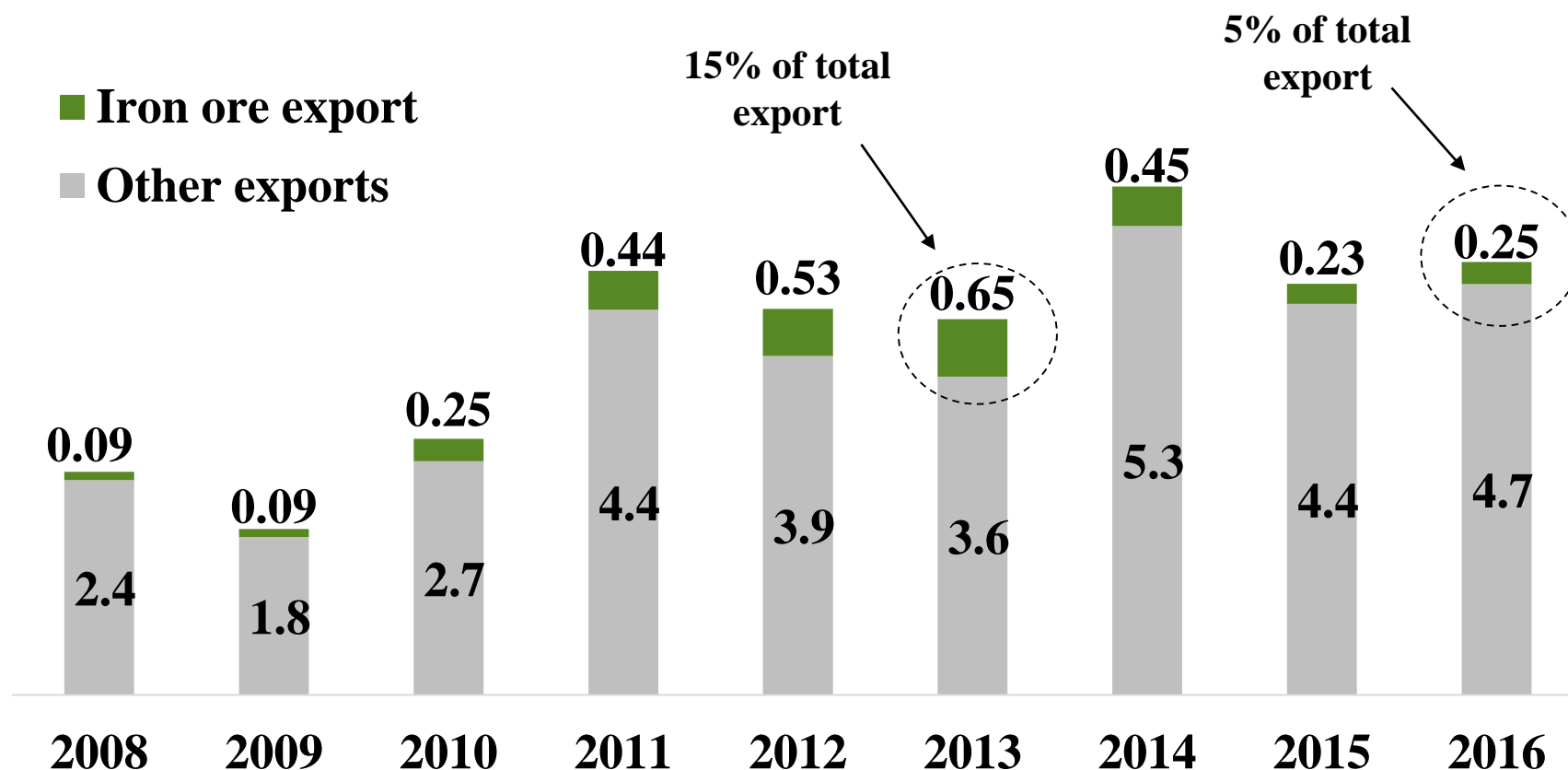# IRON ORE STUDY

B.Bat, PhD, Economic Research Institute
Z.Manlaibaatar, Economic Research Institute

2017-03-09

Content

1. Background

2. Demand side analysis

3. Supply side analysis

4. Iron ore trade

5. Iron ore price

1. Background: Mongolia's export, USD bln

■ Iron ore export
■ Other exports

15% of total export

5% of total export

0.09 / 2.4 — 2008
0.09 / 1.8 — 2009
0.25 / 2.7 — 2010
0.44 / 4.4 — 2011
0.53 / 3.9 — 2012
0.65 / 3.6 — 2013
0.45 / 5.3 — 2014
0.23 / 4.4 — 2015
0.25 / 4.7 — 2016

Source: Custom's Office, 2008-2016

1. Background: Global iron ore market in 2014, Fe 62% Mt

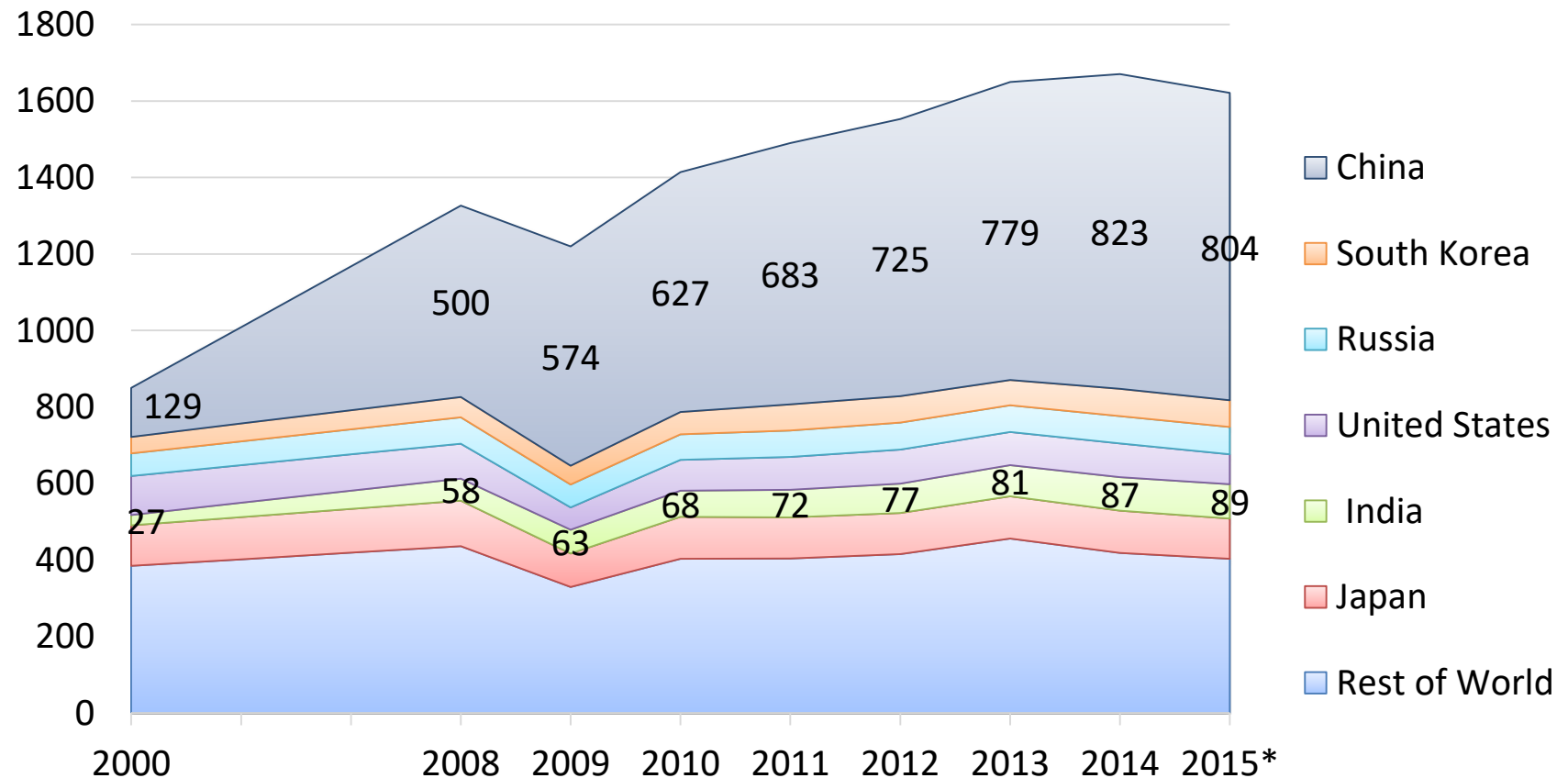| Countries and regions	Production	- Exports	+ Imports	= Apparent consumption
Europe	43.5	53.6	166.9	156.8
CIS	199.5	78.4	13.7	134.8
NAFTA	115.7	55	15.6	76.4
Brazil	399.4	344.4	0	55
Other Latin America	36.1	31.5	11.9	16.5
Africa	113.2	105.1	5.5	13.5
Middle East	48.5	23.1	26.5	51.9
China*	193.2	0.1	933.1	1126.2
India	129.8	9.8	7.4	127.4
Japan	0	0	136.4	136.4
South Korea	0	0.1	73.5	73.4
Australia	723.7	754.3	3	-27.6
Other Asia and Oceania	30.6	33.5	92.4	89.5
World	**2033.2**	**1488.9**	**1485.9**	**2030.2**

Source: World Steel Association, 2016

2. Demand: Steel making

- 98% of the mined iron ore is used to produce steel

World steel-making capacity, steel production and use, Mt

Legend: Apparent steel use | Steel production | Steelmaking capacity | Capacity utilization (right axis)

Data labels shown: 1148, 1376 (2005); Capacity utilization: 83%, 86%, 85%, 80%, 70%, 76%, 77%, 74%, 73%, 72%, 69%; 2364 (2015 capacity), 1623 (2015 production)
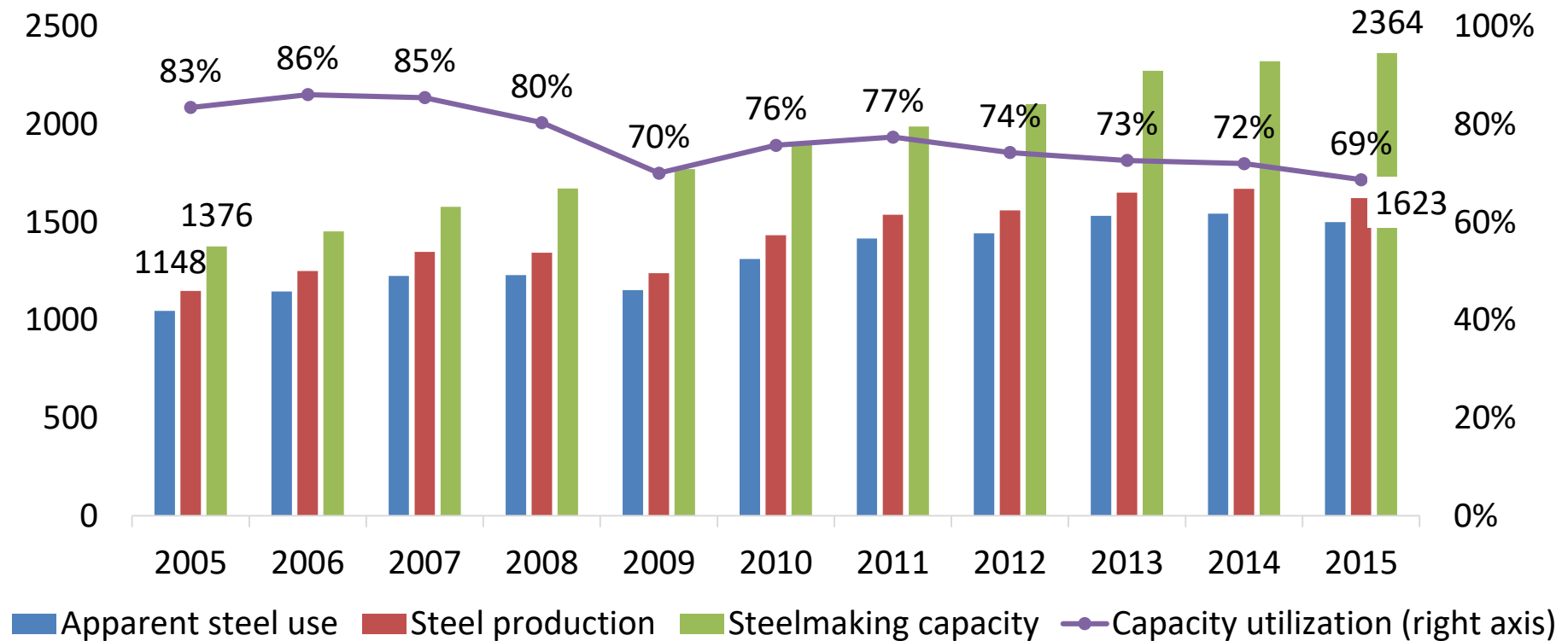
Source: International Trade Administration, 2016
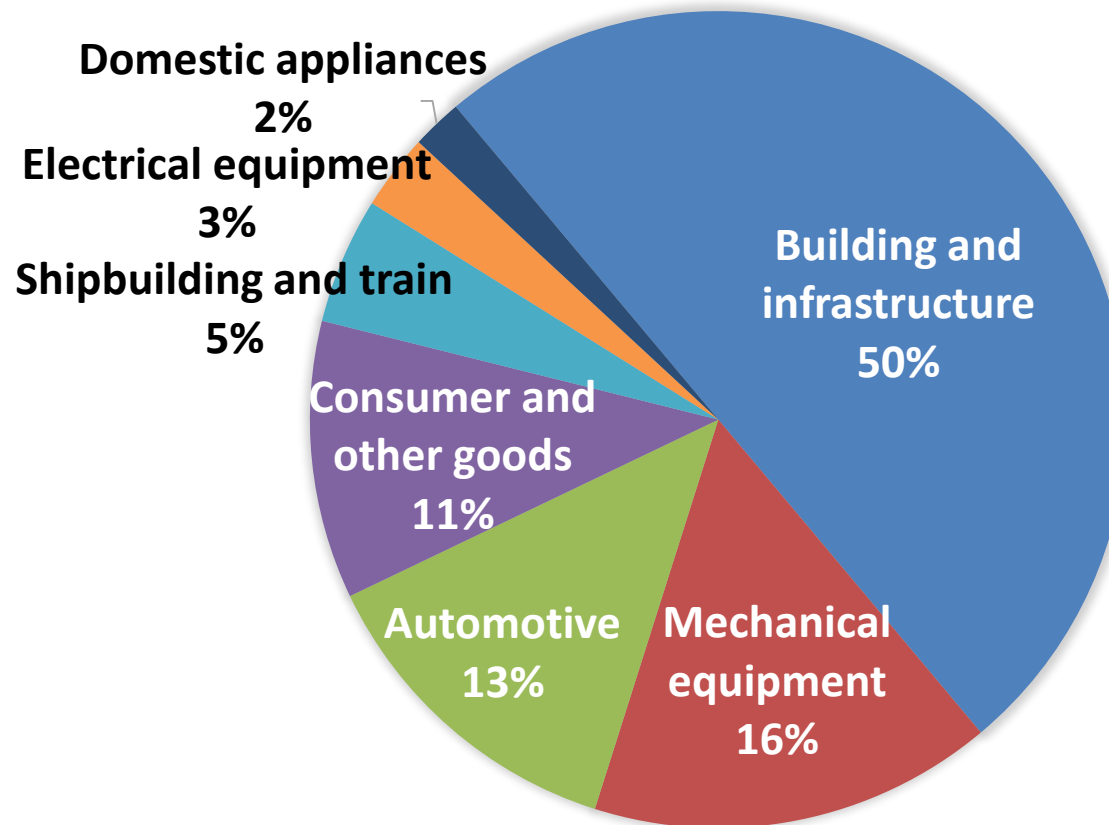
5

Source: World Steel Association, 2016

2. Demand : Top 20 steel mills as of 2015, Mt

❑ Top 20 companies produced 37% of world steel, 10 of them are Chinese

#	Company	Country	Tonnage	#	Company	Country	Tonnage
1	ArcelorMittal	India	97.1	11	Wuhan Steel Group	China	25.8
2	Hesteel Group	China	47.8	12	Shandong Steel Group	China	21.7
3	NSSMC	Japan	46.4	13	Hyundai Steel	S. Korea	20.5
4	POSCO	S. Korea	42.0	14	Nucor Corporation	U.S.	19.6
5	Baosteel Group	China	34.9	15	Maanshan Steel	China	18.8
6	Shagang Group	China	34.2	16	Thyssen-krupp	Germany	17.3
7	Ansteel Group	China	32.5	17	Gerdau	Brazil	17.0
8	JFE Steel Corporation	Japan	29.8	18	Tianjin Bohai Steel	China	16.3
9	Shougang Group	China	28.6	19	NLMK	Russia	16.1
10	Tata Steel Group	India	26.3	20	Jianlong Group	China	15.1

Source: World Steel Association, 2016

7

2. Demand: Steel use

Domestic appliances 2%
Electrical equipment 3%
Shipbuilding and train 5%
Consumer and other goods 11%
Automotive 13%
Mechanical equipment 16%
Building and infrastructure 50%

Source: World Steel Association, 2016

2. Demand: China's growth is the main factor

❑ Chinese annual investment growth is 11% since 2000

❑ China's highways expanded: 1 mln kms in 1990 →
4 mln kms in 2013

❑ Rail road length increased: 59'000 kms in 2000 →
66'000 kms in 2012.

❑ Real estate floor space grew: 7 mln sq.feet in 2000 →
266 mln sq.feet in 2014

Source: Port Jackson Partners, 2015

2. Demand: Iron ore export to China in 2015

#		Value imported (USD mln)	Quantity imported (mln.ton)	Unit value (USD/ton)	Growth in imported value, 2014-2015 (%)
1	Australia	36,002	607.6	59	-34
2	Brazil	12,214	191.7	64	-32
3	South Africa	3,080	45.4	68	-37
4	Ukraine	1,510	20.2	75	-34
5	Canada	708	9.4	75	-49
6	Iran	695	13.1	53	-63
7	Chile	677	9.7	70	-47
8	Peru	594	10.7	55	-40
9	Russia	449	7.2	62	-34
10	Mauritania	408	7.5	55	-57
11	Venezuela	282	4.4	63	14
12	Mongolia	258	5.9	44	-45
13	Sierra Leone	148	2.6	57	-91
14	Liberia	146	2.6	57	-42
15	India	102	2.1	49	-88
	Other	598	13.2	53	-
	Total	**57,871**	**953.2**	**61**	**-38**

Source: International Trade Center, 2016

10

2. Demand: Still Mills in Northern China

Source: Haranga Resource, 2013

2. Demand: Other factors

❑ Recycling Steel
- ❑ It is cheaper than to mine iron ore and make steel.
- ❑ The average recycling rate for steel today is 85%.
- ❑ In 2015, **650Mt** of scrap was recycled
- ❑ Scrap supply will continue to grow in future. Obsolete Chinese scrap will increase by 3 times in 2015-2030.

❑ Technological advance in steel making
- ❑ In the 1980s, to produce 100kg of steel needed 144kg of raw materials
- ❑ In 2009, **115 kg** of inputs was used.
- ❑ This trend will continue further.

Source: Steel Recycling Institute, 2017; Arcelor Mittal, 2016; Rio Tinto, 2016; World Steel Association, 2009 and 2016;

3. Supply: Global reserve, Mt

Countries	Reserves	
	Crude ore	**Iron content**
Australia	54,000	24,000
Russia	25,000	14,000
Brazil	23,000	12,000
China	23,000	7,200
United States	11,500	3,500
India	8,100	5,200
Ukraine	6,500	2,300
Canada	6,300	2,300
Sweden	3,500	2,200
Iran	2,700	1,500
Kazakhstan	2,500	900
South Africa	1,000	650
Other	18,000	9,500
World	**190,000**	**85,000**

Source: U.S. Geological Survey , 2016

3. Supply: The biggest iron ore mines

Mines	Country	Owner	Production, Mt, 2015	Reserve, Bt	Life of the mine, years
Western Australia	Australia	BHP 85%	222	2.8	15
Hamersley	Australia	Rio Tinto	189	1.7	10
Carajas	Brazil	Vale	130	7.3	50
Simandou	Guinea	Rio Tinto 46.6%, Chalco 41.3%	95	1.8	40
Chichester Hub	Australia	Fortescue Metals Group	90	1.5	17
Solomon Hub	Australia	Fortescue Metals Group	70	0.7	10
Sishen	S. Africa	Anglo American 69.7%	36	0.9	18
Minas Itabiritos	Brazil	Vale	32	2.8	31
Karara	Australia	Karara Mining Limited	30	1.0	30
Vargem Grande	Brazil	Vale	29	2.5	42
Minas-Rio	Brazil	Anglo American	27	2.8	45
Samarco Alergia	Brazil	BHP 50% and Vale 50%	25	3.0	37

Source: mining-technology.com, 2014; mining.com, 2015; Anglo-American, 2016; BHP Billiton, 2016; Rio Tinto, 2016; Fortescue, 2016; Vale, 2016; Glencore, 2016

3. Supply: Top iron ore producers

Top producer countries

Australia 40%
Brazil 21%
India 7%
China 6%
Other 26%
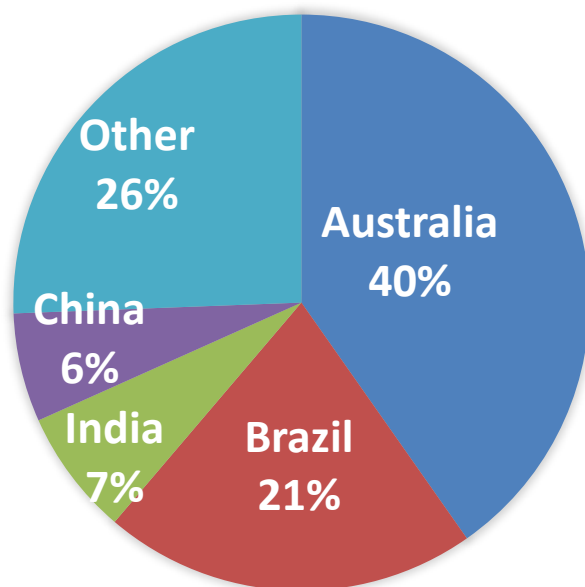
Source: UNCTAD, 2016

8 biggest companies - 37% of world iron ore production, control iron ore trade

#	Company	Country	# of mines	Prod, Mt, 2015	Earnings, $mln
1	Vale	Brazil	11	346.1	4105
2	Rio Tinto	Australia	18	263	7872
3	BHP Billiton	Australia	6	227.0	5599
4	Fortesque	Australia	4	169.4	3195
5	Arcelor Mittal	India	9	63.9*	-
6	Anglo-American	UK& S.Africa	2	54.1	1026
7	Glencore	UK& Switz.	3	41.2	-14
8	Cliffs Natural Resources	USA	6	31	352

Source: (Anglo-American, 2016; BHP Billiton, 2016; Rio Tinto, 2016; Fortescue, 2016; Glencore, 2016; Vale, 2016; Arcelor Mittal, 2016; Cliffs Natural Resources, 2016;

- Mongolia's iron ore reserve ~ 1.7 bln tons as of 2016 (MRAM, 2016).
- 63 deposits (16.5% - 55.6% Fe, magnetide type) are registered.

Deposits	Crude ore, Mt	Owner	Details
Bayantsogt	249	Haranga Resources	Eruu soum, Selenge Grade is 16.5%. Not developed yet.
Tumurtei	230	Darkhan Met. Plant	Khuder soum, Selenge Ore grade is 50-51.6%. Only strategic, iron ore deposit. Started in 2011. (www.dmp.mn)
Bayangol	174	Bold Tumur Eruu Gol LLC /BTEG/	Eruu soum, Selenge. Has own rail facilities. Ore grade is 46.5-52.9%. Started in 2007. The projected capacity is 6 Mt.
Tayannuur	101	Altain khuder LLC	Tseel soum, Govi-Altai. Ore grade is 46.5-52.9%. Production capacity is 2.3 Mt. Started in 2007. (www.altainkhuder.mn)

3. Supply: Mongolian export, by destination & company

		2011	2012	2013	2014	2015	2016*
China	Quantity, Mt	5.80	6.42	6.73	6.33	4.53	5.84
	Price, USD/ton	76	83	97	71	46	41
Singapore, Hong Kong	Quantity, Mt	-	-	-	-	0.53	0.24
	Price, USD/ton	-	-	-	-	38.1	40

Source: Custom's Office, 2011-2016

Companies exported in 2015	Quantity, Mt	Sales, USD.mln*
Bold Tumur Eruu Gol	3.37	101
Altain Khuder	0.98	35
Darkhan Metal. Plant	0.75	14
Mongolrostsvetmet	0.17	14
Jinhua Ord	0.07	2

Source: EITI Mongolia, 2016

3. Supply: Local transportation

❏ Rail transportation
   ❏ Mongolian rail tariff – USD 0.015 per ton.km
   ❏ No significant discount from UBTZ
   ❏ 10 Mtpa capacity
   ❏ Bayangol; Tumurtei → Chinese border = USD 17 per ton + tariffs for cross border

❏ Road transportation
   ❏ 8 times higher than rail tariff
   ❏ Tayannuur → Chinese border = 170 km
   ❏ Most deposits are small. Don't justify rail road construction

Source: MRAM, 2016

4. Trade

World iron ore import share

- China 64%
- Other 15%
- Japan 10%
- S. Korea 6%
- Germany 3%
- Taipei 2%
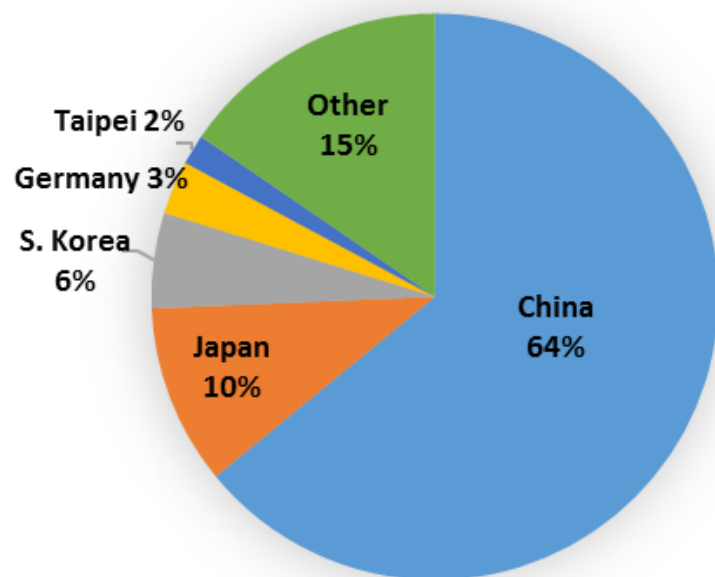
World iron ore export share

- Australia 54%
- Brazil 26%
- Other 7%
- Canada 3%
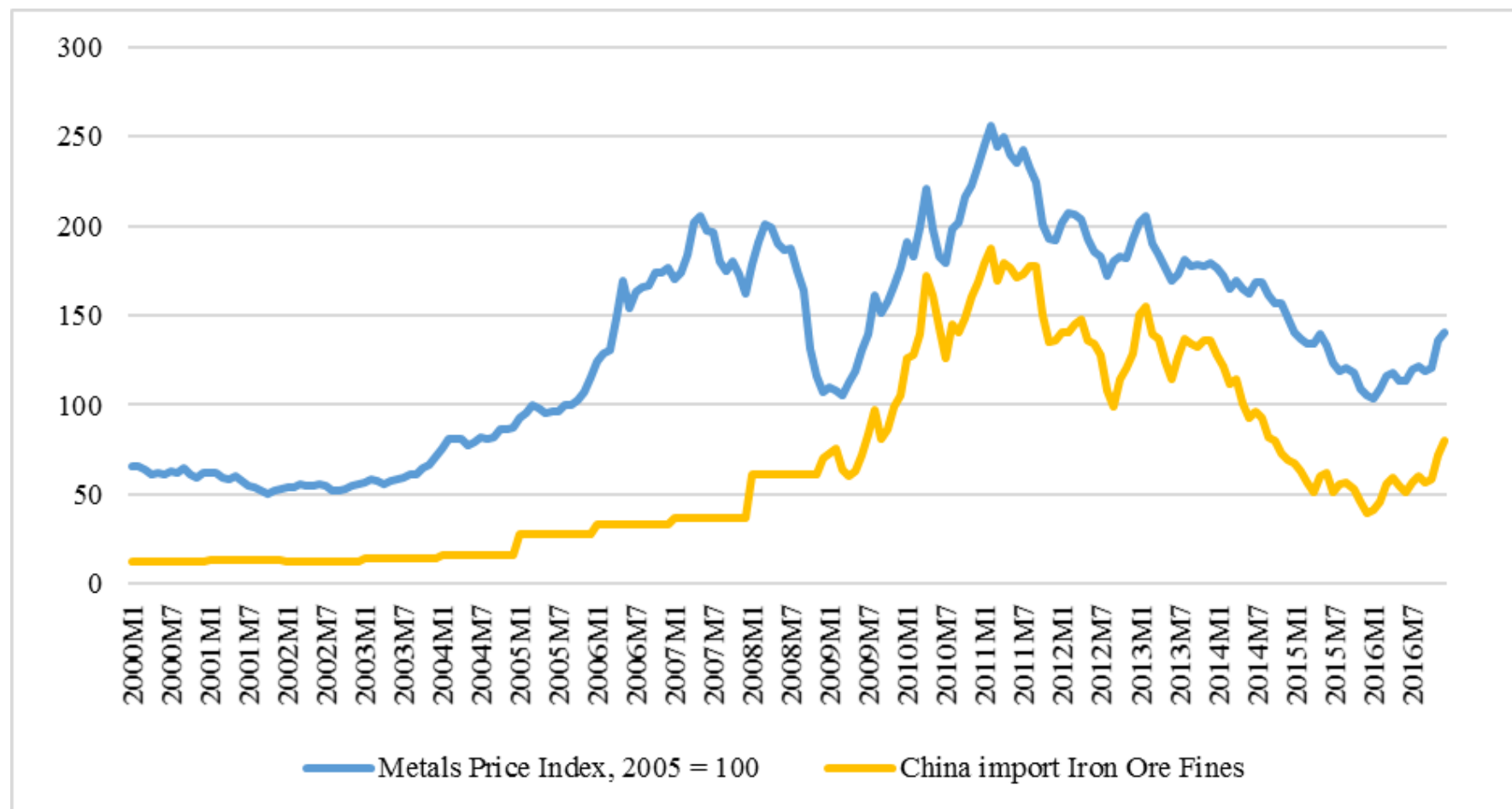- South Africa 3%
- Ukraine 3%
- Sweden 1%
- Russia 1%
- Chile 1%
- Iran 1%
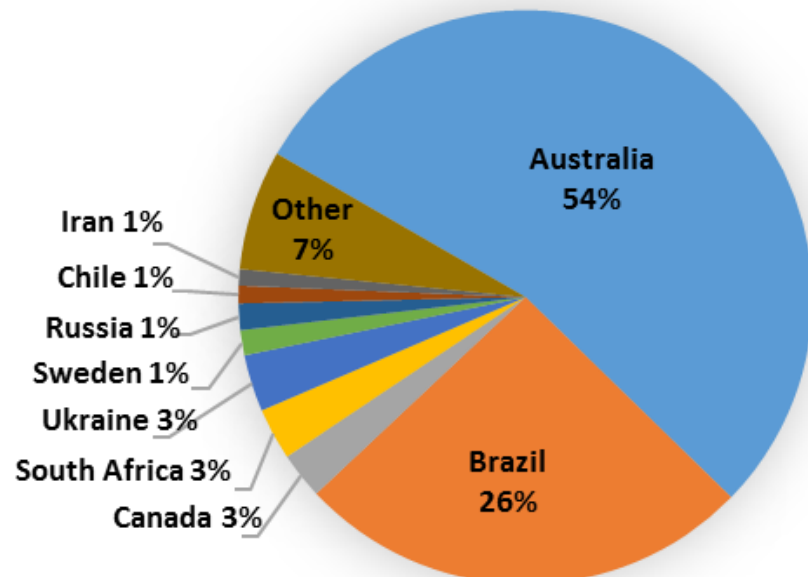
Source: International Trade Center, 2016

4. Trade: Iron ore export to China, Mt
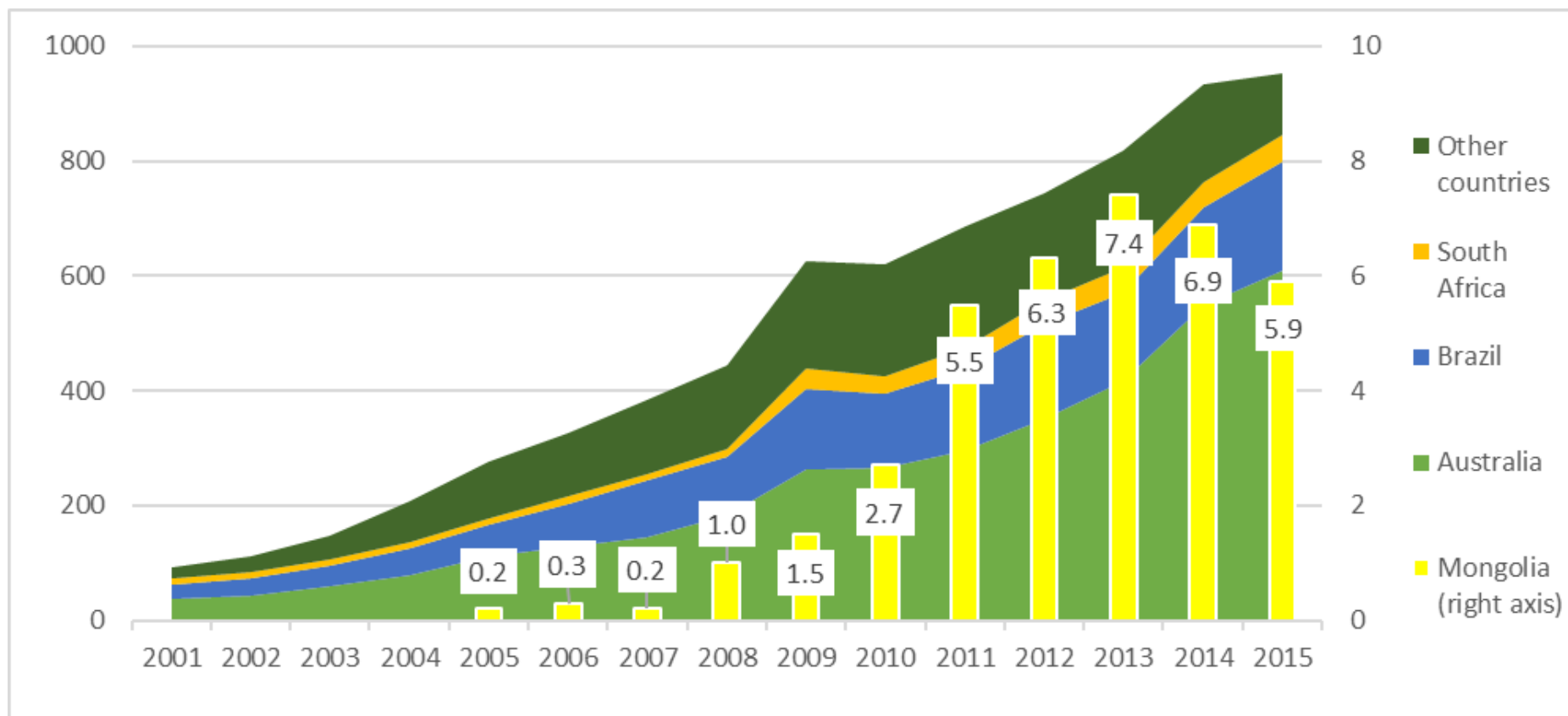
*Source: International Trade Center, 2016*

Source: Monthly Data, International Monetary Fund

5. Iron ore price: Key drivers

❑ Overall economic situation: Infrastructure development, urbanization

❑ Investments and innovations in the mining capacity

❑ Energy costs: Shipping prices are falling

❑ Oligopolistic market: Big 3 controls 50% of the market, but the China Iron & Steel Association became an important player

❑ Speculation on the market

❑ Few steel mills in Inner Mongolia set price for Mongolian iron ore

5. Demand outlook

Moderate growth in iron ore demand, Mt

Other emerging markets

China

Developed Economies

2010 2015 2020 2025 2030
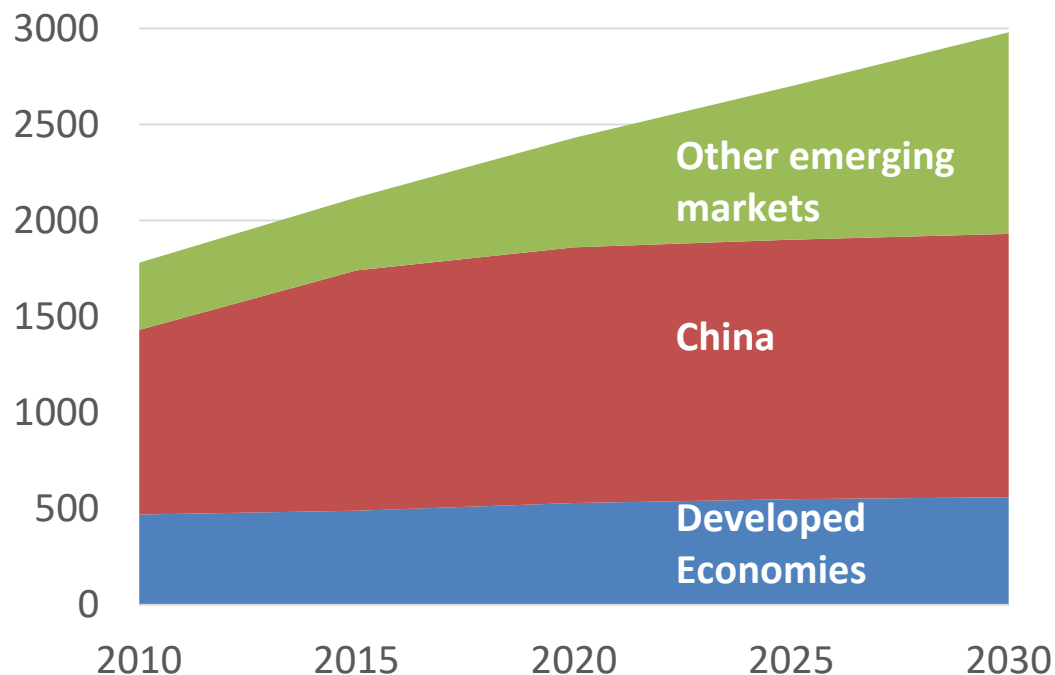
Source: Rio Tinto, 2016

- China's demographic transition, slowing urbanization, emphasis on services and consumption

- Huge amount of Chinese scrap

- China's steel production to be reduced by 100-150 Mt by 2020, due to climate target

+ By 2030, 25% of the current buildings will be rebuilt

+ Cars rise by 280 mln or 3 times

+ China's export of finished goods will double

+ Urbanization & industrialization in India, ASEAN

5. Supply outlook

Countries with output greater than 10Mt per annum

Mines with output above 5Mt per annum
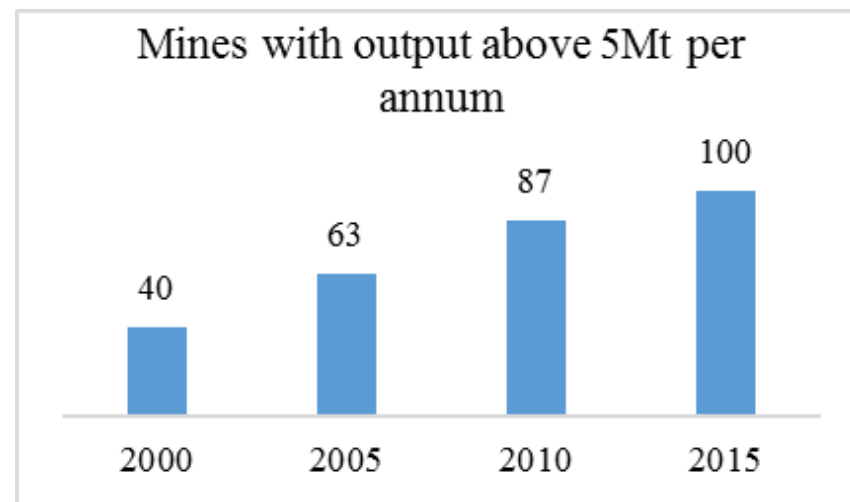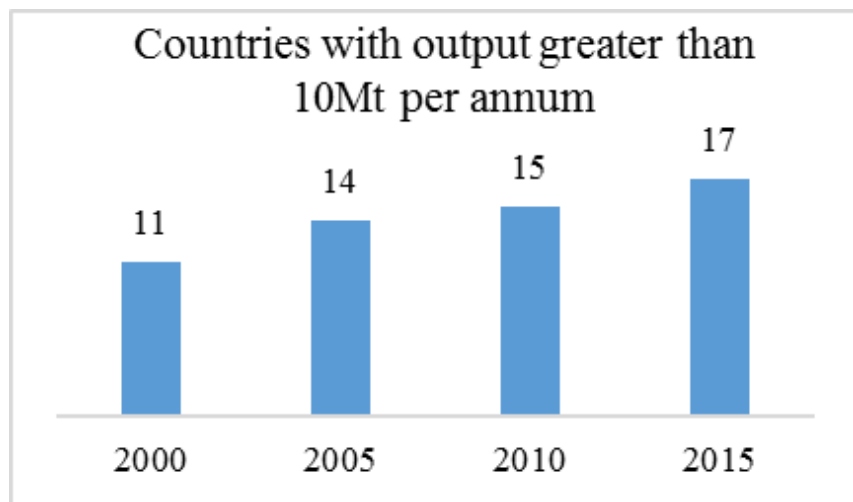
Source: (Port Jackson Partners, 2015)

	2015	2016E	2017E	2018E	2019E	2020E
Total new production, Mt /cumulative/	977.4	1076	1160	1227	1262	1267
Australia	79.5%	78.4%	77.3%	75.0%	74.1%	74.2%
Brazil	15.7%	17.9%	19.2%	21.7%	22.7%	22.6%
Africa	4.7%	3.6%	3.4%	3.3%	3.2%	3.2%
Other	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Source: (Bloomberg, 2016)

5. Price projection

❑ World Bank: $55-$56.2 per ton in 2017-20

❑ Morgan Stanley: ~$58 in 2017-18 due to surplus

❑ Bloomberg: In the short-term, prices won't rise due to oversupply. However, by 2020, prices will rise due to deficit of 50 Mtpa.

Thank you for your attention