 different industries at this fourth level) gold, copper and iron ore are the biggest contributors, accounting for 45% of total cumulative deal value on a 10 year basis. For 2015, gold was the most targeted commodity by value, with a 31% share or $13.2 bn (up from $9.6 bn in 2014) with copper a close second with 28% or $12.1 bn of the total purse (up from $10.7 bn in 2014). Lastly, iron ore recovered from $0.6 bn in 2014 to $3.6 bn in 2015.

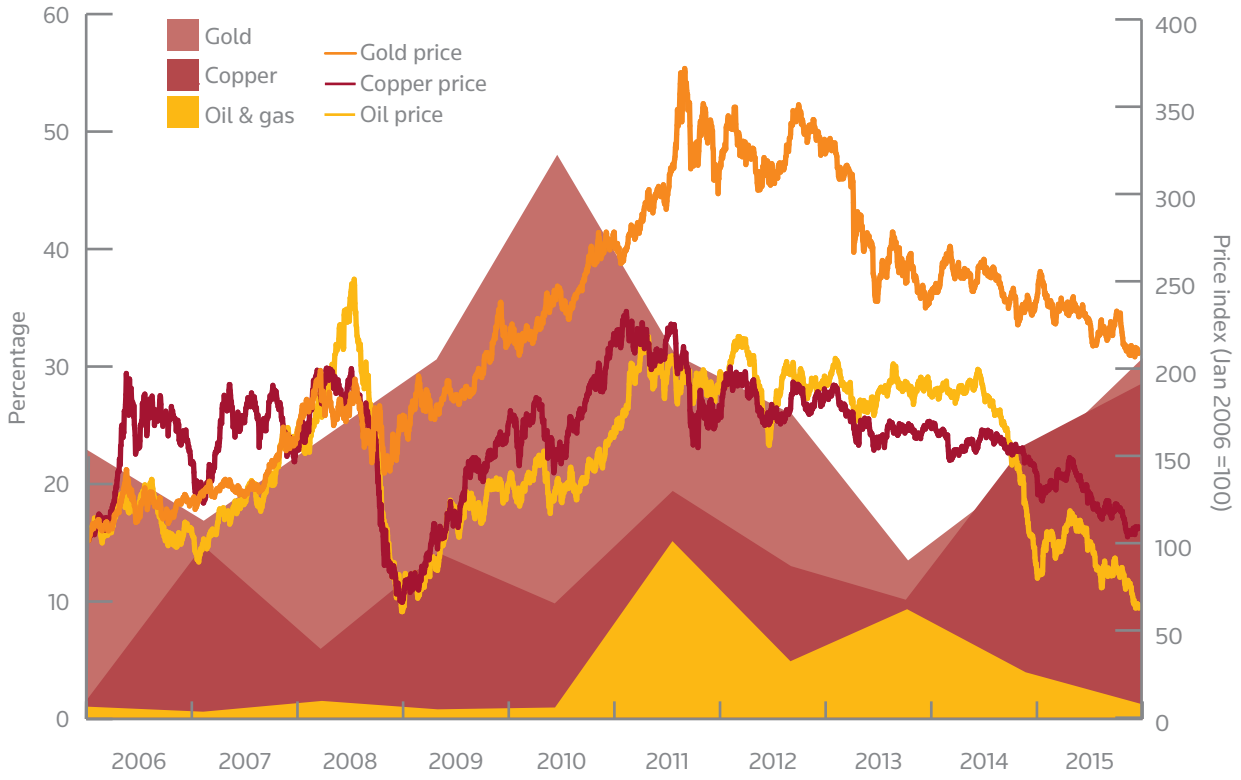
As mentioned above, some of the biggest deals in 2015 were triggered by miners wanting to shore up balance sheets or spin off non-core assets, and of the 16 deals outlined in the table, seven were in this category with a combined value of $13.3 billion. Three deals, all in the gold sector, were friendly stock swaps to "combine operations and expertise and strengthen balance sheets". Two deals resulted in the target company delisting, Polyus Gold and PanAust. A further two, a copper mine (Anglo American Norte) and a niobium mine (Iamgold) were purchased by investor groups.

CAPITAL RAISED BY ASSET CLASS AND INDUSTRY SECTOR

Not surprisingly, falling commodity prices and elevated risk were not supportive of fresh capital raising. Last year was another challenging one for the industry with proceeds declining by $43.1 billion, or 15% year-on-year to $254 bn. There were year-on-year falls from proceeds raised by IPOs, convertibles, bonds and syndicated loans. Unfortunately, and reflecting the tough market conditions, the only increase was noted in proceeds from follow on, or equity issuance, the most expensive and dilutive option of near-last resort, which recorded a $20.1 bn or 69% increase year-on-year.

Looking at the split of capital raised across the four sectors, Steel accounted for more than half at 51.1%, Precious Metals 22.8%, Mining/Metals-Speciality 14% and Aluminium 12.2%. The only sector to record an increase in proceeds raised was in the Precious Metals space, with a $6.0 bn increase year-on-year. The biggest decline was in the Mining/Metals-Speciality sector with

SHARE OF TOTAL DEAL VALUE BY TARGET COMMODITY - GOLD, COPPER AND OIL & GAS



Source: Thomson Reuters

MAJOR M&A DEALS - PART 1

Deal	Announced	Completed	Value ($m)	Deal Value inc. Net Debt of Target	Target/Issuer	Buyers/Investors
1	Aug-14	May-15	8,719	9,378	BHP Billiton	Shareholders
2	Sep-15	Nov-15	5,384	5,705	Polyus Gold	Sacturino Ltd
3	May-15	Sep-15	1,413	1,367	Sirius Resources	Independence Group
4	Mar-15	Jul-15	1,268	1,394	RTI International	Alcoa
5	Jul-15	Sep-15	1,185	1,185	Mineracoes Brasileiras Reunidas (Vale)	FIP Multisetorial Plus II
6	Feb-15	Apr-15	1,068	1,055	Rio Alto Mining	Tahoe Resources Inc
7	Jul-15	Dec-15	1,005	1,005	Zaldivar mine (Barrick)	Antofagasta
8	Dec-13	Feb-15	862	862	Cemig GT-Power Assets	Vale SA
9	Jun-15	Aug-15	820	820	Cripple Creek & Victor Gold (AngloGold Ashanti)	Newmont Mining Corp
10	Apr-15	Jul-15	758	404	Alamos Gold Inc	AuRico Gold Inc
11	Mar-15	Jun-15	737	837	PanAust Ltd	Guangdong Rising HK
12	Jul-15	Oct-15	653	523	Romarco Minerals Inc	OceanaGold Corp
13	May-15	Jul-15	550	550	Cowal mine (Barrick)	Evolution Mining Ltd
14	Oct-14	Jan-15	530	530	Niobec Niobium (Iamgold)	Investor Group
15	Aug-15	Sep-15	500	500	Anglo American Norte SA	Investor Group
16	Nov-14	Feb-15	436	395	Virginia Mines Inc	Osisko Gold Royalties

Source: GFMS, Thomson Reuters

MAJOR M&A DEALS - PART 2

Deal	Deal Type	Rationale	Target Commodity	% Shares Acquired
1	Spin off	BHP spin off to focus on long life assets	Diversified	100
2	Going Private	Sacturino to strengthen and expand its business operations	Gold	59.78
3	Reverse takeover	Independence to strengthen its operations, diversify production	Nickel	100
4	Stock Swap	Alcoa to broaden its multi-material product suite	Ttitanium	100
5	Privately Negotiated Purchase	Vale to strengthen balance sheet	Iron ore	36.4
6	Stock Swap	Combine and strengthen operations and financials	Gold	100
7	Divestiture/Joint Venture	Barrick to strengthen balance sheet	Copper	50
8	Divestiture/Joint Venture	Consolidate power generation assets	Power	100
9	Divestiture	Anglogold Ashanti to strengthen balance sheet	Gold	100
10	Reverse Takeover	Combine and strengthen operations and financials	Gold	100
11	Going Private	Increase shareholder value	Copper	77.51
12	Stock Swap	Oceanagold to diversify asset base	Gold	100
13	Divestiture	Barrick Gold Corp to use the sale proceeds to pay down its debt	Gold	100
14	Divestiture	N/A	Rare Earth	100
15	Divestiture	Anglo American PLC to focus on its larger and more accretive assets	Copper	100
16	Stock Swap	Combine operational expertise, expand mining operations	Gold	100

Source: GFMS, Thomson Reuters

a reported 38% fall in proceeds raised from the prior year to $35 billion.

MINE ECONOMICS

For the 25 mining companies covered in our industry cost analysis - Copper Mine Economics on EIKON – we have aggregated financial results on a semi-annual basis to examine industry trends. Perhaps not surprisingly, most financial statement metrics have deteriorated on a year-on-year basis. Based on the half year to June 2015 (at the time of writing not all of the stocks under coverage had reported financials), EBITDA had dropped by 5% from the prior year, while normalised income after taxes was $7.3 bn, a $15.8 bn or 68% fall year-on-year.

Turning to the cash flow statement, H1 2015 operating cash flow for the 25 miners at $36.7 bn

represented a four year low. However, new lows were also recorded in investing cash flow, such that free cash flow "only" dropped by $4.8 bn, or by 44% year-on-year. The two biggest "levers" for reducing investing cash flow – acquisitions and capital expenditure – are obviously areas of intense focus for management. This is especially the case as shareholder pressure has seen cash dividends (until recently) hold up at fairly consistent levels (at around $12 bn on a semi-annual basis for the last four years).

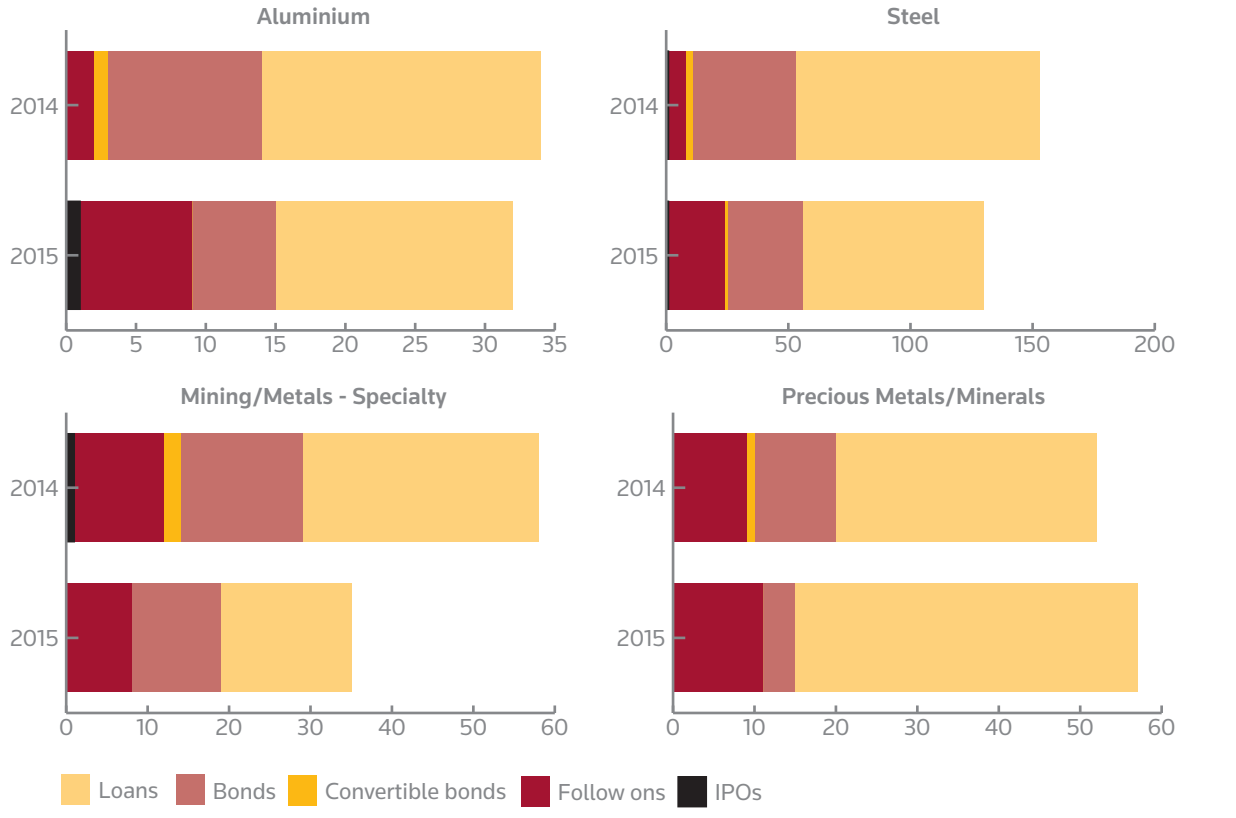
While not as widely reported as cuts to big ticket capital items and sustaining capex, improved management of working capital is also evident. Changes in working capital for the 25 copper producers in our analysis amounted to a negative $0.8 bn (i.e. a net funding requirement) for the six months to June 2015, compared to negative $7.9 bn in H1 2014 and negative $4.9 bn in H2 2014. The focus on improved supply chain management to free up cash is a trend, in our view, that is likely to continue, as the rapid fall in commodity prices has left miners stuck with very expensive inventory and spares. Producers need to monetise that inventory, and going forward need to better manage buying it.

Maintaining dividend payments, by cutting capital and doing more to managing working capital, is, of course, preferable to borrowing money to pay dividends. And while ramping up debt to pay dividends is a minority pursuit, overall, increased borrowing and returns of capital to shareholders are increasing leverage. From H1 2012 to date the gearing ratio (debt to equity) has increased from 34% to just over 70%. Net debt to EBITDA, meanwhile has, over the same time period, increased from 2.4x to 6.4x.

Taking advantage of low interest rates by rolling over long-term borrowing and taking on higher debt levels is all well and good while commodity prices are relatively stable. The collapse in commodity prices in 2015 early 2016, however, and the risk of Fed rate hikes, creates the possibility of a double negative for some miners as dollar revenues collapse, and interest repayments on dollar denominated debt balloon.

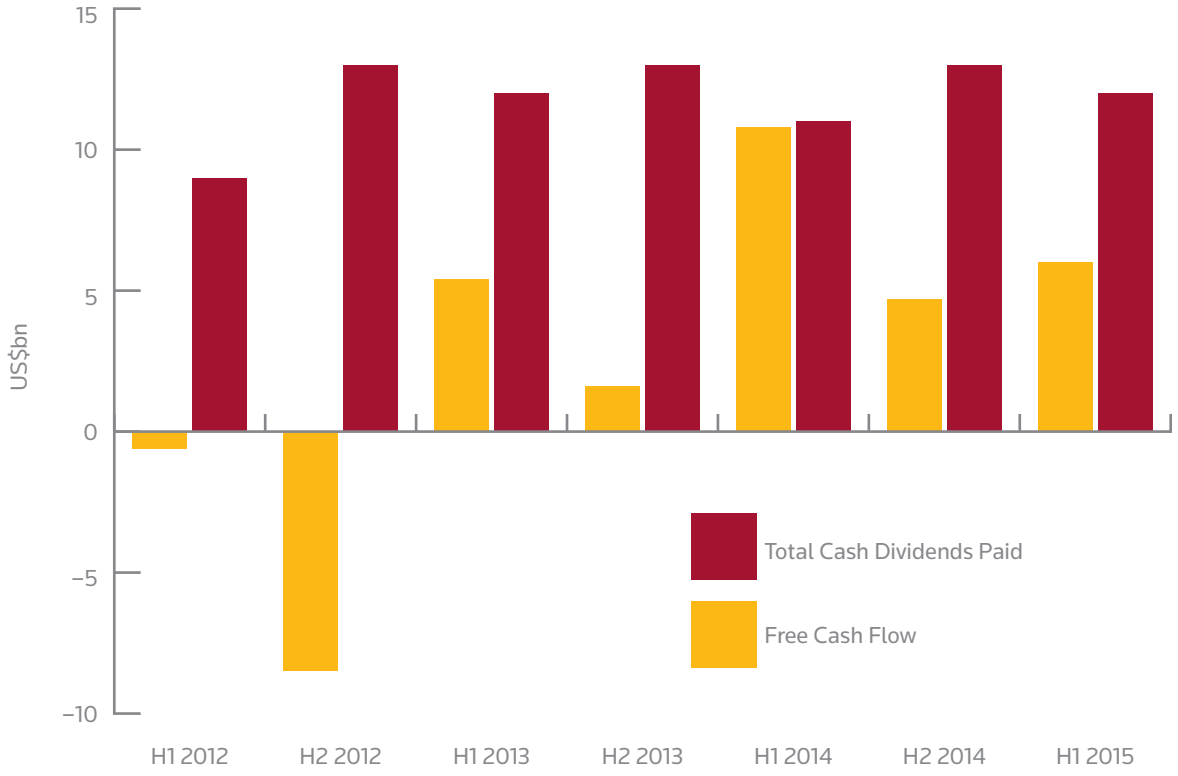
At $11.4 billion, impairment charges in H1 2015 were only slightly lower than the $11.7 bn recorded in the six months to December 2014. However, the relative levels of capex across the two periods

CAPITAL RAISED BY SECTOR AND ASSET CLASS (US$ BN)



Source: Thomson Reuters

AGGREGATED FREE CASH FLOW (GFMS MINE ECONOMICS COVERAGE)



Source: Thomson Reuters

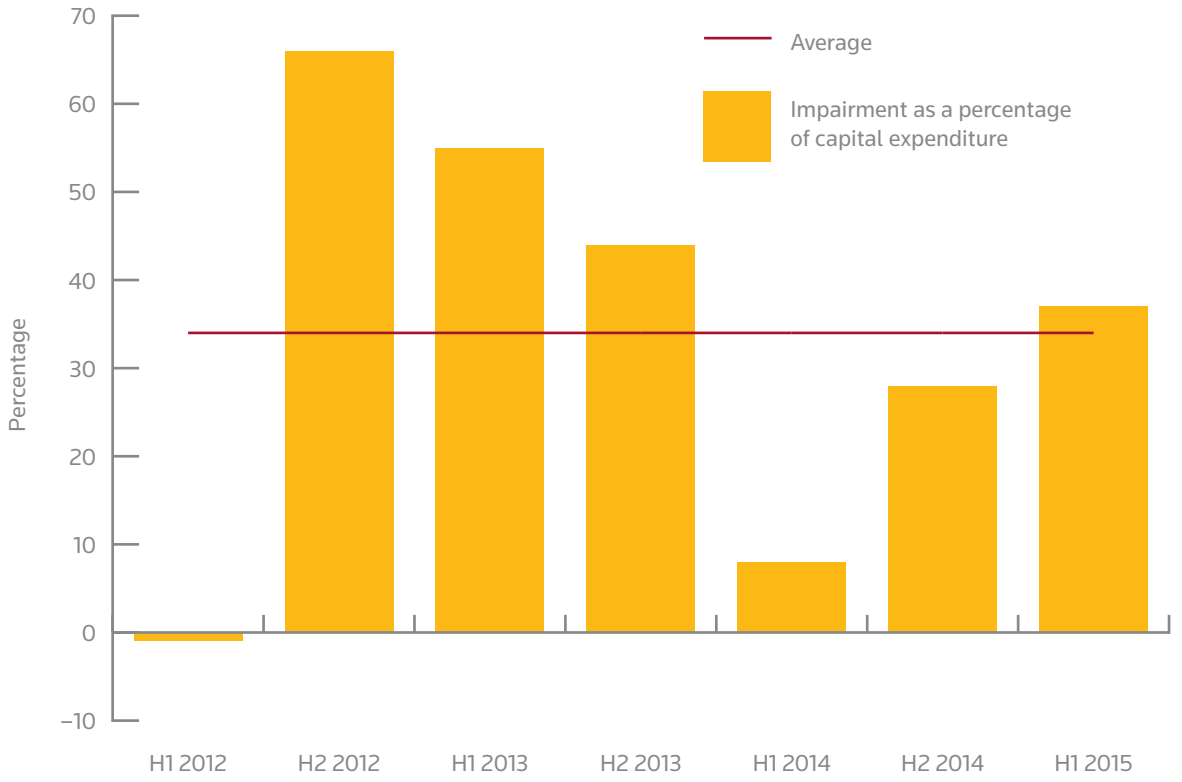
meant that impairments as a proportion of capital expenditure increased fairly sharply from 28% to 37%, and were above the four-year average of 34%. Furthermore, declining ratios of market capitalisation to tangible book value confirms negative investor sentiment in the mining sector and also indicates that impairment testing for the full year may result in further write downs.

Notwithstanding the risk of year-end impairments, unless write downs are significantly above the recent level, the sector looks "cheap". Using aggregated market values (spot basis at the time of writing) the price to tangible book value of the 24 miners (we exclude state owned Codelco) is 0.9x, compared to a four-year average of 1.8x. To be clear, in our analysis Tangible book value (common stock) represents Total Equity less: goodwill, intangibles, and preferred stock. Tangible common equity is considered the most conservative valuation of a company and the best approximation of the company's value should it be forced to liquidate.

The sector-wide price to book (P/B) ratio of 0.9x however, masks a wide divergence within the coverage stocks. The two key components of variation across the mining space are financial leverage (described by EV/EBITDA) and operational leverage (described by EBITDA margins). Stocks with the highest financial gearing (high EV/EBITDA ratios) tend to have the lowest P/B multiples, while stocks with the highest EBITDA margins (lowest operational leverage) are trading at the higher P/B ratios.

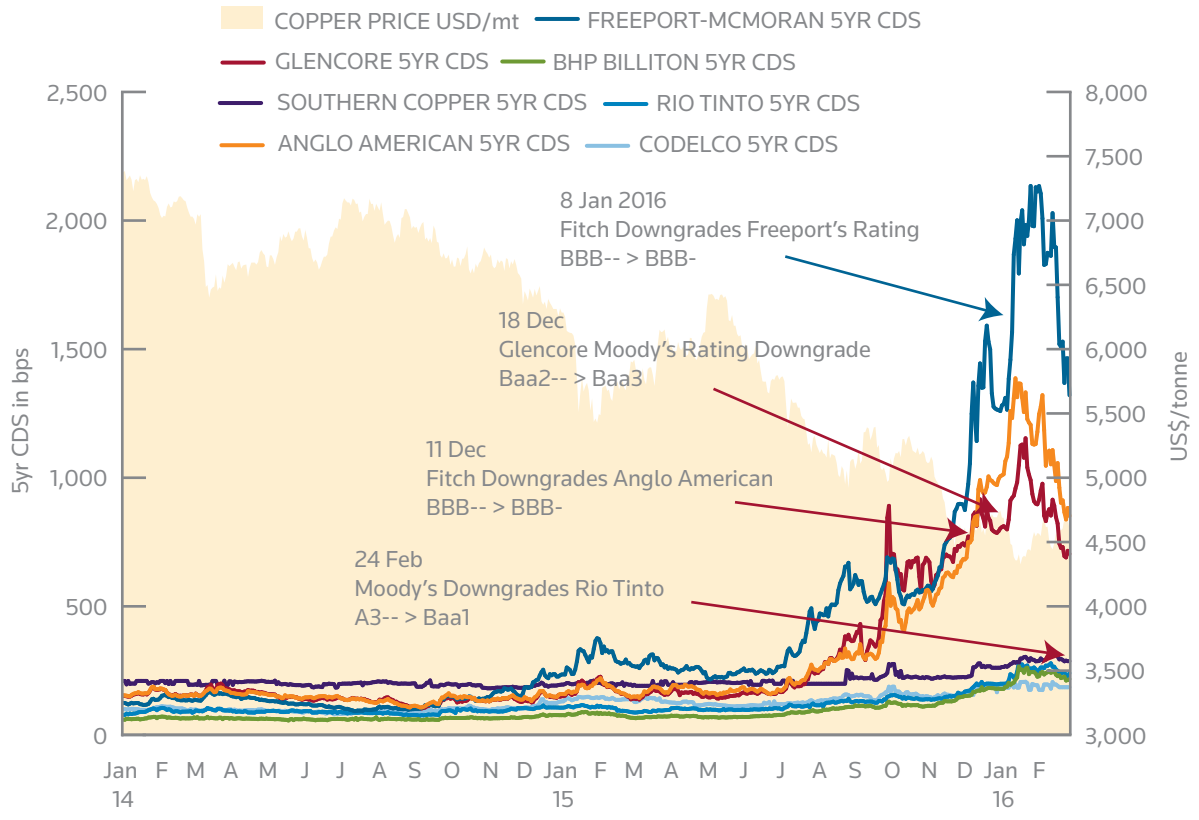
For the purpose of benchmarking Codelco, the world's largest copper miner, we have included the state-owned company in this valuation analysis. To generate a P/B we have to estimate an implied market value for the stock (as the company is not listed). In brief we use the average EV/EBITDA ratio for 24 listed mining stocks and then use this to calculate an EV for Codelco. We then add back net debt and the minority interest to calculate the group's "market capitalisation". With regard to financial leverage (net debt to EBITDA) Codelco ranks 18 out of 25 (where 1=lowest financial leverage). Regarding the operational leverage, Codelco ranks 19 out of 25 (where 1= lowest leverage or highest EBITDA margin).

AGGREGATED IMPAIRMENT AS A % OF CAPITAL EXPENDITURE (GFMS MINE ECONOMICS COVERAGE)



Source: Thomson Reuters

MAJOR MINERS 5Y CREDIT DEFAULT SWAP (CDS) AND ISSUER RATINGS



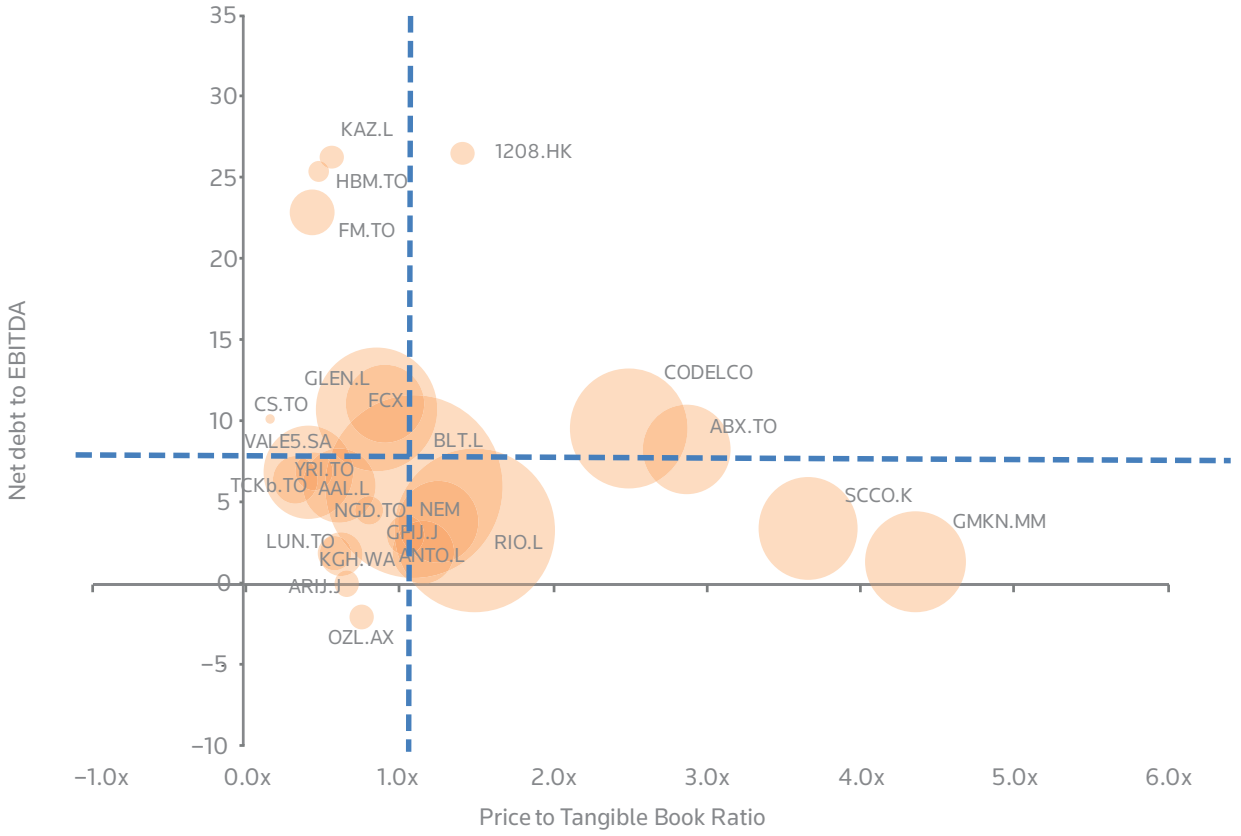
Source: Thomson Reuters

AGGREGATED FINACIAL RESULTS (GFMS MINE ECONOMICS COVERAGE)

	H1 2012	H2 2012	H1 2013	H2 2013	H1 2014	H2 2014	H1 2015
Aggregate market capitalisation	733.3	745.1	604.3	642.2	655.4	533.8	435.4
Aggregated income statement							
Total revenue	260.9	265.1	249.0	278.7	246.3	245.7	188.6
Total operating expense	212.0	257.7	229.2	250.2	210.1	228.0	185.1
Operating Income	48.8	7.4	19.8	28.4	36.2	17.7	3.5
Net finance cost	–2.8	–1.5	–7.3	–4.0	–0.1	–11.5	–7.0
Other, net	–0.9	–1.0	–0.4	–2.9	–0.8	–0.7	–0.2
Net income Before taxes	45.1	4.9	12.1	21.5	35.3	5.5	–3.7
Income tax expense	9.3	5.1	10.7	14.6	12.0	7.5	2.3
Net Income After Taxes	35.9	–0.2	1.4	6.9	23.3	–2.0	–6.0
Minority interests, Equity in Affiliates	–3.0	–1.7	–1.8	0.5	–1.6	–1.2	–0.8
Net Income Before Extra. Items	32.9	–1.8	–0.4	7.4	21.7	–3.2	–6.9
Extradordinary items	0.4	–2.5	–0.9	–1.4	0.2	–2.3	0.6
Net income	33.3	–4.4	–1.3	6.0	21.9	–5.5	–6.3
Normalised income After taxes	24.3	19.4	8.9	19.0	23.1	7.3	7.3
Normalised income available to Com.	21.6	18.1	7.3	19.6	21.5	6.2	6.6
Normalised EBIT	45.1	46.8	42.8	49.1	40.2	29.8	16.8
normalised EBITDA	59.5	63.1	57.4	68.3	60.9	52.1	38.1
Year–on–Year change revenue	—	—	–5%	5%	–1%	–12%	–23%
Year–on–year change EBITDA	—	—	–4%	8%	6%	–24%	–37%
EBITDA margin	23%	24%	23%	25%	25%	21%	20%
Aggregated cash flow statement							
Operating Activities	44.0	46.1	50.6	51.4	48.3	45.9	36.7
Investing activities	–47.0	–67.9	–47.9	–41.6	–34.2	–35.6	–30.4
Financing activities	0.6	24.8	–0.6	–7.3	–12.5	–15.4	–7.1
Free Cash Flow	–0.6	–8.5	5.4	1.6	10.8	4.7	6.0
Aggregated balance sheet							
Property, plant and equipment	479.5	502.1	569.5	571.4	589.3	575.7	542.9
Other assets	347.1	366.5	357.2	354.1	355.9	324.7	309.4
Total assets	826.5	868.6	926.7	925.4	945.2	900.4	852.2
Total liabilities	405.8	456.5	512.5	517.1	524.2	517.6	505.9
Total equity	420.7	412.1	414.2	408.3	421.0	382.8	346.3
Net debt	142.7	184.2	230.8	232.6	239.4	239.5	244.3
Tangible Book Value, Common Equity	370.5	365.2	361.7	361.5	373.2	339.5	304.6
Net debt/EBITDA	2.40	2.92	4.02	3.40	3.93	4.60	6.41
Price to tangible book value ratio	2.02	2.08	1.70	1.81	1.79	1.60	1.46
Gearing ratio	34%	45%	56%	57%	57%	63%	71%

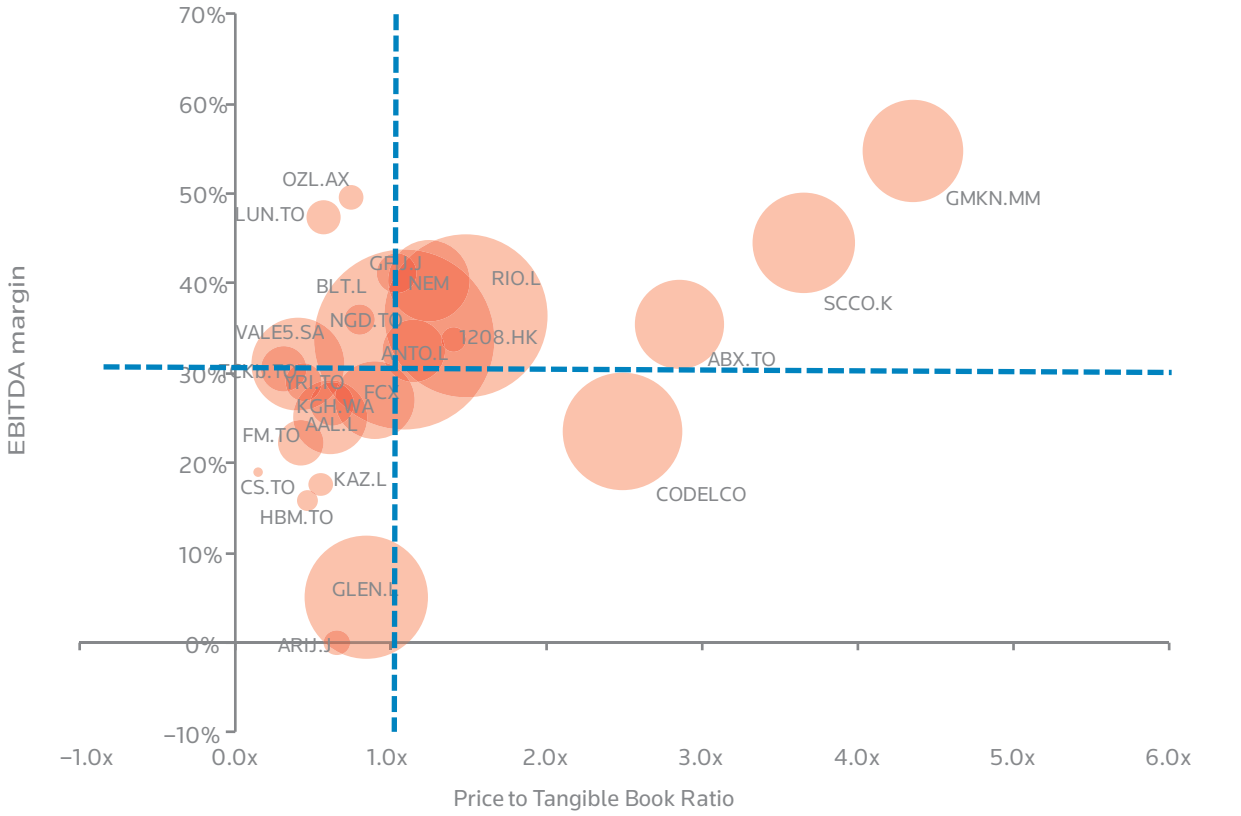
Source: GFMS, Thomson Reuters

PRICE TO TANGIBLE BOOK VS. FINANCIAL GEARING



Source: Thomson Reuters

PRICE TO TANGIBLE BOOK VS. OPERATIONAL GEARING



Source: Thomson Reuters

THOMSON REUTERS

EIKON™

GFMS Copper Market Research and Forecasts

SEEK MORE

Dig deeper into the copper market with GFMS research and forecasts on Thomson Reuters Eikon. Use the new GFMS copper pages to quickly understand the key drivers behind market movements. See which factors drove price performance in the past, what will drive the evolution of these markets in the future, and what is happening inside these sectors today.

GFMS copper pages include:

- Historical supply and demand statistics
- Forecasts of supply, demand and price
- Field research reports on key markets
- Exclusive analyst commentaries giving expert insight on news and market development

To find out more contact us on commoditiesenergy@thomsonreuters.com

For more information visit thomsonreuterseikon.com

© 2014 Thomson Reuters. 1006308 03/14.

THOMSON REUTERS™

6. REFINED & CONCENTRATES

2015 global refined output up, **2.3%**

Record Chinese concentrate imports up **12%**

2016 TC/RCs down **9%**, spot terms fall further

Refined copper output growth pace slows

REFINED COPPER OUTPUT GROWTH PACE SLOWS

Global refined copper production continued to grow last year to reach a record 22.2 million tonnes. However, the 2.3% pace of that rise, which was aided by generally ample concentrate supply and high processing charges, was below the annual average of approximately 3% seen over the past decade, and relatively sedate at less than half the near-5% increase in 2014.

Within this we estimate that output of primary copper from concentrate grew by close to 4% last year, while cathode output from SX-EW plants rose by a paltry 0.2% and secondary production contracted slightly amid, among others, slower output in China, particularly towards year-end. Looking ahead to 2016, the respectable 3.5% rise in global copper mine output last year is expected to help facilitate another year of refined production growth even as the copper mine cutbacks announced towards the end of last year start to register. The curbs at SX-EW operations will make further inroads while generally tight scrap supply will see secondary output post another modest decline.

Among the curtailments to date at a number of SX-EW operations, the most notable has been at Glencore's Katanga operation in the Democratic Republic of Congo (DRC), which has fed straight through to the bottom line. Curbs at others have taken somewhat longer to filter through.

Predictably, meanwhile, China was again responsible for the bulk of the growth in global refined output last year despite being pegged back by the deferral of some new smelters and expansions to existing capacity along with pronouncements over curtailments. The country produced an estimated 7.4 million tonnes of copper cathode in 2015, accounting for around one-third of the global total.

Record Chinese imports of copper-in-concentrate played a key role in this rise, against the backdrop of the highest benchmark concentrate treatment and refining charges (TC/RCs) since their peak ten years earlier.

CHINA CONCENTRATE IMPORTS HIT NEW RECORD

China's imports of copper-in-concentrate rose by more than 12% last year, falling just short of four million tonnes. The world's largest copper mining nation Chile inevitably remained by far the main source of concentrate supplies to China, accounting for 28% of the total, up from 25% in 2014. Chinese imports from Chile jumped by 27% to 1.12 million tonnes from a little over 880,000 tonnes in 2014.

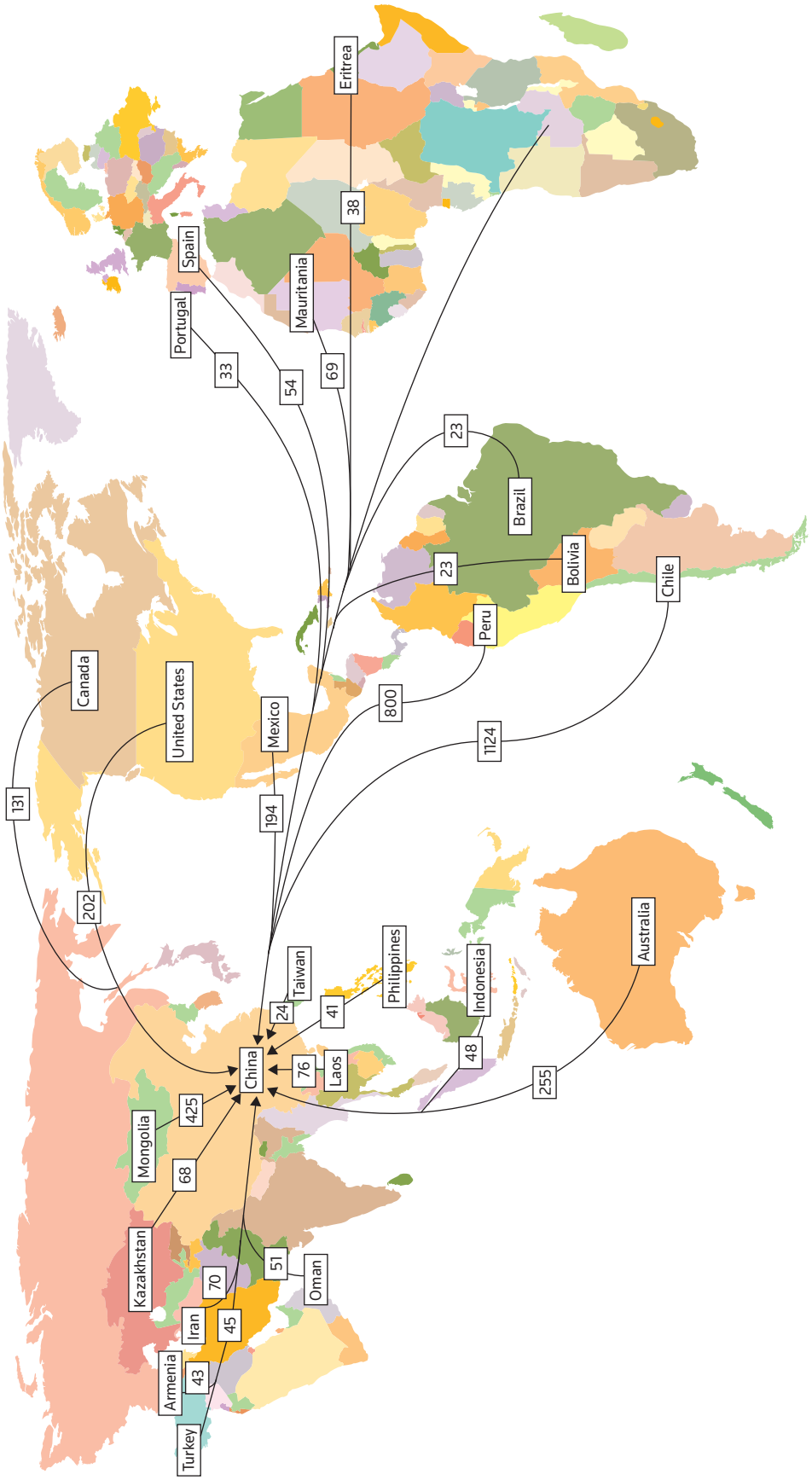
During the early part of last year it emerged that Chile's state-owned Codelco, the world's biggest producer was not, as previously feared, having problems finding a home in China for concentrate that had been blended due to high impurities. The company has had to blend high-arsenic concentrate from its Ministro Hales mine to be able to supply cleaner grades to Chinese

REFINED PRODUCTION BY REGION

000 tonnes	2010	2011	2012	2013	2014	2015
North America	1,664	1,708	1,654	1,715	1,813	1,883
South America	3,897	3,715	3,420	3,405	3,343	3,307
of which Chile	3,244	3,092	2,902	2,755	2,729	2,688
Europe	3,648	3,796	3,821	3,677	3,788	3,764
Asia	8,483	8,942	9,578	10,132	10,897	11,382
of which China	4,541	5,162	5,670	6,292	6,885	7,350
of which Japan	1,549	1,328	1,516	1,468	1,555	1,467
Africa	870	960	1,057	1,275	1,359	1,388
Oceania	424	477	460	481	509	487
Total Refined Production	**18,985**	**19,598**	**19,990**	**20,685**	**21,708**	**22,212**
	4.0%	**3.2%**	**2.0%**	**3.5%**	**4.9%**	**2.3%**

Source: GFMS, Thomson Reuters

MAJOR TRADE FLOWS IN COPPER CONCENTRATE TO CHINA IN 2015



Figures provided refer to "thousand tonnes of copper-in-concentrate" and were calculated using gross concentrates trade data, adjusted with exporting country's average concentrate grades

Source: National Statistics, GTIS; GFMS, Thomson Reuters

smelters, given China's restrictions on imports of material containing more than 0.5% of the deleterious element.

Codelco's roaster, which has been designed to remove arsenic, experienced some teething problems, but these were understood to have been resolved later in the year. Indeed, by last August the roaster was said to be operating slightly above design capacity, with the company eyeing a second roaster, which could provide a processing service to third parties, in addition to being used for ore from Ministro Hales and the nearby Chuquicamata mine.

A 26% surge in Peruvian mined concentrate output, boosted by new mines and expansions, facilitated a jump of almost one-third in this nation's exports of copper in concentrate to China to 800,000 tonnes last year. Looking ahead to 2016, a similar story looks set to play out in terms of the country's influence on the trade picture, with another year of strong mine output growth on the cards. Bearing this out, official data showed that Peruvian copper mine output jumped by 41% year-on-year in January 2016. The new Las Bambas mine will play a key role. Owner MMG announced in early January that the huge mine, the start-up of which seems to be running smoothly so far, made its first shipment of concentrate from the port of Matarani in mid-January, with China its destination. Las Bambas, which eventually will produce 400,000 tonnes per annum of contained copper, is expected to produce some 250,000-300,000 tonnes this year, though we are currently erring slightly on the side of caution.

Now that the Oyu Tolgoi mine in Mongolia is firmly up and running at a steady rate, the country appears to have become firmly established as China's third largest supplier of concentrate. However, now that earlier teething problems have been ironed out, its growth in exports moderated to a 5% increase last year from 2014 to reach an estimated 425,000 tonnes of contained copper.

Elsewhere among significant China's most significant copper concentrate suppliers, exports from Australia were 12% lower year-on-year, 16% lower from Mexico, 13.5% lower from Canada and 9% higher from the United States. A 43% decline in imports from Kazakhstan can no doubt be ascribed to the restart of the previously suspended Zhezkazgan smelter, though at 68,000 tonnes the volumes involved are relatively small.

Though also not a high ranking supplier, a 733% rise in Chinese imports from Iran to almost 70,000 tonnes merits an honourable mention, helped in part by a double-digit rise in mine output and a dip in refined production. As Iran emerges from global economic isolation with the lifting of western sanctions in return for curbs on its nuclear programme, China continues to seek even closer ties with the country. Among other minerals, Iran is known to have rich deposits of copper and while their development is likely to take time, China may well be at the forefront, significantly viewing Iran as a key part of its One Belt One Road initiative.

BENCHMARK TC/RCS BEAT RETREAT; STILL HIGH BY HISTORICAL STANDARDS

Benchmark treatment and refining charges (TC/RCs) for 2015 were agreed between miners and smelters at $107/tonne and 10.7 cents/lb, falling just short of the $112.5/tonne and 11.25 cents/lb peak achieved ten years earlier.

While global mine output increased by a modest 2.1% in 2014, a far cry from the 8% jump in 2013, smelters still won a 16% increase from 2014 benchmark terms last year, citing ample concentrates and the prospect of a continued wave of new mine supply.

The negotiation process has become rather more disjointed in recent years, though, particularly with the advent of concentrate with higher levels of impurities, which command higher smelter charges.

Spot terms for standard clean concentrate for China meanwhile, which started last year where they left off in 2014 at $127.5/tonne, and their highest since early 2011, generally trended lower through to August. A series of maintenance closures at major smelters reduced concentrate demand, although spot terms fell below $90/tonne and stayed there for much of the third

quarter. Approaching the end of 2015, terms rose towards the year's benchmark as smelters reduced purchases ahead of talks on term shipments.

BENCHMARK 2016 TERMS SETTLE 9% LOWER

Last December, the industry also learnt that China's Jiangxi Copper and Antofagasta had agreed to benchmark terms for 2016 of $97.35/tonne and 9.735 cents/lb, 9% lower than for 2015.

Less surprising than the benchmark level reached perhaps was the fact that Antofagasta is not normally known as a trend setter in such talks. Nevertheless, subsequent deals, such as that between Freeport McMoRan and Japan's Pan Pacific Copper have followed suit. As was the case last year, terms for blended material from Codelco's Ministro Hales mine reportedly were settled at $10/tonne and 1c/lb above the 2016 benchmark.

The benchmark terms were agreed against a backdrop of global mine output which, it turned out, had outpaced average annual growth over the past decade or so in 2015, despite a year of considerable ups and downs. The estimated 3.5% rise was achieved, despite adverse El Niño-related weather conditions for several countries, including Chile, particularly in the first part, and some high profile price-related cutbacks in the second half.

Cutbacks by miners approaching 700,000 tonnes on an annualised basis, though involving in some instances SX-EW cathode output, helped to swing the balance more in miners' favour than the previous year.

Since the start of 2016, spot charges have been under more concerted pressure, against a backdrop of widespread expectation of further deeper cutbacks by miners. Curtailments mooted by smelters, meanwhile, primarily concerning the 350,000 tonnes announced by a group of Chinese producers, have been treated with greater caution. Spot terms at time of writing were reported at around $80/tonne, more than 20% below levels seen at the end of last year and at around their lowest since Q3 2013. Interest for concentrates was said to be strong as players returned after the Chinese Spring Festival.

It is early days yet, but if our current expectation of lower mine supply growth pans out this year charges are likely to remain broadly under pressure, and set the tone for next year's benchmark.

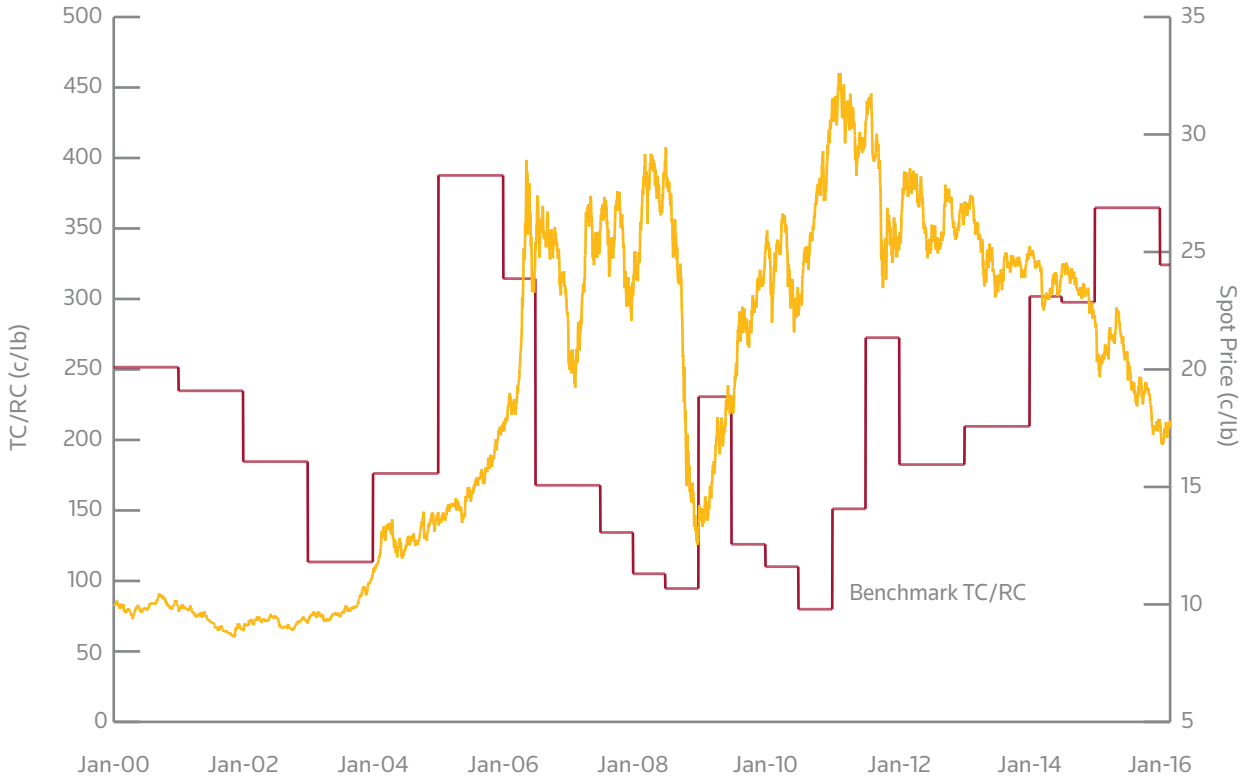
THE UPS AND DOWNS IN REFINED PRODUCTION

As noted earlier, the growth in world refined copper production last year was driven once again by the continued expansion of smelting and refining capacity in top producer China. Partly offsetting this were declines in several of the world's other large producing nations including Chile and Japan and well-documented problems at plants in the United States (Kennecott), Indonesia (Gresik) and Australia (Olympic Dam). Looking to 2016, we expect another year of growth, albeit at 1.3% somewhat lower than the annual average rate of the past decade as further cutbacks rein it back.

We estimate that Chinese output rose by almost 7% last year. Growth was still strong despite a number of significant maintenance closures, project delays, production problems and some constraints on secondary output from tight scrap supply. On a gross weight basis, Chinese imports of scrap were almost 6% lower year-on-year, while growth in domestic scrap generation also fell, particularly in the final months of the year as the decline in copper prices accelerated.

This year, the ongoing ramp-up of two new smelters commissioned in the final quarter of last year, owned by Dongying Fangyuan and Zijin Hunchun Copper, will continue to make a positive contribution. In addition to these two plants with combined capacity of 400,000 tonnes per annum (tpa), production this year is also expected to be boosted by the addition of more than half a million tpa of new capacity, including 200,000 tpa by China Gold at Sanmenxia. We currently take the view that, if they materialise, the cutbacks announced late last year for 2016 by nine large Chinese copper smelters will fall significantly short of the 350,000 tpa minimum announced late

TC/RCS AND THE COPPER PRICE



N.B. TC/RCs are expressed on a combined basis not including price participation.
Source: Thomson Reuters

last year. The uptick in prices in place at time of writing is likely to remove some of the pressure, with large producers likely to have hedged and locked in profits. Maintenance closures in the first half of this year may well be dressed up as cutbacks, but production growth is likely to gather momentum in the latter half.

One of the most significant developments outside China in the final months of last year, which will have a far more significant impact in 2016, was Glencore's decision in September to close its Katanga (Luilu) SX-EW operation in the DRC for a period of "up to" 18 months as part of a broader response to falling prices. This proved a watershed moment in underlining the need for more concerted producer reaction than those that had been seen until that point.

Despite all the excitement, however, DRC's total refined copper output still posted a small increase last year. The Luilu facility produced 114,000 tonnes of metal in 2015, down 28% from 158,000 tonnes the preceding year. As it stands there are no plans for production from the site in 2016. During the closure the company has stated its aim to continue with the planned $880 million investment, part of which was destined for ongoing processing plant upgrades, with a view to improving copper recoveries and reducing operating unit costs once processing restarts. The "Whole Ore Leach" project will leave the facility far better placed to face any subsequent price downturns. In light primarily of Luilu's closure, we are looking for DRC output to fall by some 14% this year. Partly offsetting this will be the new small- to mid-sized Sicomines operation as it continues its ramp-up. Sinohydro Corp and China Railway Group have pledged to plough $3 bn into roads, railways and other infrastructure for a 68% stake in this joint venture.

In the meantime, Chile, the world's second largest producer of refined copper behind China, recorded a sixth consecutive annual decline in output last year, with a 1.5% fall taking the total to 2.688 million tonnes.

Within this, SX-EW production fell by a more significant 3.6%, amid among others a decline

at El Abra, lower grades and recoveries at Antofagasta's El Tesoro on top of a pit wall slide in the third quarter, and the winding down by end-year of the latter's Michilla leach operation. These negatives were only partially offset by a 2.8% increase in refinery output. Output at El Abra will fall further still in 2016 with the halving of mining and stacking rates. As it stands, we expect Chilean SX-EW output to more or less level off this year at 1.78 million tonnes. Despite other negative inputs such as the closure of the leach operation at the big Collahuasi mine, higher guidance at Codelco's Radomiro Tomic operation and, more significantly, ramp-up of Antofagasta's Antucoya will offset.

In the United States, a decline in primary refined production from concentrate largely countered an almost one-fifth rise in SX-EW output which was driven by the expansion at Freeport McMoRan's majority-owned Morenci operation. Playing a significant role was the near halving in refined output at Rio Tinto's Kennecott operation in Utah to 115,200 tonnes as a result of the company's continued work on de-weighting and de-watering the east wall of the Bingham Canyon mine. Production there jumped 24% year-on-year in the final quarter, however, thanks to better volumes and grades from the mine. The company has been toll smelting concentrate for third party customers to optimise smelter utilisation, receiving just over 400,000 tonnes of concentrate last year.

In August, Grupo Mexico's Asarco unit announced it would be reducing strip leaching at its Ray SX-EW facility in Arizona and Freeport McMoRan said it would be cutting production at several operations, while pointing out that it would take time for the reduced material on SX-EW stacks to have an impact on overall output levels. Asarco's Amarillo refinery in Arizona, meanwhile, produced around 125,000 tonnes of refined copper last year, down 12% from the previous year. Meanwhile, in Mexico, expansions at Grupo Mexico's indirect subsidiary Southern Copper, and higher refinery output boosted the country's production by 7% last year, with a further 5% overall gain currently envisaged in 2016.

Output also fell in parts of Europe. In Scandinavia, Boliden said an extended maintenance shutdown at its Ronnskar facility in Sweden resulted in a 5% drop in production from 2014 to 206,000 tonnes. Despite the decline in overall output, electronic scrap increased its proportion of the plant's total feed to 13% from 12% in 2014. Meanwhile, the firm's Harjavalta facility in Finland saw a near-four percent decline to 126,000 tonnes from the record level achieved the previous year. Freeport's Atlantic Copper operation in Spain produced 284,800 tonnes of cathode, slightly higher than in 2014. We see room for a further modest decline in the region's production this year.

Cathode production in Kazakhstan increased by 16% in 2015 with the restart of the Zhezkazgan smelter-refinery after production had been suspended in September 2013. KAZ Minerals meanwhile said its copper cathode output fell 3% year-on-year in 2015 due to maintenance work at its Balkhash smelter. In 2016, the country's refined output will receive a further boost from the start-up in late 2015 of the latter's Aktogay SX-EW plant which at full capacity will produce 25,000 tpa of metal.

In other parts of Asia, the world's biggest producing region, the picture was mixed. Indonesian output fell by almost 15% last year, largely as a result of the closure for several weeks of the PT Smelting's Gresik facility because of a broken pipe system. The production halt was reported in mid-July with the restart announced in early September. Looking further ahead, Indonesia has said that it is reviewing its plan to ban copper concentrate exports from 2017 as construction plans for a new smelter for a value-add processing industry have been scuppered for now by low commodity prices. In late February 2016, the country's lawmakers said they hoped to revise resource rules by September.

In the Philippines, production at the PASAR facility benefited from positive comparison with the previous year, when the plant was ramping up early on after being closed in late 2013 due to structural damage caused by Typhoon Haiyan. The double-digit increase was achieved despite a maintenance closure in April/May. Though involving relatively small numbers, production in Myanmar rose by almost half in 2015, driven, we understand, by an ongoing expansion at the Monywa SX-EW operation, which should result in further strong growth this year.

THIRD PARTY THREATS
COULD YOU BE HELD LIABLE FOR THIRD PARTY SHORTCOMINGS?

Trends such as outsourcing, globalization, lean processes and the geographical concentration of production have made supply chain networks more efficient, but have also changed, and increased, their risk profile. Thomson Reuters Risk Management Solutions offers a connected solutions-based approach to mitigating, on-boarding and maintaining your third party relationships in terms of risk.

When used together, our products form a solution that helps mitigate third party risk by:

- Helping to manage overwhelming workload
- Using market leading risk intelligence
- Applying time & resources spent where most needed
- Offering comprehensive support services

A third party who provides no serious questions at the outset may present difficulties as the relationship unfolds. The due diligence process should, therefore, never be considered finished!

For more information, visit **risk.thomsonreuters.com**

THOMSON REUTERS™

© 2015 Thomson Reuters GRC01000/9-15

7. COPPER CONSUMPTION

Global copper demand up **1.9%** in 2015 vs **3.9%** in 2014

China copper consumption up **4%**, power sector still key

Housing sector remains **"Achilles' heel"** for China

Mature economies up **0.8%** in 2015, rest of BRICs down **12%**

MATURE ECONOMIES

Copper demand in the mature economies improved only slightly throughout 2015, pegged back primarily by the impact of weakness in Japan. Performance was stronger during the first half of the year, while it deteriorated significantly in some countries over the second half against the backdrop of a slowing world economy. For the second consecutive year, EU-28 countries performed reasonably well. Copper consumption in the region increased, although at a slower pace than 2014, rising by 2.4% to reach 3.21 million tonnes. Germany is and will remain the key driver for European copper consumption, accounting for approximately 37% of total EU-28 copper usage.

Germany's construction sector is booming on the back of population growth, record low borrowing costs and rising real wages. Construction accounts for 4% of Germany's GDP, while every year around 10% of annual GDP is spent on construction projects. According to the Federal Statistical Office (Destatis), in the first nine months of 2015 building permits were up 4.8% year-on-year at 222,800 dwellings.

The electrical and electronic industry is also growing in Europe's powerhouse with German sales rising by 4%, to €178.5 bn in 2015, amid improved demand from other euro zone countries. Production in the sector also rose by almost 1% year-on-year, a slower pace though when compared to a 2.6% increase in 2014.

In transportation, new passenger car registrations in Germany rose by 5.6% to 3,206,042 in 2015 compared to a 2.9% increase in 2014. Passenger car production also posted a solid performance, increasing by 2% in 2015 to 5,707,938 units, according to the German Association of Automotive Industry (VDA). Meanwhile, in the industrial machinery market, exports increased by 2.4% in the first eleven months of 2015 while domestic demand was weak.

Further monetary easing from the European Central Bank (ECB) and a weaker euro helped smaller European economies, such as Spain and Italy, to sustain overall growth despite some issues. The manufacturing sectors of both countries continued to make solid progress throughout 2015 amid improved exports and production. Italy's construction sector faced a downturn in 2015 and according to Eurostat data posted a 1.8% decline. Poorly viewed government policies, a high debt structure that led to strict austerity measures and a lack of investor confidence may explain this negative trend for another year in Italy. On the contrary, the Spanish construction industry is estimated

GLOBAL CONSUMPTION BY REGION

	000 tonnes							Average Annual Growth*	
	1995	2005	2011	2012	2013	2014	2015	1995-2005	2005-2015
Mature	7,924	7,672	6,156	5,896	5,890	6,164	6,212	–0.3%	–2.1%
of which EU-28	3,785	3,887	3,364	3,100	3,027	3,137	3,212	0.3%	–1.9%
of which Japan	1,415	1,229	1,003	978	988	1,064	1,015	–1.4%	–1.9%
of which United States	2,534	2,276	1,642	1,663	1715	1,800	1,820	–1.1%	–2.2%
of which Canada	190	280	146	155	159	163	165	4.0%	–5.2%
BRICs	1,649	4,993	9,516	9,854	10,533	11,033	11,234	11.7%	8.4%
of which China	1,148	3,729	7,932	8,312	8,967	9,560	9,942	12.5%	10.3%
of which India	116	295	466	456	455	440	462	9.8%	4.6%
North East Asia	1,103	1,430	1,262	1,153	1151	1210	1,202	2.6%	–1.7%
of which South Korea	540	795	803	720	714	745	739	3.9%	–0.7%
of which Taiwan	563	635	459	433	437	465	463	1.2%	–3.1%
ASEAN	421	661	645	709	731	749	765	4.6%	1.5%
Other	1,180	1,880	2,157	2,187	2,335	2,295	2,436	4.8%	2.6%
Total	**12,277**	**16,636**	**19,736**	**19,799**	**20,640**	**21,450**	**21,849**	**3.1%**	**2.8%**

* Each period includes 10 years of growth using the first year as the base year.

Source: GFMS, Thomson Reuters

to have grown by 1% in 2015, mainly due to private consumption as high public debt and budget deficit limited government spending plans.

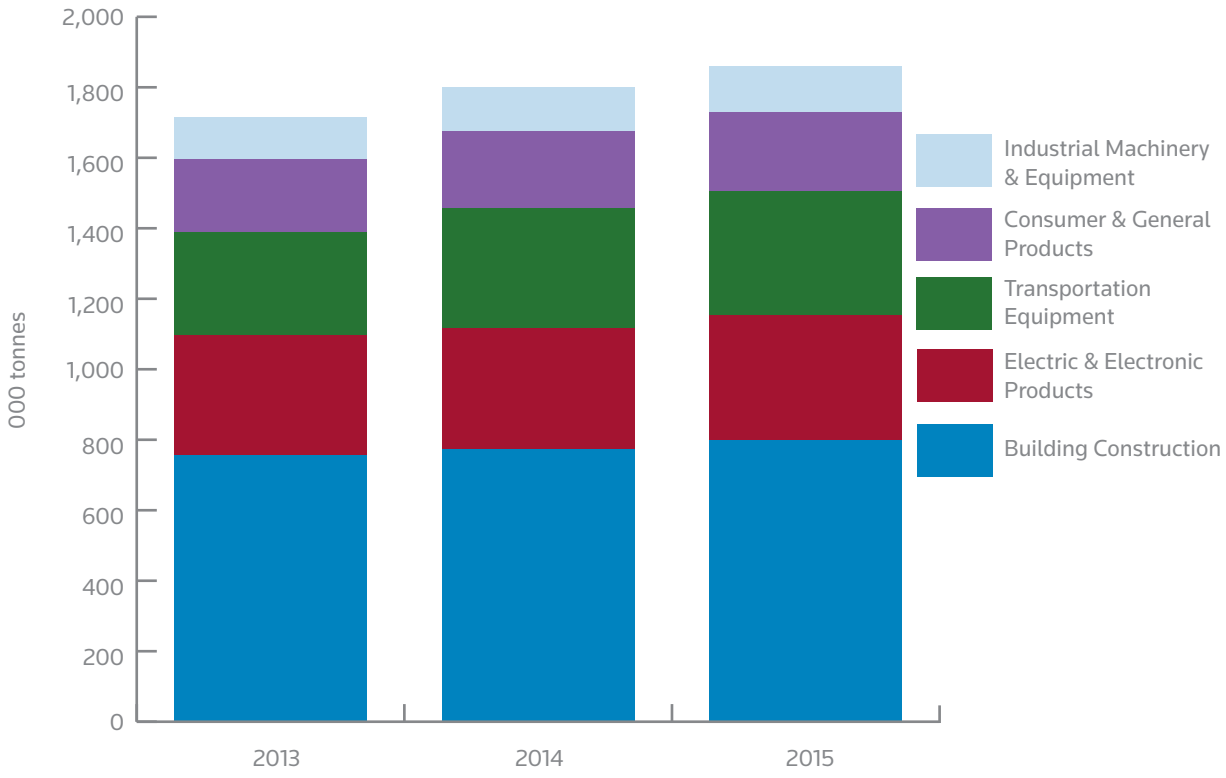
Looking at the EU-28 overall, the picture remains mixed. In the building construction sector, growth for 2015 is estimated to have risen about 0.8% year-on-year (Eurostat), a marginally positive figure which compares to a 3.3% increase in 2014. Uncertainty about the future of the global economy combined with pre-existing economic problems in many euro zone countries has led to a lack of financing for infrastructure projects which continues to affect the whole construction industry.

Electrical and electronic products are estimated to have grown by 2.1% in 2015. Businesses producing high value-added products, such as submarine high-voltage, automotive cables and LAN cables, helped the industry to expand with many European semi-fabricators reporting solid revenue growth and earnings for 2015 . New passenger car registrations in the European Union as a whole rose by an estimated 9.3% in 2015 compared to a 5.7% increase in 2014. Looking ahead, the automobile industry's reaction to stricter EU regulations on emission standards will be of interest, particularly after the scandal over diesel cars late last year.

In the consumer and general products market, an upward trend was in evidence in 2015. Major domestic appliances, such as washing machines, grew by almost 5% year-on-year in Western European countries, while in the rest of Europe sales volumes were also expected to rise to between 12-15 million appliances. In contrast, consumer electronics sales volumes fell by approximately 5% year-on-year on the back of lower demand for televisions.

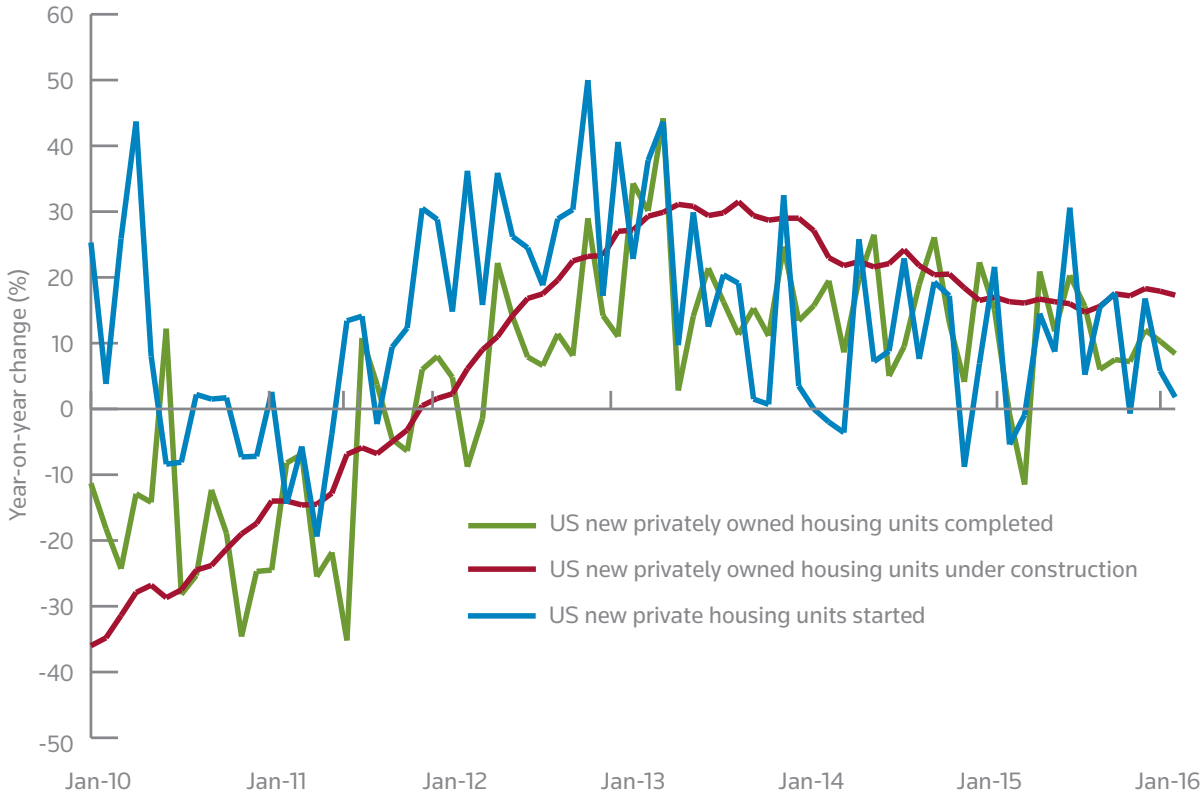
In the United States, copper demand continued to grow, albeit at a slower rate than in 2014, reaching 1.82 million tonnes, a 1.1% increase. In terms of demand by end-use market, U.S. copper usage is still dominated by the

US COPPER DEMAND BY END-USE MARKET



Source: GFMS, Thomson Reuters

US BUILDING CONSTRUCTION



Source: Thomson Reuters, US Census Bureau

construction industry (45%), followed by electric and electronic products and transportation equipment. Consumer and general products and industrial machinery and equipments complete the breakdown list.

The construction industry enjoyed another year of growth in 2015. According to latest U.S. Census Bureau data, construction spending increased substantially last year by 10% year-on-year, standing at $13.1 bn. In particular, private residential spending rose by almost 13% y-o-y and private non-residential spending by 9%. Public spending also increased but at a slower pace of 5% year-on-year.

Taking a closer look at the private housing market, the sector has made a steady recovery since the 2008 crash, peaking during 2012-2013, before stabilising at a slightly lower level. Building permits were up by 11% year-on-year, the same percentage as units started. Potential home buyers were mostly motivated by low interest rates for mortgage loans. There are also government plans for infrastructure projects in order to boost public construction even further.

U.S. manufacturing industry prospects seemed gloomy, particularly during the last quarter of 2015, during which the PMI index dipped below the threshold of 50, showing that the U.S. economy was generally contracting. Lower investment in the oil and mining sector has affected negatively sales volumes in the electronic and electrical industry.

Turning to the automobile market, U.S. passenger car registrations fell by 2.4% in 2015, the first drop since 2009. Nevertheless, total light vehicle sales rose for the sixth consecutive year and were up by almost 6% year-on-year at 17.39 million units. Factors sustaining this upturn were new car models introduced and the availability of credit for auto loans. Light trucks and small and mid-sized cars were the main preferences for customers in auto sales in 2015. This year is also expected to be a firm one for the U.S. auto industry.

Consumer spending remained solid throughout 2015 amid low inflation and robust labour income growth. Expenditure on major household appliances and small electric household appliances increased by 1% and 3% respectively year-on-year, while on video and audio equipment it rose by 1.5%. Household appliances production rose around 5% year-on-year during the first half of 2015. Machinery production was relatively flat in 2015. Construction machinery production was up amid growth in the building sector, while mining equipment production declined due to falling commodity prices.

Canadian consumption exhibited slightly stronger growth than its neighbour, with offtake rising 1.5% year-on-year. During the second half of 2015, Canada's Manufacturing PMI was below the threshold of 50, and showed no significant signs of improvement.

Expectations that the 2014 recovery in Japanese refined copper consumption might represent a stage of renewed growth for the country were upset with year-on-year levels declining by an estimated 4.6%. That said, our estimated consumption of 1.02 million tonnes in 2015 remains at elevated levels compared to 2011-2013, when the country was mired in recession and weak industrial production growth as the post-tsunami reconstruction efforts were slower than expected.

According to the Japanese Electric Wire and Cable Makers Association (JCMA), Asia's second largest copper consumer shipped a total of 707,094 tonnes of copper cable, a 2.9% decline from the previous year. Weakness mostly stemmed from the industrial machinery and equipment demand (-5.5%) and construction sector demand (-3.5%). Similar sentiments were echoed by the Japan Copper and Brass Association (JCBA), where production of brass mill semis weighed in at 765,789 tonnes in 2015. This gross weight copper figure implied production fell by 6.1% from the previous year. Again, weakness in industrial machinery and equipment sector were to blame. Vehicle production, a downstream indicator of demand for Japanese produced copper and copper alloy flat rolled products, fell by 5.1% from 2014 as the VAT increase in 2014 curtailed automotive purchases. While new housing construction in 2015 appeared to have improved from 2014, it failed to translate into increased uptake for copper products over the year. Copper products are typically installed towards the end of the construction cycle, and we expect this to provide some support to copper demand as construction projects head towards completion this year.

BRICS

Brazil, India, Russia and China accounted for approximately 51% of world copper usage in 2015, a similar level to the previous year. While indicative of the investment-led growth that these countries have experienced, this trend is evolving, particularly for China as it moves to a more consumer-based model.

Consumption growth across the BRICs slowed quite markedly to 1.8% in 2015. This was a consequence of a slowing Chinese economy and contractions for the second consecutive year in Russia and Brazil, with only India among the smaller economies exhibiting reasonable growth. The steady increase in Chinese copper demand, albeit at its slowest pace in almost a decade, helped by the weak economic performance of the remaining BRICs, boosted its share of total BRICs demand to 88%.

Brazilian copper consumption contracted sharply in 2015, falling by an estimated 8%. Brazil has faced major headwinds during the last two years amid poor economic performance and weak commodity prices, particularly for iron ore and oil. The situation has also been exacerbated by corruption scandals, an unemployment rate in 2015 of 6.6%, or close to ten-year highs, and deteriorating investment interest. Indeed the country recently lost its investment grade credit rating. High inflation of around 9% in 2015 has contributed to weak copper consumption and increased costs in Reais for copper fabricators. For most of last year, the manufacturing sector index was, below the positive threshold of 50 with no signs of recovery in sight.

The Brazilian construction sector has been hurt by a large budget deficit and the "Lava Jato" scandal that has dented confidence, harmed financing prospects for many companies and led to severe delays to many infrastructure projects. The residual infrastructure still needed for the forthcoming Olympic Games may boost slightly the sector, however growth will be sluggish.

Turning to the Electrical and Electronic industry, performance was weak in 2015 due to the recession and consumer trends. The Brazilian Electrical and Electronics Industry Association (Abinee) reported that total market revenues for the market were down 4% from BRL153.8 bn in 2014 to 148.3 bn in 2015. Going further downstream, the largest decline was posted in the computers sub-sector (13%), followed by electrical supplies (11%) and home appliances (9%).

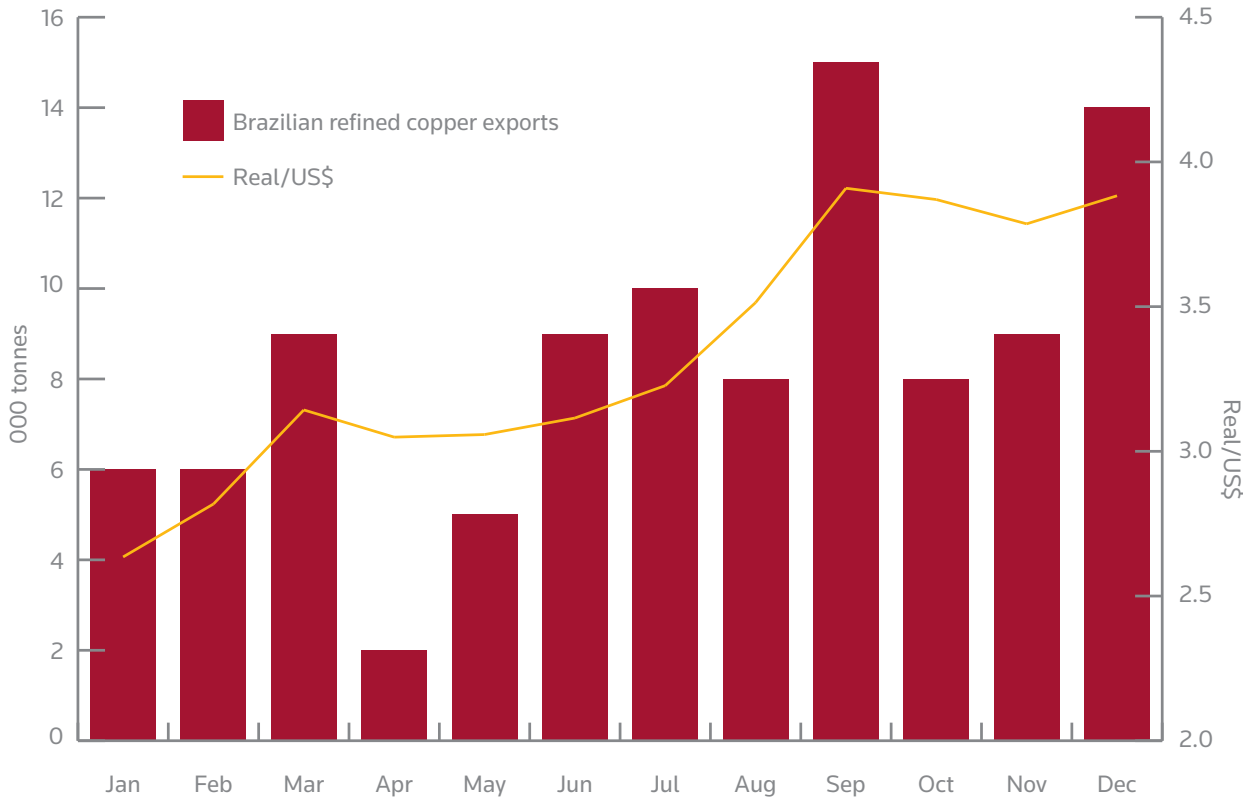
The automobile industry also faces a worsening outlook in Brazil. Total vehicle production fell substantially by 23% year-on-year in 2015, while light vehicle production dropped by approximately 22%. Sales were also down by around 27%, reflecting deteriorating demand and the weakening macro-economic environment. Austerity measures introduced by the Brazilian government to eliminate the budget deficit have resulted in a roll back of the costly tax incentives that previously had stimulated car sales growth.

Consequently, weak domestic demand for copper and the real's depreciation against the dollar have boosted exports of copper cathode (see chart below)

The growth in copper exports was also assisted by continued investment in new capacity by firms, such as Paranapanema, the country's sole smelter-refinery and also one of the largest producers of semi-fabricated products.

Moving to Russia, copper demand has fallen significantly by 27% amid a combination of factors including an export duty change, low oil prices, international sanctions, a lack of foreign capital investment and rouble devaluation.

BRAZILIAN REFINED COPPER EXPORTS VS REAL 2015



Source: GFMS, Thomson Reuters; GTIS

Currency devaluation has led to a high inflation rate (average consumer prices) of 15.8% and declining real incomes, a factor which has made even more difficult a potential recovery. Real GDP growth shrank by 3.8% year-on-year last year; a negative trend that will continue throughout 2016, with only slight improvement, according to the latest forecast from the International Monetary Fund (IMF).

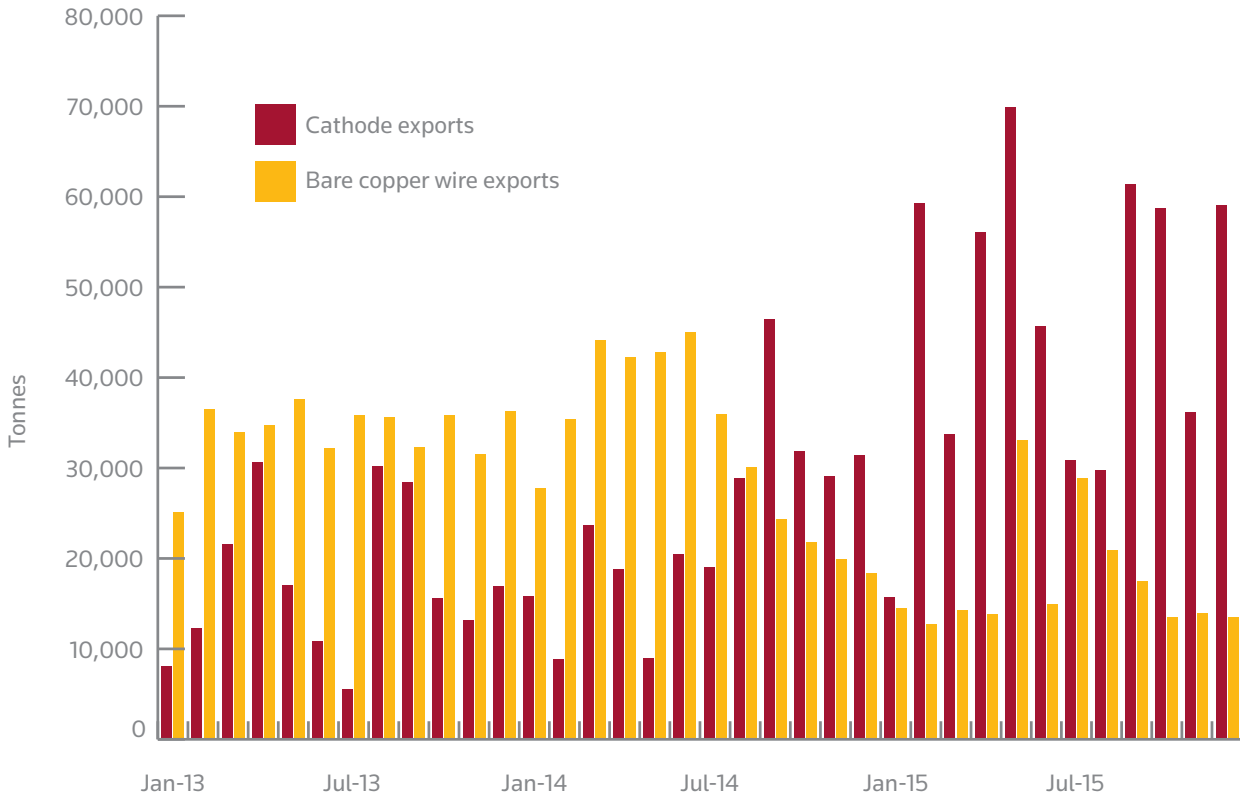
However, it has to be said that Russian copper consumption was mostly affected by the government's decision to cancel a 10% duty on copper cathode exports in August 2014. Since the duty was lifted, copper cathode exports have doubled, reaching 556,000 tonnes in 2015 at the expense of bare copper wire exports that decreased by 45% year-on-year. Copper wire rod output fell by 34%, with the largest decline posted by Elkat (75%), followed by Transkat (58%).

The dramatic collapse of the rouble has been another factor, making exports of downstream products uncompetitive. Furthermore, the decline in oil prices constrained Russian energy companies' revenues, which led to a decrease of their investment in power networks, whose main material is copper wire rod. Another decline in wire rod output is expected this year, although planned power grid projects may partially offset partly the decline.

Construction industry growth in Russia was weak in 2015, due to economic instability and a lack of investment. Dented real income levels constrained consumer spending while interest in the Russian real estate market was low. This year this sector is expected to post modest growth, while the Socio-Economic Development 2020 programme, under which the Russian government aims to modernise the country's infrastructure and housing, will also help.

Russia's electronics market also faced a tough year. At the end of 2014, the industry saw unusual growth as many Russians brought forward purchases on electronics and appliances amid fears of rouble devaluation. The picture changed a few months later as currency devaluation, high

MONTHLY RUSSIAN COPPER CATHODE & BARE WIRE EXPORTS



Source: Thomson Reuters; GTIS

inflation and shrinking income had an impact on consumers' purchasing power. Refrigerator and freezer production was down by 16% year-on-year in 2015. This year a recovery may be seen if the rouble stabilises.

Meanwhile, passenger car production decreased by 28% year-on-year, from 1.7 million units in 2014 to 1.2 million in 2015. Sales fell by an even greater 36% to 1.6 million, a decline which reflected the overall worsening purchasing power of Russian consumers. A scrappage scheme and subsidies on auto loans offered by the government to support auto sales may help the market in 2016.

Indian copper demand fell short of expectations again, growing by 5% year-on-year, to reach 462,000 tonnes in 2015. Despite efforts made by the government of National Democratic Alliance (NDA) to modernise the country through reforms and the lifting of barriers for foreign investment in the country, more robust economic growth is still some way off.

The construction sector will offer opportunities for foreign investors in the near future, with growth rates of around 7 to 8% mooted over the next decade. Infrastructure accounts for 50% of the overall sector, housing for around 42% and industrial projects the remaining 8%. The government launched the project "Make in India" in order to develop the construction sector. In the 2015-2016 budget, the government announced the development of "Smart Cities", comprising 100 smart cities which will be satellite towns of larger cities. Nevertheless, project implementation has been delayed and thus copper demand is not expected to receive a significant boost this year.

Also, in the electrical and electronics sector a range of projects are ready to be put forward over the coming years. The value of the electronics market is expected to expand to $400 bn in 2022 from $69.6 bn in 2012. The country's growing customer base is also expected to help boost demand in this sector.

CHINA

For 2015, we estimate that Chinese consumption stripping put changes in both SHFE stocks and off-exchange stocks, stood at 9.9 million tonnes, up by 4% on a year-on-year basis. This represents 46% of global demand, up from a 45% share in 2014. The uptrend in Chinese copper consumption last year amid the broader slowdown in growth in a host of key economic indicators. Real GDP for example, stood at 6.9%, down from 7.3% in 2014. Total fixed assets investment, meanwhile, slowed down by 12% in 2015, the slowest growth rate of expansion for around a decade.

Growth in Chinese copper consumption slipped to 4% in 2015 from 6.6% in 2014 amid the country's broader macroeconomic slow down. The power sector remained the key driver behind the increase, up by an estimated 6.9% in 2015. Looking ahead, we expect power to continue to outperform albeit at a slightly lower growth rate of 6.5% in 2016. The construction sector recorded an estimated 1.8% gain in copper consumption year-on-year, forecast to slow to a 1.5% in 2016. White goods suffered the largest drop with copper demand in this sector only up by 2.5% from roughly 9% in previous year. This was chiefly explained by a poor performance in the air conditioner space, where production growth went into negative territory. Automobiles were adversely impacted by government regulations specifically to the Tier 1 and Tier 2 cities, although, we continue to expect the 4% growth in 2015 to be maintained in 2016.

POWER SECTOR

The power sector remains the key pillar of Chinese copper consumption representing half of the total. Demand in this sector falls into two categories. First, copper is used directly in power grid projects (transmission and distribution) and in power generation stations. Examples include China State Grid's UHV (Ultra High Voltage) long distance transmission as well as smart grid

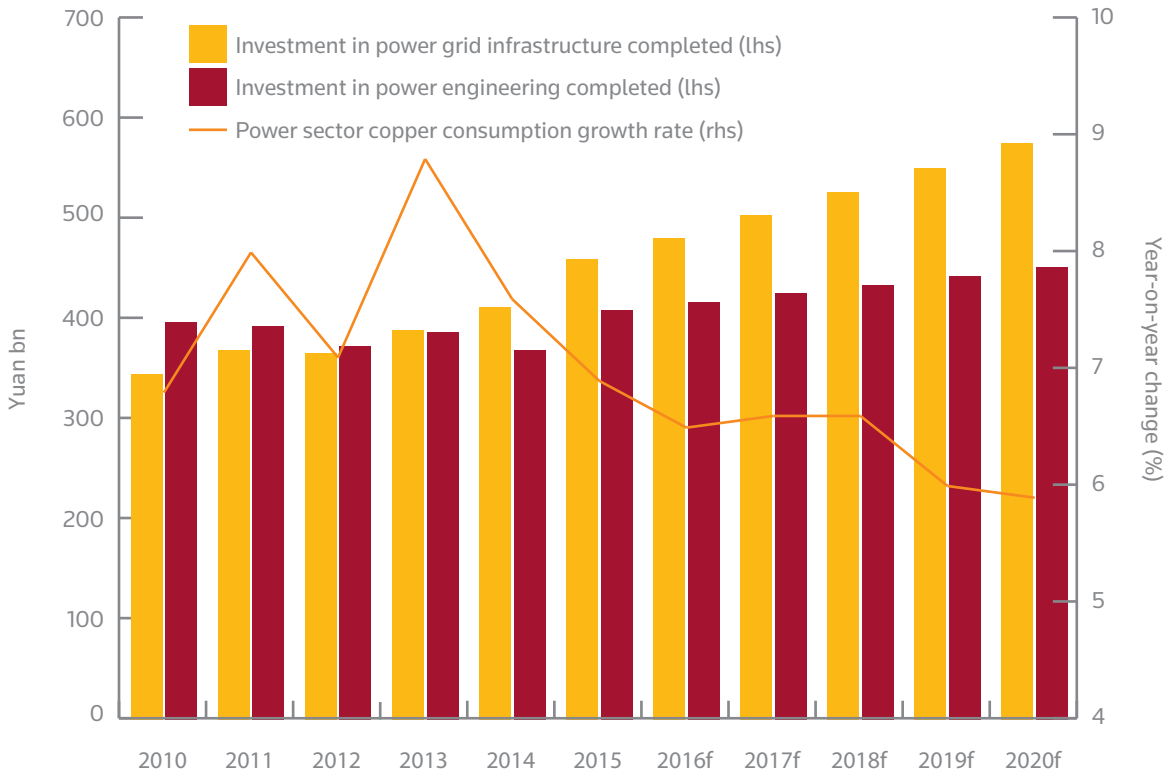
projects. Second is its use in the power sector but associated with real estate, such as in cables and transformers for buildings as well as in substations for newly developed residential communities.

The pull factors for these two categories are in the power sector and infrastructure construction including the real estate industry. For the first category, investment completed in grid infrastructure and power generation engineering retained positive growth of 11.8% and 12.2% respectively in 2015. Furthermore, we remain positive towards investment growth based on Beijing's strategic plan for the power sector in the 13th Five Year Plan (2016-2020). For the second category, copper in power related to the real estate sector is being directed by the slowdown in China's house construction activities. And the outlook in this area, not surprisingly, is much less positive. Growth in the floor space of property under construction is only one third of that which we saw two years ago when China's copper consumption was growing at around 7% year-on-year. Leading indicators for the real estate sector suggest further downside risks.

Paradoxically while investment in grid infrastructure remained pretty strong at double-digit growth at the end of 2015, power cable production only grew by an annualised 0.2% year-on-year (based on figures for the first 11 months). In 2015, China's power cable production grew at its slowest pace in a decade, data from China's National Bureau of Statistics showed. We forecast that investment completed in the power sector will continue to grow in the next five years with the grid infrastructure sector leading that growth. However, the rate of copper consumption growth in China's power sector will slow. To understand the reasons behind the miscorrelation between rising investment completion in both power infrastructure and engineering, and slower copper consumption growth in the power sector, we must first look at the three stages of development in China's power industry in the last decade. The latest stage will have implications for a change in copper consumption intensity.

In China, power sector development is mainly carried out as part of the government's strategic

CHINA'S INVESTMENT COMPLETED IN POWER GRID VS COPPER CONSUMPTION



Source: GFMS, Thomson Reuters

plan or guidelines. We see three broad stages in the Chinese power industry's development and at each stage, different projects are highlighted. However, this does not mean that those projects are only to be executed within a specific timeframe. Instead, usually there is a lag between government plans and realisation of these projects. Ultra High Voltage (UHV) projects are one such example. These were highlighted mainly during the 2010-2015 period, and while it is true that many UHV projects were constructed during that time, we expect acceleration in 2016.

Returning to the three stages, Stage 1 (2005-2010) involved power generation; the key proposal was to meet fast growing power demand by focusing on power generation engineering projects. Stage 2 (2010-2015) concerned power transmission, with investment focusing on growing power transmission line length in order to meet the need for new electricity infrastructure and power generation capacity growth. The so called "X horizontal Y vertical" transmission line projects are connecting supply and demand centres spread across different regions. Highlighted projects for the period include long distance power transmission and UHV projects. Stage 3 is a more balanced development goal between generation, transmission and distribution. Highlighted projects are rural area network improvement, UHV as well as smart grid.

COPPER INTENSITY MAY DECLINE IN POWER WITH 2016 INVESTMENT FOCUS SHIFT

We expect the growth rate in the power sector to moderate in the near term before stepping lower over the next couple of years. This reflects the shift from stage 2 to stage 3, as projects for the 13th Five Year Plan are dominated by UHV and rural power network upgrade as well as smart grid, which are less copper-intensive.

According to the latest figures released by China's State Grid, which represents 80% of China's total market share, the initial investment plan for 2016 will decrease by 2.6% year-on-year with focus on UHV projects. At the end of February 2016, China Southern Grid, accounting for the balance of

CHINESE POWER CABLE PRODUCTION

* Annualised figure based on first eleven months data
Source: National Bureau of Statistics of China

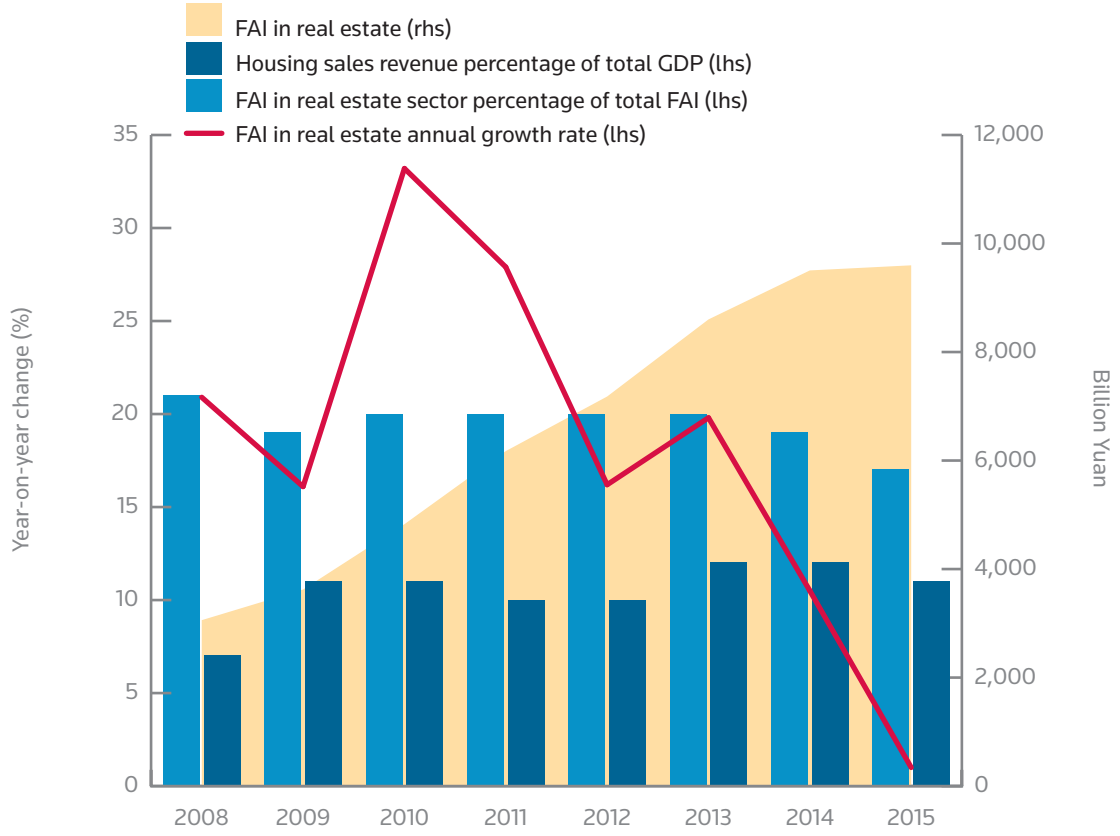
the market, revealed its investment plan for Guangdong province during the 13th Five Year Plan. The target budget is 200 bn Yuan for power generation (pumped-storage hydroelectric power stations in Meizhou city and Yangjiang city); transmission (UHV transmission line from northern Yunnan province to Guangdong) and distribution (power network upgrade both in cities and rural area). The exact breakdown of investment between the three sectors is not given but the Southern Grid had put forward the emphasis in the distribution sector and within that 43% of funds will be put into rural network upgrade. We expect further announcements from China Southern Grid as it is also in charge of other four provinces in Southern China including Yunnan and Guangxi.

At the end of August 2015, China's National Energy Administration (NEA) provided guidelines with 2 trillion Yuan announced for investment in the power distribution network as part of the 13th Five Year Plan. In mid-February 2016 the NEA stated that no less than 700 bn Yuan would be dedicated to upgrade the rural power network. However, this figure is part of and not in addition to the original 2 trillion Yuan. Therefore, it follows that the rural network upgrade accounts for 35% of the total budget. We know that the grid companies used to make additional investments in the second half of the year. The final plan for 2016 is as yet unclear but even if additional investments are made in the second half this time, they will likely be put into lower copper intensity UHV or rural areas upgrade projects, much the same as the State Grid did in 2015.

REAL ESTATE

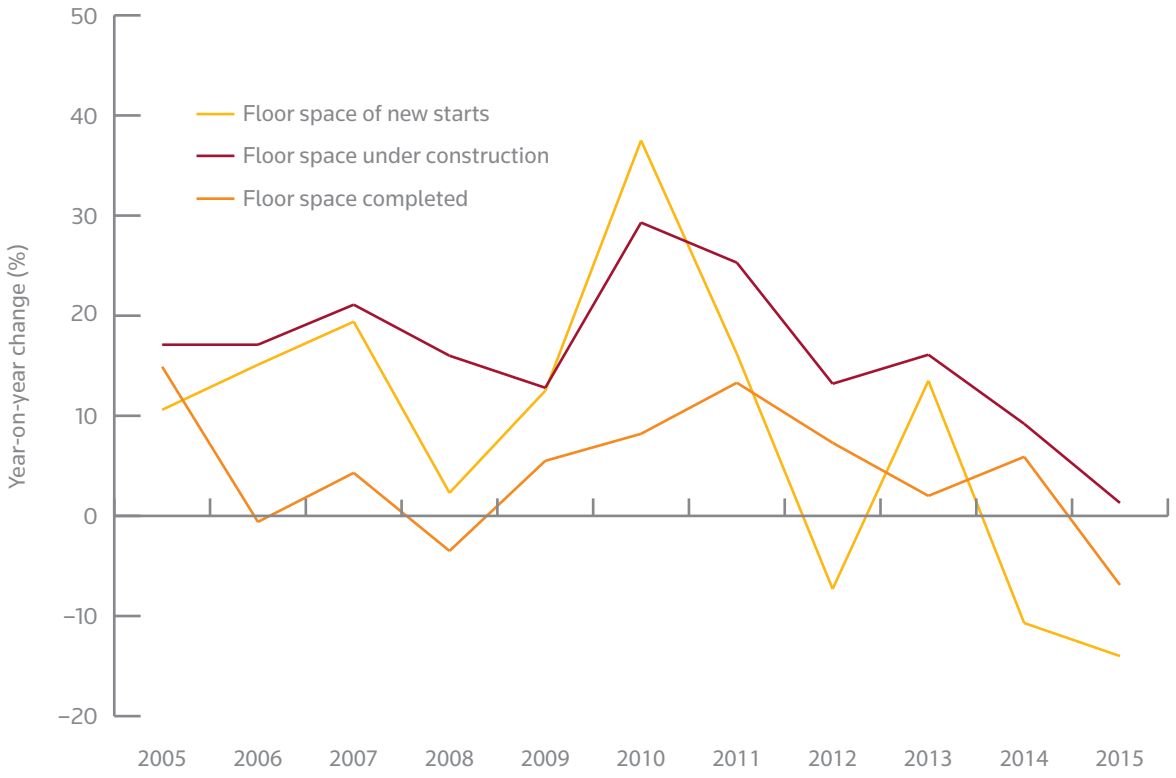
Real estate construction is a pillar of China's economy, driving demand for copper, steel, cement and other basic materials. It is also important to other linked industries such as white goods and the power network system. Our copper end use study in China suggests that there are strong correlations between construction completions and copper usage in construction sector as well as in air conditioners.

CHINESE FIXED ASSETS INVESTMENT IN REAL ESTATE INDUSTRY



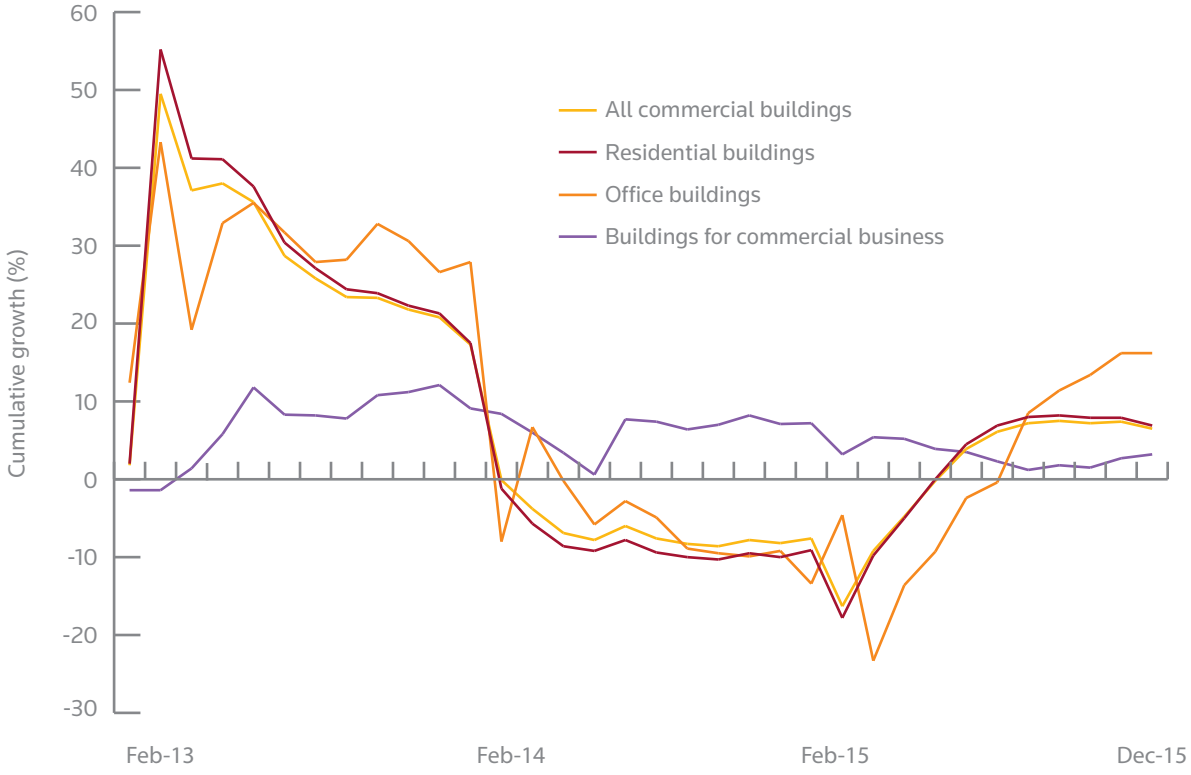
Source: National Bureau of Statistics of China

CHINESE CONSTRUCTION ACTIVITY



Source: National Bureau of Statistics of China

CHINESE PROPERTY SALES BY SPACE



Source: National Bureau of Statistics of China

Total property market revenue in China accounted for 11% of GDP in 2015, up slightly from the 10% average in the past decade. Total fixed asset investment (FAI) in the country's real estate construction sector still remained one of the primary drivers of China's total FAI although it also became the largest downside risk.

Since 2014, the Chinese real estate industry has been in a downturn and the situation deteriorated further in 2015. The growth rate in real estate decelerated to only 1% year-on-year compared to 10.5% in 2014. Total FAI fell comparatively moderately from 15.7% in 2014 to 10% in 2015 year-on-year. More detailed data from the segment have all pointed to the very slow or deep negative growth. Floor space of both new starts and completions fell to -14% and -6.9% respectively year-on-year. Helped by the government's stimulus measures in the property sector, total commercial building sales have been in positive territory since June 2015 and stood at 6.5% year-on-year.

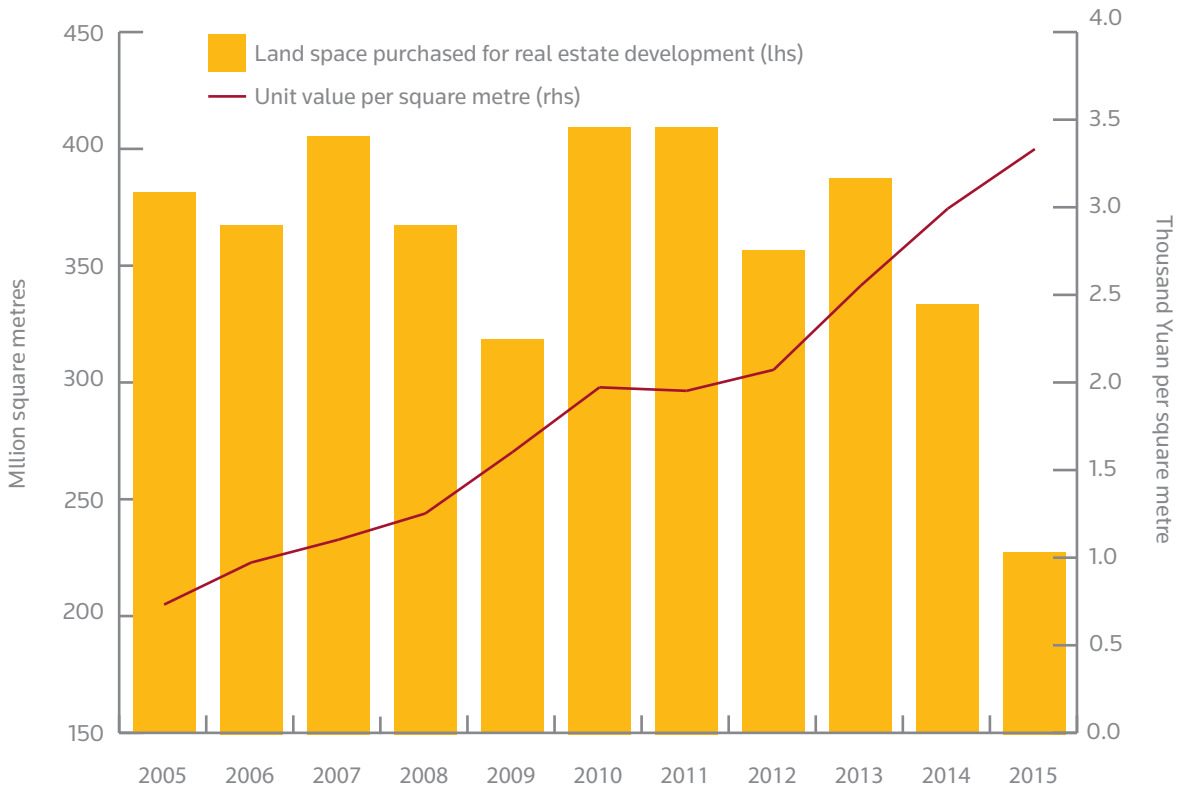
As a consequence, total copper consumption growth in the real estate construction sector slowed to 1.8% year-on-year in 2015 from 2% in 2014. With regard to the outlook for 2016, we remain bearish with growth forecast to slow further to a 1.5% rise year-on-year.

HOUSING SECTOR STILL THE BIGGEST RISK TO CHINA COPPER CONSUMPTION

Apart from the impact of slowing construction activities, massive housing inventories pose another challenge as they are weighing on new starts and add risks to the closely related China's banking system. Accordingly, the Chinese government has put forward a number of measures that apply to the property industry both from a supply and demand perspective.

On the supply side, since the government would like to limit land supply for property development as part of its supply side reform, the total area of land space purchased by property developers fell by 31.7% year-on-year in 2015. As a result of limited land supply, unit value per square metre rose by over 11% year-on-year in 2015, which has further

CHINESE LAND SPACE PURCHASED FOR REAL ESTATE DEVELOPMENT



Source: National Bureau of Statistics of China

prevented property developers' land acquisition for new development. A collapse in land supply to the market also poses great risks to future construction and thus to copper consumption.

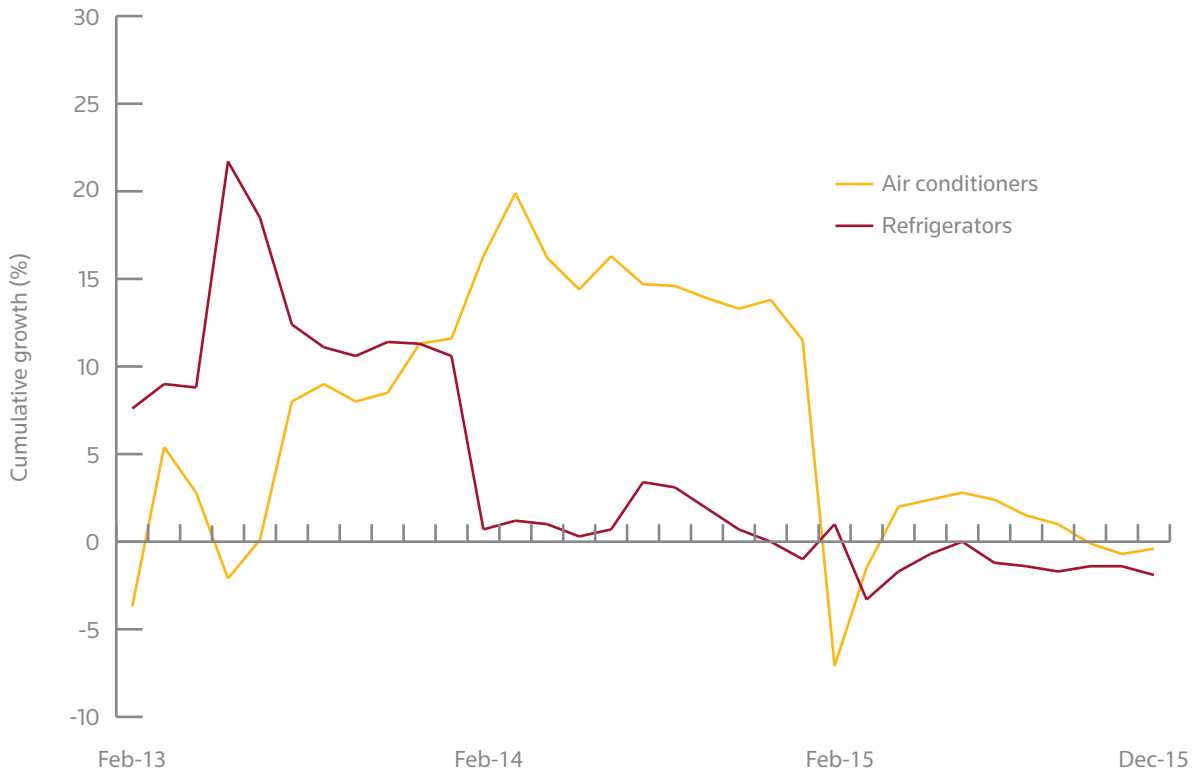
However, a moderate pick-up in property sales helped by the government's demand-side stimulus measures would provide mild support to copper consumption, although as of March 2016 the impact has been limited. Many of the stimulus measures put forward are dedicated to cities without home buying restrictions. In a reversal of previous policies, new measures are loosening restrictions, including, reducing the percentage of down-payment for purchase of a second home and cutting deed tax. Moreover, the government is extending the measures supporting urban household to families from rural areas, encouraging them to buy homes in cities. Certainly, a surge in property transaction volume and jumping house prices in Tier-1 cities (Beijing, Shanghai, Guangzhou and Shenzhen) has rekindled some hope towards the property sector. Some are expecting that the buying frenzy in Tier-1 cities will spread to lower tier cities in China and lead to new constructions. We are less optimistic. Speculative players stoking panic in Tier-1 cities, is not going to resolve the structural problems in the smaller cities where the largest overhang of housing stocks are located.

WHITE GOODS

White goods remained the second largest consumption segment in China, with copper mainly used as condenser tubes and pipes in some white goods; mainly air conditioners. In 2015, copper consumption in this segment declined by an estimated 2.5% year-on-year compared to 8.5% in 2014.

According to data from China's NBS production growth of air conditioner units and home refrigerators

CHINESE PRODUCTION OF AIR CONDITIONERS AND REFRIGERATORS



Source: National Bureau of Statistics of China

in 2015 has plunged into negative territory. Air conditioners suffered the largest drop going from 11.5% year-on-year growth in 2014 to a 0.4% fall in 2015.

The white goods industry is well past the rapid growth stage and is now heading towards consolidation. The "golden age" of demand, when Beijing was subsidising rural area buying as well as introducing a series of measures to boost off take during 2007 is now behind us.

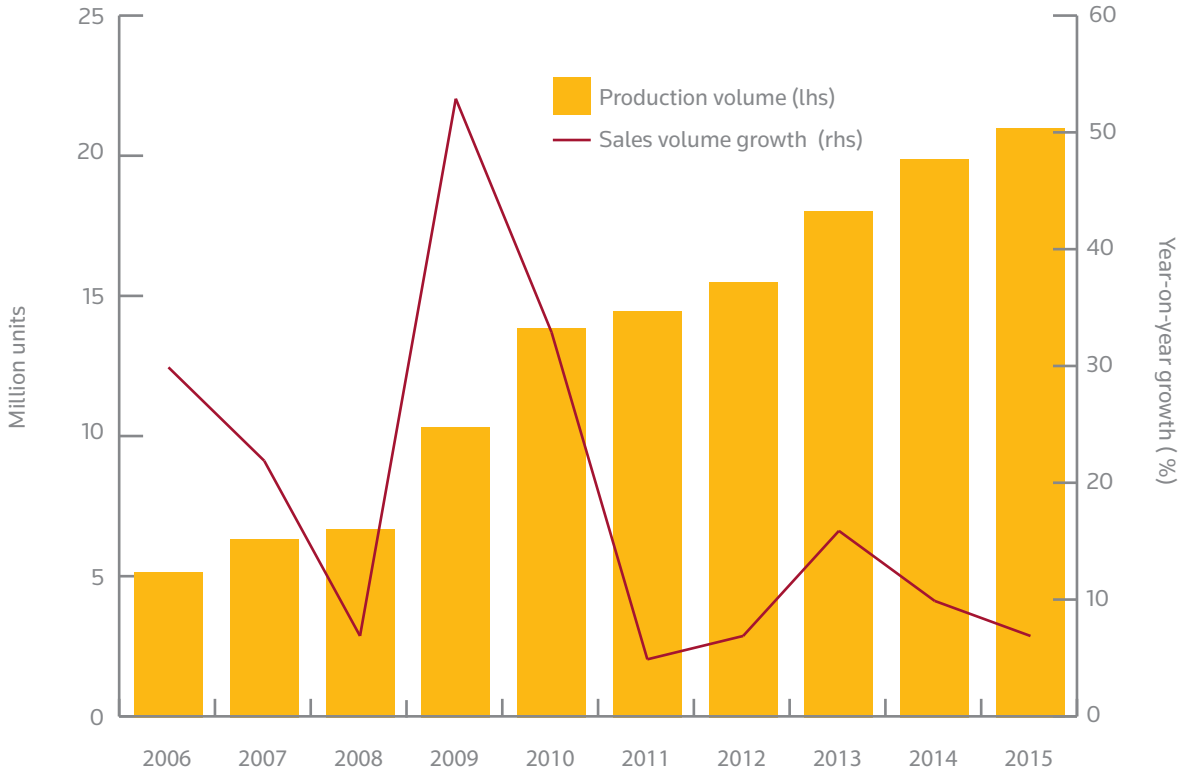
Part of the consequence of the previous stimulus is that the production of white goods remained at inflated levels, and as demand has slowed, this has led to massive inventories. In the meantime, fierce competition in the domestic market ignited a "price war". On the one hand, many have had to lower prices for their products in a bid to maintain market share. On the other hand, white goods manufacturers are faced with difficulties in obtaining financing while rising labour and raw material costs add to their woes.

Although this all sounds rather gloomy, the massive inventories should act as a catalyst for government to find new solutions for destocking. In the near term, the moderate recovery in house sales may be benefit to home appliance sales. But this is a slow process. In addition, Chinese RMB depreciation should also help the export market. In the longer term, prospects perhaps rely on Beijing's new initiative "Made in China 2025" which is to be modelled on Germany's "Industry 4.0", and designed to encourage industrial innovation, automation and greener practices. However, so far we have not seen concrete plans for the white goods industry.

TRANSPORTATION EQUIPMENT

China passenger car production increased by 5.6% year-on-year in 2015 to 21.04 million units, according to data from Chinese Association of Automobile Manufactures (CAAM). A shadow

CHINESE PASSENGER VEHICLE PRODUCTION AND SALES



Source: CAAM

CHART THE RIGHT COURSE TO SUCCESS

As you strive to steer your organization through uncharted territories, your success depends upon how thoroughly you understand the competition, how accurately you identify new markets, and how sharply you weigh up potential mergers and acquisitions.

With Thomson Reuters you can chart the course to success with trusted information and embargoed research.

Find out more at financial.thomsonreuters.com

© 2015 Thomson Reuters S025848 09/15

THOMSON REUTERS™

of the stimulus-fuelled growth of over 50% and 30% growth seen during 2009 and 2010, this is roughly the same level seen in 2008 and it is the third consecutive year China reported a slowing in the growth rate in vehicle production. Sales volumes have broadly tracked production levels, but last year they delivered a slightly better performance, registering a 7.2% year-on-year increase.

On an intra-year basis, the growth rate of both production and sales trended lower, partly due to the booming equity market that saw many prospective buyers hold back on major purchases as they chased profits in the stock market. Activity only picked up in the last quarter of the year thanks to Beijing's stimulus package. Purchase tax for vehicles with 1.6 litre engines or smaller was halved until the end of 2016.

On a longer horizon, a key factor behind the slowing growth rate is ongoing regulations to ease traffic congestion and alleviate air pollution. By the end of 2015, a total of seven Chinese cities had come up with license plate restriction including Shanghai, Beijing, Guiyang, Guangzhou, Tianjin, Hangzhou and Shenzhen. Beijing, for example, has been cutting the issue of new licence plates and other cities are expected to follow. Green energy vehicles, although only a fraction of the car market, are also seen as part of the solution, with subsidies on purchase and free licenses available in selected cities. In the mean time, other disruptive factors such as the rising trend of e-hailing, car sharing as well as growing public transport are also impacting new vehicles sales.

Regarding future trends in copper consumption, green or new energy vehicles have a much higher copper intensity than traditional passenger vehicles in particular through copper foils. According to CAAM, new energy car production and sales volumes reached 340,471 and 331,092 units, up by 2.3% and 3.5% year-on-year. The increase mainly reflects government's drive to promote cleaner energy cars on roads. And CAAM is forecasting new energy car sales to reach 700,000 units in 2016, which is 111% year-on-year growth.

OTHER ASIA

Korea, the third largest copper consumer in Asia, consumed an estimated 739,000 tonnes of copper in 2015, almost unchanged from the previous year. Nevertheless, copper consumption in the country has been steadily decreasing from its peak of 931,700 tonnes in the middle of the last decade driven first by the relocation of fabrication facilities to emerging Asia to co-locate with offshored automotive and electronic manufacturing plants in the region, and second, by the reduction of copper products exports to China, as the latter became increasingly self-sufficient in producing its own copper products to cater to its manufacturing industry. Indeed, exports of copper products from Korea fell by 10% last year, particularly for copper wire, which saw a dramatic slump of 21%. While Japan has also been plagued by the same problem, currency depreciation has somewhat supported its export markets in the past two years.

With faltering demand for exports, refined copper consumption in Korea relies on domestic end-use uptake. However, according to Korean Statistical Information Service, domestic shipments of copper semis declined by 1.8% in 2015, primarily due to weak uptake from copper rolled products and copper tubes shipments. This is despite a robust performance from the automotive industry, which saw car production increase by 1.2%. We expect uptake to be relatively muted this year as Korea struggles with weak demand orders both domestically and from its traditional export partners.

Despite the subdued economic outlook in the region this year, a few structural developments offer glimmers of hope for copper consumption in the longer term: the emphasis on energy efficiency and the rise of hybrid and electric vehicle production are both positive developments for copper demand, as use of larger wire gauges and wiring used per vehicle

increases to improve connectivity. Both these automotive manufacturing powerhouses are fast adopters of new technology and we expect these trends will help underpin refined copper consumption in the future.

COPPER IMPORTS TO CHINA SHIFT FROM TRADE FINANCE TO ARBITRAGE

Copper imports for trade finance in China, as widely reported, boomed in recent years and the metal accumulated in so-called "bonded warehouses". Post-Qingdao in May 2014, however, activities cooled as a result of stricter regulations and lower risk appetite. The State Administration of Foreign Exchange (SAFE), for instance, now requires banks to fulfil investigations into the use of foreign currency in cross border trade. Risk appetite, meanwhile remains low. Since the Qingdao scandal, all banks have become very cautious in issuing letters of credit (L/Cs) to facilitate this trade. A stark reminder is the ongoing legal wrangling between Citigroup and Mercuria over metals financing deals uncovered in the probe launched at suspected fraud at Qingdao and nearby Penglai port. To be clear, neither Citigroup nor Mercuria are accused of fraud, but have been both caught up in the fallout of the investigation.

The increase in refined imports last year, and in particular the surge in the fourth quarter, therefore, came as a surprise. Stories of stock building in bonded warehouses suggested, at first, a resumption of the copper finance trade. However, the driver, in our view, is more likely to have been the physical arbitrage between SHFE and LME copper– which is largely decided by the USD/CNY exchange rate.

Usually mixed arbitrage strategies are at play, as traders take advantage of price disparities either cross-exchange or cross-commodity. Rather than adopt a single strategy, market participants use a combination of both futures and the physical market. Last year, there were two principal arbitrage strategies that had an impact on the copper market last year. The first was a reverse cross-market copper arbitrage, which involves buying on SHFE and selling on LME (and is contrary to common practice). Such a reverse strategy was mainly fuelled by RMB depreciation pressures against the US dollar which offers favourable SHFE/LME ratios. At the same time, copper's spread structures in the two markets indicated positive rolling yields on both sides under this reverse strategy. This could explain why SHFE copper prices outperformed LME prices in 2015.

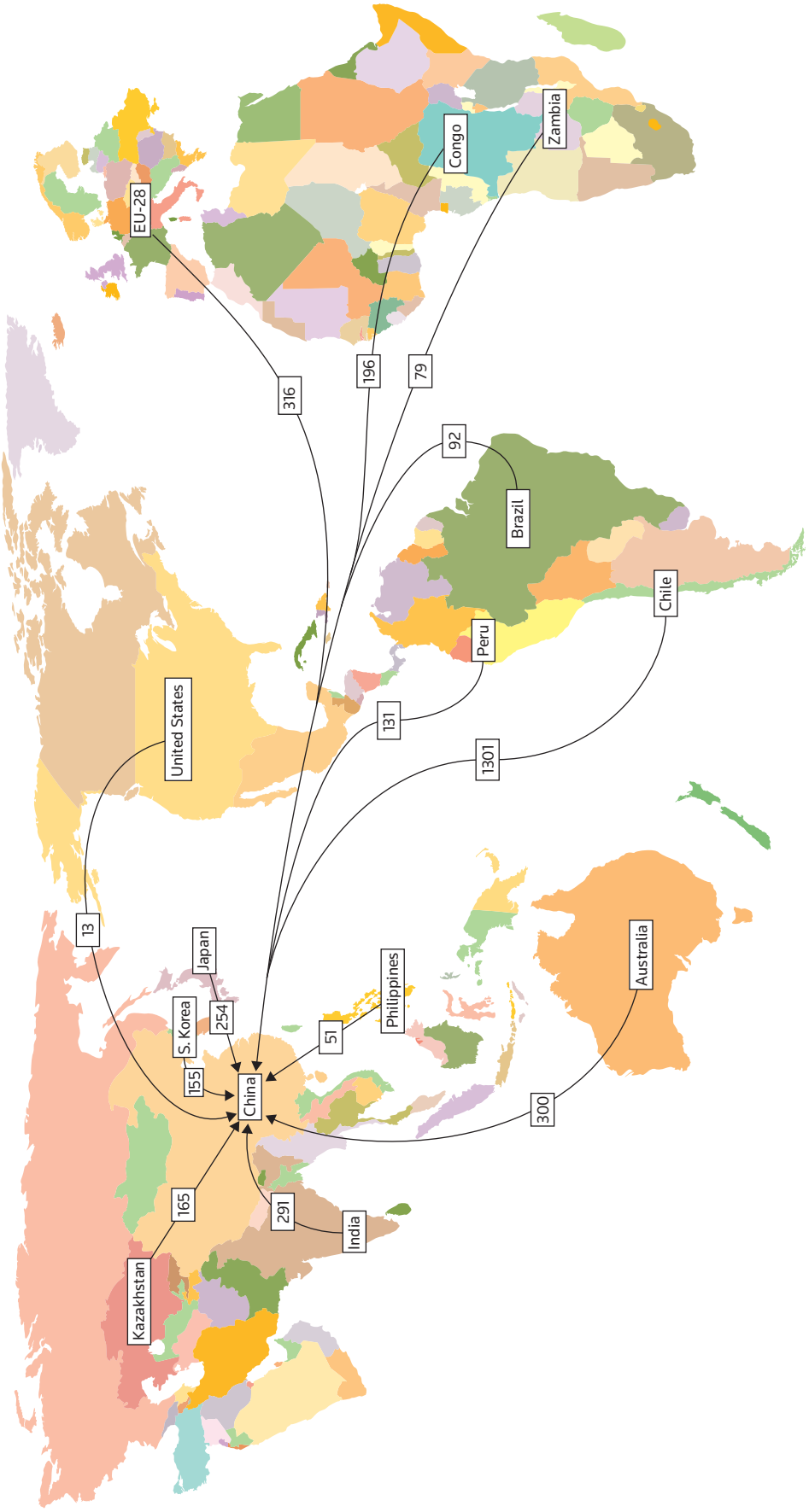
In the second half of 2015, SHFE copper traded at a premium to LME. For example, for more than half the trading days from mid-August to end-September, SHFE was at a premium of over 1,000 Yuan/tonne (VAT-adjusted and excluding freight). This presented an opportunity for physical arbitrage as long as the full cost was covered. We have modelled the physical arbitrage breakeven, and this confirms that in the period from June to September, it was profitable to import copper (with full cost factors considered). To avoid or minimise any losses on the domestic physical market (as the metal is at a discount to the spot contract),

CHINESE REFINED COPPER IMPORTS BY ORIGIN

	000 tonnes			y-o-y% change			% Share		
	2013	2014	2015	13/12	14/13	15/14	2013	2014	2015
Chile	1,075	1,265	1,301	–18%	18%	3%	34%	35%	35%
Australia	249	313	300	68%	26%	–4%	8%	9%	8%
India	247	332	291	–9%	35%	–13%	8%	9%	8%
Japan	234	233	254	0%	0%	9%	7%	6%	7%
DRC	53	84	196	–65%	60%	133%	2%	2%	5%
Kazakhstan	198	168	165	8%	–15%	–2%	6%	5%	4%
South Korea	137	110	155	–11%	–20%	41%	4%	3%	4%
Peru	128	154	131	28%	20%	–15%	4%	4%	4%
Poland	91	117	126	6%	29%	7%	3%	3%	3%
Russia	2	18	115	–93%	740%	532%	0%	1%	3%
Total	**3,206**	**3,590**	**3,678**	**–6%**	**12%**	**2%**	**100%**	**100%**	**100%**

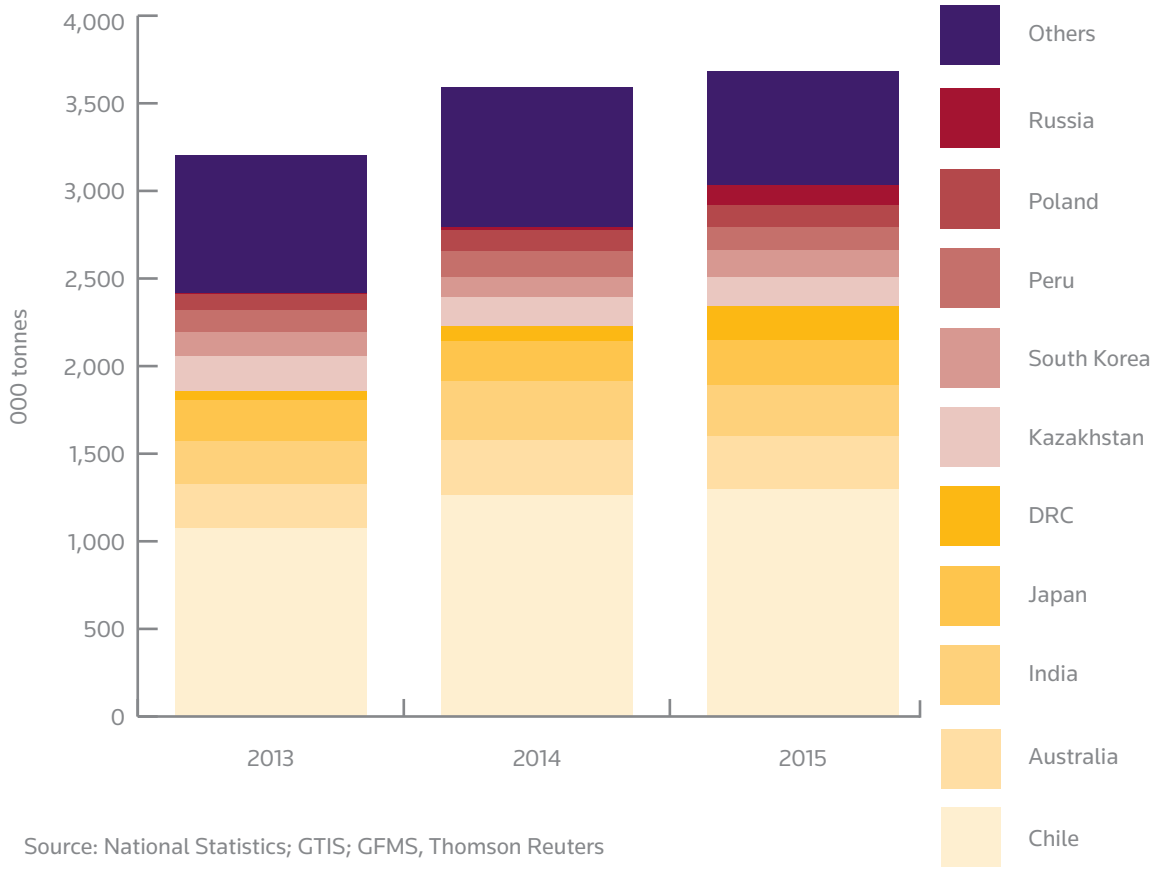
Source: National Statistics; GTIS, GFMS, Thomson Reuters

MAJOR REFINED COPPER IMPORTS INTO CHINA IN 2015



Figures provided in thousand tonnes.
Source: National Statistics, GTIS; GFMS, Thomson Reuters

CHINESE REFINED COPPER IMPORTS BY ORIGIN



Source: National Statistics; GTIS; GFMS, Thomson Reuters

refined copper does not have to be shipped directly into the physical market, but rather delivered into bonded warehouses. The importer can then wait for a more favourable ratio before clearing customs. This partly explains the build-up in bonded warehouse stocks identified towards the end of last year, although we also believe that there was also a certain amount of end-user stock rebuilding.

COPPER FABRICATORS

Copper semi-fabricators are first users of refined copper and scrap, supplying products for a broad range of end-uses, ranging from power distribution to specialised cables for medical equipment. Some 38% of world copper and copper alloy fabrication capacity is concentrated in China, with the remainder relatively well spread across other regions. Western Europe, which is home to some of the leading companies in the sector, including Prysmian and Nexans, accounts for 15% of the world total.

Ahead of Western Europe, other East Asia and Oceania is the second largest region for copper fabrication, and accounted for 21% of the world total in 2015. The grouping includes countries such as Japan, Taiwan, South Korea and India. Furukawa Electric and Fujikura Ltd are the larger companies operating in the region. The remaining 26% is split between North America (10%), Eastern Europe and Central Asia (7%), Africa and Middle East (5%) and South and Central America (4%).

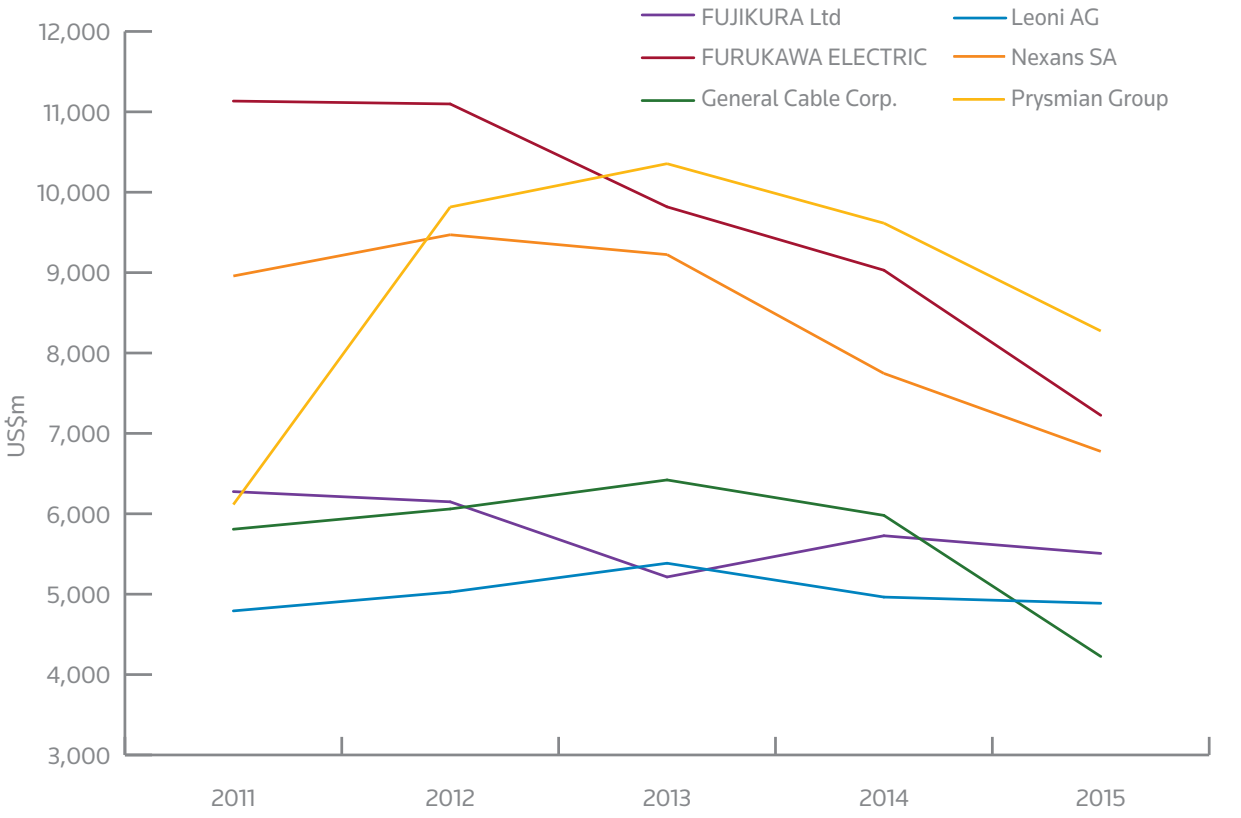
Copper wire rod accounts for 54% of total semis production, with flat rolled products a distant second accounting for 14%.

Taking a closer look at the major players in the industry, copper semis products sales were slightly lower year-on-year for most of the leading fabricators. However, for some of the European firms, sales were better than expected amid stronger demand for wire rod products from end-use markets within the region. Furthermore, competition from other regions, particularly Russia, was lower in 2015 as the decision to end a 10% duty on copper cathode exports, which led to a drop in the country's wire rod exports.

The relative ranking for the main players, on a revenue basis, was largely unchanged, with European semis fabricators, Prysmian Group (Italy) and Nexans (France), maintaining their dominate positions. Although both companies have a presence in many countries, their greatest exposure is to EMEA, representing 63% for Prysmian and 43% for Nexans.

Revenues (in U.S. dollar terms) for all but one of the companies in our peer analysis peaked in 2013 and again, for all but one, have since trended lower. In percentage terms the losses from the 2013 peak to 2015, range from 9% to 34% with an average decline of 23%. With regard to specifics (and in U.S. dollar terms), General Cable Corp reported the biggest fall in year-on-year revenues in 2015, chiefly due to lower demand for cables in the oil and gas industry in the USA. Revenues were also lower year-on-year for Prysmian and Nexans, although the fall was somewhat tempered, for Prysmian by a recovery in the energy and infrastructure sectors and power distribution and for Nexan, which reported an increase in sales of high value-added businesses such as submarine high voltage cables and auto harnesses. The breakdown by business area for each company is tabled below. (A caveat: splits for each category cannot always be exact due to varied levels of detail reported by each company.)

REVENUE COMPARISON



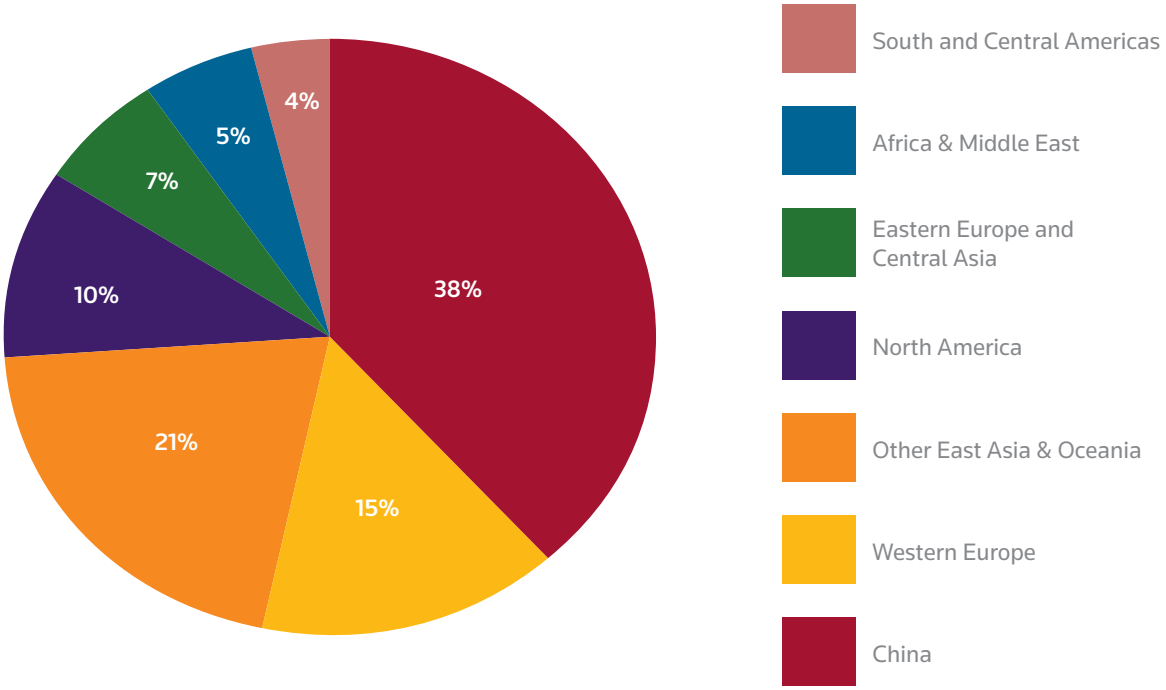
Source: Thomson Reuters; Company Reports

MAJOR FABRICATORS BUSINESS AREA

Breakdown by Business area	Prysmian Group	Nexans SA	Leoni AG	General Cable Corp.	FURUKAWA ELECTRIC	FUJIKURA Ltd
Industry (automotive & transport)	23%	16%	58%	29%	30%	20%
Industry (non-automotive)	38%	8%	42%			24%
Infrastructure & Building		28%		19%		2%
Metals (including Light Metals)				6%	24%	
Telecommunications	15%			12%	16%	22%
Transmission & Distribution	22%	36%		34%	28%	32%
Other	2%	12%			3%	
Total	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Source: GFMS, Thomson Reuters; Company reports

WORLD COPPER AND COPPER ALLOY FABRICATION CAPACITY 2015 BY REGION



Source: ICSG; Thomson Reuters

© 2015 Thomson Reuters. S020161 03/15.

REUTERS/Akhtar Soomro

Sometimes the Most Valuable Commodity Isn't Copper or Gold

Whatever your role, we provide more than information, we provide insight – truly relevant, accurate and timely news, forward-looking market analysis and research, exclusive fundamentals, and more. This unique market insight enables you to grasp exactly where the market is and where it is likely to go – and gives you the confidence to act.

OUR UNIQUE MARKET INSIGHT
YOUR MOST VALUABLE COMMODITY

financial.thomsonreuters.com/commodities

THOMSON REUTERS™

© 2016 Thomson Reuters. All rights reserved. Republication or redistribution of Thomson Reuters content, including by framing or similar means, is prohibited without the prior written consent of Thomson Reuters. Thomson Reuters and the Kinesis logo are trademarks of Thomson Reuters.

THOMSON REUTERS