3 March 2014 | 66 pages

Global

Global Iron Ore

Vive La Différence!

- **Citi's third global iron ore report.** We are downgrading our benchmark iron ore price forecasts, forecasting a decline to an average of $80/t in 2016 before a modest rebound. We also introduce explicit forecasts for lumps, pellets, 58%, and 65% ore, accompanied by granular examinations of these markets. For previous reports, see Strike while the iron is (still) hot? and Pumping Iron II.

- **Differentiation is becoming increasingly important as quality products command premiums representing a rising share of overall prices.** While a forecast fall in iron ore prices is likely to see nominal premiums decline for many products, we expect significantly higher premiums on a percentage basis moving forward. This is being driven primarily by greater emphasis on pollution controls in China as well as declining domestic ore grades.

- **Chinese iron ore production is more resilient than commonly assumed.** While Chinese mines are among the highest cost in the market, several factors are likely to support production even in the face of falling prices, including vertical integration (70% of output is owned by steel mills), freight advantages, and continued development of new mines.

- **Traditional cost curves present a misleading picture.** While many companies publish cash cost figures, normalizing these for product and grade premiums, freight, moisture, and fx effects yields a very different picture. We currently see the top of the ex-China cost curve around $100/t on a benchmark equivalent basis, with an increasingly significant portion of supply in the $75-95/t range. We also evaluate the likelihood of project delays or cancellations, which we expect to play an important role in balancing the market in the medium term.

- **Chinese steel demand is slowing structurally, but even continued demand at 2013's level would be insufficient to absorb the current surge in supply.** Moreover, scrap supply is likely to increase rapidly as steel produced in the early 2000s is recycled, reducing the share of steel production fed by iron ore. The government's focus on local government debt and controlling credit is likely to slow demand but decisions around urbanization will still have a large impact on the path of demand.

- **Iron ore market participants would do well to heed the lessons of coal, aluminium and nickel.** Prices will need to fall clearly below cash costs for a prolonged period to force production curtailments. This is especially true as iron ore lacks the potential to replicate the inventory financing seen for aluminium, though it should avoid the fate of met coal.

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Vive la Différence

With a strong market consensus that iron ore prices will fall in the coming years, there is a sense among many that the story is already well defined with little new to add. We disagree and believe there are several key factors facing the market, a number of which are underappreciated:

Resilient Chinese iron ore production: 70% of output is controlled by steel mills and project pipeline stretches out several years

- **Chinese iron ore mine production:** possibly the biggest area of debate in the market given the dispersion of small mines and sensitivity of the government. We see two key factors often being overlooked in the market: 70% of production is controlled by steel mills and thus less sensitive to iron ore market prices; and new mines continue to be developed with a pipeline stretching out several years.

- **Ex-China iron ore cost curve:** frequently misinterpreted as companies generally report costs on a FOB wmt basis. Normalizing production for freight, moisture content, grades, and product premiums yields a very different picture. We have modeled likely operational curtailments under varying price scenarios as well as likely project cancellations and postponements.

- **Indian supply rebound:** an underappreciated factor in helping to sustain prices as exports fell from ~100 Mt/y to 15 Mt in 2013. We expect exports to rebound to 35 Mt in 2014 and 45 Mt in 2016, adding to downside pressure on prices.

Premiums for quality products expected to remain structurally high

- **Differentiation amongst iron ore products and grades:** pricing differentials for pellets, lumps, and different grades of ore are becoming increasingly important, with premiums for quality products expected to remain structurally higher as a share of total iron ore prices. This is being driven by increased pollution controls in China and declining Chinese iron ore grades.

- **Chinese steel demand:** growth is expected to slow both cyclically and structurally. Tight credit, real estate cooling measures, and a lack of new infrastructure stimulus present short term headwinds. Pressure on local government debt, slowing population growth, and a transition away from investment led growth are among the structural negatives. Nevertheless, we do not expect China to reach peak steel production this decade.

Not only is Chinese steel production growth slowing, but the share supplied by iron ore is also likely to decline

- .**Chinese scrap supply:** growth has been modest in recent years but is likely to accelerate and grow rapidly through the end of the decade as metal that was consumed in the early and mid 2000s is recycled. The result is that not only is Chinese steel production growth slowing, but the share supplied by iron ore is also likely to decline.

Price Outlook

We have revised our price forecasts and expect benchmark 62% Fe CFR China prices to decline to an average of $80 in 2016, followed by a modest rebound. The driving factors behind this forecast include:

- Growth in supply over 2013-2015, driven by Big 4 mining companies which collectively are poised to add 100 Mt of supply *each year*.

- Rebound in Indian exports, shifting from an average decline of 19 Mt/y over 2010-2013 to an increase of 20 Mt in 2014, nearly a 40 Mt swing.

- Resilience of Chinese iron ore production, which is expected to decline but is more insulated from price declines than many believe due to vertical integration, the prevalence of SOEs, and new projects being developed.

Figure 1. Iron Ore S&D

Mt	Q1 2013	Q2 2013	Q3 2013	Q4 2013e	Q1 2014e	Q2 2014e	Q3 2014e	Q4 2014e	Q1 2015e	Q2 2015e	Q3 2015e	Q4 2015e	2010	2011	2012	2013e	2014e	2015e	2016e	2017e	2018e	2019e	2020e
Supply (Exports)																							
Rio Tinto	*58*	*62*	*64*	*61*	*58*	*71*	*72*	*72*	*69*	*85*	*84*	*84*	*224*	*231*	*239*	*245*	*274*	*323*	*339*	*348*	*357*	*364*	*360*
BHP	*38*	*45*	*46*	*54*	*47*	*58*	*55*	*55*	*52*	*64*	*59*	*59*	*116*	*138*	*150*	*182*	*216*	*235*	*252*	*261*	*265*	*265*	*265*
FMG	*21*	*24*	*26*	*31*	*33*	*40*	*39*	*39*	*35*	*43*	*39*	*39*	*39*	*49*	*66*	*102*	*150*	*155*	*155*	*155*	*155*	*155*	*155*
Australia	**125**	**142**	**151**	**161**	**152**	**185**	**182**	**183**	**172**	**209**	**201**	**202**	**402**	**438**	**492**	**579**	**703**	**785**	**847**	**881**	**908**	**925**	**912**
Vale	*68*	*73*	*86*	*85*	*72*	*83*	*83*	*83*	*89*	*89*	*89*	*89*	*310*	*323*	*320*	*312*	*321*	*357*	*366*	*366*	*401*	*431*	*451*
Brazil	**68**	**77**	**90**	**95**	**76**	**88**	**90**	**90**	**96**	**97**	**99**	**100**	**311**	**331**	**327**	**330**	**344**	**391**	**419**	**437**	**472**	**502**	**522**
India	4	3	4	4	5	11	7	12	11	10	7	12	105	79	30	15	35	40	45	45	45	45	45
South Africa	15	16	15	17	16	18	16	18	17	18	16	19	48	53	54	64	68	69	69	70	71	79	79
Canada	7	10	11	10	7	10	10	10	7	10	11	11	33	34	35	38	37	39	39	39	39	39	39
Others	56	58	57	61	60	62	59	63	62	65	61	65	152	159	212	231	243	252	261	275	280	285	290
Price Induced Curtailments					***0***	***0***	***0***	***0***	***5***	***8***	***12***	***12***	***0***	***0***	***0***	***0***	***0***	***37***	***115***	***106***	***162***	***206***	***198***
Total Seaborne Exports	**275**	**306**	**328**	**348**	**316**	**373**	**363**	**377**	**360**	**401**	**383**	**396**	**1,050**	**1,094**	**1,148**	**1,257**	**1,430**	**1,540**	**1,564**	**1,641**	**1,653**	**1,669**	**1,690**
Ex-China Demand (Imports)																							
Japan	32	34	35	34	34	34	34	34	34	34	34	34	134	128	131	136	137	137	136	136	136	136	136
Korea	15	14	16	18	17	17	17	17	17	17	17	17	56	65	66	63	68	69	70	71	72	75	78
Taiwan	5	6	6	5	5	5	5	5	5	5	5	5	19	21	18	22	20	20	20	20	21	21	21
EU	35	37	40	38	37	38	39	38	37	38	39	38	157	151	142	150	151	152	155	159	162	166	169
Others	7	10	8	10	9	11	8	11	9	11	9	11	51	43	38	35	38	40	43	44	46	48	49
Total Seaborne Imports	**95**	**101**	**104**	**106**	**102**	**105**	**103**	**105**	**103**	**106**	**104**	**106**	**417**	**408**	**396**	**406**	**415**	**419**	**424**	**431**	**437**	**445**	**454**
Trade data reconciliation	*6*	*-7*	*-7*	*-23*	*14*	*-13*	*4*	*-12*	*7*	*-9*	*8*	*-12*	*-14*	*1*	*-6*	*-31*	*-7*	*-6*	*3*	*-12*	*8*	*5*	*3*
Market balance ex-China (62% Fe)	***163***	***210***	***198***	***208***	***216***	***241***	***249***	***245***	***250***	***269***	***270***	***263***	***536***	***676***	***746***	***779***	***951***	***1,052***	***1,079***	***1,132***	***1,154***	***1,159***	***1,170***
Chinese Market																							
Crude Steel Production	**194**	**202**	**206**	**203**	**194**	**215**	**215**	**219**	**202**	**224**	**224**	**228**	**655**	**746**	**755**	**805**	**843**	**877**	**910**	**944**	**976**	**1,007**	**1,036**
Scrap Supply	17	20	19	20	18	21	21	22	22	25	26	28	89	91	84	76	81	100	123	155	189	227	236
Total Demand (62% Fe)	282	292	299	293	281	311	311	316	288	318	316	320	905	1,048	1,074	1,166	1,218	1,243	1,260	1,263	1,258	1,248	1,279
Balance Pre-Domestic Production	-119	-82	-101	-85	-65	-70	-61	-71	-38	-49	-46	-58	-369	-372	-328	-387	-268	-191	-181	-132	-104	-88	-109
Domestic Production (62% Fe)	**83**	**95**	**103**	**108**	**73**	**90**	**89**	**83**	**51**	**67**	**53**	**52**	**325**	**357**	**341**	**389**	**335**	**223**	**166**	**153**	**140**	**90**	**116**
Market Balance	**-36**	**13**	**2**	**23**	**7**	**20**	**28**	**12**	**13**	**18**	**7**	**-6**	**-44**	**-15**	**13**	**2**	**67**	**32**	**-15**	**21**	**36**	**2**	**7**
% seaborne exports +Chinese supply	-10%	3%	0%	5%	2%	4%	6%	3%	3%	4%	2%	-1%	-3%	-1%	1%	0%	4%	2%	-1%	1%	2%	0%	0%
Iron Ore Price & Forecast	148	125	133	135	124	112	110	105	98	92	85	85	147	168	129	135	113	90	80	83	85	85	90

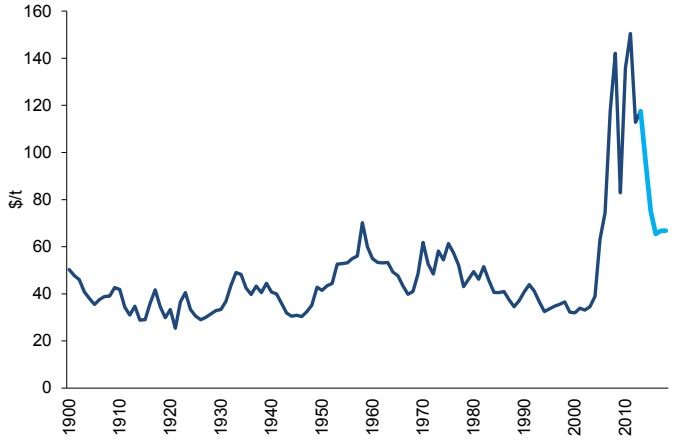
Source: Citi Research

Figure 2. Iron ore price outlook (nominal)

Source: Bloomberg, Citi Research

Figure 3. Long term real iron ore prices

Base year: 2006



Source: Citi Research

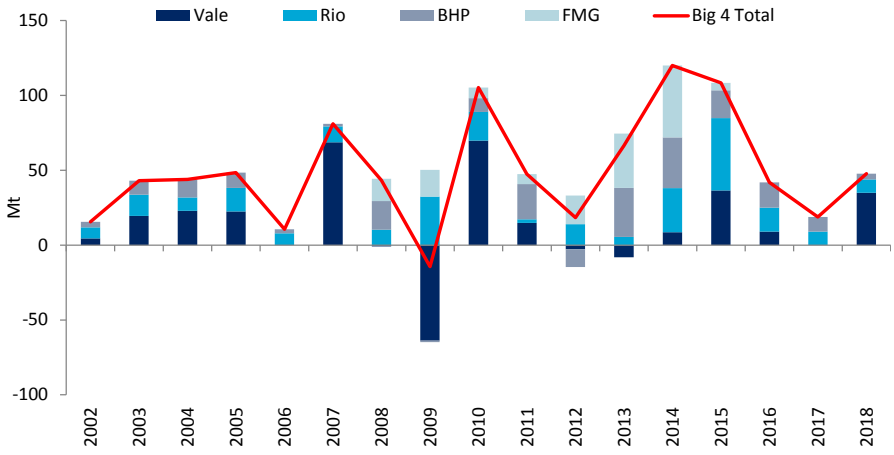
With 2014 and 2015 facing seemingly inescapable market surpluses, the question becomes the price needed to force sufficient production curtailments to bring the market back into balance in 2016. While this is dependent on demand growth, most notably from China, our scenario analysis (detailed in later sections) yields a range of $70-90/t as the necessary annual average, with a baseline forecast of $80/t.

Thereafter, market balances also become quite sensitive to the likelihood of project delays or cancellations. Based on a slowing growth pipeline, rising operating costs (notably in China) and our analysis of project price sensitivity, we forecast a modest rebound in prices to average $85 in 2018 and $90 in 2020, with risks to the upside.

Supply Growth

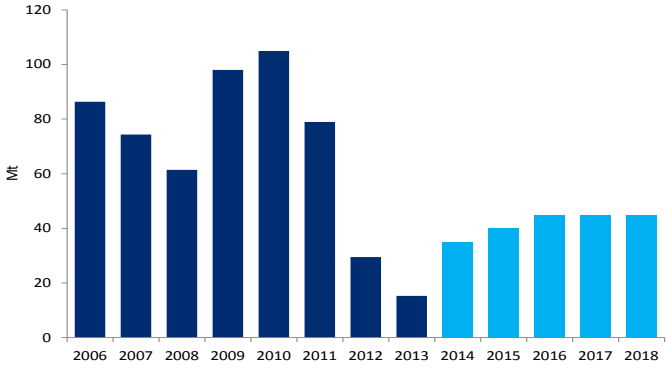
2013-2015 represents the height of the much heralded “wave of supply.” With 2013 having realized over 100 Mt of additional seaborne exports, 2014 and 2015 stand poised to exceed this market, adding a forecast 178 Mt and 147 Mt respectively (assuming no price induced curtailments).

Figure 4. Supply growth driven by Big 4, with peak growth in 2013-2015



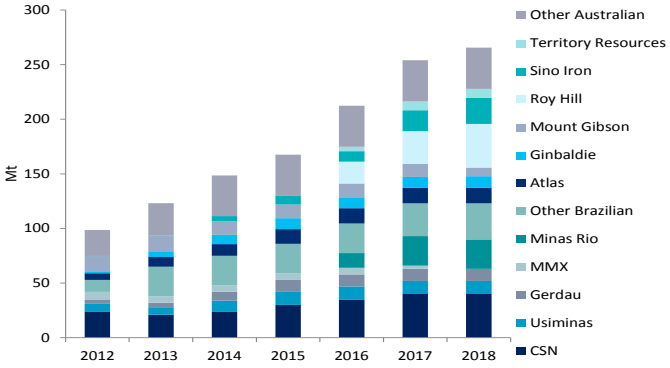
Source: Company reports, Citi Research

Figure 5. The decline in Indian exports is an underappreciated factor that has helped sustain prices



Source: GTIS, Citi Research

Figure 6. Australian and Brazilian iron ore supply ex-Big 4



Source: Company reports, Citi Research

Moreover, this supply growth is being driven not by marginal projects in peripheral locations, but rather by iron ore's core suppliers:

- **Big 4:** 229 Mt/y over 2014 & 2015, adding over 100 Mt/y of new supply *each year*
- **Other Australian and Brazilian producers:** 42 Mt/y of 2014 & 2015, with each expected to add 10 Mt/y each year
- **India:** 25 Mt/y increase in exports, including a 20 Mt increase in 2014 and another 5 Mt in 2015

Figure 7. Iron ore project pipeline

Project	Company/Region	Country	Timing	Capex (US$m)	Additional capacity	Capex per annual production (US$/t)
BHP 260-270mtpa	BHP Billiton	Australia	2016-	4500	45	100
Outer Harbour	BHP Billiton	Australia	2020+	19800	110	180
Expansion	Rio Tinto	Australia	2015	19065	123	155
Solomon - Kings	Fortescue	Australia	2014	6300	60	105
Mt Webber	Atlas Iron	Australia	2014	300	6	50
Roy Hill	Hancock Prospecting	Australia	2015	9500	55	173
Karara - Stage 2	Gindalbie/Ansteel	Australia	2017	1800	8	225
Sino Iron	Citic Pacific	Australia	2013	10000	28	357
Carajas +40 (+ logistics)	Vale	Brazil	2014	6445	40	161
Carajas Serra Sul (+ logistics)	Vale	Brazil	2017	19439	90	216
Carajas Serra Leste	Vale	Brazil	2014	478	6	80
Conceicao Itabiritos	Vale	Brazil	2014	1174	12	98
Vargem Grande Iabiritos	Vale	Brazil	2014	1645	10	165
Caue Itabiritos	Vale	Brazil	2015	1504	4	270
Conceicao Itabiritos II	Vale	Brazil	2014	1189	0	63
CSN - Casa De Pedra expansion (+port)	CSN	Brazil	2015	3500	20	175
Minas Rio Phase 1	Anglo American	Brazil	2015	3800	27	141
Usiminas - Friables	Usiminas	Brazil	2014	900	5	180
Usiminas - Compact	Usiminas	Brazil	2016	2000	12	167
Cerro Negro Norte	CAP	Chile	2015	1100	4	275
Los Colorados	CAP	Chile	2014	400	2	200
Askaf	Sphere Minerals	Mauritania	2011	540	6	90
Guelb el Auoj	Sphere Minerals	Mauritania	2015	1650	7	236
Lebtheinia	Sphere Minerals	Mauritania	2020		30	
Putu	Severstal	Liberia	2017	3000-4000	12	292
Tonkolili Phase 1	African Minerals	Sierra Leone	4Q2011	1900	20	95
Tonkolili Phase 2	African Minerals	Sierra Leone	2016	785	5	157
Tonkolili Phase 3	African Minerals	Sierra Leone	2020+	7200	45	160
Marampa	Cape Lambert	Sierra Leone	2016	2337	15	156
Marampa Phase 1	London Mining	Sierra Leone	1Q12	580	5	116
Marampa Phase 1a	London Mining	Sierra Leone	2015	40	1	40
Isua	London Mining	Greenland		2820	15	188
Kalia Phase 1	Bellzone	Guinea		865	7	124
Mbalam-Nabeba	Sundance Resources	Cameroon		4686	35	134
Mayoko phase 1	Exxaro	ROC	2H14	340	2	170
Avima Phase 1	Core Mining	ROC	2015		3	
Avima Phase 2	Core Mining	ROC	2019		32	
Zanaga Phase 1	Zanaga	ROC		2500-3000	12	200
Zanaga Phase 2	Zanaga	ROC			23	
Nimba Phase 1	ArcelorMittal	Liberia	2012	700	4	175
Nimba Phase 2	ArcelorMittal	Liberia	2015	1500	11	136
Faleme		Senegal	2020		15-25	
Kolomela	Kumba	S Africa			4	
Khumani	Assmang	S Africa		695.38864	6	116
Yeristovskoye	Ferrexpo	Ukraine	2013	383	3.8	101

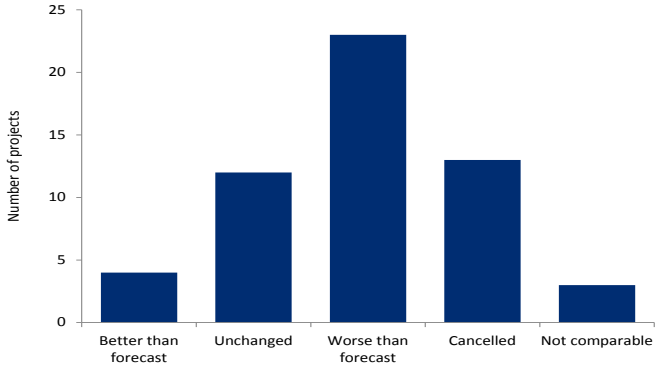
Source: Company reports, Citi Research

Looking at the market as a whole, there is a long list of projects under development or consideration. The question becomes how many of these will be executed and at what price would they be delayed or cancelled.

We have conducted a comparison with the list of projects we compiled in 2012 and found that over the past two years, of the 55 projects on the 2012 list, 24% (13 projects) have been cancelled and 42% have encountered other setbacks. Only 7% (4 projects) have exceeded expectations.

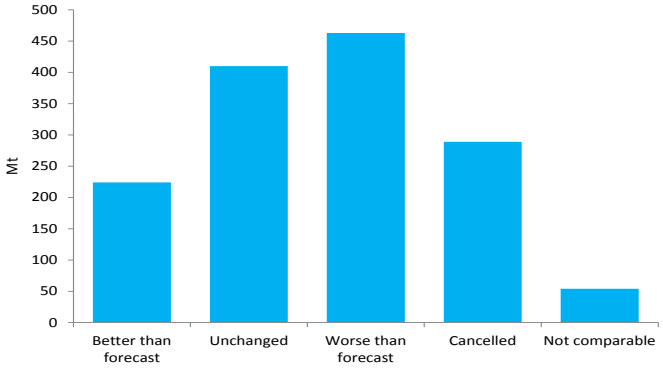
Weighting the projects by size yields somewhat better results, but still shows fully 289 Mt/y (20%) of projects having been cancelled and 463 Mt/y (32%) having suffered setbacks.

Figure 8. 2012 vs. 2014 project list comparison



Source: Company reports, Citi Research

Figure 9. 2012 vs. 2014 project list comparison



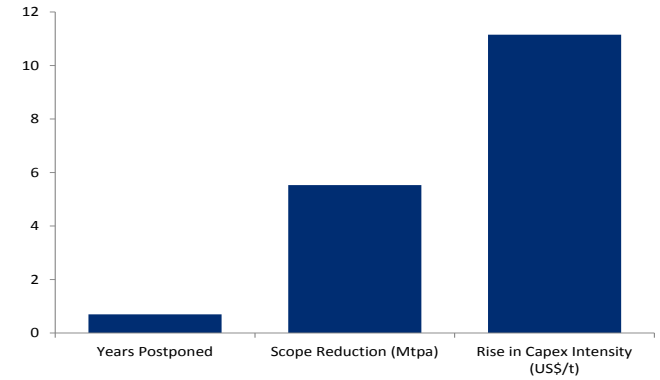
Source: Company reports, Citi Research

Given that iron ore prices have declined only moderately over this time period (though weathering the plunge in prices in Q3 2012), risks to the current pipeline should be seen as quite high. Several major projects in particular are at risk in the event of a significant fall in prices:

- **Roy Hill:** targeting production starting in 2015 and ramping up to 55 Mt/y
- **Sino Iron:** planning to ramp-up to 28 Mt/y
- **Carajas Serra Sul:** aiming to ramp-up beginning in 2017 and reaching 90 Mt/y

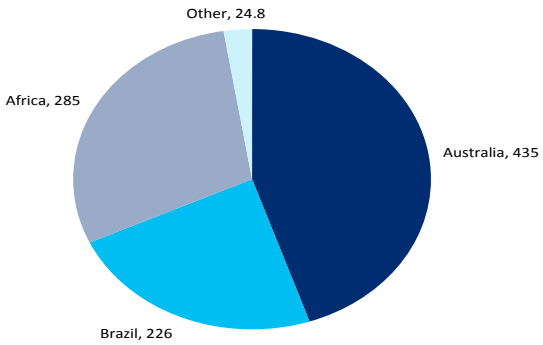
The cancellation or postponement of these three projects could collectively cut 155 Mt of potential 2020 supply.

Figure 10. Averages for projects that have suffered setbacks but have not been cancelled



Source: Company reports, Citi Research

Figure 11. Geographic distribution of 2014 project list



Source: Company reports, Citi Research

Product Differentiation

We believe that one of the most important themes in the iron ore market is the increasing divergence in pricing of varieties of ore. Most notably, premiums for higher quality ore are increasing. This is playing out both with respect to product – lump and pellet premiums – as well as grade differentials.

Premiums for higher quality ore are increasing

While our expectation of declining benchmark iron ore prices leads us to forecast a general decline in nominal premiums, we expect these differentials to rise as a percentage of iron ore prices. As a result, the importance of such premiums will increase (similar to, if less extreme than, what has played out with aluminium physical premiums), and prices of higher quality ore are expected to outperform.

Figure 12. Price forecasts for iron ore products and grades

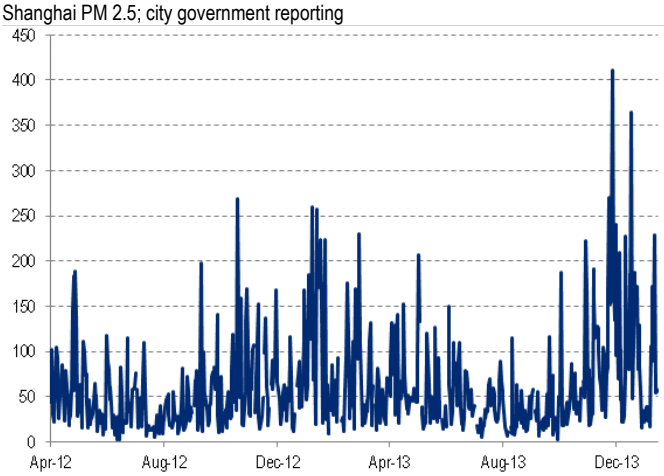
	Q1 2013	Q2 2013	Q3 2013	Q4 2013	Q1 2014	Q2 2014	Q3 2014	Q4 2014	Q1 2015	Q2 2015	Q3 2015	Q4 2015	2012	2013	2014	2015	2016	2017	2018	2019	2020
TSI 62% Ore	148	126	133	135	124	112	110	105	98	92	85	85	128	135	113	90	80	83	85	85	90
IODEX 62% Ore	149	126	133	135	124	112	110	105	98	92	85	85	130	135	113	90	80	83	85	85	90
IODEX 65% Ore	157	134	140	146	136	122	120	114	106	99	91	91	139	144	123	97	88	92	93	93	99
IODEX 58% Ore	132	111	118	117	107	94	93	90	84	79	73	74	115	119	96	77	69	72	74	74	79
Lump Premium	10	12	12	15	20	17	16	15	14	12	10	9	7	12	17	11	9	10	11	11	12
Pellet Premium	24	33	37	42	47	42	41	39	36	32	28	26	30	34	42	31	28	32	31	31	33
Lump % 62 ore	*6.6%*	*9.6%*	*8.7%*	*11.4%*	*16.1%*	*15.2%*	*14.5%*	*14.3%*	*14.3%*	*13.0%*	*11.8%*	*10.6%*	*5.5%*	*9.1%*	*15.1%*	*12.5%*	*11.3%*	*12.0%*	*12.9%*	*12.9%*	*13.3%*
Pellet % 62 ore	*16.0%*	*26.2%*	*28.1%*	*31.4%*	*37.9%*	*37.5%*	*37.3%*	*37.1%*	*36.7%*	*34.8%*	*32.9%*	*30.6%*	*23.4%*	*25.4%*	*37.5%*	*33.9%*	*35.0%*	*38.4%*	*36.5%*	*36.5%*	*36.7%*
65% - 62%	*8.1*	*8.0*	*7.7*	*11.4*	*11.5*	*10*	*9.5*	*9*	*8*	*7*	*6*	*6*	*9.4*	*8.8*	*10.0*	*6.8*	*8*	*9*	*8*	*8*	*9*
62% - 58%	*16.9*	*15.2*	*14.6*	*18.1*	*17*	*18*	*17.5*	*15*	*14*	*13*	*12.5*	*11.5*	*15.4*	*16.2*	*16.9*	*12.8*	*11.5*	*11.0*	*11.0*	*11.0*	*11.5*
65% Quality Premium	0.8	1.8	1.2	4.6	5.2	4.4	4.0	3.7	3.1	2.4	1.8	1.8	2.9	2.1	4.3	2.3	3.5	4.3	3.2	3.2	4.0
62% Quality Premium	7.8	7.5	6.5	10.1	9.6	11.5	11.1	8.8	8.2	7.6	7.5	6.4	7.5	8.0	10.3	7.4	6.8	6.0	5.9	5.9	6.1
65% Premium %	5.4%	6.3%	5.8%	8.4%	9.3%	8.9%	8.6%	8.6%	8.2%	7.6%	7.1%	7.1%	7.2%	6.5%	8.9%	7.5%	9.4%	10.2%	8.8%	8.8%	9.4%
62% Premium %	11.4%	12.0%	11.0%	13.4%	13.7%	16.1%	15.9%	14.3%	14.3%	14.1%	14.7%	13.5%	11.8%	12.0%	15.0%	14.2%	14.4%	13.2%	12.9%	12.9%	12.8%

Source: Citi Research

Demand for higher quality ore is being driven primarily by developments in China. In particular, environmental pressures are rising. This includes both pressure from the central government, including the Ministry of Environmental Protection and Ministry of Industry and Information Technology, as well as local governments, including the top three steel producing provinces: Hebei, Jiangsu, and Shandong. For steel, many of these initiatives are intertwined with efforts to alleviate overcapacity.

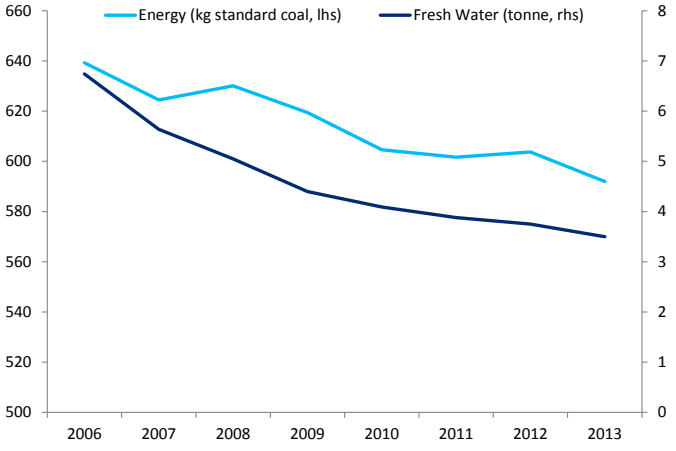
Figure 13. Chinese pollution continues to worsen…

Shanghai PM 2.5; city government reporting



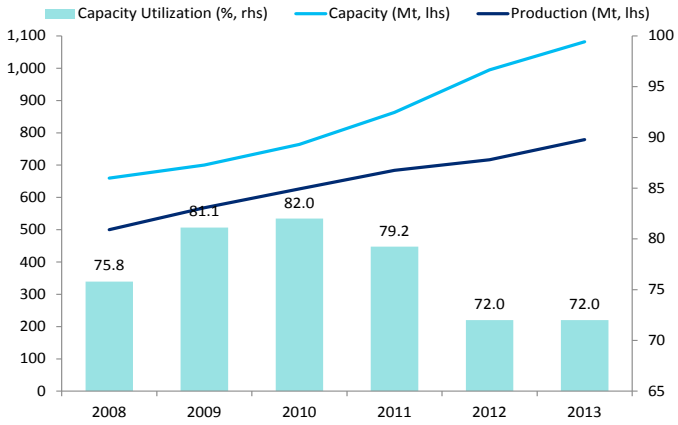
Source: Shanghai Municipal Environmental Monitoring, Citi Research

Figure 14. …And steel remains a target despite some efficiency gains



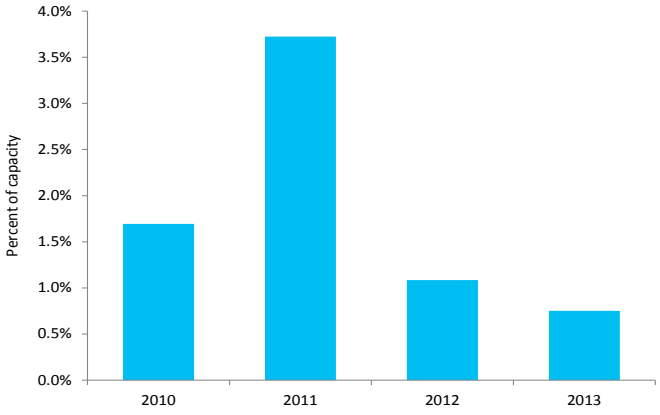
Source: MITT, Citi Research

Figure 15. Overcapacity remains a huge problem



Source: MIIT, Citi Research

Figure 16. Capacity eliminations have been limited



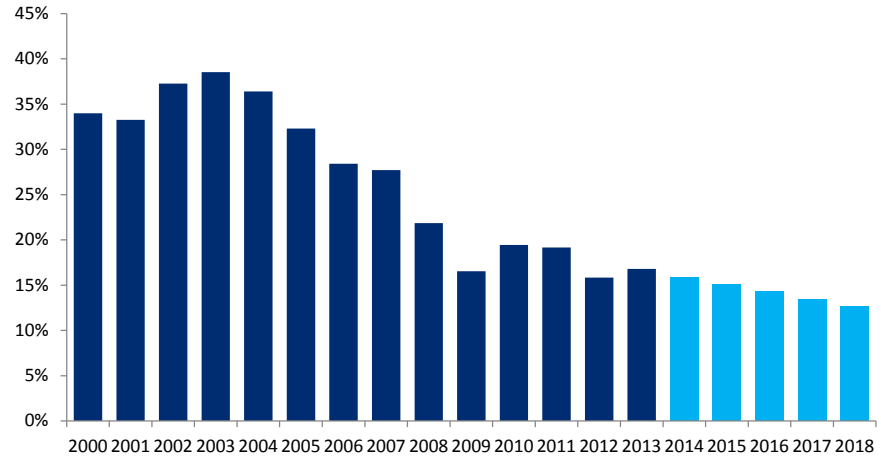
Source: MIIT, Citi Research

The new leadership has made tackling overcapacity a priority and is explicitly targeting the steel sector. A program was launched in 2013 with the goal of shifting the criterion by which plants are selected for closure as part of the overcapacity program. Traditionally this had been done almost entirely on the basis of production capacity. However, this created the incentive to avoid curtailment by expanding capacity, building a new plant, or merging with another company. As a result, past overcapacity programs have been unsuccessful.

The new program instead uses certain technical and environmental standards to evaluate steel mills. Two rounds of inspections were conducted in 2013 with a third taking place in Q1 of this year. Mills that fail to meet the standards this round are at risk of being put on notice for closure.

While follow-through remains crucial and yet to be seen, the government has emphasized implementation, including in the Central Economic Work Conference in December (China's premier annual economic planning forum) where it stressed "full implementation of central government decisions to ease overcapacity" and ordered local governments and ministries to establish special organizations to focus on implementing reforms more generally.

Figure 17. Chinese domestic iron ore grades are declining



Source: Citi Research

Environmental pressure on Chinese sinter and beneficiation plants

Environmental measures at steel mills have focused on sinter plants, with many mills being forced to close their facilities for several weeks while upgrades are made. This round of upgrading is likely to be concluded in 2014, but increased environmental standards are encouraging mills to switch to products that can avoid sinter plants (pellets, lumps) and that generally require less processing (higher grade ore).

Declining domestic ore grades spurring imported ore demand for blending

The other important factor is the continued decline in Chinese domestic iron ore grades. This has been an ongoing story, but is having an increasing impact. Partly, this is because grades have now declined to such a degree for many mines that even passing through the beneficiation process, they remain unacceptably low grade material. As a result, high grade imported ore is being blended to produce adequate feedstock.

Another is that aside from sinter plants, the portion of the steel supply chain most impacted by environmental measures is beneficiation. This has led to a reduction in effective beneficiation capacity, increasing the attraction of imported quality ore.

Looking ahead, with domestic ore grades expected to continue to decline, blending demand for high grade imported ore should remain strong.

Pellets

We have seen the perfect storm over the past year for pellets, with some factors likely to persist and others to wane. Structurally, pellet prices should be higher due to the increased environmental initiatives in China, making pellets an attractive alternative to running sinter feed. On the other hand, falling benchmark iron ore prices are likely to exert downwards pressure on the level of pellet premiums, though not on their percentage premium.

Pellet production growth is expected to be notably slower than overall iron ore output growth

The other factor that has supported prices is supply. We estimate that ex-China pellet supply actually declined in 2013, compared to roughly 10% growth in overall iron ore supply. Pellet production growth is expected to be stronger in 2014 and 2015, before slowing in 2016 and 2017, but to remain notably slower than overall iron ore production growth. This should keep pellet premiums supported compared to historical levels.

Figure 18. Pellet premium forecast

Source: WIND, Bloomberg, Citi Research

Figure 19. Pellet premium as percent of benchmark iron ore prices

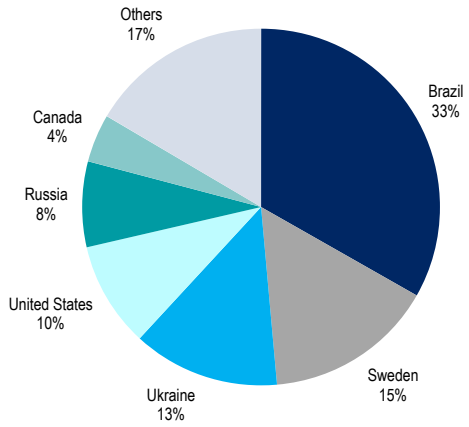
Source: WIND, Bloomberg, Citi Research

Figure 20. Global seaborne pellet supply outlook

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Pellet Supply Ex-China	117.1	116.0	120.4	127.7	128.7	127.9	133.0	137.5	140.8
Growth		*-1.0*	*4.4*	*7.3*	*1.0*	*-0.8*	*5.1*	*4.5*	*3.2*
Growth Rate		*-0.9%*	*3.8%*	*6.1%*	*0.8%*	*-0.7%*	*4.0%*	*3.4%*	*2.4%*
Growth vs. total IO growth		*-10.4%*	*-9.8%*	*-4.3%*	*-4.6%*	*-3.3%*	*0.0%*	*0.0%*	*1.6%*

Source: Citi Research

Figure 21. 2014 global seaborne pellet supply



Source: Citi Research

The outlook becomes less clear in 2018-2020 due to Vale's expansion plans. Should these be fully executed, the pellet market would once again see stronger growth. However, a period of lower prices could jeopardize this expansion, leaving the pellet market tight. On the other hand, Vale has 10 Mt of mothballed pellet capacity that could be activated in the event of better pricing.

These variables should keep the pellet market somewhat contained, as well as leveraged to the progress of benchmark ore prices and sensitive to Vale's capex decisions.

Lumps

Like for pellets, lump premiums have been driven up by environmental pressures on steel mills' sinter plants. Similarly, nominal premiums should come under pressure from falling benchmark ore prices.

Figure 22. Lumps premium forecast

Source: WIND, Bloomberg, Citi Research

Figure 23. Lumps premium as percent of benchmark iron ore prices

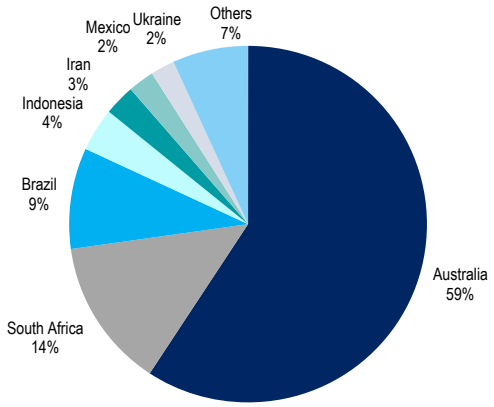
Source: WIND, Bloomberg, Citi Research

Figure 24. Global seaborne lumps supply outlook

	2012	2013	2014	2015	2016	2017	2018	2019	2020
Lump Supply Ex-China	219.9	248.3	275.3	305.1	330.6	346.5	359.3	375.5	376.4
Growth		*28.4*	*27.0*	*29.8*	*25.5*	*16.0*	*12.8*	*16.2*	*0.9*
Growth Rate		*12.9%*	*10.9%*	*10.8%*	*8.4%*	*4.8%*	*3.7%*	*4.5%*	*0.2%*
Growth vs. total IO growth		*3.4%*	*-2.7%*	*0.4%*	*3.0%*	*2.2%*	*-0.3%*	*1.1%*	*-0.5%*
Ex-Roy Hill									
Lump Supply Ex-China	219.9	248.3	275.3	305.1	321.8	333.3	341.7	353.5	354.4
Growth		*28.4*	*27.0*	*29.8*	*16.7*	*11.6*	*8.4*	*11.8*	*0.9*
Growth Rate		*12.9%*	*10.9%*	*10.8%*	*5.5%*	*3.6%*	*2.5%*	*3.5%*	*0.3%*
Growth vs. total IO growth		*3.4%*	*-2.7%*	*0.4%*	*0.1%*	*0.9%*	*-1.5%*	*0.1%*	*-0.5%*

Source: Citi Research

Figure 25. 2014 global seaborne lumps supply



Source: Citi Research

The supply side is quite different though, with much stronger growth in supply for lumps than pellets. This is being driven by rising production in Australia, particularly from BHPB. Supply growth is nevertheless expected to be weaker in 2014 than for overall iron ore, but this is set to flip over the 2014-2017 period and should help push lump premiums lower.

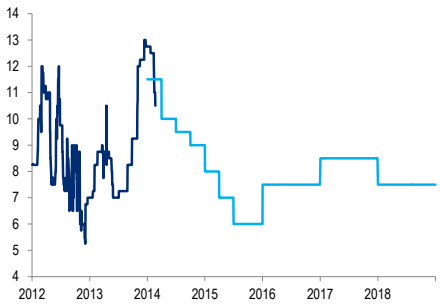
Lump demand strong, but so is supply

However, the Roy Hill project presents notable supply risk as its postponement or cancellation would remove 22 Mt/y of lump supply growth from the market.

Grade Differentials

Demand for high grade iron ore is structurally supported by continued declining grades of Chinese production, as even after running through the beneficiation process, an increasing portion of domestic ore needs to be blended with high grade imported ore in order to yield an acceptable product. Environmental pressure on beneficiation plants and steel mills is also helping boost demand.

Figure 26. 65% - 62% iron ore prices



Source: Citi Research

Figure 27. 65% iron ore quality premium

Source: Citi Research
Note: Calculated as the difference between 65% prices adjusted to a 62% basis and 62% benchmark prices

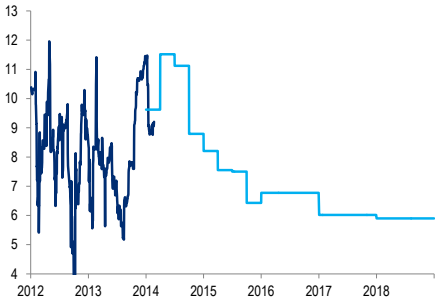
Figure 28. 65% - 62% premium as percent of 62% iron ore prices

Source: Citi Research

Figure 29. 62% - 58% iron ore prices

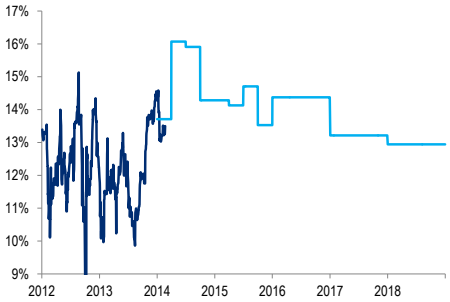
Source: Citi Research

Figure 30. 62% iron ore quality premium



Source: Citi Research
Note: Calculated as the difference between 62% iron ore prices and 58% price adjusted to a 62% basis

Figure 31. 62% - 58% premium as percent of 62% iron ore prices



Source: Citi Research

Differentials between 62% and 58% iron ore are likely to be quite strong in 2014 due to extremely rapid growth of 58% ore supply (from FMG and other Australian producers), declining grades in China leading to greater demand for better quality ore, and environmental pressure on Chinese beneficiation plants. However, falling benchmark iron ore prices and slower growth of 58% ore in the coming years, combined with still strong growth of 62% ore, should see the price differential decline.

In terms of supply, growth for 65% Fe ore is much slower than for lower grade ore, with the difference particularly acute in 2013 and 2014. This year looks to be quite tight, but 2015 should see a burst of supply out of Brazil, as Vale's Carajas expansion adds high grade volumes from the north of the country and new concentrating capacity allows Vale to upgrade compact itabirite ore produced from its Southern systems.

2016 and 2017 should then see slower growth, and as we move on to 2018-2020, supply growth becomes almost entirely dependent on Vale's Carajas Serra Sul project. Should the project go through on schedule, it would result in another surge of high grade ore onto the market. However, should it be delayed due to unfavorable market conditions, then the high grade market could remain in prolonged tightness through 2020.

Figure 32. Global seaborne 65+% iron ore supply outlook

	2012	2013	2014	2015	2016	2017	2018	2019	2020
65+% Supply Ex-China	303.9	316.5	337.4	395.7	416.2	419.0	460.3	495.3	516.0
Growth		*12.5*	*20.9*	*58.3*	*20.5*	*2.8*	*41.4*	*35.0*	*20.6*
Growth Rate		*4.1%*	*6.6%*	*17.3%*	*5.2%*	*0.7%*	*9.9%*	*7.6%*	*4.2%*
Growth vs. 60-65% Growth		*-3.7%*	*-4.0%*	*8.2%*	*-2.0%*	*-3.5%*	*7.2%*	*5.0%*	*4.7%*
Ex-Carajas Serra Sul									
65+% Supply Ex-China	303.9	316.5	337.4	395.7	416.2	419.0	425.3	430.3	431.0
Growth		*12.5*	*20.9*	*58.3*	*20.5*	*2.8*	*6.4*	*5.0*	*0.6*
Growth Rate		*4.1%*	*6.6%*	*17.3%*	*5.2%*	*0.7%*	*1.5%*	*1.2%*	*0.1%*
Growth vs. 60-65% Growth		*-3.7%*	*-4.0%*	*8.2%*	*-2.0%*	*-3.5%*	*-1.1%*	*-1.4%*	*0.6%*

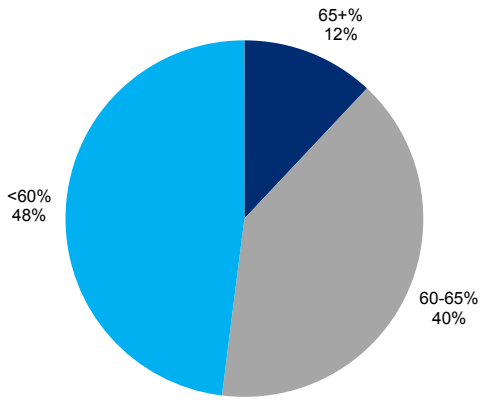
Source: Citi Research

Figure 33. Global seaborne <60% iron ore supply outlook

	2012	2013	2014	2015	2016	2017	2018	2019	2020
< 60% Supply Ex-China	263.8	314.5	397.9	425.2	434.8	442.2	446.8	449.9	447.7
Growth		*50.7*	*83.4*	*27.3*	*9.7*	*7.4*	*4.6*	*3.1*	*-2.2*
Growth Rate		*19.2%*	*26.5%*	*6.9%*	*2.3%*	*1.7%*	*1.0%*	*0.7%*	*-0.5%*
Growth vs. 60-65% Growth		*11.4%*	*15.9%*	*-2.2%*	*-4.9%*	*-2.5%*	*-1.6%*	*-1.9%*	*0.0%*

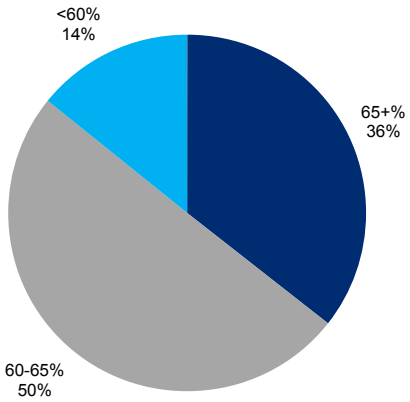
Source: Citi Research

Figure 34. Growth in iron ore supply 2012-2014



Source: Citi Research

Figure 35. Growth in iron ore supply 2014-2018



Source: Citi Research

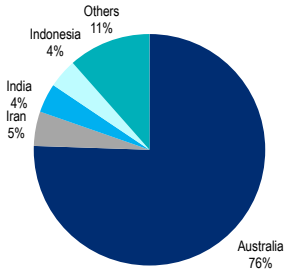
2014-2015 should see growth of high grade ore overtake that of low grade material

2014-2015 is likely to represent a tipping point in the iron ore market in more ways than one. While growth over the 2012-2014 period has been driven disproportionately by low grade ore (<60%), with very little high grade (65+%) material, this is likely to shift radically thereafter. In fact, comparing the 2012-2014 and 2014-2018 periods, the share of incremental production represented by low grade ore is expected to shrink from 48% to 14% while that of high grade ore should rise from 10% to 36%.

Looking on a regional basis, the high grade and low grade ore markets are very much dominated by Brazil and Australia respectively. For high grade ore, the importance of Brazil is only increasing, with 73% of the growth to 2018 expected to derive from Brazil. However, Australia is also poised to play a bigger role in the high grade market, accounting for 18% of growth, with the Sino Iron and Karara projects exporting higher grade concentrates.

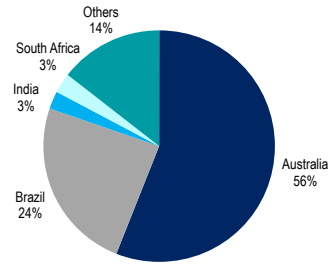
The low grade ore market has been driven by Australia, which is poised to account for 85% of the massive supply growth taking place over 2012-2014. However, incremental growth should slow considerably thereafter as low grade ore expansions in Australia mature, leaving the market more driven by a variety of peripheral projects in smaller exporting nations around the world.

Figure 36. 2014 low grade ore supply (<60%)



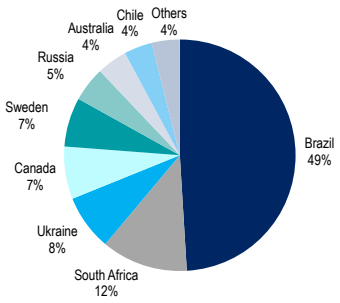
Source: Citi Research

Figure 37. 2014 mid-grade ore supply (60-65%)



Source: Citi Research

Figure 38. 2014 high grade ore supply (65+%)



Source: Citi Research

Chinese Demand Outlook

China remains the overwhelming driver of iron ore demand, accounting for 67% of global iron ore imports in 2013 and 89% of the growth in imports. Growth has slowed though from the 17% annual rate experienced over 2001-2011 to 6.5% in 2013, and is expected to slow further in the coming years.

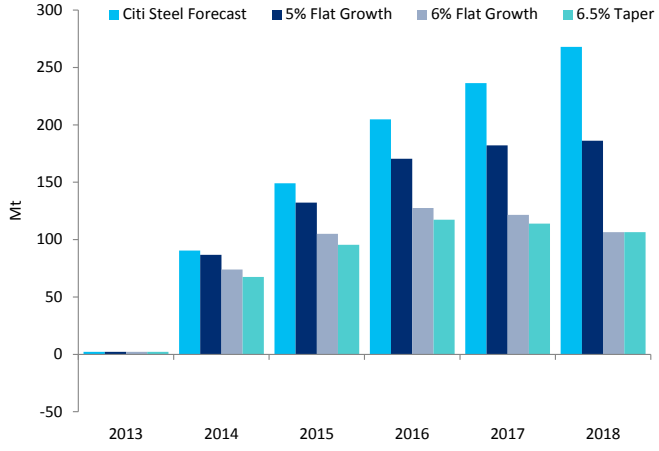
Stronger than expected steel production growth would not be sufficient to absorb supply growth

However, given the scope of supply hitting the market over 2013-2015, even were steel production growth to accelerate to 8% per year, the iron ore market would still experience significant surpluses in 2014 and 2015. In fact, at current prices a flat 6.5% growth profile would see significant surpluses through 2018.

The inescapable conclusion is that prices need to fall in order to force supply curtailments. Examining the sensitivity of Citi's iron ore forecasts to various Chinese steel production growth rates, we find the 2016-2018 period rather sensitive to various steel growth rates, with a 5% flat growth scenario likely leading to prices bottoming on an annual basis at $85-90/t and 6% flat growth likely leading to a $90-95/t annual bottom rather than the $80/t we have forecast for 2016.

Figure 39. Assuming current prices persist, even dramatically faster Chinese steel production growth would be insufficient to absorb the growth in supply

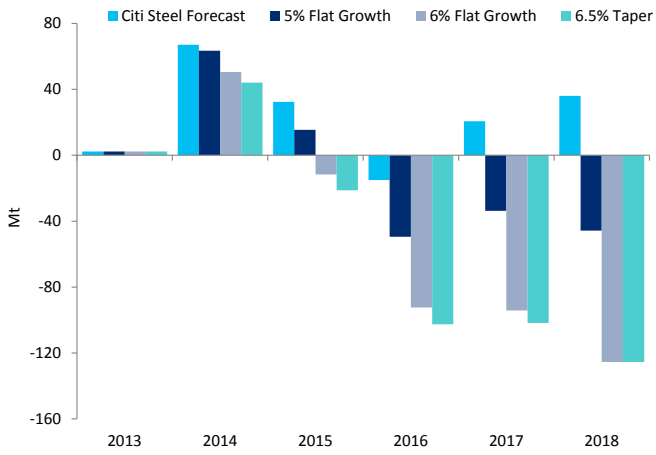
Iron ore annual market balance based on flat $120/t price



Source: Citi Research

Figure 40. Better than expected Chinese steel production growth would pose a significant bullish risk to our medium term forecast though

Iron ore annual market balance based on Citi iron ore price forecast

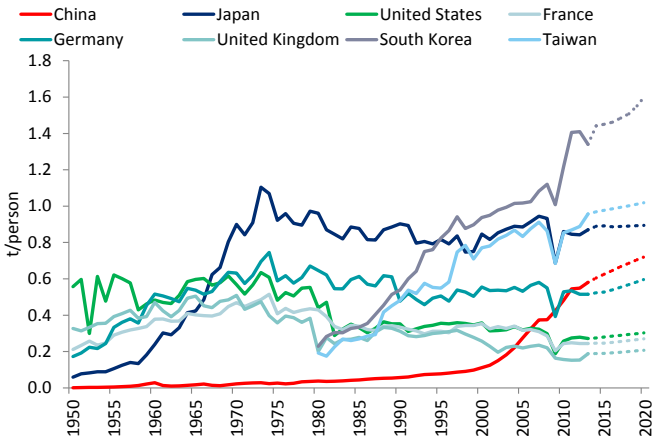


Source: Citi Research

Chinese steel production growth is unlikely ever again to reach the heights seen over 2001-2008. That period was exceptional, with a prolonged spike in the steel intensity of GDP and IP growth. It is unreasonable to expect a repeat of the coalescing of the broad set of conditions that drove such growth; however Chinese steel production is expected to continue to increase.

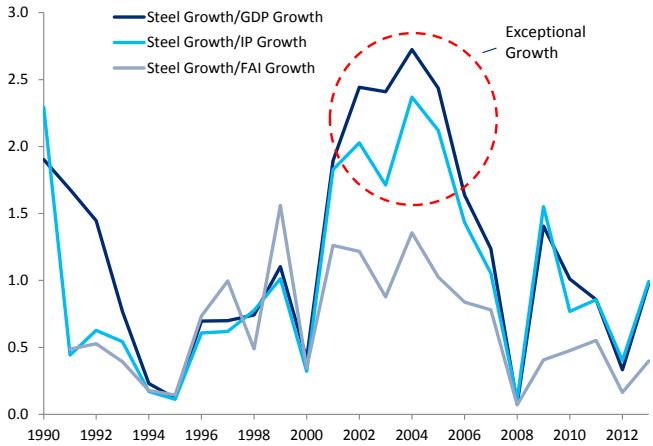
In fact, even accounting for underreporting of steel production by official Chinese data sources and despite slowing population growth, our forecast production profile sees Chinese steel production per capita through 2020 remaining well below current levels in Japan, Taiwan, and Korea, and below the peaks reached by Germany and Russia. Estimates of the stock of steel in China likewise show low levels relative to developed countries. In other words, there is still significant room for steel production to continue to increase, albeit at greatly reduced growth rates.

Figure 41. Long-run per capita steel consumption



Source: UN, Worldsteel, Citi Research

Figure 42. Chinese steel production: 2001-2008 was an exceptional period that is unlikely to be repeated



Source: NBS, Citi Research

Figure 43. China steel S&D (Mt)

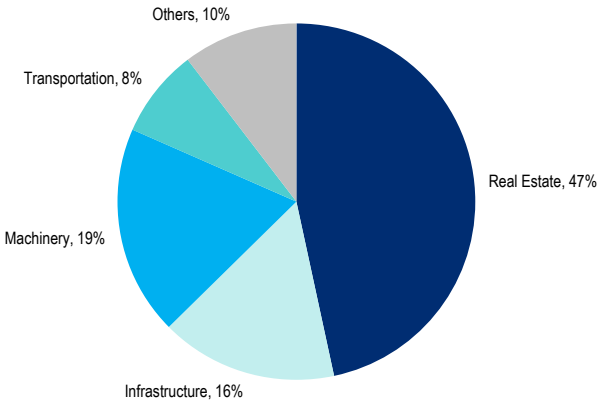
	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Real Demand	702	710	750	783	815	847	879	910	939	966
		1.1%	*5.7%*	*4.4%*	*4.0%*	*3.9%*	*3.8%*	*3.4%*	*3.3%*	*2.9%*
Net Exports	33	42	48	53	58	60	62	64	66	68
		26.5%	*14.5%*	*9.8%*	*9.4%*	*3.4%*	*3.3%*	*3.2%*	*3.1%*	*3.0%*
Inventory	97	100	106	112	117	122	126	130	135	138
Inventory Builds	10	3	6	6	5	5	5	4	4	4
		-69.2%	*94.3%*	*6.0%*	*-28.8%*	*-1.9%*	*1.4%*	*-7.1%*	*-1.5%*	*-7.7%*
Production	**746**	**755**	**805**	**843**	**877**	**911**	**946**	**978**	**1,009**	**1,038**
		1.3%	***6.5%***	***4.7%***	***4.1%***	***3.9%***	***3.8%***	***3.4%***	***3.2%***	***2.9%***
Demand Breakdown										
Real Estate	308	327	350	358	363	371	380	387	394	400
Infrastructure	99	107	120	127	136	143	149	155	160	166
Machinery	137	135	143	153	162	172	182	191	201	210
Transportation	57	57	60	65	69	74	78	83	87	92
Others	101	85	78	81	85	88	91	94	97	100
Growth										
Real Estate		*6.1%*	*7.1%*	*2.3%*	*1.5%*	*2.2%*	*2.2%*	*1.9%*	*1.9%*	*1.5%*
Infrastructure		*7.5%*	*12.5%*	*5.9%*	*7.2%*	*4.9%*	*4.6%*	*3.9%*	*3.6%*	*3.3%*
Machinery		*-1.8%*	*5.7%*	*7.0%*	*6.2%*	*6.0%*	*5.8%*	*5.3%*	*4.9%*	*4.4%*
Transportation		*0.0%*	*6.0%*	*7.4%*	*6.9%*	*6.5%*	*6.2%*	*5.9%*	*5.5%*	*5.3%*
Others		*-15.7%*	*-8.6%*	*4.4%*	*4.0%*	*3.7%*	*3.6%*	*3.4%*	*3.0%*	*2.8%*
Total		*1.1%*	*5.7%*	*4.4%*	*4.0%*	*3.9%*	*3.8%*	*3.4%*	*3.3%*	*2.9%*

Source: Citi Research

End-Use Sector Outlooks

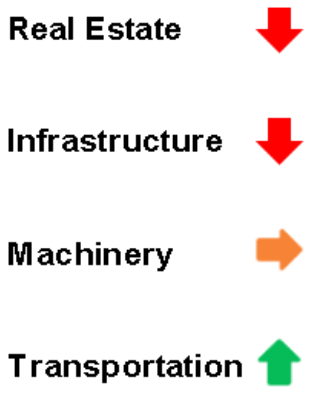
Chinese steel demand is dominated by real estate, infrastructure, and machinery, with the three sectors accounting for roughly 80% of total steel demand. All three sectors face significantly weaker prospects for 2014 and the medium term, particularly real estate and infrastructure.

Figure 44. 2013 steel demand by sector



Source: Citi Research

Figure 45. 2014 sector demand scorecard



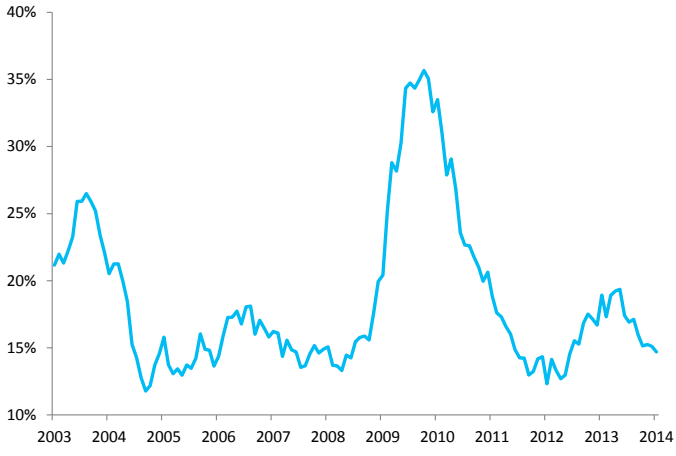
Source: Citi Research

Real estate

In 2014, we expect weaker demand from the real estate sector due to cooling measures being applied by governments and tighter credit. Efforts to cool the housing market include measures taken both directly and via banks, most notably higher mortgage rates and down-payment requirements, and tighter restrictions on home purchases. Tighter credit conditions, particularly for alternative "shadow banking" credit, should constrain both funds available to investors as well as credit for developers (including the extreme recent example of certain banks temporarily cutting off credit entirely to developers).

Figure 46. Credit tightening is slowing Chinese growth

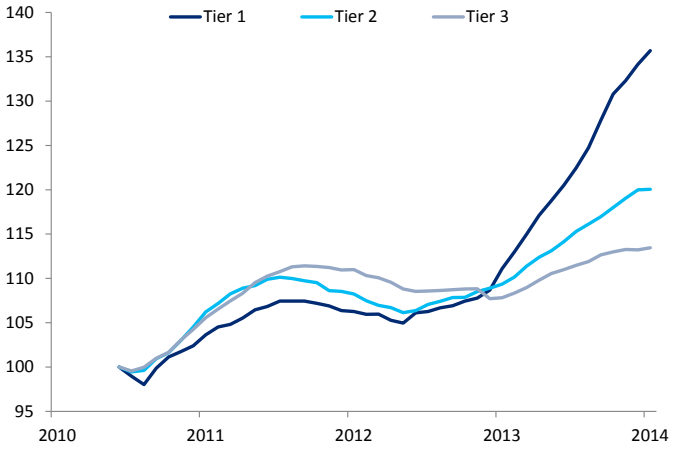
Real YoY change in the stock of social financing



Source: PBoC, Citi Research

Figure 47. Rapidly rising housing prices are prompting a response from the government

Indexed; June 2010 = 100



Source: Soufun, Citi Research

More fundamentally, real estate demand has been driven by a number of factors, including: urbanization, population growth, rising incomes, rise of mortgage lending, lack of investment alternatives, growth of alternative credit, and cultural pressure to purchase a house before getting married. In the medium term, most of the factors should either slow or disappear entirely.

With respect to real demand for occupancy, urban population growth rates are slowing, incomes should continue to rise but are likely to slow with GDP, and while mortgages are still not as commonly used as in the West, the 'S' curve has already been hit in its development cycle.

Real estate sector demand likely to slow

As for investment demand, gradual capital account liberalization and development of the domestic securities industry is expanding the scope of alternatives for domestic investors. This includes wealth management products, gold, and pilot programs for investment in certain foreign securities. The channeling of investment via non-traditional credit into real estate is also likely to come under increasing pressure from regulators.

Infrastructure

Infrastructure growth is likely to slow significantly in 2014 as the mini stimulus implemented in 2012 (the last cyclical trough was in Q1 2012) has rolled off and the government remains less concerned with supporting growth rates than tackling structural problems. In the medium term, we expect structurally slower growth due to pressure on local government debt.

Infrastructure demand should see structurally slower growth

The national government debt audit conducted last year revealed that local government debt has risen at 20% per year since 2010. The leadership is responding, with the Central Economic Work Conference report containing the strongest language yet from a top policy document for increased supervision and transparency of local government debt. Local governments have also been banned "in principle" from establishing certain companies that had been used to fund infrastructure and real estate activity.

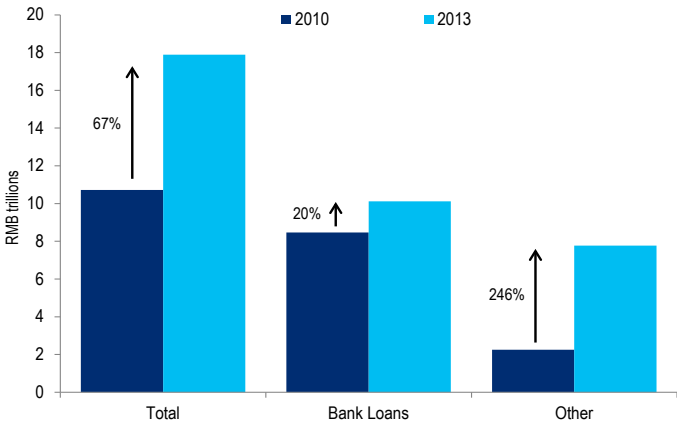
Initiatives to control the "shadow banking" sector are also likely to slow infrastructure and real estate growth as these sectors have been prime beneficiaries from such non-traditional financing channels (local government debt ex-bank loans rose 246% since 2010).

Figure 48. Infrastructure investment growth has slowed as the mini stimulus from 2012 has rolled off

Real infrastructure FAI, QoQ, seasonally adjusted

Source: Citi Research

Figure 49. Concerns over local government debt are likely to lead to structurally slower infrastructure growth



Source: State Council, Citi Research

Machinery

Machinery prospects mixed

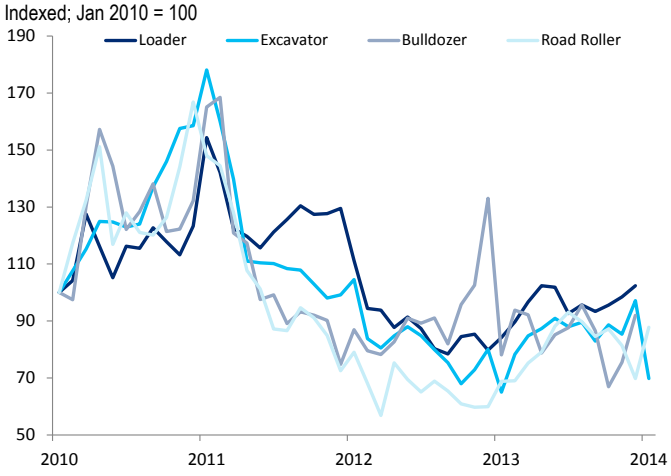
Prospects for machinery are more mixed. On the positive side, producers have worked off the very high inventories that were accumulated over 2011 and 2012. However, strong sales in 2010 and 2011 boosted by attractive credit, have left end-users relatively well stocked. Moreover, slowing growth in the manufacturing, infrastructure, and real estate sectors will cap growth from the sector in 2014. In the medium term, the machinery sector is likely to experience modest positive growth but to remain far below pre-2011 growth rates due to slower real estate, infrastructure, and manufacturing growth.

Transportation

Transportation the brightest component of Chinese steel demand

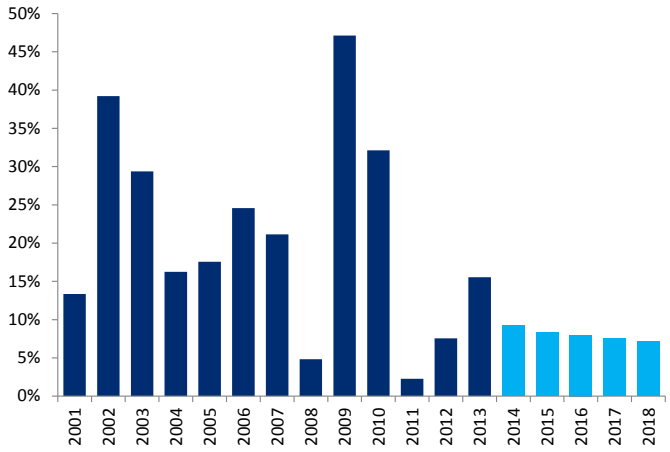
Transportation is the brightest component of steel demand in China, driven primarily by auto production growth, though also by continued rail expansion – both passenger and freight. Auto production grew by 15.5% in 2013 and while we expect a moderation, auto ownership remains low and exports are likely to become increasingly significant. Moreover, while license plate restrictions in Shanghai and Beijing have grabbed headlines, such measures are confined to a very limited number of mega cities, with real growth coming from lower tier cities.

Figure 50. Machinery sales have stabilized as producer inventories have been worked off but face weaker demand and high end-user stocks



Source: CCMA, Citi Research

Figure 51. Auto production growth is expected to moderate but remain quite rapid



Source: NBS, Citi Research

Structural Demand Drivers

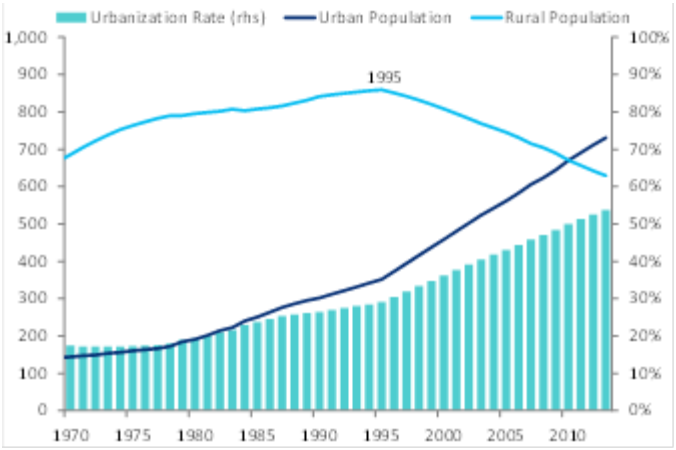
The key fundamental drivers of Chinese steel demand moving forward are urbanization and the transition from investment to consumption driven growth.

Urbanization

Urbanization represents the primary driver of Chinese steel demand, with the growth of China's urban population stimulating demand for everything from real estate and infrastructure, to consumer goods.

Looking forward, the pace of Chinese urbanization will largely be dependent on two factors:

Figure 52. Urbanization is the largest driver of Chinese steel demand



Source: NBS, Citi Research

Figure 53. Both the pace and composition of China's urbanization will be important in shaping future steel demand

Proposed city clusters

Source: Citi Research

- **Residence permit (*hukou*) liberalization:** one of the most high profile topics in Chinese politics and which is being pushed forward in smaller cities. Liberalization is positive for urbanization rates, but its expansion to larger cities is contentious given concerns of overcrowding and the pressure on local government budgets to provide social services for additional residence permit holders. It also does not help that the most proactive large city in *hukou* liberalization was Chongqing under Bo Xilai.

- **Rural land reform:** received a boost at the Third Plenum and earlier this year it was announced that farmers will be permitted to use their agricultural land as collateral to obtain loans. Further measures to allow farmers to monetize or transfer their land rights would be positive for urbanization as one important disincentive currently is the opportunity cost of giving up land use rights without compensation.

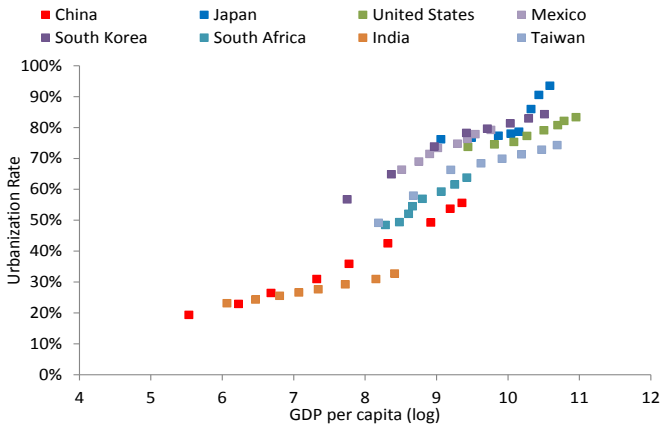
Urbanization policies are key signposts to watch

Beyond the pace of urbanization, its composition will also have an important impact on steel demand. There are two competing visions for urbanization in China: focusing on a cluster of large city-hubs, or spread out among smaller cities across the country. The former is significantly less steel intensive and was endorsed by China's first ever Central Urbanization Work Conference last December, which called for creating major city clusters in China's West, Center, and Northwest along the lines of the current three major clusters (Beijing/Tianjin/Hebei, Yangtze River Delta, and Pearl River Delta).

However, residence permit liberalization is focused on smaller cities, with large cities unlikely to liberalize in the near future, and many in the government favor a focus on growing smaller cities. This pattern of urbanization would be significantly more steel intensive given lower population densities and inability to take advantage of shared infrastructure.

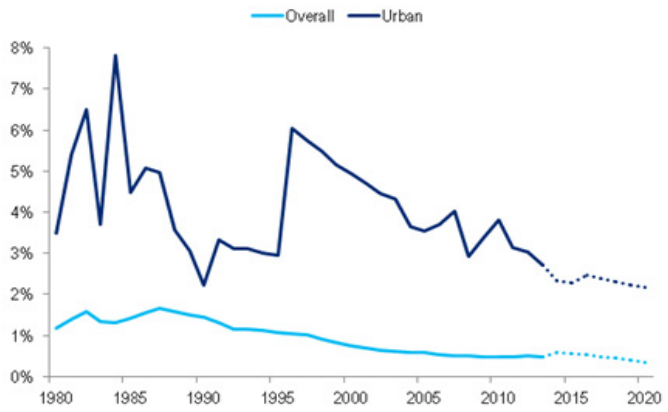
From a more structural perspective, China still has a long way to go in its urbanization process, with the current 54% urbanization rate well below that of typical middle and upper income countries. Countries at China's GDP per capita (PPP) are typically at over 60% urbanization, and those at $20,000 per capita GDP (PPP) in the mid-70s%.

Figure 54. Chinese urbanization still has a long way to go



Source: UN, Penn World Tables, NBS, Citi Research

Figure 55. Slowing population growth will dampen steel demand growth



Source: UN, NBS, Citi Research

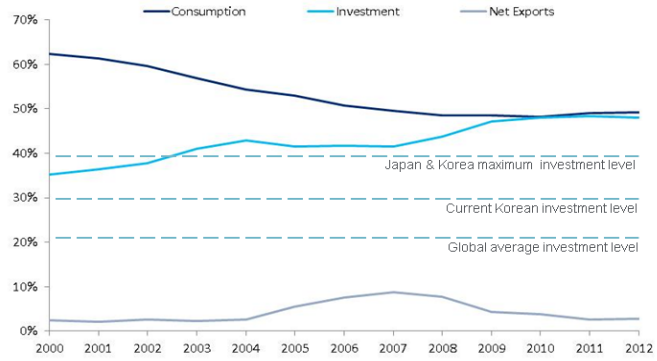
However, China is also facing slowing population growth. This has helped to slow urban population growth despite continued migration and will serve to dampen steel demand regardless.

Economic transition

Over the next decade, China's economy will transition from investment- to consumption-led growth – whether via a smooth process or a sudden crisis. The scope of the needed transition is massive, with Chinese growth over the past few years experiencing the greatest dependency on investment of any major economy on record. Investment's share of GDP is currently 10 percentage points higher than the peak experienced by Japan and Korea, and 28 points above the global average.

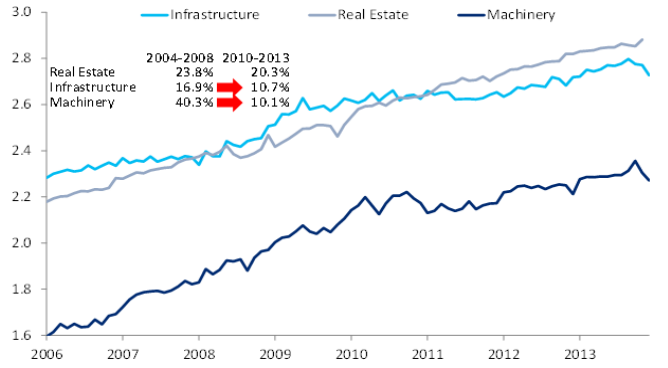
Part of this transition is already being felt, with growth rates of infrastructure and machinery investment having slowed significantly from pre-financial crisis levels. This transition should accelerate, particularly as the central government applies increasing pressure on local government debt accumulation.

Figure 56. The transition from investment to consumption is a massive challenge that has just begun



Source: NBS, World Bank, Citi Research

Figure 57. Capital formation has slowed and will continue to do so



Source: Citi Research

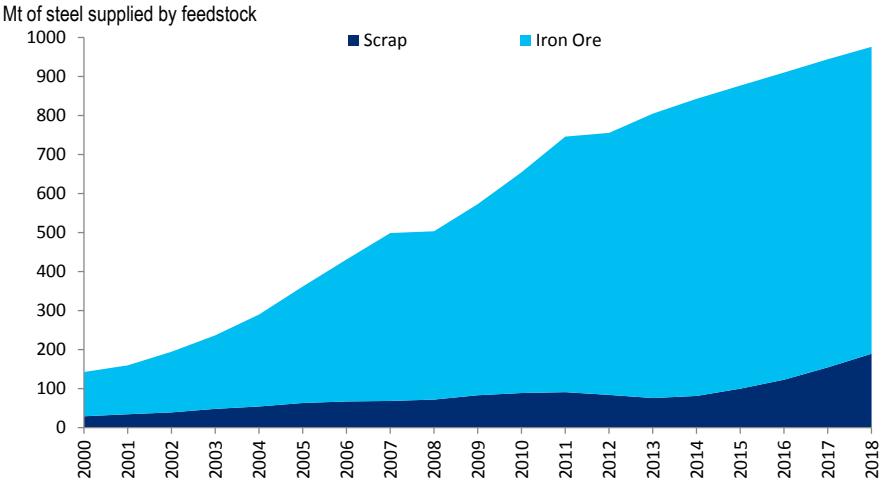
Scrap Supply

Chinese scrap supply is an often overlooked factor in the iron ore market. This is partly due to the slow growth of scrap in recent years, particularly compared to the expansion of overall steel production. However, this is set to shift in the coming years as scrap supply growth is expected to greatly accelerate at the same time that steel production slows. The result is that Chinese iron ore demand growth rates should slow not only due to moderating steel demand growth but also due to a reduction in iron ore's share of steel feedstock.

Scrap supply should increase rapidly, reducing potential iron ore demand growth

China currently consumes a very low share of scrap compared to developed economies due to the rapid expansion of steel production. However, the coming years should see recycling of metal that was produced during the early and mid 2000s – the peak period of production growth. While price fluctuations will inevitably lead to inventory cycles and may lead to lower recovery rates than in the past, scrap supply growth should nevertheless greatly exceed steel production growth in the medium term.

Figure 58. Steel scrap is set to rapidly gain in importance as a feedstock in China

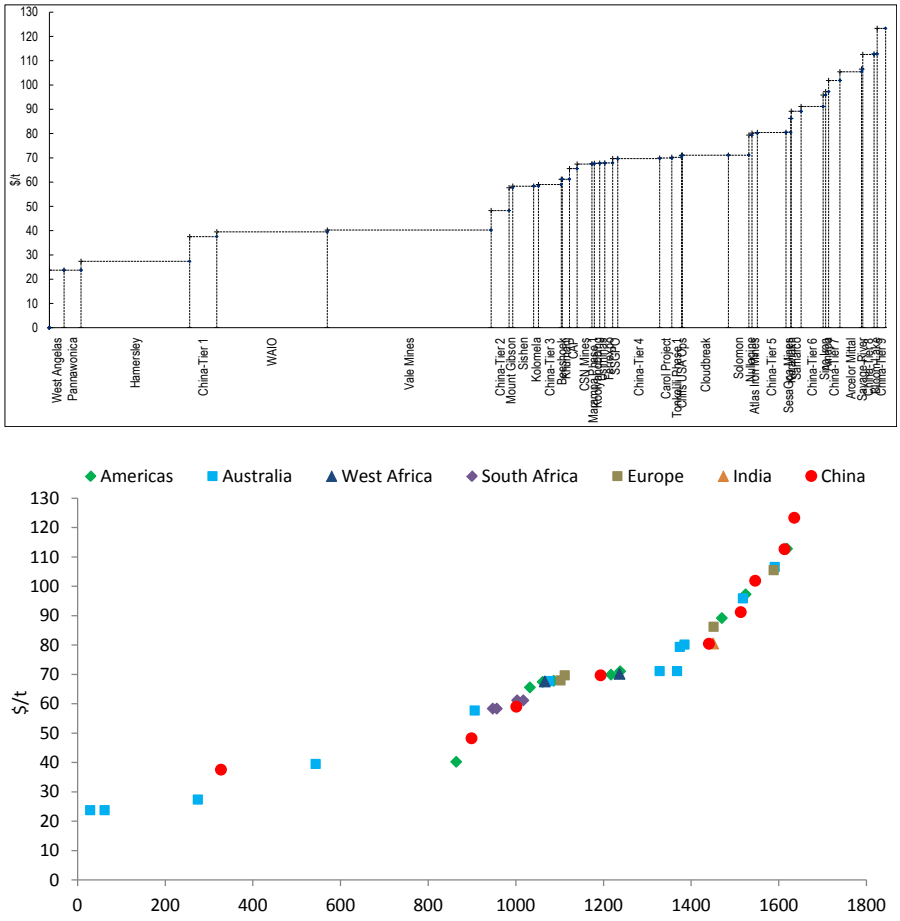


Source: Citi Research

Cost Support

Given the large volume of incremental supply entering the market, much of the focus of iron ore pricing is on potential cost support. While we present global cost curves in Figure 59, we find it most insightful to examine China and ex-China production separately.

Figure 59. 2014 global iron ore cash cost curve, 62% Fe fines CFR China basis



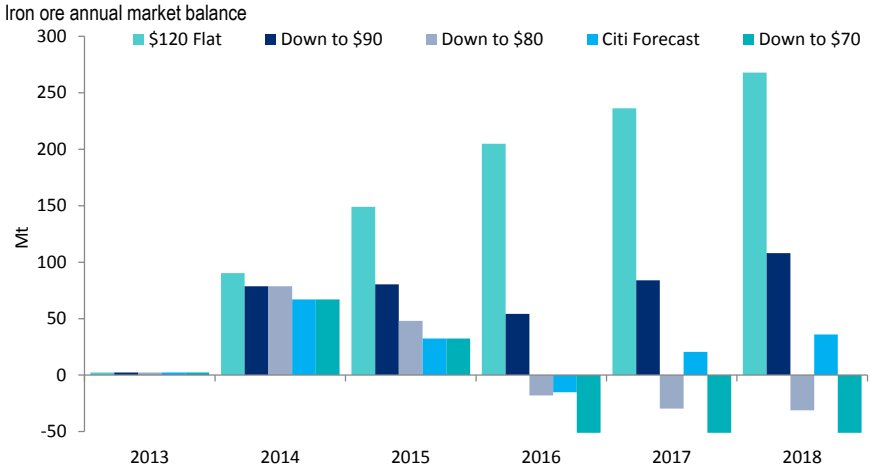
Source: Citi Research

For Ex-China production, we normalize cash costs to a 62% Fe fines CFR China per dry metric tonne basis. We then evaluate likely price sensitivity of individual mines and companies on the basis of a number of external considerations.

For Chinese production, we present costs directly on an incentive price basis, also normalized to a TSI 62% index basis.

Finally, we also model the sensitivity of several projects currently planned to postponement or cancellation based on iron ore price movements. These three sets of sensitivities are incorporated into our S&D model, with Figure 60 displaying estimated market balances under a variety of price scenarios.

Figure 60. Estimated S&D sensitivities to various price scenarios



Source: Citi Research

Our primary takeaway is that a price of $70-80/t will likely be needed to bring the market back into balance in the face of the rapid expansion in seaborne supply over 2013-2015. However, as a prolonged period at such levels would be expected to leave the market in deficit, we forecast a modest rebound in prices after a decline to such levels.

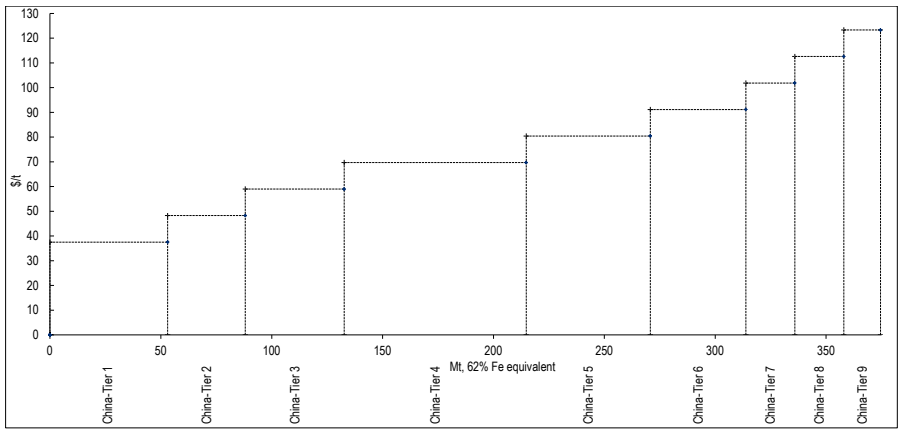
China

Chinese iron ore production costs are one of the most important but least understood factors in the iron ore market. Partly this is due to the dispersion of numerous small mines and partly because of the sensitivity of the government to research on the topic.

Resilience of Chinese iron ore production is frequently underestimated

We present our picture of Chinese costs differently from a classic cost curve. Rather than a pure focus on cost, we present what is essentially an incentive cost curve: the benchmark 62% Fe CFR China price at which production is likely to be curtailed (similar to Figure 75 for ex-China production).

Figure 61. 2014 Chinese iron ore incentive cost curve



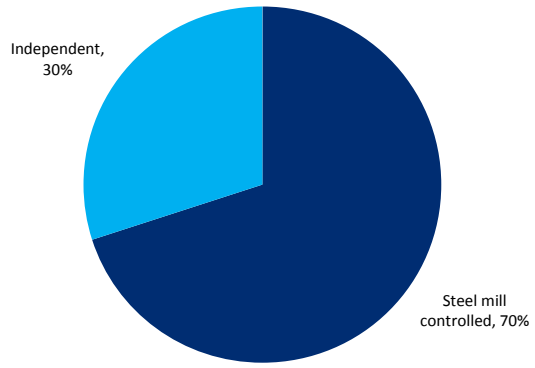
Source: Citi Research

The resulting incentive cost curve still shows far more capacity at the top end than the ex-China pure cost curve: for 2014, 60 Mt or 16% above $100/t and 160 Mt or 43% above $80/t.

There are several reasons for presenting Chinese costs on an incentive basis:

- **Integrated production:** approximately 70% of 2014 Chinese iron ore production is controlled by subsidiaries of steel mills. Such captive supply is not subject to market prices and mills are generally quite hesitant to curtail iron ore production unless they are also cutting steel production. Given our expectation of reduced steel overcapacity and better mill margins in the medium term, such cuts are not expected to be common.
- **SOEs:** most iron ore production is controlled by SOEs, particularly integrated production: 9 of the 10 largest steel mills are SOEs and it is primarily large steel mills that own mining assets. By far the largest independent miner, Minmetals, also falls under this category. SOEs are typically much slower to react to market forces in curtailing production due to the negative impact on employment and local economies.

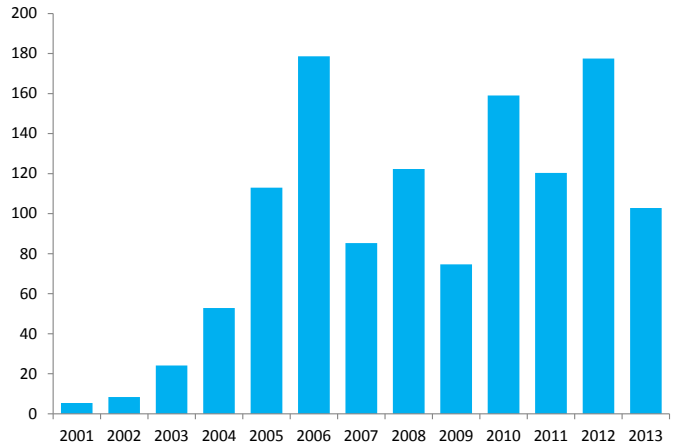
Figure 62. Chinese iron ore production by type



Source: NBS, Citi Research

Figure 63. Chinese domestic iron ore production has expanded rapidly

Mt, increase in run of mine production

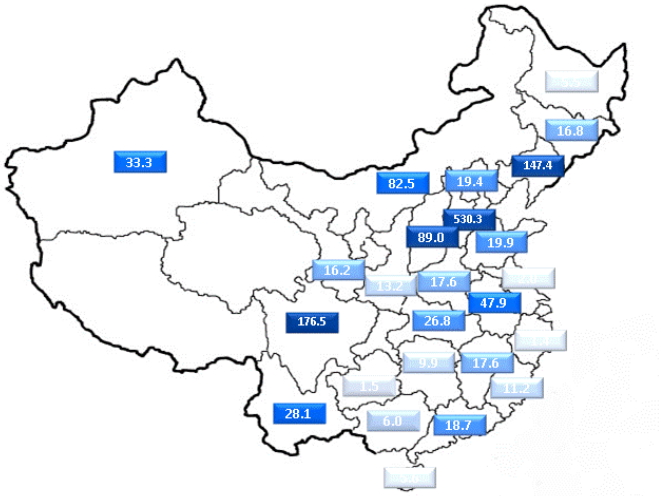


Source: NBS, Citi Research

- **Project pipeline:** while many Western analysts assume that Chinese iron ore production will simply decline in response to the surge in seaborne supply, there is actually a decent pipeline of new projects. Such projects are less price sensitive, particularly for 2014 and 2015 due to already committed capital and expectations of falling operating costs as production ramps-up. Moreover, new projects are generally larger mines controlled by large steel mills.
- **Geography:** iron ore benchmark prices represent port delivery prices; however there are costs to transport such ore to actual steel mills. It is not uncommon to face $10/t additional transportation costs for mills in coastal provinces, and $30/t or more for delivery to interior provinces.

Figure 64. China 2013 iron ore production by province

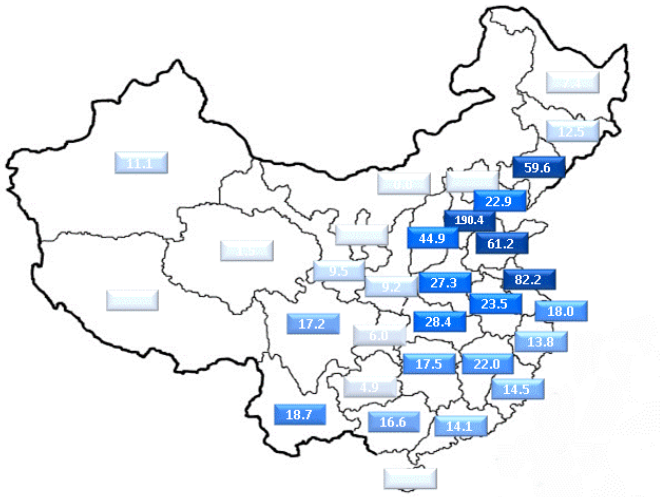
Mt, run of mine production



Source: NBS, Citi Research

Figure 65. China 2013 crude steel production by province

Mt

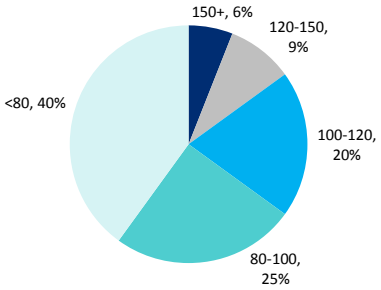


Source: NBS, Citi Research

Moreover, the structure of Chinese iron ore production is also changing in several ways. The most well-known of these is grade depletion, shown in Figure 17. We estimate that average domestic iron ore grades have fallen from 30+% in the early 2000s to around 16% at present and are likely to continue to decline. While this story is well recognized, the rapidity of declines has often surprised the market.

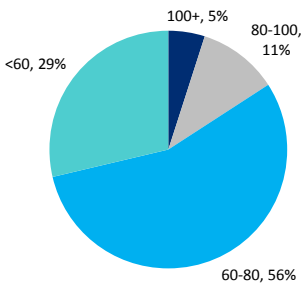
Chinese production costs are also rising and expected to continue to do so at a rate exceeding that of most ex-China mines. Partly this is due to ongoing grade depletion increasing costs on a 62% Fe equivalent, but also due to an appreciating RMB increasing costs on a USD basis, rising nominal wages (consistently over 10% per year), and increasing electricity costs.

Figure 66. Cost structure of Chinese iron ore mines: Custeel



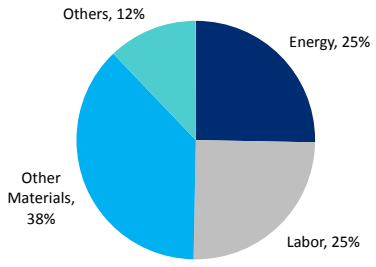
Source: Custeel, Citi Research

Figure 67. Cost structure of Chinese iron ore mines: Mysteel



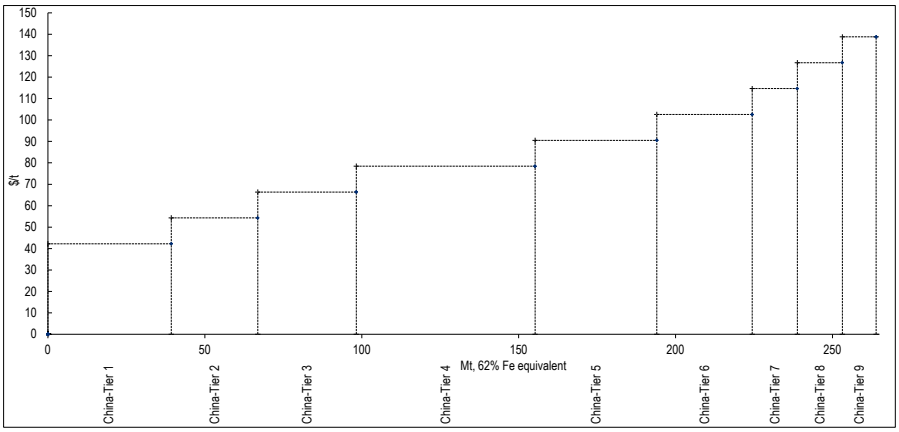
Source: Mysteel, Citi Research

Figure 68. Operating cost breakdown of Chinese iron ore mines: Mysteel



Source: Mysteel, Citi Research

Figure 69. 2018 Chinese iron ore incentive cost curve

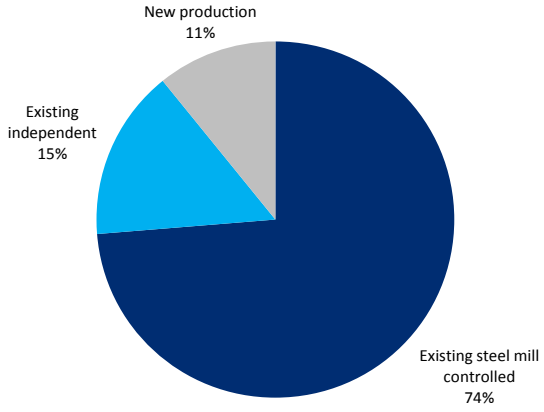


Source: Citi Research

In 2018, we thus estimate the share of production above $100/t to have risen from 16% in 2014 to 26%.

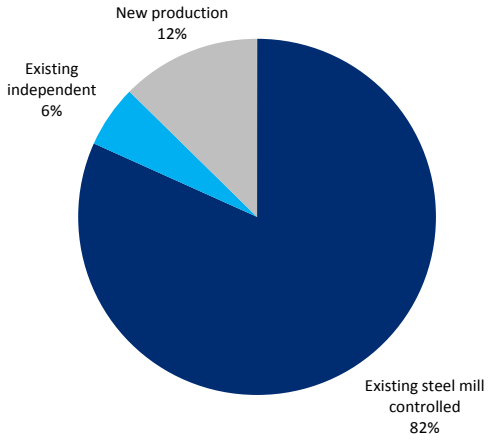
We expect the composition of Chinese iron ore production to shift as well. While we estimate that currently 30% of production derives from independent, non-vertically integrated producers, we expect cost pressures to curtail this output and at the same time for new steel mill owned mines to come online, pushing the share of independent production significantly lower.

Figure 70. Estimated 2018 iron ore production breakdown assuming $120/t iron ore



Source: Citi Research

Figure 71. Estimated 2018 iron ore production breakdown under Citi forecast

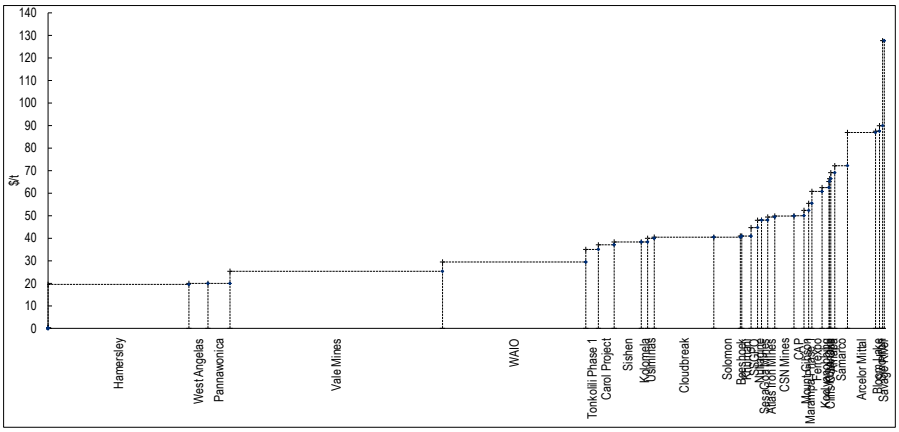


Source: Citi Research

Rest of World

Cash costs are generally reported by companies on an FOB wet metric tonne basis. However, benchmark iron ore prices are based on 62% Fe fines CFR China per dry metric tonne, making it impossible to conduct a direct comparison. Moreover, due to differences amongst mines' grades, freight charges and other factors, comparisons of mines' cost on a reported basis give a distorted picture of true competitiveness and market position.

Figure 72. Traditional presentation of cost curves: 2014 ex-China iron ore cost curve (FOB)



Source: Citi Research

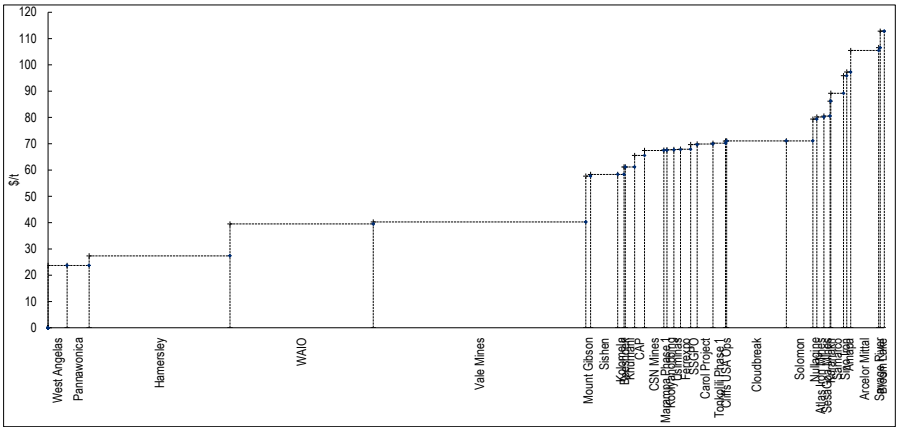
Making adjustments for grade and product differentials, moisture, freight, and currency yields a very different picture of costs and allows a much better assessment of margins and competitiveness.

Costs are significantly higher when adjusted to a TSI index basis

The first point to note is that costs are much higher once all adjustments are factored in. The 95th percentile of our ex-China cost curve coverage on an FOB dmt basis is $72/t, while on a fully adjusted basis it is $89.

Individual mines and companies' positions also see significant shifts. For example, Mount Gibson appears above the 90th percentile on an unadjusted basis, but around the 65th when fully adjusted. In contrast, the Tonkolili mine in Sierra Leone appears as one of the lowest cost producers outside the Big 3 on a raw basis, but is at the 81st percentile on our adjusted curve.

Figure 73. A better picture: 2014 ex-China iron ore cost curve, 62% Fe fines CFR China basis

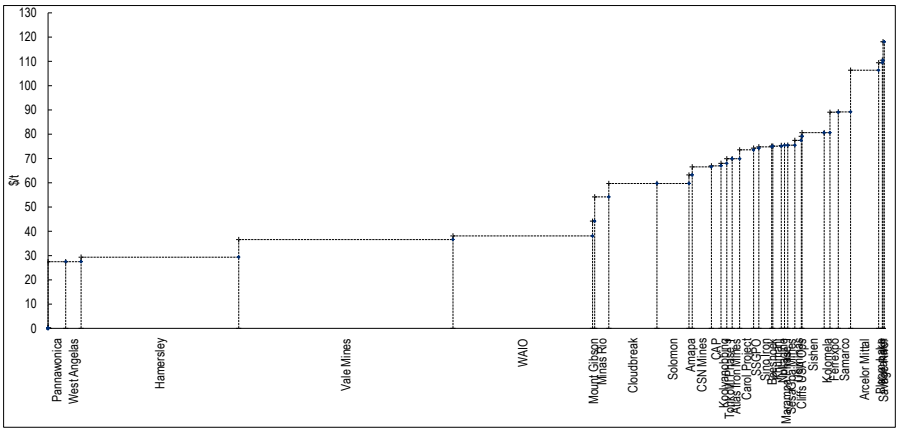


Source: Citi Research

In evaluating the price elasticity of production, we have examined forecast cost curves for each year out through 2020. This encompasses an analysis of cash operating margins by mine and company, but also consideration of the willingness of companies to endure losses based on factors including:

- **Vertical integration** – captive supply for steel mills
- **Geography of sales** – whether volumes are exported to China or sold to markets at cheaper transportation costs

Figure 74. Looking forward: 2018 ex-China iron ore cost curve, 62% Fe fines CFR China basis



Source: Citi Research

- **Expansion projects** – companies are more hesitant to curtail production during expansion phases when costs generally fall as production ramps up

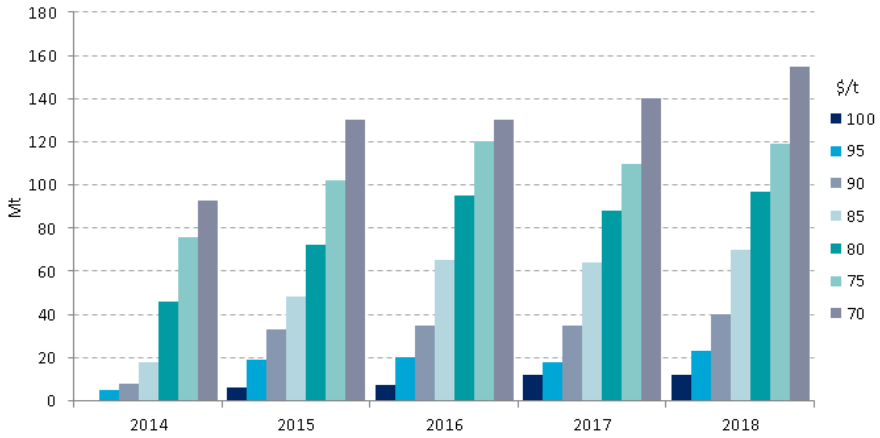
Mines do not uniformly cut production when cash costs turn negative

- **Composition of company assets** – companies with assets that range in cost are more likely to curb production at their highest cost assets than companies with only a single asset; on the other hand, large diversified miners can better offset losses than single asset companies

Our analysis has also included both an evaluation of likely curtailments of operating mines at different price ranges, as well as of risks to project pipelines (the latter can be found in Figure 7). We find a relatively linear likely increase in such curtailments from $90/t to $70/t, averaging roughly 25 Mt/y per $5 increment. At benchmark prices above $90/t, we see quite modest potential for curtailments currently, but becoming more substantial in the coming years.

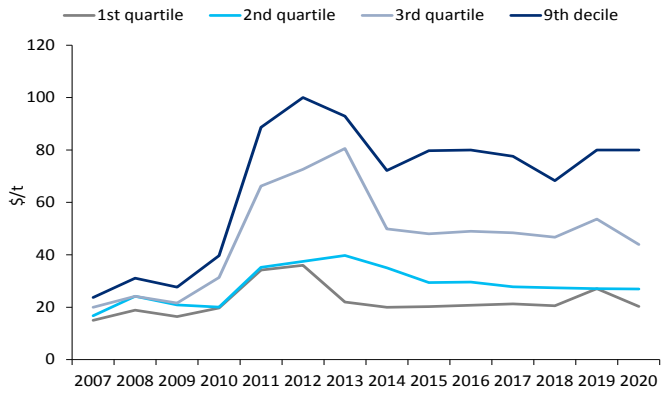
However, operating costs are not expected to continue the rapid increases of recent years and in fact are likely to fall for many mines. Companies compete not only with other iron ore producers but mining companies more broadly for labor and machinery and markets for these have eased somewhat from the extreme tightness of a few years ago, and are likely to ease quite a bit further as global mining

Figure 75. Forecast price-induced curtailments for ex-China operating mines, by benchmark spot price



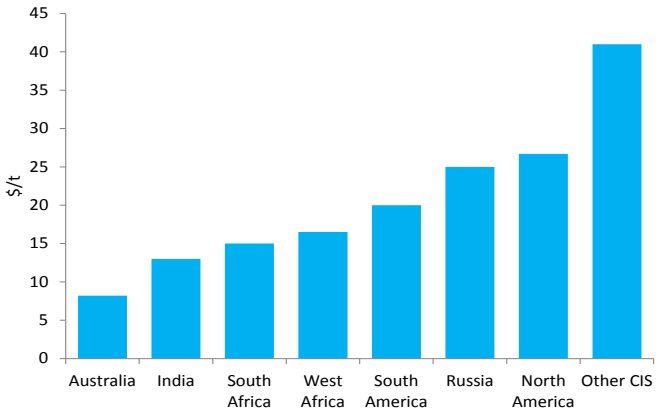
Source: Citi Research

Figure 76. Cost inflation is easing after the rapid increases of recent years



Source: Citi Research

Figure 77. Selected freight rates to China



Source: Citi Research

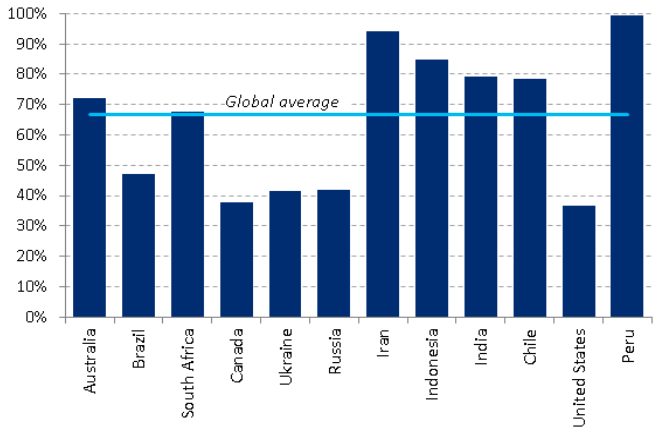
Operating costs may move lower

investment slows. Moreover, faced with lower prices, companies are becoming increasingly aggressive in finding ways to cut costs, including applying best practices and utilizing greater automation. The experience of falling cost curves for met coal and aluminium provide some hint at how this can develop in the face of falling prices. Depreciation of key producer currencies, including the AUD, ZAR, and BRL are also serving to decrease USD costs.

It is also important to note that for some mines, China is not the primary market. Figure 78 shows the share of exports which the top exporting countries send to China. While the overall average is quite high, there is a large degree of differentiation. In particular, Brazil, North America, and CIS producers send less than half of exports to China. In contrast, Australia, South Africa, Asian nations, and Latin American countries outside Brazil send almost all their exports to China.

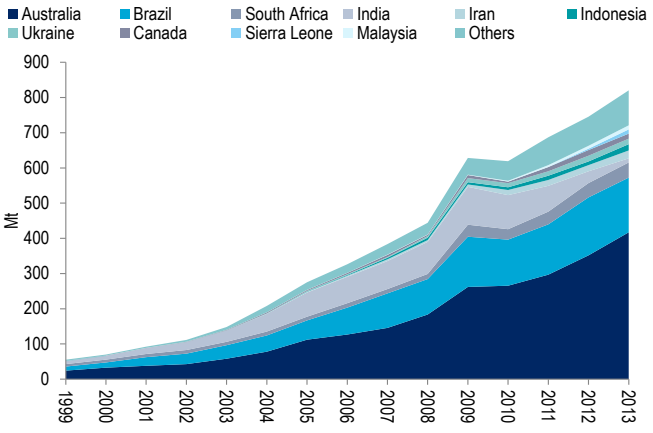
While iron ore prices across the are heavily influenced by CFR China prices, mines that are able to sell to more convenient geographies with lower freight costs (such as European and CIS mines selling into those markets) will be more insulated to benchmark price declines. Actual margins will not be as bad as suggested by looking at their costs on a CFR China basis and they will maintain competitiveness given their freight advantage to supply such markets versus more distant mines.

Figure 78. Share of exports to China – for some exporters, China is not the primary consumer



Source: China Customs, GTIS, Citi Research

Figure 79. Chinese imports by country



Source: China Customs, Citi Research

Iron Ore Is Not Aluminium, But Is It Met Coal?

The iron ore market is enduring a wave of supply that is pushing the market into surplus, not unlike what has occurred in recent years with aluminum, nickel, thermal coal, and met coal. The classical industrial commodity cycle is bearing out that "nothing cures high prices like high prices" as massive capex on the back of elevated prices in the mid and late 2000s is translated into actual supply growth.

The question is whether iron ore prices will endure a similar fate to that of these other commodities. One of the most intriguing comparisons is with aluminium, where large surpluses have been absorbed by inventory financing. The question of whether surpluses in the iron ore market can be similarly absorbed will have significant repercussions for iron ore prices in coming years. It is also gaining attention in the market due to the financing of rising Chinese iron ore port stocks.

Large scale cash and carry deals unlikely for iron ore

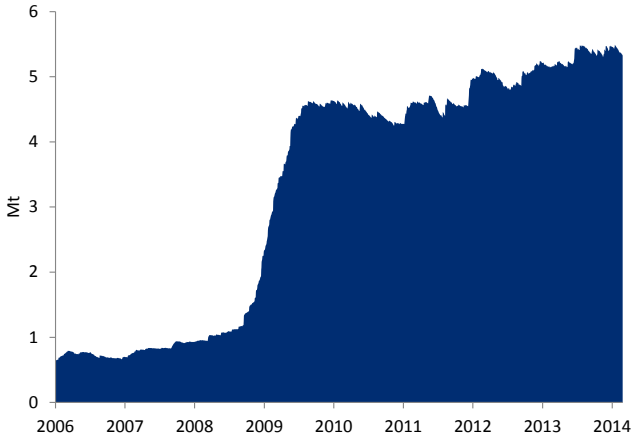
In our opinion, the short answer is that no, iron ore will not be repeating aluminium's experience. Several key differences exist between the two markets:

- Aluminium possesses a physical warehouse system linked to a futures contract (namely the LME) which allows physical delivery against forward hedging.
- The aluminium futures market is far more liquid than iron ore swaps or futures, both in raw terms, and especially relative to the size of the respective markets. LME aluminium trading volumes are currently roughly 50 times that of iron ore.
- Aluminium cash and carry deals have arisen at a time of exceptionally low interest rates. With rates rising, financing iron ore inventories will be more expensive.
- LME warehousing rules created the ability and incentive to stash metal in warehouses behind long load-out queues rendering it inaccessible to end-users.

On the other hand, it is worth noting that while cash and carry financing is of course impossible currently in the iron ore market given the curve is in backwardation, this is likely to change as inventories build and spot prices fall.

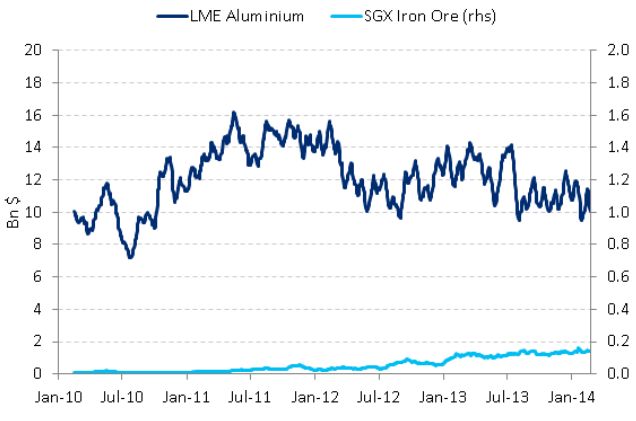
Figure 80. Iron ore does not possess a physical warehouse system linked to a futures contract such as the LME for aluminium

LME aluminium inventories



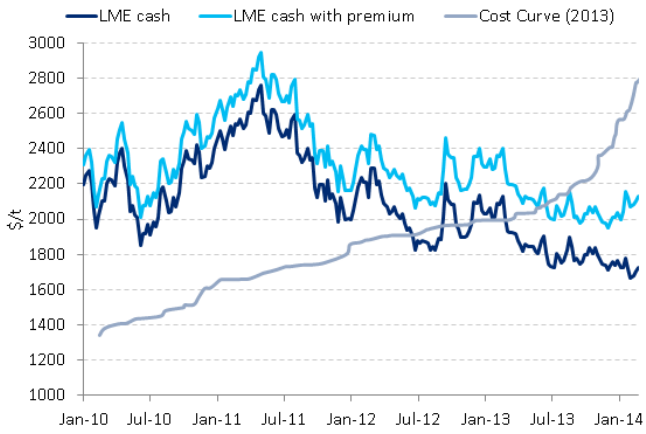
Source: Bloomberg, Citi Research

Figure 81. Iron ore trading volumes still pale in comparison to aluminium



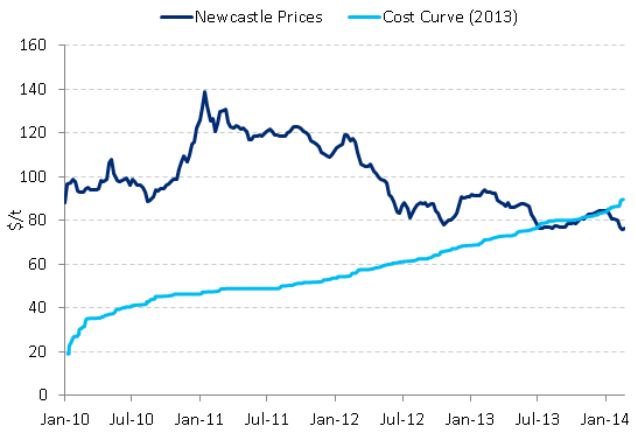
Source: SGX, Bloomberg, Citi Research

Figure 82. Despite strong financing off-take, aluminium prices have fallen well into the cost curve



Source: Bloomberg, Metal Bulletin, Citi Research

Figure 83. Thermal coal prices have also fallen into the cost curve



Source: Bloomberg, Citi Research

Nevertheless, iron ore will not benefit from the set of conditions that absorbed the rise in aluminium inventories. Moreover, it is worth noting that despite the ability of financing deals to absorb aluminium inventory, prices for the metal have declined significantly and cut well into the cost curve (around the 80th percentile of the ex-China cost curve).

Iron ore is not as attractive for financing in China as copper

Likely a more significant source of financing is China, where copper bonded inventory financing is the best parallel. However, even here iron ore faces difficulties, including the potential for the Dalian exchange to turn into a physical delivery point like the SHFE for copper. The far wider range of specifications for iron ore than refined copper also leaves most of Chinese iron ore imports outside the range covered by Dalian futures, as well as creating a less uniform and more opaque market for banks looking to extend financing. In this respect, iron ore resembles copper concentrate to a far greater degree, where banks have been much more reluctant to extend financing, particularly to traders.

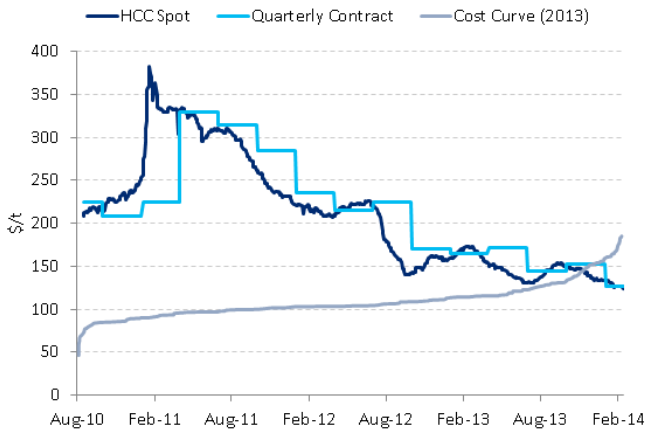
With respect to the limited ability to absorb inventories via financing, iron ore bears a far greater resemblance to coal. Both thermal and met coal markets have seen supply growth push prices down into their respective cost curves.

While many similarities exist, there are some important differences between iron ore and coal:

The iron ore market has some insulating factors compared to coal

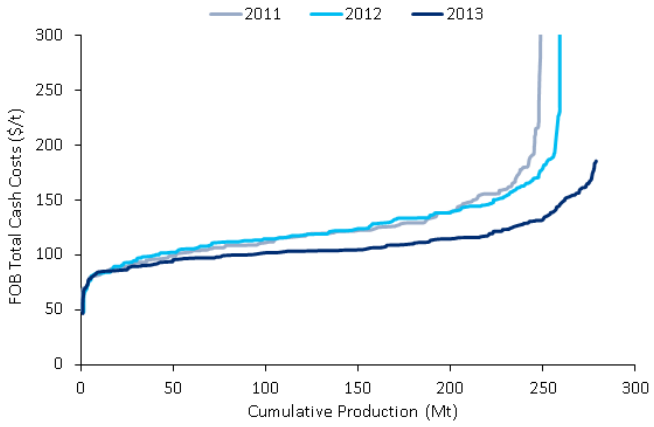
- Take-or-pay rail contracts are common for Australian coal producers and have incentivized continued production due to the requirement to pay rail costs regardless of volumes shipped.
- Chinese iron ore resources are of lower quality and are less extensive than coal resources.
- Supply in the seaborne iron ore market is very concentrated around the Big 4 producers, while seaborne coal supply is more dispersed.

Figure 84. Met coal prices have been hit even harder by the increase in supply…



Source: Platts, Citi Research

Figure 85. …And this has forced the cost curve lower



Source: Citi Research

These factors should lessen the impact of surging supply on iron ore prices to a degree compared to met coal particularly, but the iron ore market would do well to heed the lessons learned from the experiences of other industrial commodities:

The iron ore market would do well to heed the lessons of other industrial commodities

- Producers do not cut production easily and are even more reluctant to close assets completely. This is particularly true for companies that are diversified or vertically integrated.
- Prices need to be clearly below cash costs for a prolonged period to induce significant production cuts. As a result, when markets move into oversupply, prices do not simply fall to the top of the cost curve but rather dig into it.
- Cost curves will be forced lower, whether through reduced demand for input prices, or eventual closure of high cost production.

Equity Implications – Greater Differentials

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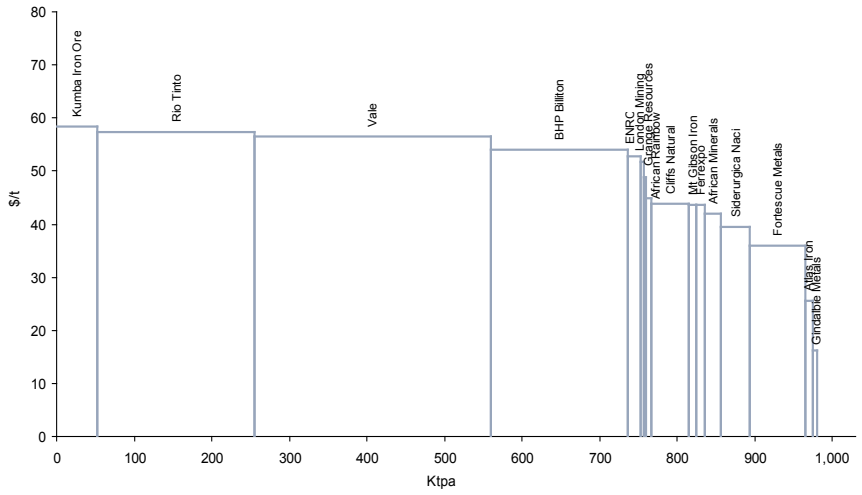
We believe the implications from our revised iron ore price forecasts are likely to result in greater differentials in the iron-ore-related equities, namely:

- Citi's headline price forecast for 2016e has only dropped by $10/t, from $90/t to $80/t. Importantly, we are increasing our lump and pellet premiums, and also expect higher grade ores are likely to be structurally supported going forward. This is likely to lead to greater differentiation in pricing outcomes between companies. The profitability of the iron ore companies on a value in use basis along with profitability and capital intensity is likely to widen.

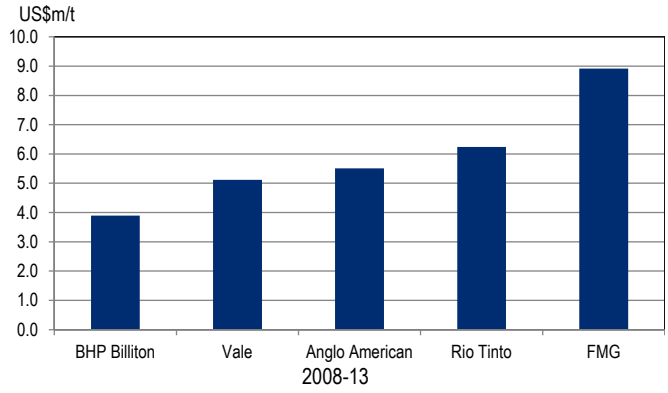
Figure 86. Iron Ore 2013 EBITDA/t



Source: Citi Research, company data

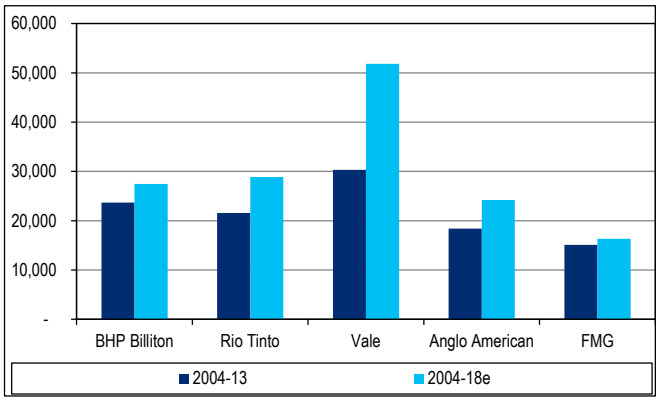
- Return on capital and the efficient deployment of capital are likely to play greater differentiation. Vale and Anglo American are continuing to develop large growth projects such as Carajas +40, Serra Sul and Minas Rio. In contrast the Australian producers have been lowering their capital intensity and going for more brownfield expansion growth

Figure 87. Major Miners: Sustaining Capex Per Tonne



Source: Citi Research, Company Data

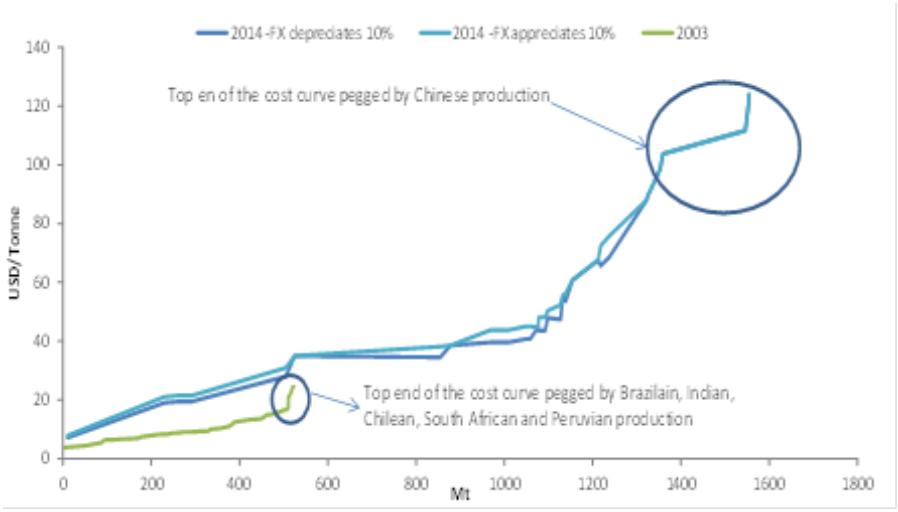
Figure 88. Capex Growth of Major Iron Ore Miners (US$bn)



Source: Citi Research Company Data

- The position of the company on the cost curve is likely to play a greater role on overall margin outcomes. Weakening commodity currencies such as the ZAR, AUD and BRL are likely to lead to cost falling at the bottom end of the cost curve; however, this phenomenon is only likely to remain intact while China is the marginal producer and while the RMB and local costs are appreciating.

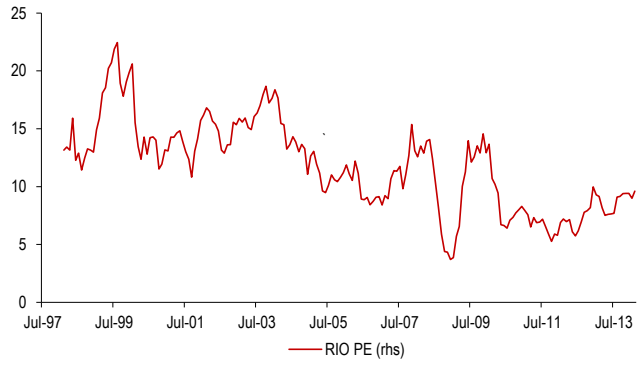
Figure 89. Iron Ore Cost Curve Adjusted for FX



Source: Citi Research

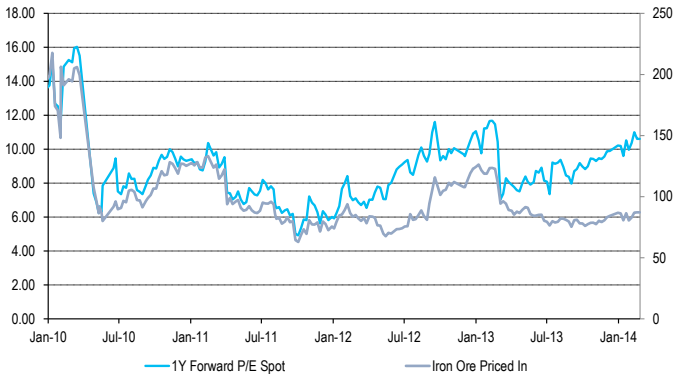
- We would also argue that the equities are already discounting falling iron ore prices. The majority of iron ore companies have already been derated on forward price-to-earnings multiples; as an example, the forward PE of Rio has fallen from around 17x in 1997-07 to around 10x since 2008. Arguably there are a number of factors that have driven this (declining ROE, capital deployment, balance sheet etc). However, it is interesting to look at what effectively Rio Tinto is pricing in for the PE to normalize to around 13x forward PE, which suggests the company is pricing in a c$88/t spot iron ore price

Figure 90. Rio: One-year Forward PE



Source: Citi Research

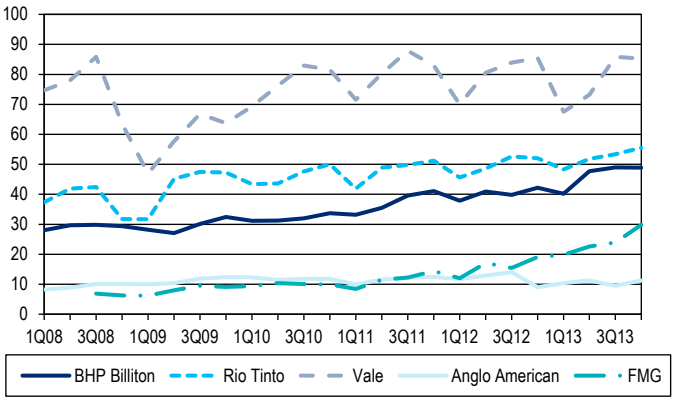
Figure 91. Rio: One-year Forward PE on Spot versus a 13x PE Multiple



Source: Citi Research

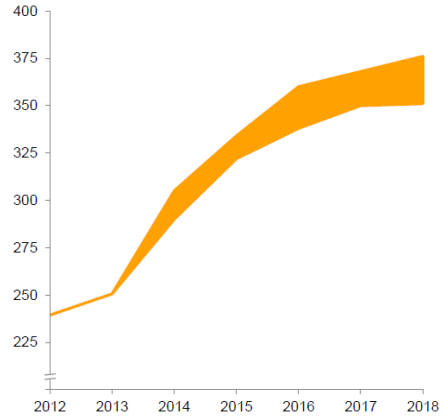
- Industry discipline could play a larger role going forward for the iron ore industry. The iron ore market is still an oligopoly market which has chased volume increases rather than price (or profitability). The unknown is if we see a demand drop for iron ore will the large companies cut back production to restore prices. In the financial crisis Rio Tinto and Vale cut back production largely due to a lack of demand, while FMG, BHBP and Anglo continued to produce. Interestingly, Rio Tinto at its recent results indicated a potential range of volume capacity outcomes depending on what happened to underlying demand. We think going forward the industry could be more rational to lower prices and could reduce marginal tonnes to increase profitability, as is the current case in other commodities such as thermal coal, metallurgical coal and titanium dioxide.

Figure 92. Quarterly Volume by Company (Mt)



Source: Citi Research, Company Data

Figure 93. Rio Tinto Volume Mine Capacity Potential (Mt pa)



Source: Company Data *100% basis

Regional Views

Australia: Production Growth Keeps Coming

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Australia has been the only country of the big 4 exporters – Australia, Brazil, Africa and India – to be able to consistently and significantly expand production growth over the last 5 years. We expect this expansion to continue for the next 5+ years driven by expansions from the big 3 – BHP, RIO and FMG – but also as expansions from the smaller producers and new entrants contribute.

Although the production growth has been delivered, it does not mean that there has not been a graveyard of failed or ailing projects that have struggled in a highly inflationary cost environment present in Australia in the last few years. The volatility in iron ore prices and equity markets, not conducive to raising equity to fund projects, has also been a significant stumbling block for a number of new mines.

Magnetite projects have found the going particularly hard in Australia with Karara and Sino Iron beset with construction delays and commissioning issues due to the added complexity of processing magnetite ore. Outside of these 2 projects that have made it into construction, most magnetite projects have faded into the background and now look to have missed the sweet spot to get into production.

Production Growth Outlook

Existing Producers

The vast majority of the production growth that we forecast from Australia comes from projects that have been approved, with a significant portion nearing completion or fully committed:

- **BHP Billiton** – Capacity is expected to reach 220mtpa by end-15 once Jimblebar reaches capacity of 35mtpa. A low-cost expansion of Jimblebar to 55mtpa and debottlenecking of the rail and port infrastructure are expected to increase capacity to 260-270mtpa at significantly lower capex spend (<US$100/t v US$180+/t for growth to date). We expect BHP to reach 265mtpa run rate by end-18, although it could be reached sooner depending on rate of approval for additional capex. BHP has approval to build an additional 2 berths in Port Hedland (without additional allocated capacity at this stage), which if constructed could increase capacity by a further 60+mtpa if matched with further mine and rail capacity expansions.

- **Rio Tinto** – Pilbara managed capacity is expected to reach 290mtpa by the middle of 2014, with infrastructure capacity expanded to 360mtpa by mid-15. The key uncertainty is how long it will take mine capacity to ramp up to 360mtpa given not all of this capex has been approved. RIO expects to produce >330mt in 2015 and we have the 360mtpa run rate being achieved by mid-18. Capacity of Cape Lambert has an option to increase capacity by a further 100+mtpa, which we see as unlikely given the expected trajectory of iron ore prices and focus on reducing debt and returning cash to shareholders.

- **Fortescue** – Fortescue is on track to expand capacity to 155mtpa by mid-14 with the last mine Kings at the Solomon hub well into the commissioning process. Once the 5th berth is constructed at the port in 2015 the in load/out load capacity of the port could approach 170-180mtpa, which could be filled by low cost brownfield expansions of the existing mines and rail. The key risk for FMG in stretching capacity to this is that the actual allocation through the port remains 120mtpa and is therefore reliant on others not using their allocation, or the capacity being higher than what is allocated, to be able to achieve this rate.

- **Atlas** – Atlas production is running at just over a 10mtpa run rate and this will be expanded to a rate approaching 15mtpa by 2015. This is all based on the trucking to Port Hedland and use of the common user Port Utah as negotiations for rail access remain on going. To go beyond 15mtpa and reach the targeted 30mtpa run rate by FY17 Atlas needs to access either FMG or Roy Hill's rail line. The key bargaining chip that Atlas has is an effectively unused 31.5mtpa allocation through Port Hedland, but actual value of this as a bargaining chip remains debateable due to excess capacity in the harbour and limitations on how it is used. For near-term access to rail Atlas a deal with FMG is easiest as this capacity is built and operating, but this requires potentially displacing FMG's own higher margin tonnes and is likely to carry significant upfront pre-payments. Roy Hill rail access is a longer-term option given this will not be operational to 2016 and fully ramped up until 2018.

- **Mt Gibson** – Production is running at >9mtpa with ~4mtpa from Koolan Island and the balance from the Mid-west. Closure of Prominent Hill later this year will reduce capacity to 7-8mtpa from FY15+. Key challenge for Mt Gibson is finding enough ore in the Mid-West region to keep 6mtpa infrastructure capacity full. Shine acquisition from Gindalbie and recent exploration success have shown promise in this regard, but at best production looks to be in the 7-9mtpa range going forward, rather than being able to grow beyond 10mtpa.

- **Arrium** – Currently exports ~12mtpa (hematite lump and fines) from South Australia following a two-year 6mtpa mine/port expansion. Formerly known as Onesteel, the company acquired WPG Resources in 2011 and these projects have formed the main path for growth.

- **Cliffs Natural Resources** – Produces 11mtpa from the Koolyanobbing mine near Kalgoorlie following a recent 3mtpa expansion programme. Hematite lump and fines is exported through the Port of Esperance to the south.

- **Mineral Resources** – Operates the 4mtpa Carina mine in the Yilgarn, East of Perth, as well as Phil's Creek and Spinifex ridge in the Pilbara. Currently exports ~11mtpa through Kwinana south of Perth and Port Hedland.

- **IMX Resources** – Produces ~2mtpa from the Cairn Hill project (50% interest) in South Australia. Mining is expected to cease in Feb-15 although the company is exploring opportunities to add 12 months to the mine life. IMX is also conducting feasibility studies on the nearby Mt Woods magnetite project.

New Entrants

- **Citic Pacific Sino Iron Project** – Production finally commenced in late 2013, many years late. Exact capacity remains somewhat uncertain as we understand it only 2 of the eventual 6 crushing and milling lines that would give a total capacity of 25-27mtpa have been completed. As cash generation would be minimal until full capacity is reached, the ability to continue to fund construction of the remainder of the plant is dependent on the willingness and financial reserves of parent Citi Pacific to continue to fund the project.

- **Gindalbie** – Gindalbie developed the 8mtpa Karara magnetite mine (+2mtpa of DSO) in an original 50:50 JV with Ansteel, but cost overruns and commissioning delays will ultimately dilute Gindalbie down to a 38% interest as the funding shortfall has been met by Ansteel. The plant has struggled to reach full capacity due to an issue with the dry tailings system and an engineering solution is still being investigated so it looks unlikely that the plant will reach capacity in 2014. Stage 2 growth to 16mtpa is still a possibility as it significantly lowers costs, but

significant capex means that it is ultimately dependent on the willingness of Ansteel to provide additional funding as operating cash flow will not provide it at our iron ore price forecasts.

- **Hancock Prospecting - Roy Hill** – Work has started on the greenfield 55mtpa mine in the Pilbara that will build a new ~340km railway and export through a new port facility in Port Hedland. Hancock Prospecting owns 70% of the project with other partners being POSCO (paid US$1.3b to increase stake from 5 to 12.5%), STX (US$332m for 5% in 2010), Marubeni (US$1.5b for 12.5% stake) and CSC (US$305m to acquire 2.5% stake from POSCO). Although construction is underway, full financing of the US$6+b in debt required has yet to be fully secured – total capex is estimated at ~US$10b.

- **Western Desert Resources** – Commenced shipping from its 100%-owned Roper Bar mine in DQ13. Located in the Northern Territory, the mine is currently ramping up to a maximum capacity of 3mtpa of DSO although the company is exploring the possibility of beneficiating low grade ore and exporting ~10mtpa via a 50km slurry pipeline.

The Hopefuls

- **Asia Iron Extension Hill** – Based in Western Australia's Midwest, Extension Hill is a 10mtpa magnetite JV between Chongqing Chonggang Minerals Development and SINOM Investments. First production was originally slated for 2014 but political changes in the City of Chongqing brought the project's development to a standstill. A final investment decision is expected in October 2014. Capex cost is estimated at US$3b, similar to Gindalbie's Karara project but unlike Karara, Extension Hill ore will be transported via slurry pipeline to Geraldton.

- **Grange Resources** – Run Savage River, a ~2.3mtpa pellet operation in Tasmania. The previously proposed 10mtpa Southdown magnetite project near Albany, WA has been put on hold while the company seeks investment funding through a strategic partner. The Board is conducting a review into Southdown's cost assumptions, due mid-2014.

- **Brockman Resources** – Marillana project is planned at 18.5mtpa and has critical port entitlement through NWI. Rail access remains the key hurdle before a BFS and project financing can be secured. Brockman continues to assess the potential for an independent rail network in the Pilbara whilst also appealing to WA's Economic Regulation Authority for access to FMG's line.

- **Aquila Resources** – Aquila owns 50% of the West Pilbara Iron Ore project that is planning Stage 1 production of 30mtpa. The project requires a new ~250km rail line and port at Anketell Point but was put on ice in Feb-2013 after a 25.5% JV partner AMCI failed to support the $7.7bn capex estimate, arbitration is ongoing.

- **Golden West Resources** – Has a DSO resource (69mt reserve and 130mt resource) called Wiluna West that is looking to be exported through either Geraldton or Esperance. Environmental approval was received in April 2013 for up to 10mtpa capacity but the project has been delayed until a port and rail solution can be reached.

- **Ironclad Mining - Wilcherry Hill** – Initial 1mtpa DSO mine in South Australia, increasing to 2mtpa through beneficiation plant, then 3mtpa through the development of the magnetite resource as well. Longer-term target of 10-12mtpa

from the larger Hercules deposit 15km to the east (combination of hematite and magnetite). Final approval for Lucky Bay multi-user port facility was received in Jan-2014 and the project now awaits the conclusion of funding negotiations before mining can commence.

- **Australasian Resources** – Has a 50:50 JV with Mineralogy to develop the Balmoral South project adjacent to the Sino Iron ore project. Target is 24mtpa of magnetite concentrate, currently seeking relevant approvals as well as Chinese export credit funding.

- **Iron Road** – Iron Road aims to develop the Central Eyre Iron Project, a 21.5mtpa 67% magnetite concentrate operation in South Australia. Proposed capex of US$4bn includes a 150km rail line and a 70mtpa multi-user port. The company is aiming for first production in 2018 at an FOB cash cost of US$44/t and is currently seeking relevant regulatory approvals as well as investment partners.

- **Royal Resources** – Definitive feasibility studies are underway to assess the 100% owned Razorback project in South Australia. PFS base case outlines an 8.2mtpa 67% magnetite concentrate operation at a cost of $2.2bn with $68/t cash cost.

- **Flinders Mines** – 2011 PFS has outlined case for the 25mtpa Pilbara Iron Ore project at a cost of A$1-1.1bn. Flinders Mines hopes to produce a 58.5% product for >10years and has been exploring the possibility of building rail/port infrastructure through a commercial JV. The company is targeting a final investment decision in 1Q15 and first production 2017.

Do Lower Prices Impact Production Growth

With iron ore prices expected to fall significantly over the next few years the key question are:

- Will this derail the production growth being delivered?

- What does it mean for future projects in Australia?

The vast majority of Australian production growth near-term is being delivered by RIO, BHP and FMG. With production costs of <US$40/t, we do not see any significant risk to our production forecasts for 2015-2019 from iron ore prices at US$80/t.

If prices were to breach this level then the story could become quite different. Firstly, a price of US$80/t for the benchmark level equates to a realised price of ~US$67/t for BHP/RIO, but only US$57/t for FMG.

Although costs are expected to be less than <US$30/t for BHP and Rio and <US$40/t for FMG, there are a number of mines that make up the Pilbara operations of each company and some of these would have costs over US$40/t and potentially be susceptible to curtailment.

With Pilbara sustaining capex typically running at US$5-7/t these operations would not generate any cash flow at less than US$80/t iron ore.

Rio Tinto

Rio Tinto is the lowest cost of the Pilbara producers, although the historical margin gap that this should have driven relative to BHP has been somewhat closed up by BHP realising a higher price due to product mix (RIO has more low grade production due to impact of Robe).

Figure 94. BHP v RIO v FMG Historical Realised Price, Cost and Margin – Revenue and Costs on FOB US$/t basis

		1H08	2H08	1H09	2H09	1H10	2H10	1H11	2H11	1H12	2H12	1H13	2H13	Average
Iron Ore price	CFR China DMT	186	119	72	104	145	148	177	159	141	116	137	134	137
BHP Billiton	Revenue	82	87	65	63	97	131	151	142	124	101	115	113	106
	Costs	28	17	24	24	29	40	35	38	38	38	37	38	32
	Margin	55	71	41	38	68	91	116	104	87	63	78	75	74
		66%	81%	63%	61%	70%	69%	77%	73%	70%	62%	68%	66%	70%
Rio Tinto	Revenue	82	91	59	59	92	128	141	140	123	102	114	111	103
	Costs	26	23	20	21	23	32	33	33	34	32	35	27	28
	Margin	56	68	40	38	69	97	108	108	89	70	79	84	75
		69%	75%	67%	64%	75%	75%	77%	77%	72%	69%	69%	76%	73%
FMG	Revenue	73	72	44	52	81	110	137	111	105	85	100	103	89
	Costs	37	30	27	30	37	44	62	54	57	54	46	40	43
	Margin	37	42	18	22	44	66	75	57	48	31	55	62	46
		50%	58%	40%	42%	54%	60%	55%	51%	46%	37%	54%	61%	52%

Source: Company Reports and Citi Research Estimates

Going forward we expect costs to decline with iron ore prices, partly driven by lower royalties, and this means that $/t margins decline significantly from current levels, although % EBITDA margins still remain pretty robust.

Figure 95. BHP v RIO v FMG Forecast Realised Price, Cost and Margin – Revenue and Costs on FOB US$/t basis

		1H14e	2H14e	1H15e	2H15e	1H15e	2H16e	1H17e	2H17e	L/T - 2021 Real
Iron Ore price	CFR China DMT	118	108	95	85	80	80	83	83	81
BHP Billiton	Revenue	104	94	82	72	67	67	70	70	66
	Costs	36	35	32	31	29	27	28	28	24
	Margin	68	60	50	41	38	40	43	42	42
		66%	63%	61%	57%	56%	59%	60%	60%	63%
Rio Tinto	Revenue	101	91	82	72	67	67	70	70	66
	Costs	27	27	27	26	26	27	27	27	23
	Margin	73	64	55	46	41	41	43	43	42
		73%	70%	68%	63%	61%	61%	62%	61%	64%
FMG	Revenue	88	79	69	61	57	57	59	59	55
	Costs	42	41	38	38	38	38	39	39	34
	Margin	45	38	32	23	19	18	20	19	22
		52%	48%	46%	38%	33%	32%	34%	33%	39%

Source: Citi Research estimates

BHP Billiton

BHP Billiton has the simplest mining infrastructure of the Australian producers with 3 large hubs (Newman, Yandi and MAC) feeding into Port Hedland. Newman is the highest cost mine in the portfolio due to the strip ratio (>5:1 v average for BHP of ~2-2.5:1), but it also produces the highest grade product and greatest proportion of lump.

Depending on what blending strategy BHP is able to adopt going forward it would therefore need to adjust production across the mines rather than at an individual operation.

With BHP's philosophy to take price of the day and be the lowest cost producer, they may be prepared to keep running at full capacity through any period of price weakness to squeeze the high cost capacity permanently out of the industry, and also cut-off potential new supply that may get financed at higher prices.

Fortescue

The key operation at risk from Fortescue from lower prices are the Chichester mines that have a higher strip ratio than the Solomon Hub (~3.5:1 v <2:1). A potential response from FMG to lower prices would therefore to be to wind back production at these higher cost operations.

The Chichester Hub (Cloud Break and Christmas Creek mines) produce ~90mtpa of the planned 155mtpa run rate, and could be would back by 20-30mtpa to lower costs. With CB being an owner operated mining operation, there is more flexibility to wind back production without incurring contractor termination/demobilisation costs, but it would still not be a decision taken lightly.

Shorter-term the company could also lower strip ratios across the mines to reduce costs if prices persisted at this level.

Impact of Lower prices on Production Growth

The impact of US$80/t iron ore on projects will be a very different story.

In the first instance there are unlikely to be any greenfield iron ore projects that will work at this price, especially not the more capex intensive magnetite projects. You could basically say goodbye to all the "Hopefuls" on the list previously.

Additionally, any major projects for the majors will also stay on hold. The big 3 iron ore producers in Australia have already taken a considerably more conservative stance on capex spend as they seek to reduce debt with BHP's Outer Harbour and FMG's Western Hub delayed indefinitely. At US$80/t we would not expect RIO to add the potential further 100mtpa through doubling capacity of the new Robe port or for BHP to incur the capex for the additional 2 berths approved in Port Hedland.

What could still work and be a source of additional production growth at these prices would be low cost brownfield expansions to further lower operating costs. These expansions will have to be extremely capital efficient to get up, but with the margins that will still be generated even at US$80/t iron ore they still generate a high enough return.

If BHP and RIO can add brownfield capacity at ~US$50/t then this still generates IRR's of a highly attractive ~40%. For FMG with a lower price and higher cost, brownfield expansions with a capex intensity of US$50/t will have an IRR of >20%.

Figure 96. IRR for Brownfield Projects with Capex of US$50/t

	Margin	Capex	IRR
BHP	29	50	41%
RIO	30	50	42%
FMG	15	50	22%

Source: Citi Research

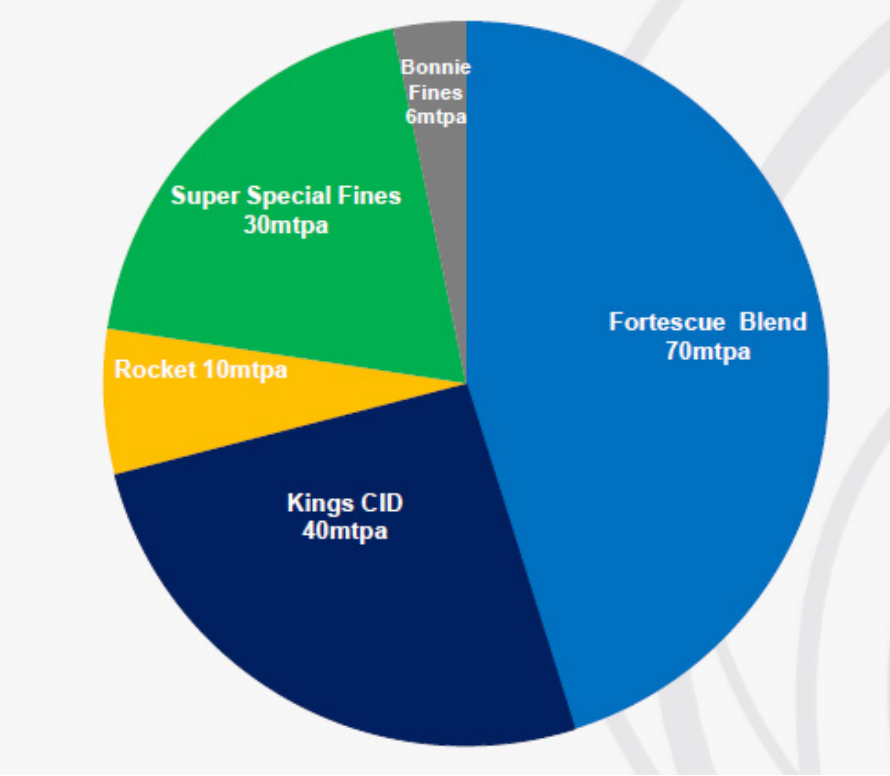
Grade & Quality

For BHP, RIO and FMG there is no significant change to the grade or impurities for the foreseeable future – 20+ years. This is driven by the vast Pilbara resources allowing the ability to blend out impurities through blending Brockman and Marra Mamba ores into “Pilbara Blends”.

Rio Tinto has been more advanced than the other players in moving to a Pilbara blend, with BHP hamstrung by on-going negotiations with JV partners around equitable treatment of the different parties and less ability to blend at the port due to constrained stockpile areas.

With the development of the Solomon Hub Fortescue will be producing a lower grade version called the Fortescue Blend – grade ~58% v 62% for RIO. Despite this and unlike RIO which has been reducing the products it produces from 13 to 5 (Pilbara Blend lump and Fines, Robe lump and fines and Yandi), FMG has been expanding its product range and will produce 5 different fines products at 155mtpa (Kings CID is a similar product to Yandi)

Figure 97. FMG Production Split by Product at 155mtpa



Source: Company Reports

Although product spec may not change, this does not mean that there are no issues that still need to be managed in the Pilbara as over time there will need to be an increased portion of mining below the water table. This will require higher capex for plants through installation of wet front ends and makes de-watering an even more critical part of operations to maintain quality spec.

Brazil: Better Late Than Never

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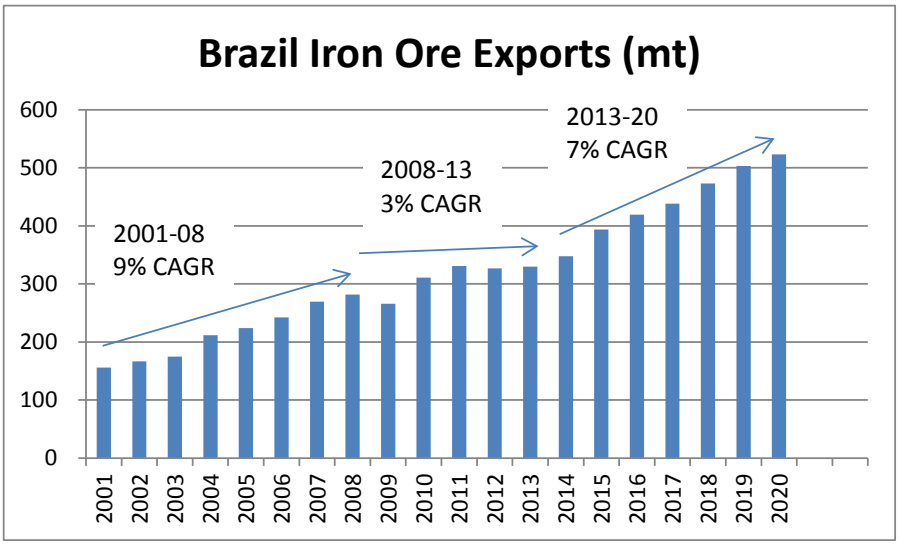
Brazilian iron ore exports are expected to grow by c.20-40mtpy for the next several years. This follows a period of very low growth from 2008-13, as the industry suffered with significant project delays, primarily from licensing. Brazil has historically produced very high quality iron ore fines, primarily from its friable itabirites. This will continue with Vale expanding Carajas and several projects to concentrate lower grade company itabirites. Brazil's main challenge in a low price environment will be its long distance from Asia. But Vale can weather any price scenario and could even help balance the market by closing some higher cost mines in an extended, ultra-low price scenario ($80/t and below).

Figure 98. Brazil Iron Ore Exports (mt)



Source: Citi Research

Product Differentiation

Brazil iron ore is expected to maintain its high quality characteristics (high Fe, low silica). Vale is expanding significantly at Carajas, which is rich in naturally occurring ores at 65%+ Fe. Ore in the south of Brazil is degrading to lower grade compact itabirites (~40%-Fe). But there are several projects to concentrate this product: 65mt of mostly replacement capacity from Vale, plus 27mt from Minas Rio.

Ability to Weather Low Prices

Brazil ore is generally low cost, but with the challenge of higher freight costs to Asian customers. Europe is an easier market with no competition from Australia.

Vale's scale and high quality product can weather any realistic price scenario. Vale's 'internal cost curve' is relative steep – and so the company could choose to close some high cost Southern mines and bring on S11D as replacement capacity if prices are low for an extended period. Vale's operating flexibility and Asian distribution would be key advantages.

Other Brazilian producers may have a harder time with less operating flexibility. Off-take agreements would become increasingly valuable (CSN with its Namisa partners, and Usiminas with Nippon-Sumitomo).

Supply Outlook

The bulk of new iron ore capacity from Brazil is expected from Vale, with contributions from CSN and Anglo American Minas Rio. We emphasize that forecasts below are still susceptible to delays. Licensing remains a significant challenge in Brazil.

Figure 99. Brazil Iron Ore Production & Exports Forecast (mtpy)

	2013	2014	2015	2016	2017	2018	2019	2020
Iron Ore Production (mtpy)								
Vale	312	321	357	366	366	401	431	451
CSN – Casa De Pedra	21	24	30	35	40	40	40	40
Usiminas	7	10	12	12	12	12	12	12
Gerdau	4	8	11	11	11	11	11	11
MMX	6	6	6	6	3	0	0	0
AAL - Minas Rio				14	27	27	27	27
Others	27	27	27	27	30	33	33	33
Total	377	396	443	471	489	524	554	574
BOF Steel Production	31	32	33	34	34	34	34	34
Domestic IO Consumption	47	48	50	51	51	51	51	51
Exports	330	348	394	420	438	473	503	523

Source: Citi Research

- **Vale:** Vale is expected to grow supply after several years of very low growth. The bulk of production will come from Vale's Northern Carajas operations which produces very high grade fines (67%-Fe). Carajas is a two phase expansion with +40mt coming online from 2014-2016; then +90mt from 2017-2020 ("S11D" project). Vale is investing in the South of Brazil but the majority of this is expected to be replacement capacity (installing concentration capacity to process lower grade compact itabirite ores and using existing infrastructure).

- **Anglo American:** Minas Rio is expected to produce 27mtpy of high grade concentrates/pellet feed. The timing on this project remains uncertain given licensing challenges. But the sunk cost on this project is so massive (US$10bn+) that it inevitably must be completed. Operating costs should be reasonably low since the project will use a slurry pipeline, instead of rail, to transfer product to the port.

- **CSN:** Casa de Pedra is expected to expand capacity +20mt, to 40mtpy total. Again the timing is a question mark since CSN has promised these expansions for several years, but failed to deliver. The CdP resource could potentially support production above 40mtpy, although licensing an expanded tailing operation could be extremely challenging. CSN has recently expanded its port capacity from 30mtpy to 45mtpy. Production from Namisa mines is expected to remain unchanged around 6mtpy.

- **Others:** Usiminas has expanded from 7mt to 12mtpy. This run-rate is sustainable for ~10 more years. A project to expand further to 25-30mtpy is on hold (this project would concentrate lower grade compact itabirites). Gerdau has expanded from 5mtpy to 11mtpy. The company could take this further to ~20mtpy, although it will depend on market conditions. MMX is producing around 6mtpy, although this ore is expected to deplete in ~5 years' time. Ferrous Resources has potential to add ~5mt extra to the market. There are other possible projects such as Manabi, Vetria and Zamin – but these remain largely unfunded for now.

India: Overwhelmed By External Issues

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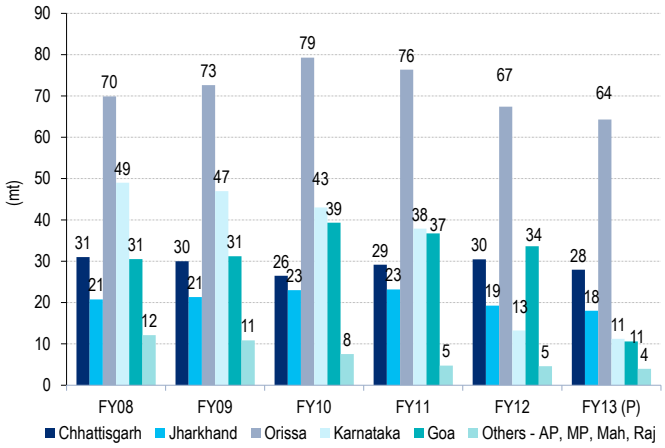
India's share in the seaborne market declined from 13% in 2008/2009 to ~1% in 2013, impacted by bans/curbs across states with a view to checking illegal mining, transport bottlenecks/constraints and higher duties/taxes. Iron ore exports out of India have plummeted from their peak of >100mt in a year to ~15mt.

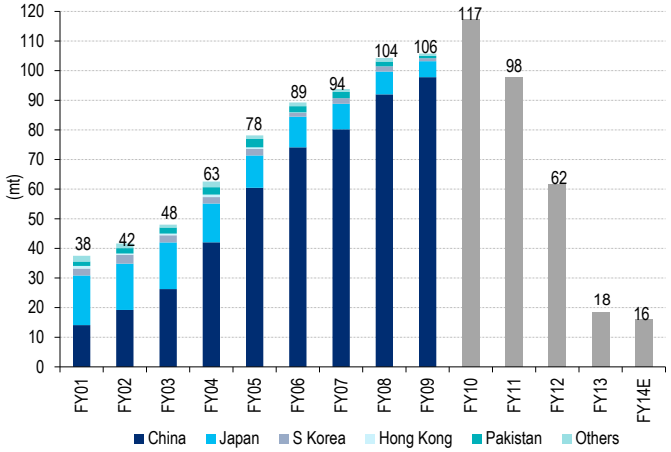
We believe iron ore exports out of India will rise from 16mt in 2013 to 35mt in 2014. This is predicated (to a large extent) on the export of iron ore inventories from Goa in 2014 and the restart of iron ore mining/exports from Goa in 2HCY14. Longer term our view is that the majority of exports from India would be from the state of Goa (most ore <62%); and given our global pricing outlook, only mine to port sea freight would be viable (not rail freight).

Figure 100. Statewise Iron Ore Production in India (mt)



Source: Ministry of Mines, IBM, Citi Research. Note FY is YE March.

Figure 101. India Iron Ore Exports, FY01-14E (mt)



Source: Ministry of Mines, IBM, FIMI, Citi Research estimates. Note FY is YE March.

Output Constraints

Karnataka

Link to report: *Karnataka: More Ore in Store*

There have been no exports out of Karnataka since July10

Exports out of Karnataka were ~25-30mt per year prior to the imposition of the export/mining bans. Ore is no longer exported from Karnataka.

July 2010: Export of iron ore out of Karnataka banned. **July-Aug 2011:** Blanket ban imposed by the Supreme Court (SC) on iron ore mining in Karnataka. **April 2013:** Ban lifted – Category A and B mines allowed to resume subject to clearances. Note the SC capped iron ore mining in Karnataka at 30mtpa vs. peak production at 45-50mt. **All ore is consumed domestically (exports allowed only if the ore is not purchased domestically).**

According to industry sources, ~21 mines (capacity 9.7mtpa), have resumed mining operations in Karnataka in addition to the ~9-10mtpa production from NMDC. Resumption of mining operations has been hindered by delays in getting environment/forest clearances and other statutory clearances from the state government.

Goa

Exports out of Goa were ~45-50mt per year prior to the imposition of the blanket ban. The mining ban still prevails; so far only 0.5mt of iron ore inventory lying in Goa has been auctioned and likely to be exported.

Link to report: *Goa Mining Ban: Karnataka Déjà Vu*

The State Government of Goa suspended mining after the Shah Commission Report was tabled in parliament in Sep12. This was followed by the suspension of environment clearances of mining leases by the Ministry of Environment and Forests. The SC imposed a ban in Oct12 and asked the Central Empowered Committee (CEC) to file a preliminary report on illegal mining in Goa.

Link to report: *First Batch of Goa Ore Auctioned, Traders/Mine Owners Bid*

In Nov13, the SC passed an interim order allowing the auction of ~15mt of already extracted ore from Goa 1) to be monitored by an appointed committee, 2) proceeds to be kept in fixed deposits till the SC decides on the legality of the mines. The first e-auction of 0.54mt Goa iron ore stocks took place on 17th Feb14 (2nd auction of 1.5mt to take place on 5th Mar14). The ore from e-auction can be utilized for sale, domestic consumption or can be exported. Reports indicate all of the bids were made by either mine owners or traders (no Indian steel producers).

The SC also set up a committee to conduct Environmental Impact Assessment (EIA) studies to determine a cap on the extraction of ore based on factors such as road capacity, sustainable development (report was to be submitted by Feb14). The SC has extended the time for the report submission by a month to 15th Mar14.

Our export estimates for 2014 incorporate the sale of 15mt of Goa ore inventory in the export market and the re-start of mining in Goa in CY14. We expect a cap on mining and estimate exports out of Goa to be below historic levels.

Orissa

Orissa is India's largest iron ore producing state (64mt in FY13). Exports out of Orissa were ~15-16mt during FY09-10 (YE March), down to 4mt in FY13. We think exports could be negligible out of Orissa, once measures are announced to check illegal mining (the Shah Commission investigation is complete).

Press reports (Hindu) suggest the Shah Commission has indicated (yet to be made public), on large-scale violation of environment and forest laws in iron ore mining in Orissa.

The Commission has recommended restricting iron ore production in Orissa to 50-55mtpa with an annual increase of 7.5% to accommodate the projected rise in the domestic steel sector's requirement. FY13 production in Orissa at ~64mt declined -5% yoy; exports were 4mt in FY13 (vs. ~10mt in FY12).

The SC hearing on the Shah Commission Report is scheduled for early March – we expect a cap on mining and likely ban on exports.

The Weight of Higher Costs

The high levels of profitability have attracted rising levies by various government arms in India and this has partly been driven by the steel industry chorus to restrict iron ore exports. Various levies such as higher royalties, export duties and disproportionately higher rail freight have all led to reducing competiveness for Indian iron ore. The draft Mining Bill could make things worse.

The current cost of mining iron ore in India (ex-mine) is ~$15-17/t. However, the FOB cost at the port rises substantially once we add the export duty (30% ad-valorem), royalty (10% of ex-mine price), mine to port freight (which could be $10 in case of sea freight as high as $45/t in case of rail freight).

As duties/taxes stand today, exports out of India would only be viable going forward if the mine to port movement is via sea, given our global iron ore price forecasts. The marginal cost today (based on rail freight) would be >$100/t.

Higher Export Duty

The steel industry has been lobbying for a ban on iron exports and export duty has been rising progressively. Duty on fines has moved from zero in Dec08 to 30% in Jan12. Recently, a 5% export duty was imposed on iron ore pellets

Figure 102. India Iron ore – Export Duty on Fines and Lumps

Feb-07	Specific export duty on all ore grades
Jun-08	15% ad-valorem duty on all ore grades
Oct-08	Rs200/t on fines; 15% ad-valorem duty on lumps
Nov-08	8% ad-valorem duty on fines; 15% ad-valorem duty on lumps
Dec-08	No duty on fines; 5% ad-valorem duty on lumps
Dec-09	5% ad-valorem duty on fines; 10% ad-valorem duty on lumps
Apr-10	5% ad-valorem duty on fines; 15% ad-valorem duty on lumps
Feb-11	20% ad-valorem duty on fines; 20% ad-valorem duty on lumps
Jan-12	30% ad-valorem duty on fines; 30% ad-valorem duty on lumps

Source: Company Reports, Citi Research

Higher export freight

Rail freight for iron ore exports is high at $45/t; almost 3x that of domestic freight.

Higher royalties

Royalties were changed from a flat rate to ad-valorem in Aug09

According to the provisions of the MMDR Act 1957, the Central government can enhance or reduce royalties with respect to minerals provided it does not enhance the rate of royalty on any mineral more than once during in three years. The last revision with respect to iron ore royalties took place in Aug09 when it was increased from a flat rate of Rs11-27/t to 10% ad-valorem based on the price determined by the Indian Bureau of Mines (current royalty ~$4-5/t).

Draft Mining Bill

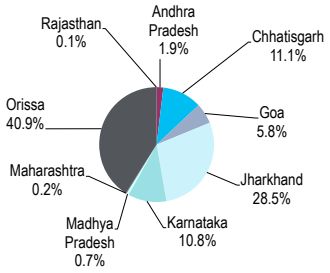
We do not have any visibility on the likely implementation – mode/timing and do not incorporate it in our cost forecasts

Separately, the Draft Mines and Minerals Development and Regulation (MMDR) Bill, 2011 has recommended a sum equivalent to royalty in case of major minerals (other than coal) is to be shared with the local population. The royalty amount would go to the State and the other amount that would go to the District Mineral Foundation. These are statutory payments and no offset would be granted to corporates against their existing CSR expenses.

Indian Iron Ore Industry Background

India has one of the world's largest iron ore reserves, estimated at 8bn tonnes as of April 2010 (source: IBM). However, India's production fell to 136mt in FY13 (vs. 169mt in FY12) on output restrictions as highlighted above – peak production at 219mt in FY10. Exports are estimated to have declined to 18mt in FY13 (y/e Mar13) from the peak level of 117mt in FY10. Iron ore imports in FY13 were 3mt.

Figure 103. State-wise Reserves, FY10



Source: IBM

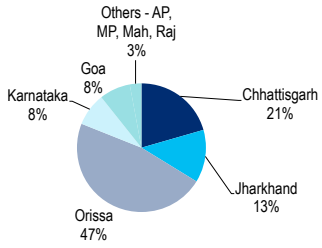
Figure 104. India – Iron ore Demand-Supply

Year	Production	Domestic Consumption/ Requirement (e)	Imports	Exports	Share of Export with production
2010-11	207.2	107.2	1.9	97.7	47.1%
2011-12	168.6	100.6	1.0	61.7	36.6%
2012-13*	136.0	103.4	3.1	18.4	13.5%

Source: Production/Consumption - Indian Bureau of Mines, Ministry of Mines; Import/Export - MMTC, Ministry of Commerce; * Provisional; e Estimated)

Most of India's iron ore production (>95%) is in the states of Orissa, Karnataka, Chhattisgarh, Goa and Jharkhand. Fines account for 55-60% of India's iron ore production and the balance is in the form of lumps. The domestic industry consumes around 90% of the lumps produced and a large proportion of fines are exported. Of the total iron ore produced (in FY12), ~20% is > 65% Fe, ~40% is between 62-65% Fe and the balance < 62% Fe.

Figure 105. State-wise Production, FY13



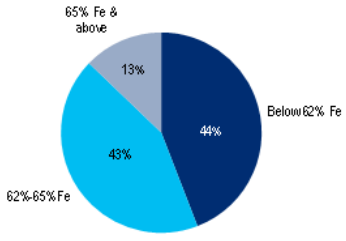
Source: Ministry of Mines

Figure 106. India's Lumps and Fines Production Breakdown

Particulars	FY06	FY07	FY08	FY09	FY10	FY11	FY12 (P)
Lumps	41%	47%	46%	43%	41%	37%	37%
Fines	57%	52%	54%	56%	58%	62%	62%
Concentrates	3%	1%	0%	0%	0%	0%	0%

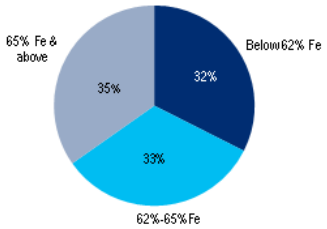
Source: Federation of India Mineral Industries, Indian Bureau of Mines. Note: FY13 data not yet available.

Figure 107. Fines Breakdown by Grade, FY12



Source: Indian Bureau of Mines

Figure 108. Lumps Breakdown by Grade, FY12



Source: Indian Bureau of Mines

Africa: Likely to Remain a Hope

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The African iron ore story has been one of great euphoria with the expectations that this area would become a major pillar of iron ore supply that would rival Australia and Brazil. However, the euphoria has been quelled by infrastructure and political issues, falling commodity prices and capital rationalization from major diversified players which initially showed a lot of interest in Western Africa.

In West Africa the fallout of this has been re-scoping of several big-ticket projects particularly around the Guinea projects such as Simandou (Figure 109). The smaller companies are facing capital squeeze from debt and equity markets while the large mining companies are cautiously downsizing the initial project scope to assess the viability and execution risk before committing more capex.

Figure 109. We Forecast the Change in Project Scope Will Result in at Least 17Mt Capacity Cut by 2015 compared to 2012 Estimates

			2012					2014					CHANGE				
Project	Company/Region	Country	Timing	2015F Production target (Mtpa)	Est. Capex (US$m)	Additional capacity	Capex per annual production unit (US$/tonne)	Timing	2015F Production target (Mtpa)	Est. Capex (US$m)	Additional capacity	Capex per annual production unit (US$/tonne)	Timing	2015F Production target (Mtpa)	Est. Capex (US$m)	Additional capacity	Capex per annual production unit (US$/tonne)
Askaf	Sphere Minerals	Mauritania	2011	4	540	6	90	2011	4	540	6	90	0	0	0	0	0
Guelb el Auoj	Sphere Minerals	Mauritania	2015	7	1650	7	236	2015	7	1650	7	236	0	0	0	0	0
Letbtheinia	Sphere Minerals	Mauritania	2020	0		30		2020	0	0	30	0	0	0	0	0	0
Putu	African Aura	Liberia	2016	0		20		2017	0	3000-4000	12	292	1	0	N/A	-8	N/A
Tonkolili Phase 1	African Minerals	Sierra Leone	4Q2011	12	1740	20	87	4Q2011	20	1900	20	95	0	8	160	0	8
Tonkolili Phase 2	African Minerals	Sierra Leone	2015	23	3600	30	120	2016	0	785	5	157	1	-23	-2,815	-25	37
Tonkolili Phase 3	African Minerals	Sierra Leone	2020+	0	7200	45	160	2020+	0	7200	45	160	0	0	0	0	0
Marampa	Cape Lambert	Sierra Leone		5		11		2016	0	2337	15	156	N/A	-5	2,337	4	156
Marampa Phase 1	London Mining	Sierra Leone	1Q12	5	332	5	66	1Q12	5	580	5	116	0	0	248	0	50
Marampa Phase 1a	London Mining	Sierra Leone	2015	4	600	4	150	2015	6	40	1	40	0	2	-560	-3	-110
Faleme	ArcelorMittal	Senegal	2020	0		15-25		2020	0	0	15-25	0	0	0	0	0	0
Mbalam	Sundance Resources	Cameroon	Q2 2014	30	3360	35	96		30	4686	35	134	N/A	0	1,326	0	38
Mayoko phase 1	Exxaro	ROC	2013	5	250	5	50	2H14	2	340	2	170	1	-3	90	-3	120
Kalia Phase 1 DSO	Bellzone	Guinea	2014	20	1179	20	59										
Kalia Phase 1	Bellzone	Guinea								865	7	124					
Avima	Core Mining	ROC	2016	5		20										15	
Avima Phase 1	Core Mining	ROC						2015			3						
Avima Phase 2	Core Mining	ROC						2019			32						
Zanaga	Zanaga	ROC	2015	0	6800	38	181									-3	
Zanaga Phase 1	Zanaga	ROC								0 2500-3000	12	200					
Zanaga Phase 2	Zanaga	ROC									23						
Nimba	ArcelorMittal	Liberia	2012	14		14										1	
Nimba Phase 1	ArcelorMittal	Liberia						2012	4	700	4	175					
Nimba Phase 2	ArcelorMittal	Liberia						2015		1500	11	136					
Marampa Phase 2	London Mining	Sierra Leone	2016	0	1200	8	150									-8	

Source: Company reports, Citi Research

We have tried to re-assess the current situation for the region through a SWOT analysis and to see what are the key upsides and risks in order to realize the potential supply from the region.

Figure 110. SWOT Analysis for Western Africa Iron ore Mining region

Strengths

- Vast resources base to support large scale, long life mines
- Chinese investment push to build self-reliance in iron ore feedstock
- Most of the countries have pegged their currencies to Euro reducing the currency volatility

Weaknesses

- Nonexistent Infrastructure requiring additional investment for seaborne market
- Skilled labor shortage creating short term demand supply mismatch
- Low grade resources resulting in higher carbon footprint

Opportunities

- Underexplored territory creating option to extract areas with low stripping and easy geology first
- Pick up in African growth story to help build self-sustaining ecology
- Global majors already investing in the region bringing technical capabilities

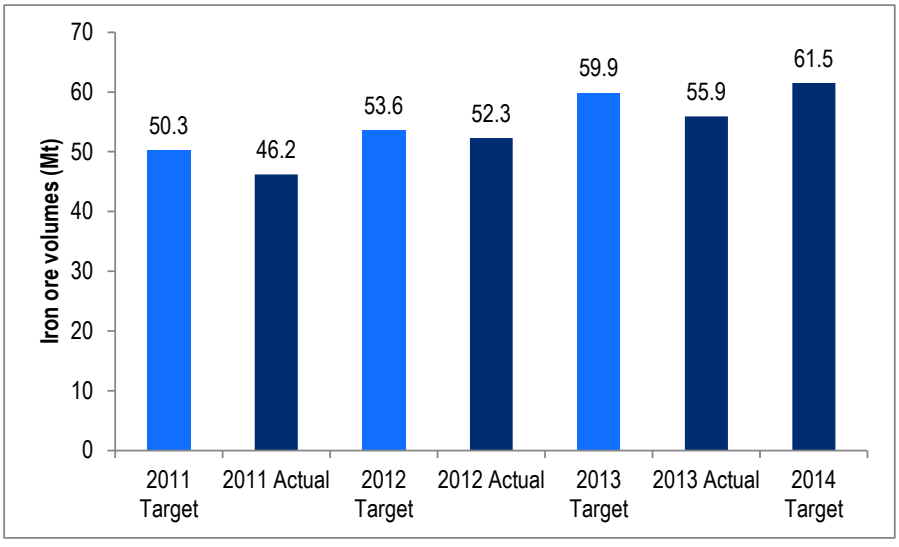
Threats

- Depressed outlook for iron ore prices could impact project economies
- Political uncertainty and still developing laws related to mining and licensing
- Funding issue given the high country risk (in certain cases non-investment grade sovereign rating)

Source: Citi Research

In South Africa Infrastructure has been arguably the major issue, however, Transnet's volume target for 2020 implies an annual CAGR of 5%. Transnet operates the iron ore export channel between Kumba and Assmang's Northern Cape mines to the Port of Saldanha. During 2013 Transnet carried 59.5Mt of iron ore through this channel and for 2014 targeted export capacity is 61.5Mt (Rail capacity of 60Mt and port capacity of 58Mt). Kumba exported 39.1Mt in 2011 and Assmang around 16.6Mt.

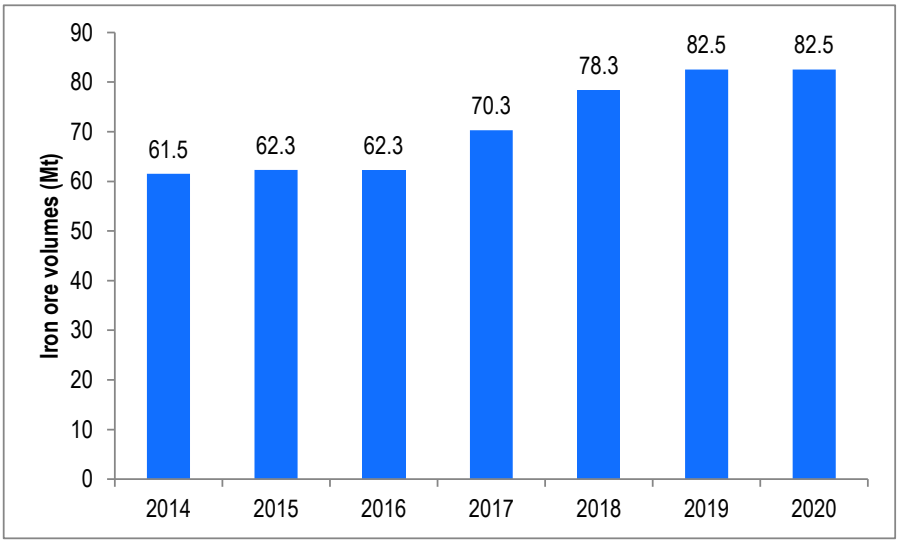
Figure 111. Transnet's Target (2010) vs. Actual Railed Volumes



Source: Transnet 2010 and 2013 operational review report, Citi Research

Transnet adopted Market demand Strategy (MDS) in 2012 that calls for expansion of iron ore corridor to 82.5 million tonnes by 2020. This is with a view to maintaining South Africa's share of 5% in seaborne iron ore market.

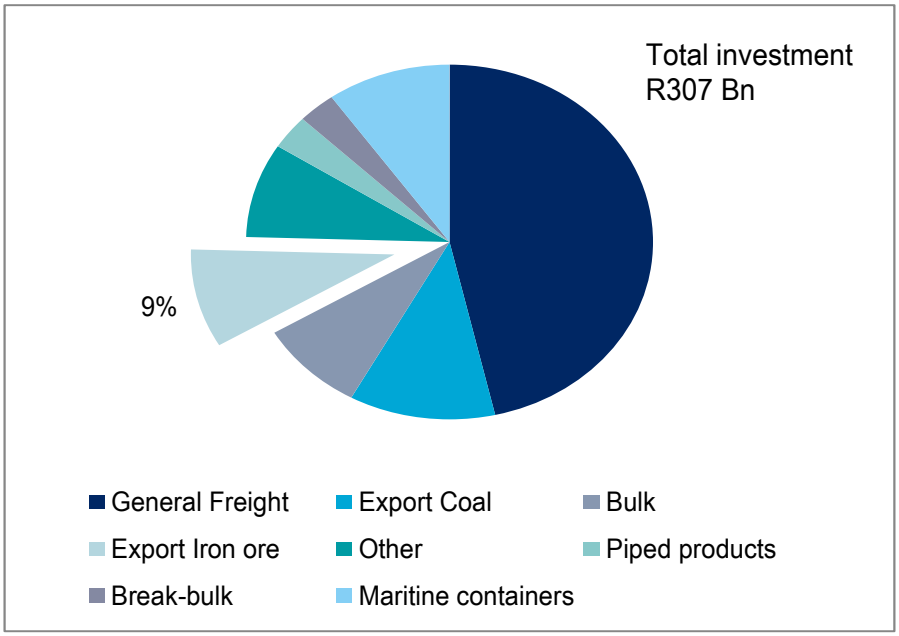
Figure 112. Transnet's Iron Ore Export Volume Targets



Source: Transnet 2013 operational review report, Citi Research

- Interestingly as big miners like Kumba struggle with their maturing assets, Transnet is looking to allocate the capacity to more junior miners and in 2013 Burk Mining and Tata Steel received allocation along with Kumba and Assmang.

Figure 113. Transnet's Investment Directed Towards Major Commodities by 2020



Source: Transnet 2013 operational review report, Citi Research

Though the higher capacity planned by Transnet will ease the infrastructure bottlenecks, at the same time, it is also going to be a double edged sword for miners that will likely have to commit additional volumes under take-or-pay agreements. This will add additional pressure on miners to deliver extra volumes even if the ruling iron ore price does not justify it, leading to a potential margin squeeze. On the other hand, if we compare (Figure 111) Transnet's past guidance

(for 2010 annual report) versus actual performance we see a downside risk to capacity delivery that certainly can create a mis-match between miners volume expansion plan and actual available capacity through Transnet's export channel

Taxation / Royalties / Political Issues

Effective tax rate of 40%

South African miners pay companies tax of 28% and iron ore miners pay royalties of around 5% on revenue. This implies an effective tax rate on EBIT of around 40% for iron ore miners.

Carbon tax

The recent announcement from the South African Govt. to postpone the carbon tax by a year to 2016 is a positive development for industry in general, in our view. Earlier, Govt. was looking to introduce a carbon tax from 2015 based on a proposal contained in the national treasury's policy paper.

The nation's Treasury department put forward a plan for a carbon tax of 120 rand (~U$11) per ton for emissions over and above a 60% threshold that will be set for a number of carbon-intensive sectors, including electricity, petroleum, iron, steel and aluminium. There is also a provision for all sectors, except electricity, to claim additional relief of at least 10%. If we consider that mining companies will get an additional 10% exemption, we estimate that the EBIT level impact for Kumba and Assmang would be between 0.10%-0.20%, which is not very concerning in our view.

Volume increases expected

Figure 114. Production and Volume Growth Estimates from Major Iron Ore Producers in South Africa

CY (000 tonnes)		2013	2014E	2015E	2016E	2017E	2018E	2019E	2020E	2013-20 CAGR
Kumba		42,373	46,000	47,000	48,000	48,000	48,500	53,000	54,500	4%
	Assmang*	16,637	16,000	17,000	18,000	18,000	18,000	18,000	18,000	1%
	Total	**59,010**	**62,000**	**64,000**	**66,000**	**66,000**	**66,500**	**71,000**	**72,500**	3%
	% change		5%	3%	3%	0%	1%	7%	2%	

Source: Company reports, Citi Research, *Owned by African Rainbow Minerals and Assore

Domestic & Regional Issues

- Labour relations remain a challenging area for South African miners though it is not as concerning for iron ore miners as precious producers but any industrial action not only impacts production and cash cost profile it is also a big negative for foreign capital inflows in the sector.
- Recent protest from NUMSA (The National Union of Metalworkers) keeps on bringing the nationalization of mines issue to the forefront. This certainly remains a concern over security of tenure in South Africa for the investors. Although the nationalization debate has been silenced by the government, higher taxes are still a probability.
- On positive side weakening of local currency has provided a cushion to the margins amid falling global iron ore prices. Again we see less room going forward from the current USD/ZAR level and risk remains on the downside in terms of some strengthening of rand.
- Like many other mining regions, South Africa faces a skills shortage.

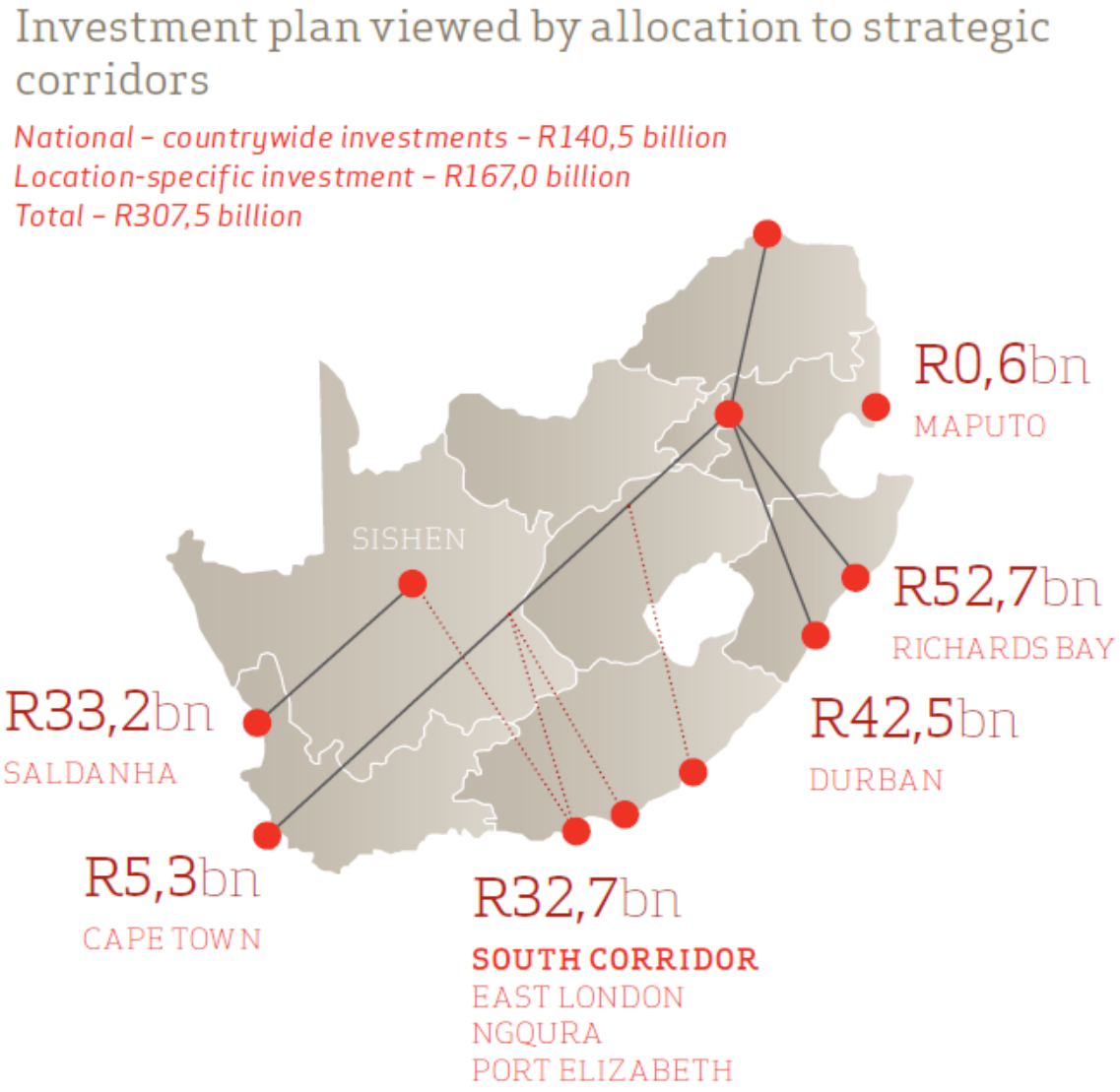
- High mining/transport inflation. Energy cost for Transnet increased 23% in 2013 due to higher fuel prices and significant increase in electricity tariff.

Figure 115. Capital Investments by Major Project over Seven-year Period to 2020

	In Rand Bn
Export coal line investment to grow to 97,5mt.	32.4
Export iron ore line to increase capacity to 82,5mt.	19.3
General Freight Business investment to increase capacity to 180,3mt.	142.7
Maritime containers investment to increase capacity at ports to 8,4m TEUs.	30.2
Bulk investment to increase capacity at ports to 232mt and terminals to 127mt.	37.6
Break-bulk investment to sustain capacity at ports at 31mt and terminals at 15mt.	9.2
NMPP investment to increase capacity to 8,7blpa.	6.6

Source: Transnet report 2013, Citi Research

Figure 116. Capital Investment Plan by 2020 in Strategic Corridors



Source: Transnet 2013 operational review report, Citi Research

CIS: Prudent Development

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Activity in the region is focused on differentiation rather than volume growth. We estimate overall product volumes are likely to expand at a 1-2% rate through 2018.

Figure 117. Iron Ore Product Output, mt

	2012	2013	2014e	2015e	2016e	2017e	2018e
Russia	214	213	215	216	219	224	225
Ukraine	145	150	151	154	155	156	157
Kazakhstan	24	26	27	28	30	31	32
Total	383	390	393	398	404	411	414
growth		*2%*	*1%*	*1%*	*2%*	*2%*	*1%*

Source: Metal, Expert Citi Research

Volume growth in Russia is due primarily to expansion from NLMK and IRC, which are planning to add a combined 14.4mt (6mnt NLMK and 8.4mnt IRC) by 2018. We risk the latter, assuming that projects not currently funded will not be started in time to contribute to 2018 output.

Domestic Customers More Valuable Than Exports

Exports from the region at ~60mt are dominated by the largest regional producers – Ferrexpo, Arcelor Mittal, Metinvest and Metalloinvest.

Figure 118. Iron Ore* Exports in 2013 vs. 2012

Mn tonnes	2012	2013	Change
Ferrexpo	9.6	10.9	14%
ArcelorMittal	9.3	10.0	8%
Metinvest	9.9	10.9	9%
Metalloinvest	12.2	8.8	-28%
Severstal	2.4	3.2	33%
Evraz	2.4	2.1	-14%
NLMK	2.6	2.9	12%
MTL	3.0	2.3	-26%
Other	8.4	9.6	14%
Total	**59.9**	**60.7**	**1%**

Source: Metal expert, *all iron ore products unweighted by Fe content

During 2013, Metalloinvest redirected export volumes to the Russian domestic market due to signing of new long-term contracts with several Russian steel manufacturers. Better quality product was cited as a factor by one of the new customers in its decision to switch to Metalloinvest supplies. Domestic iron product margins exceeded those of export markets in 2013, according to Metalloinvest, making domestic sales more profitable. Metalloinvest's mid-term strategy seeks to further expand domestic sales volumes through product differentiation.

Differentiation Strategy in Place

Many of the larger producers, including steel companies, are pursuing a product differentiation strategy primarily by adding pellet capacity. Ferrexpo should reach 12mt capacity this year (vs. 9.5mnt). The company has a long-term plan to increase this to 16mt but has not made a definitive decision on financing and the timeline. In addition, Ferrexpo plans to gradually increase the share of 65%+ pellets in its output mix.

Metalloinvest, which supplies pellets among other products to NLMK, has made substantial progress on a new 5mt pelletizer (indicated for a 2014 launch) as well as a 1.8mt HBI plant (2018 launch).

NLMK, along with the expansion of Stoilensky GOK iron ore output, plans a 6mt pelletizer by 2018.

Figure 119. Approved Pellet Capacity Upgrades

	mt	Target year
Ferrexpo	2.5	2014
Metalloinvest	5.0	2014/2015
NLMK	6.0	2018

Source: Company presentations, Citi Research

What Happens at $80/t?

Growing surpluses leading to $80/t concentrate in 2016, as per our forecasts, may move the Russian domestic iron ore market to a premium and lead producers to compete even more aggressively for landlocked customers with limited ability to purchase from Australian and Brazilian producers. Ferrexpo, in geographical proximity to its major European customers, would likely maintain its customer base. Metinvest and Metalloinvest would gradually seek to ship export volumes closer to home. Some smaller producers in the region would probably shut down. Steel producers with sub-efficient iron ore mines may shut down these (mainly smaller) mines, just as they are currently starting to do in coking coal.

North America: Expansions Done and Cuts Could Be Next

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After Cliffs indefinitely postponed its 7 mln tonne Phase II expansion at Bloom Lake, there are currently no major export-oriented expansion projects in Canada.

The Iron Ore Company of Canada (IOC) completed its expansion to roughly 26 mln tonnes of concentrate and is expected to ramp to this rate by the end of 2014. 11 mln tonnes are converted to pellets, with the rest sold. Operating costs average $67/tonne, including royalties, but we expect IOC to push costs down to roughly $50/tonne as production increases, costs are taken out, and royalties fall due to lower pricing. Given the favorable cost structure and that 42% of production will be pelletized, ICO should continue to run even at our lower $80/tonne CFR China forecast for 2016.

ArcelorMittal Mines Canada (AMMC) ramped to its full rate of 24 mln tonnes in 4Q13 with cash costs averaging around $40/tonne. Similar to IOC, AMMC's cost structure appears competitive enough to run at a benchmark of $80/tonne.

CLF continues to struggle with their Bloom Lake mine and cash costs are expected to average $86/tonne in 2014. Production of roughly 6 mln tonnes trails capacity of 7 mln tonnes as the company works to optimize the ore blend feeding into the AG mill. Net-back pricing to Eastern Canada should average $30/tonne below benchmark after taking into account moisture discount, Fe premiums and freight. Thus Bloom Lake needs roughly $116/tonne benchmark to breakeven on a cash cost basis unless it can solve the ore blend issue and potentially push costs down to the $70s. Sustaining capital adds another $20/tonne.

Notes

Notes

Notes

Appendix A-1

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