Morgan Stanley

FOUNDATION

Equity Research Spring Training

Industrials Teach-In

TUESDAY, MAY 7, 2019
MORGAN STANLEY HEADQUARTERS
NEW YORK CITY

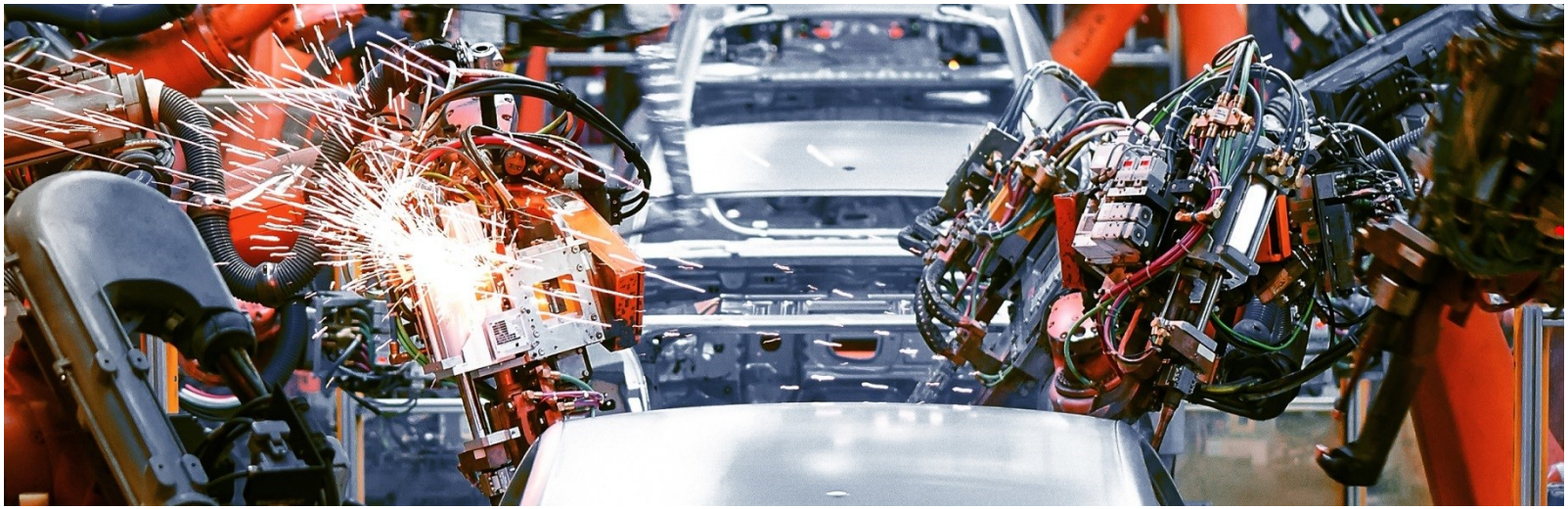


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Disclosures 446

Morgan Stanley does and seeks to do business with companies covered in Morgan Stanley Research. As a result, investors should be aware that the firm may have a conflict of interest that could affect the objectivity of Morgan Stanley Research. Investors should consider Morgan Stanley Research as only a single factor in making their investment decision.

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Agenda

MAY 7, 2019 | MORGAN STANLEY HEADQUARTERS | 1585 BROADWAY, 26TH FLOOR | NEW YORK CITY

Tuesday, May 7, 2019

8:30 a.m. – 9:00 a.m. **Registration**

8:50 a.m. – 9:00 a.m. **Welcome & Opening Remarks**
David Adelman, *Managing Director, Director of Equity Research for the Americas*

9:00 a.m. – 9:35 a.m. **Autos & Shared Mobility**
Adam Jonas, *Managing Director*

9:35 a.m. – 10:10 a.m. **Freight Transportation**
Ravi Shanker, *Executive Director*

10:10 a.m. – 10:55 a.m. **Airlines and Aerospace & Defense**
Rajeev Lalwani, *Executive Director*

10:55 a.m. – 11:05 a.m. **Break**

11:05 a.m. – 11:40 a.m. **Electrical Equipment**
Josh Pokrzywinski, *Executive Director*

11:40 a.m. – 12:15 p.m. **Machinery**
Courtney Yakavonis, *Vice President*

12:15 p.m. – 12:30 p.m. **Break & Boxed Lunch**

12:30 p.m. – 12: 50 p.m. **Industrials Product Toolkit (Sales & Trading Panel)**
Moderated by Sector Specialist Mark van der Pluym, CFA, *Executive Director*

- Katy Haber, *Vice President, Prime Brokerage*
- Joanie Kim, *Baskets*

12:50 p.m. – 1:25 p.m. **Metals & Mining**
Piyush Sood, *Vice President*

1:25 p.m. – 2:00 p.m. **Chemicals**
Vincent Andrews, *Managing Director*

2:00 p.m. – 2:35 p.m. **Paper & Packaging**
Neel Kumar, *Vice President*

2:35 p.m. – 2:45 p.m. **Break**

2:45 p.m. –3:15 p.m. **Old World Meets New World Tech Disruption Panel**
Moderated by Ravi Shanker and Adam Jonas

- James Faucette, *Executive Director, Telecom & Networking Equipment*
- Katy Huberty, *Managing Director, IT Hardware*
- Joseph Moore, *Executive Director, Semiconductors*

3:15 p.m. – 4:00 p.m. **Best Ideas Panel with the Industrial Teams**
Vincent Andrews, *Managing Director*
Adam Jonas, *Managing Director*
Rajeev Lalwani, *Executive Director*
Neel Kumar, *Vice President*
Josh Pokrzywinski, *Executive Director*
Ravi Shanker, *Executive Director*
Piyush Sood, *Vice President*
Courtney Yakavonis, *Vice President*

Biographies



Adam Jonas, CFA
Autos & Shared Mobility
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Adam Jonas is a Managing Director and leader of Morgan Stanley's Global Auto & Shared Mobility research team. Adam joined the firm's investment banking division in Chicago in 1996, specializing in corporate finance and M&A in the automotive industry. In 1999, Adam moved to Equity Research and joined the Firm's European Autos team, based in London, serving as the lead European auto analyst from 2003 to 2010. In 2010, Adam returned to the US to lead the Global Autos & Shared Mobility teams, collaborating with his research colleagues to tell the story of the future of transportation and Auto 2.0. Adam earned his bachelor's degree in business administration (with distinction) from the University of Michigan.



Ravi Shanker
Freight Transportation
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Ravi Shanker is an Executive Director at Morgan Stanley and covers the North American transportation industry. Ravi joined the firm’s global automotive industry research team in 2004 as a research associate before picking up lead coverage of North American Autos in 2009 through 2015. Ravi holds Bachelor of Commerce and Master of Management (Finance) degrees from the University of Mumbai, India. Ravi has been ranked by Institutional Investor magazine and recognized by The Financial Times as a top-10 stock picker across Wall Street and top Auto stock picker.

Biographies



Rajeev Lalwani, CFA
Airlines & Aerospace
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Rajeev Lalwani is an Executive Director and lead analyst covering the US Airlines, Aerospace & Defense, and Aircraft Lessors. Prior to his current role he was an analyst focused on energy infrastructure for over 10 years. Rajeev has been at Morgan Stanley for 5 years where he has received recognition from Institutional Investor as a Rising Star in US Airlines and his prior sector. He previously held roles at a UK-based investment manager and as a lead small- and mid-cap analyst at JPMorgan. He is also a CFA charterholder.



Courtney Yakavonis
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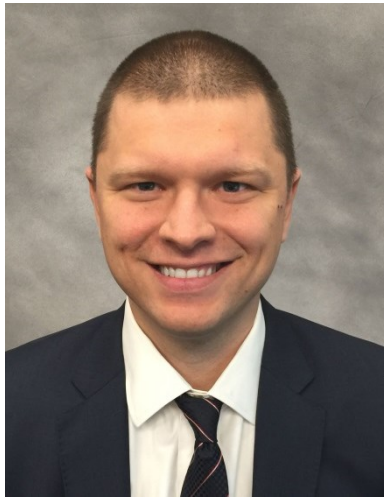
Courtney Yakavonis is a Vice President covering US Machinery. Courtney joined Morgan Stanley in 2009 as an Equity Derivatives Trader, where she focused on Industrials, Materials, and Technology. She joined Equity Research in 2013 and worked as an associate on the Restaurants team before launching on Machinery in 2018. Courtney holds an AB in Applied Mathematics/Economics from Harvard University and is a CFA charterholder. She was named a “Rising Star” by Institutional Investor.

Biographies



Josh Pokrzywinski
Multi-Industry
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Josh Pokrzywinski is an Executive Director and research analyst covering Electrical Equipment and Multi-Industry names for Morgan Stanley. He has covered the industry since 2007, starting with KeyBanc Capital Markets and most recently as a director at Wolfe Research. Prior to equity research, he was a corporate lender for ABN AMRO. He has appeared on CNBC, Bloomberg, and in The Wall Street Journal. Josh graduated with a BS degree in Business Economics from Indiana University.



Armintas Sinkevicius
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Armintas Sinkevicius is a Vice President on the US Autos & Shared Mobility research team, with lead coverage of US Auto Dealers & Suppliers. Armintas joined Morgan Stanley Research in 2011 as a member of the US Telecom Services team, before moving to the buy side in 2015. In 2017, Armintas returned to Morgan Stanley to cover the US Auto Dealers & Suppliers, and has collaborated with his research colleagues on a report on the investment implications of space. He started his career in accounting at PricewaterhouseCoopers. Armintas has Bachelor's degrees in accounting and finance from Marquette University and holds the Chartered Financial Analyst (CFA) designation..

Biographies



Piyush Sood
Metals & Mining
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Piyush Sood is a Vice President covering the North America Metals & Mining industry. He has worked on the team since joining Morgan Stanley in 2007, first in Mumbai and then in New York City. Prior to Morgan Stanley, Piyush was a Senior Officer at Tata Motors in Pune, India. Piyush holds a BE in Metallurgical Engineering from Punjab Engineering College and a PGDM from the Indian School of Business.



Neel Kumar
Paper & Packaging
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Neel Kumar is a Vice President covering the Paper & Packaging industry. Neel joined Morgan Stanley in 2014 on the Chemicals team. He began to build out mid-cap Chemicals coverage in 2016 and launched on the Paper & Packaging sector in January 2019. He holds a Bachelor of Science degree in Finance and Information Systems from the NYU Stern School of Business, an MBA from the Tuck School of Business at Dartmouth, and the CFA designation. Prior to attending Tuck, Neel worked in investment banking at Guggenheim Securities and Credit Suisse for over four years..

Biographies



Vincent Andrews
Chemicals
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Vincent Andrews, a Managing Director, joined Morgan Stanley in 2004. He covers the Chemicals industry. Vincent holds a BA from Georgetown University and an MBA from Columbia Business School.

Morgan Stanley

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May 2019

Industrials Spring Training Teach-In

Autos and Shared Mobility



MORGAN STANLEY RESEARCH
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SECTION 1: COVERAGE SUMMARY

Coverage: OEMs

	Rank	Company	Ticker	Market Cap	Current Price	Bear Case		Price Target		Bull Case	%	2019e EV / EBITDA	2019e P / E
OW	1	FCA FIAT CHRYSLER AUTOMOBILES	FCAU	$21,283	$15.40	$12	x	**$24**		$58	56%	1.3x	5.1x
OW	2	GM	GM	$55,341	$38.96	$15	x	**$44**		$56	13%	3.1x	6.6x
OW	3	HARLEY-DAVIDSON MOTOR CYCLES	HOG	$5,920	$37.23	$25	x	**$46**		$65	24%	12.2x	9.9x
EW	4	Ferrari	RACE	$23,146	$136.06	$80	x	**$140**		$200	3%	18.5x	32.8x
EW	5	TESLA	TSLA	$41,227	$238.69	$97		**$230**	x	$391	-4%	21.1x	-
EW	6	Ford	F	$41,691	$10.45	$3		**$10**	x	$17	-4%	2.5x	10.9x

Price Targets at 4/30/19

Source: Morgan Stanley Research, Bloomberg, Company reports

Coverage: Suppliers

	Rank	Company	Market Cap	Current Price	Bear Case		Price Target		Bull Case	%	2020e EV / EBITDA	2020e P / E
OW	1	AAM	$1,648	$14.76	$7	x	**$19**		$36	26%	4.1x	5.0x
OW	2	LEAR CORPORATION	$9,240	$143.03	$102	x	**$181**		$243	27%	4.4x	7.6x
OW	3	BorgWarner	$8,700	$41.77	$26	x	**$49**		$60	16%	5.7x	9.6x
EW	4	GOODYEAR	$4,514	$19.21	$10		**$19**	x	$29	-1%	5.8x	13.5x
EW	5	Delphi Technologies	$1,961	$22.13	$7		**$21**	x	$37	-7%	5.7x	7.0x
UW	6	MAGNA	$18,546	$55.66	$33		**$45**	x	$78	-18%	5.0x	7.9x
UW	7	ADIENT	$2,160	$23.10	$2		**$16**	x	$40	-31%	4.8x	4.5x
UW	8	TENNECO	$1,770	$21.93	$4		**$17**	x	$30	-20%	4.3x	4.1x
UW	9	APTIV	$22,597	$85.71	$32		**$69**	x	$94	-20%	10.1x	15.0x
UW	10	Visteon	$1,908	$66.02	$37	x	**$73**		$120	11%	15.6x	43.9x

Price Targets as of 4/30/19

Source: Morgan Stanley Research, Bloomberg, Company websites

Coverage: Dealers

	Rank	Company	Market Cap	Current Price	Bear Case		Price Target		Bull Case	%	2020e P / E	2020e EV / EBITDA
OW	1	CARMAX	$13,277	$77.88	$50	x	**$93**		$105	20%	13.4x	9.5x
OW	2	PENSKE Automotive	$3,893	$45.91	$31	x	**$56**		$63	22%	9.0x	9.3x
OW	3	LITHIA	$2,779	$113.54	$67	x	**$117**		$134	3%	10.2x	8.2x
EW	3	ASBURY AUTOMOTIVE GROUP	$1,555	$80.13	$57	x	**$85**		$104	7%	8.0x	7.6x
EW	4	GROUP 1 AUTOMOTIVE	$1,431	$78.39	$44		**$67**	x	$88	-15%	9.8x	8.5x
UW	5	AutoNation	$3,774	$41.93	$16		**$27**		$39	-36%	14.4x	8.6x
UW	6	CARVANA	$10,692	$71.58	$11		**$21**		$68	-71%	110.1x	31.5x
UW	7	Sonic Automotive	$868	$20.23	$6		**$10**		$19	-51%	16.3x	8.0x

Price Targets as of 4/30/19

Source: Morgan Stanley Research, Bloomberg, Company websites

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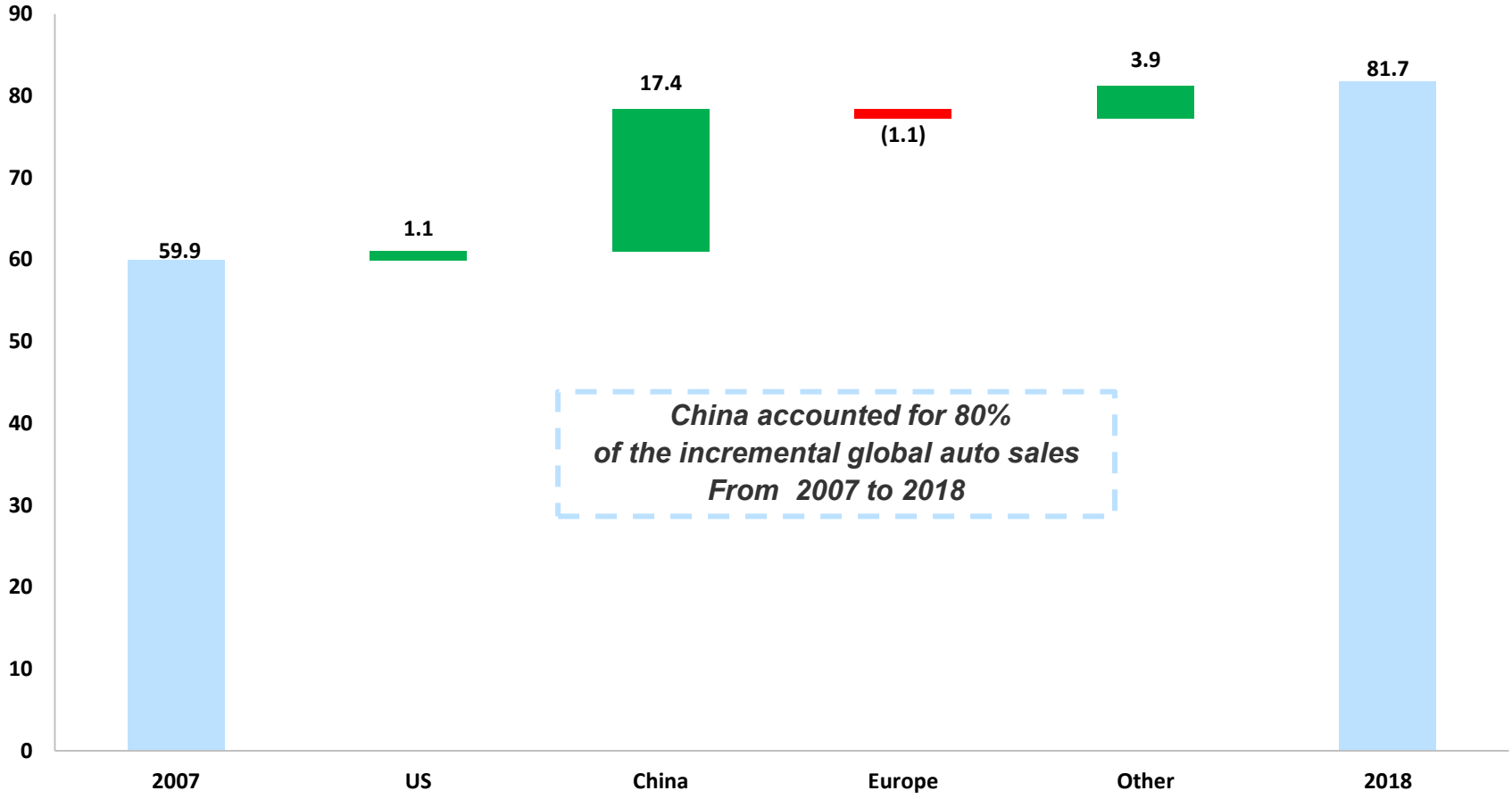
SECTION 2: REVENUE

Global New Car Sales (mm units)

PassengerCarUnits('mn)															
Country	**2007**	**2008**	**2009**	**2010**	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019e**	**2020e**	**2021e**
Asia															
China	6.3	6.8	10.3	13.8	14.5	15.5	17.9	19.7	21.1	24.4	24.7	23.7	23.9	24.2	24.4
Japan	4.3	4.2	3.9	4.2	3.5	4.5	4.5	4.7	4.2	4.0	4.4	4.3	4.3	4.3	4.2
South Korea	1.0	1.0	1.2	1.3	1.3	1.3	1.3	1.4	1.6	1.6	1.6	1.6	1.6	1.6	1.6
India	1.5	1.5	1.8	2.4	2.5	2.8	2.6	2.6	2.8	3.0	3.2	3.4	3.7	4.0	4.4
Indonesia	0.3	0.4	0.4	0.5	0.6	0.8	0.9	0.9	0.8	0.9	0.8	0.9	0.9	1.0	1.0
Australia	0.8	0.8	0.7	0.8	0.8	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9	0.9
Thailand	0.2	0.3	0.3	0.4	0.5	0.8	0.7	0.5	0.4	0.4	0.5	0.6	0.6	0.6	0.6
Rest of Asia	0.2	0.1	0.6	0.6	0.7	0.7	0.5	0.2	0.2	0.4	1.1	1.2	1.3	1.3	1.4
Total Asia	14.7	15.0	18.0	22.4	23.0	25.8	28.4	30.5	32.0	35.5	37.1	36.5	37.2	37.8	38.6
North America															
US	16.1	13.2	10.4	11.6	12.8	14.5	15.6	16.5	17.4	17.6	17.3	17.3	16.5	16.0	16.1
Canada	1.4	1.4	1.2	1.3	1.3	1.4	1.4	1.8	1.8	1.9	1.6	1.5	1.5	1.5	1.5
Mexico	0.9	0.8	0.6	0.7	0.7	0.8	0.9	1.0	1.1	1.4	1.3	1.2	1.2	1.2	1.2
Total NAFTA	18.4	15.4	12.2	13.5	14.8	16.7	17.9	19.3	20.3	20.9	20.2	20.0	19.2	18.7	18.8
South America															
Brazil	2.0	2.2	2.5	2.8	2.9	3.6	3.6	3.3	2.5	2.0	2.2	2.5	2.8	3.0	3.2
Argentina	0.4	0.5	0.4	0.5	0.7	0.8	0.9	0.7	0.6	0.7	0.7	0.6	0.5	0.5	0.6
Rest of South America	1.0	0.9	0.7	0.9	1.0	1.0	1.1	0.8	0.7	0.7	0.5	0.4	0.4	0.4	0.4
Total South America	3.9	4.1	4.2	4.9	5.3	5.6	5.6	5.0	4.0	3.4	3.4	3.5	3.7	4.0	4.2
Eastern Europe															
Russia	1.6	2.9	1.5	1.9	2.7	2.9	2.8	2.3	1.5	1.3	1.5	1.7	1.8	1.8	1.9
Turkey	0.4	0.3	0.4	0.5	0.6	0.6	0.7	0.6	0.7	0.7	0.7	0.5	0.4	0.4	0.4
Czech Republic	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.2	0.2	0.2	0.2
Poland	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.4	0.4	0.5	0.5	0.5	0.5	0.6
Romania	0.3	0.3	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other E Europe	1.9	1.1	0.5	0.4	0.4	0.5	0.5	0.9	0.8	0.9	0.8	1.0	1.0	1.1	1.1
Total E. Europe	4.7	5.1	2.9	3.4	4.2	4.5	4.4	4.4	3.7	3.6	3.9	4.0	4.1	4.3	4.4
Western Europe															
France	2.1	2.1	2.3	2.3	2.2	1.9	1.8	1.8	1.9	2.0	2.1	2.1	2.1	2.0	2.0
Germany	3.1	3.1	3.8	2.9	3.2	3.1	3.0	3.0	3.2	3.4	3.4	3.5	3.4	3.3	3.3
Italy	2.5	2.2	2.2	2.0	1.7	1.4	1.3	1.4	1.6	1.8	2.0	2.0	1.9	1.8	1.8
Spain	1.6	1.2	1.0	1.0	0.8	0.7	0.7	0.9	1.0	1.1	1.2	1.3	1.2	1.2	1.2
UK	2.4	2.1	2.0	2.0	1.9	2.0	2.3	2.5	2.6	2.7	2.5	2.5	2.4	2.4	2.4
Other	3.1	3.0	2.4	2.8	2.9	2.6	2.5	2.6	2.8	2.9	3.0	3.0	3.0	3.0	3.0
Total W. Europe	14.8	13.6	13.7	13.0	12.8	11.8	11.6	12.1	13.2	14.0	14.3	14.4	14.0	13.7	13.7
Rest of World	3.8	3.9	3.6	4.2	4.4	4.0	2.9	2.8	2.9	2.9	3.5	3.3	3.3	3.4	3.5
Global PC Total	**59.9**	**56.5**	**54.1**	**60.7**	**63.9**	**67.6**	**70.7**	**74.0**	**76.2**	**80.2**	**82.4**	**81.7**	**81.5**	**81.9**	**83.3**
EM	15.0	17.0	18.5	23.7	25.9	27.6	29.9	32.0	32.1	34.9	36.6	35.6	36.5	37.5	38.4

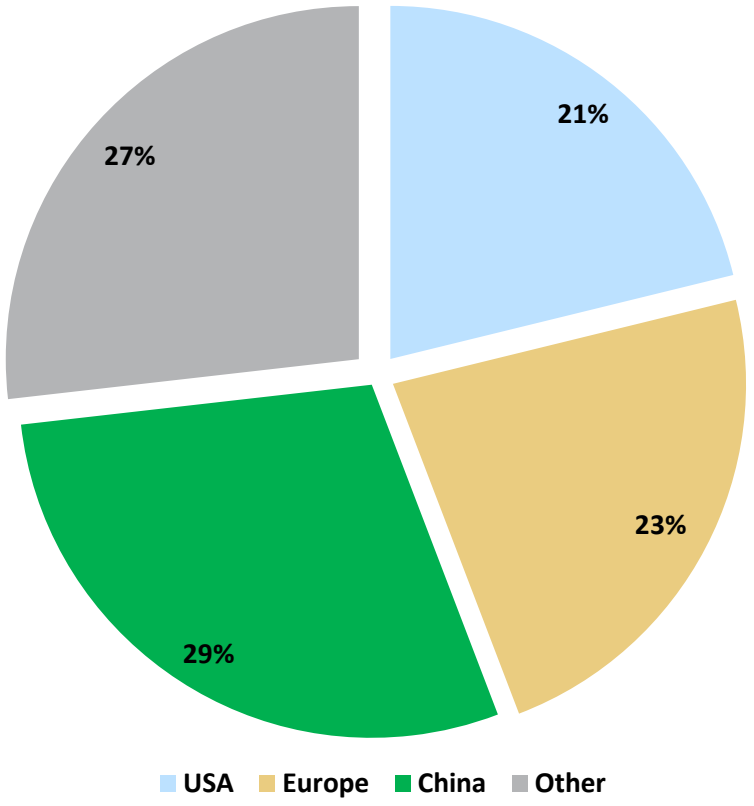
Source: Morgan Stanley Research, IHS Auto Insight

Car Sales Demand - Geography Bridge (2007 to 2018)



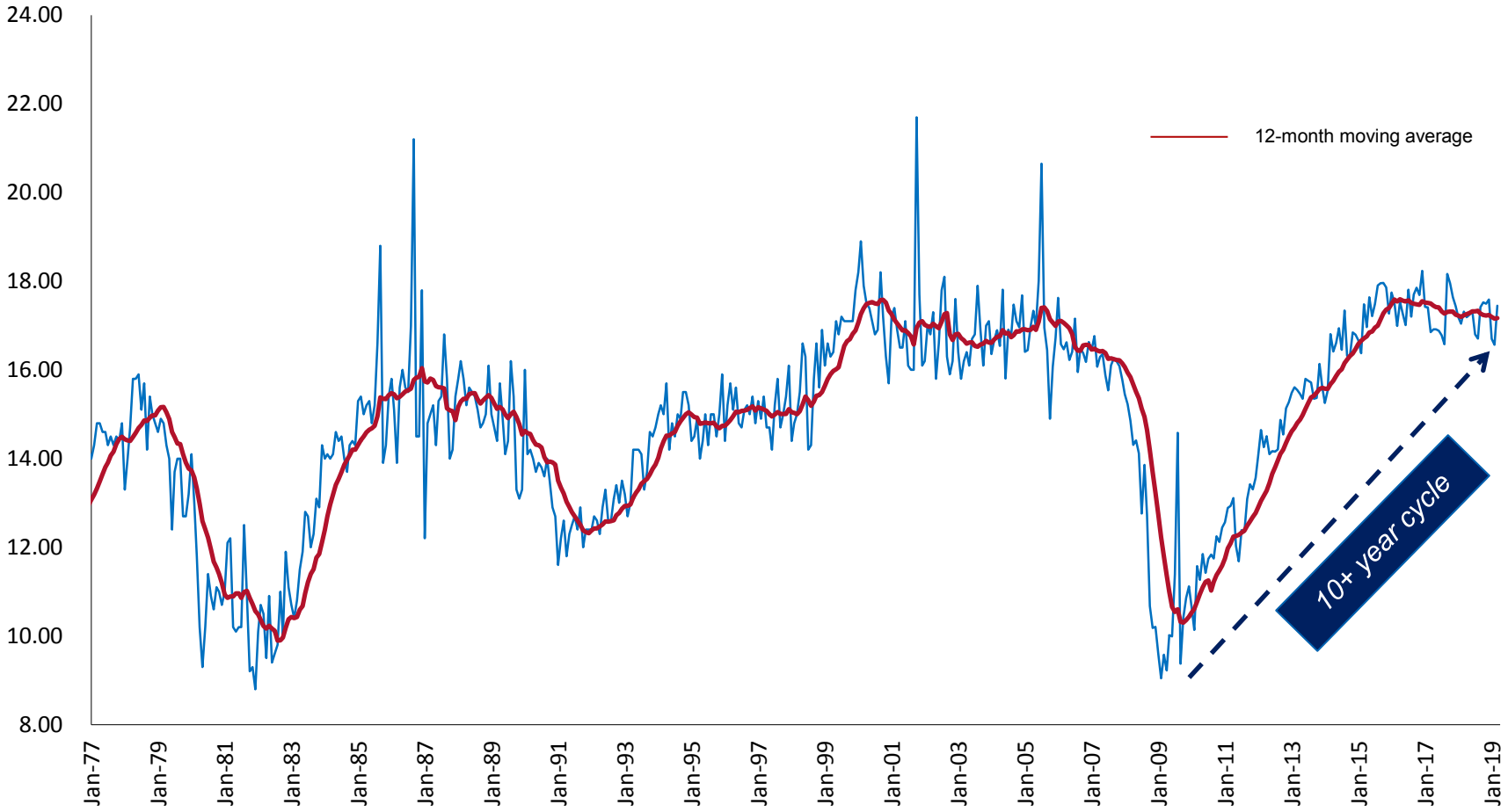
Source: Morgan Stanley Research, IHS Auto Insight

Demand (unit volume) - Passenger Car Units (2018)



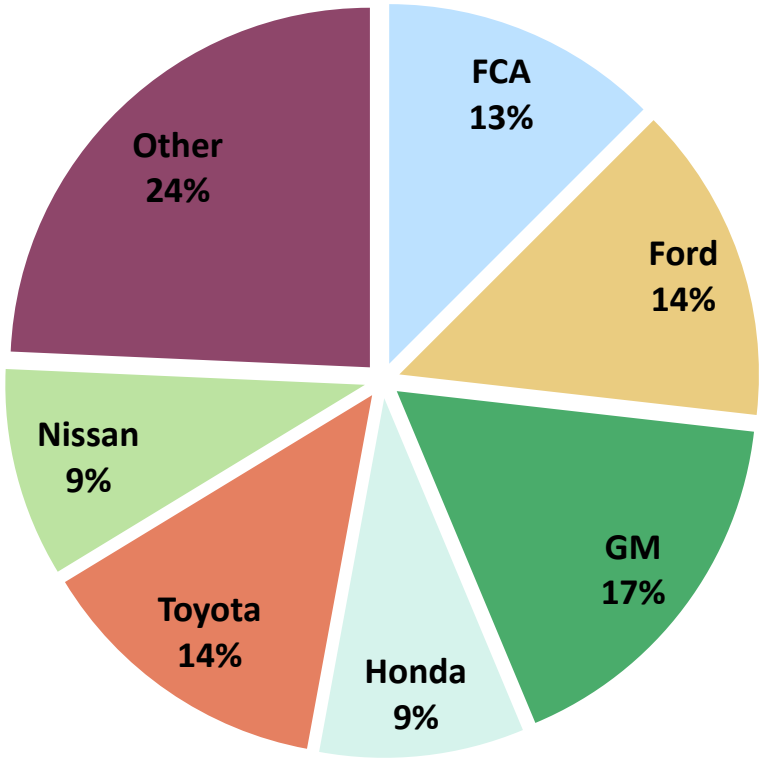
Source: Morgan Stanley Research, IHS Auto Insight

US New Vehicle Sales - Seasonal Adjusted Annual Rate (SAAR)



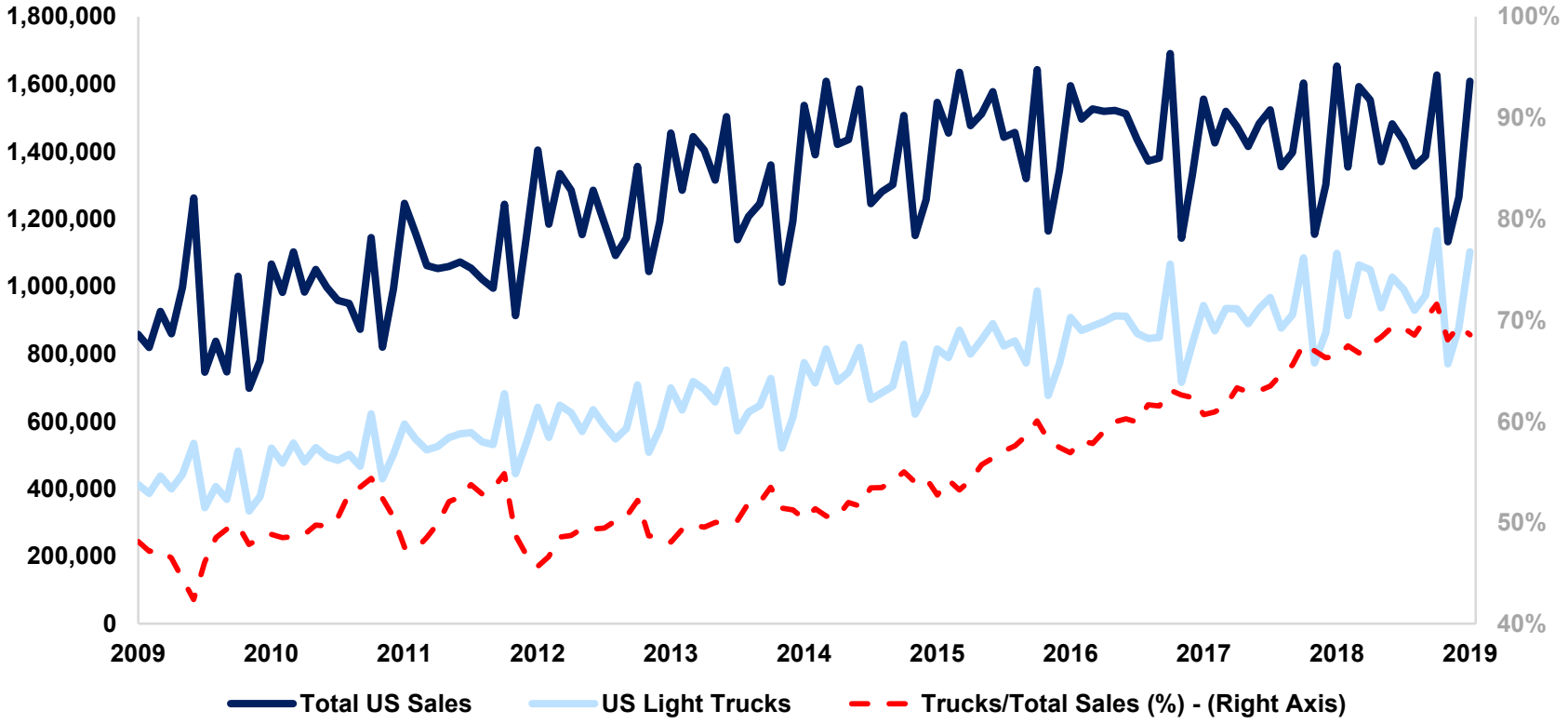
Source: Morgan Stanley Research, Motor Intelligence

US OEM Market Share - March 2019



Source: Morgan Stanley Research, Motor Intelligence

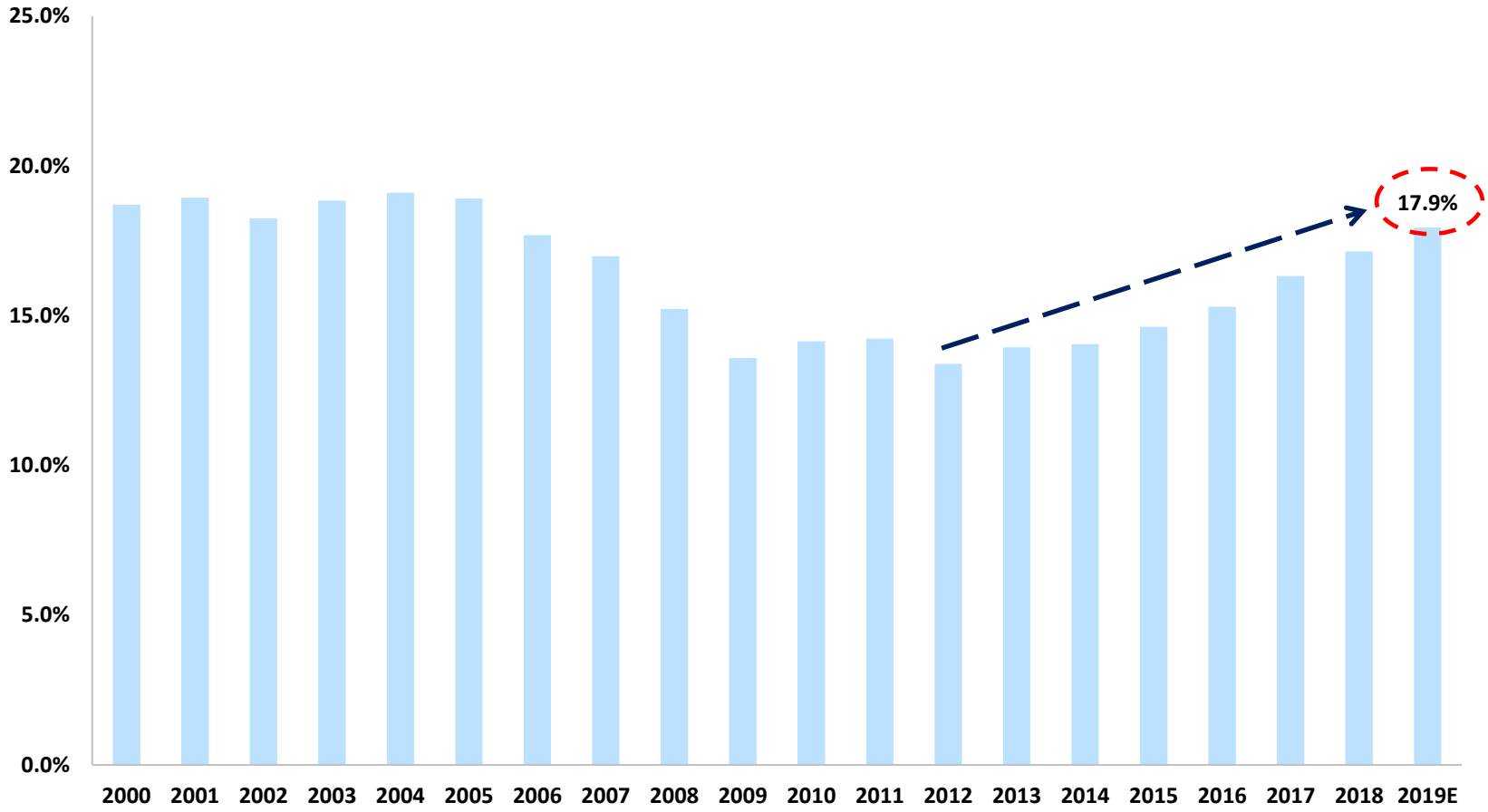
US Light Trucks as % of Sales



Appetite for trucks in the US is at an all time high (70% of US Sales) – bringing ATPs near record highs

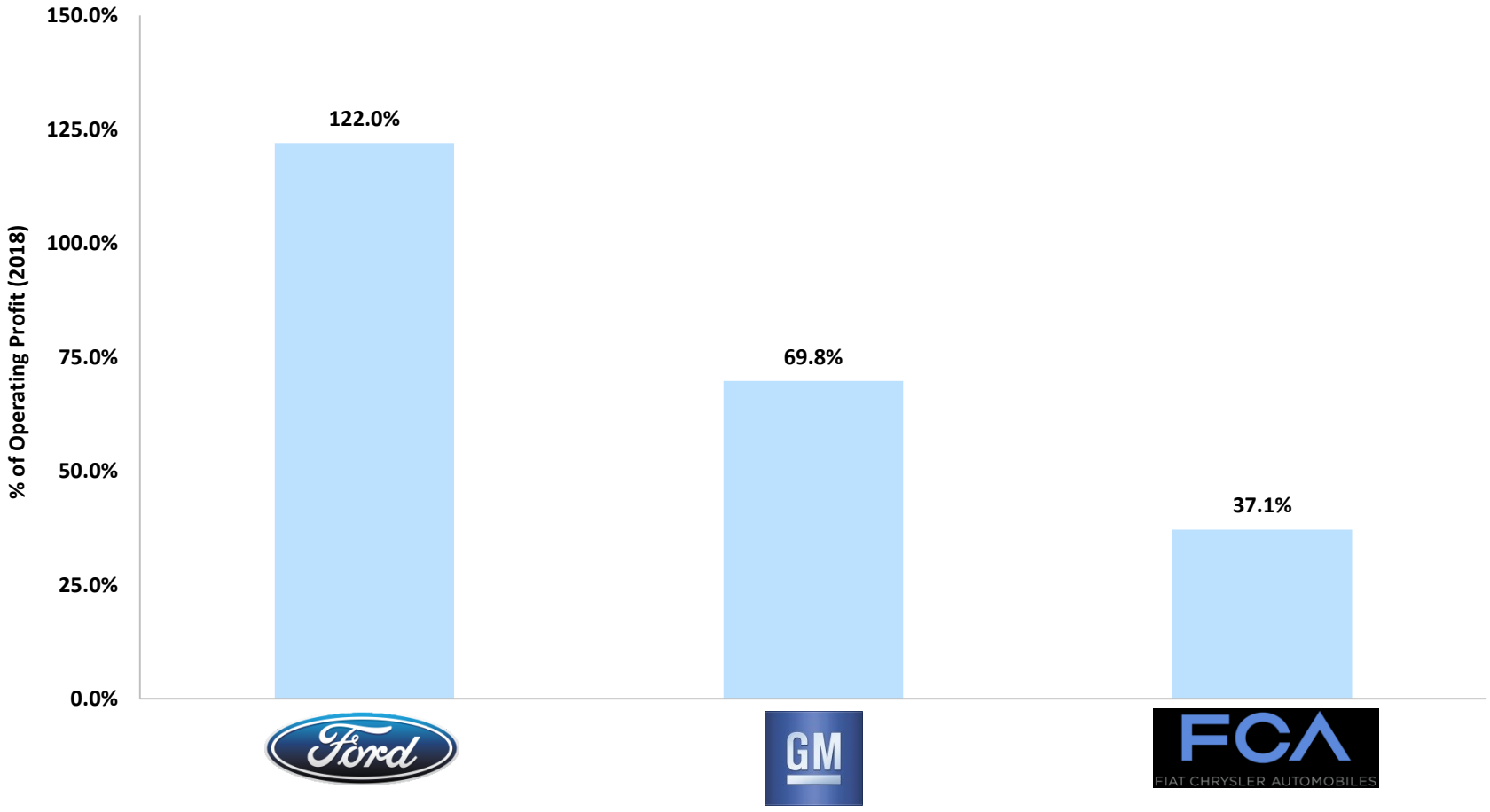
Source: Motor Intelligence, Morgan Stanley Research

Pickup Trucks % of US Sales



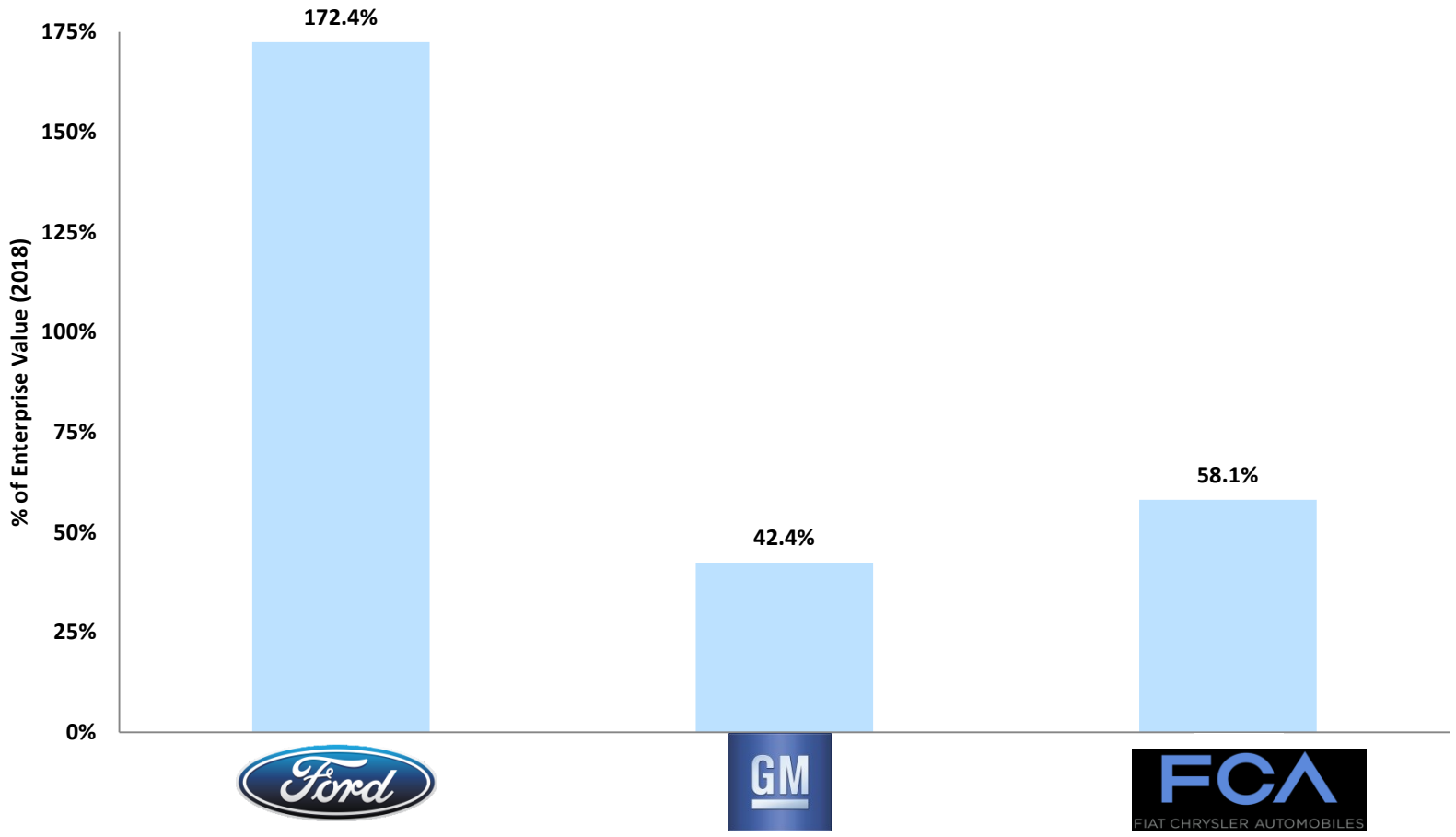
Source: IHS, Morgan Stanley Research

D3 Pick-up Truck as a % of Total Operating Profit



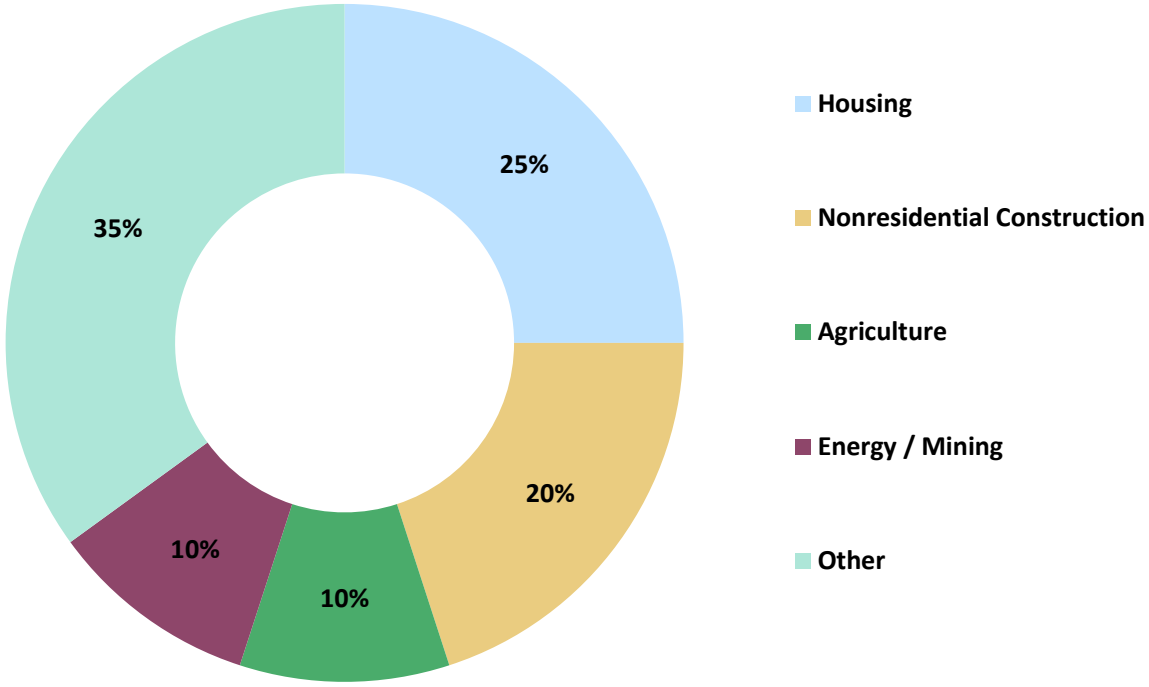
Source: IHS, Morgan Stanley Research

D3 Pick-up Value as % of Enterprise Value



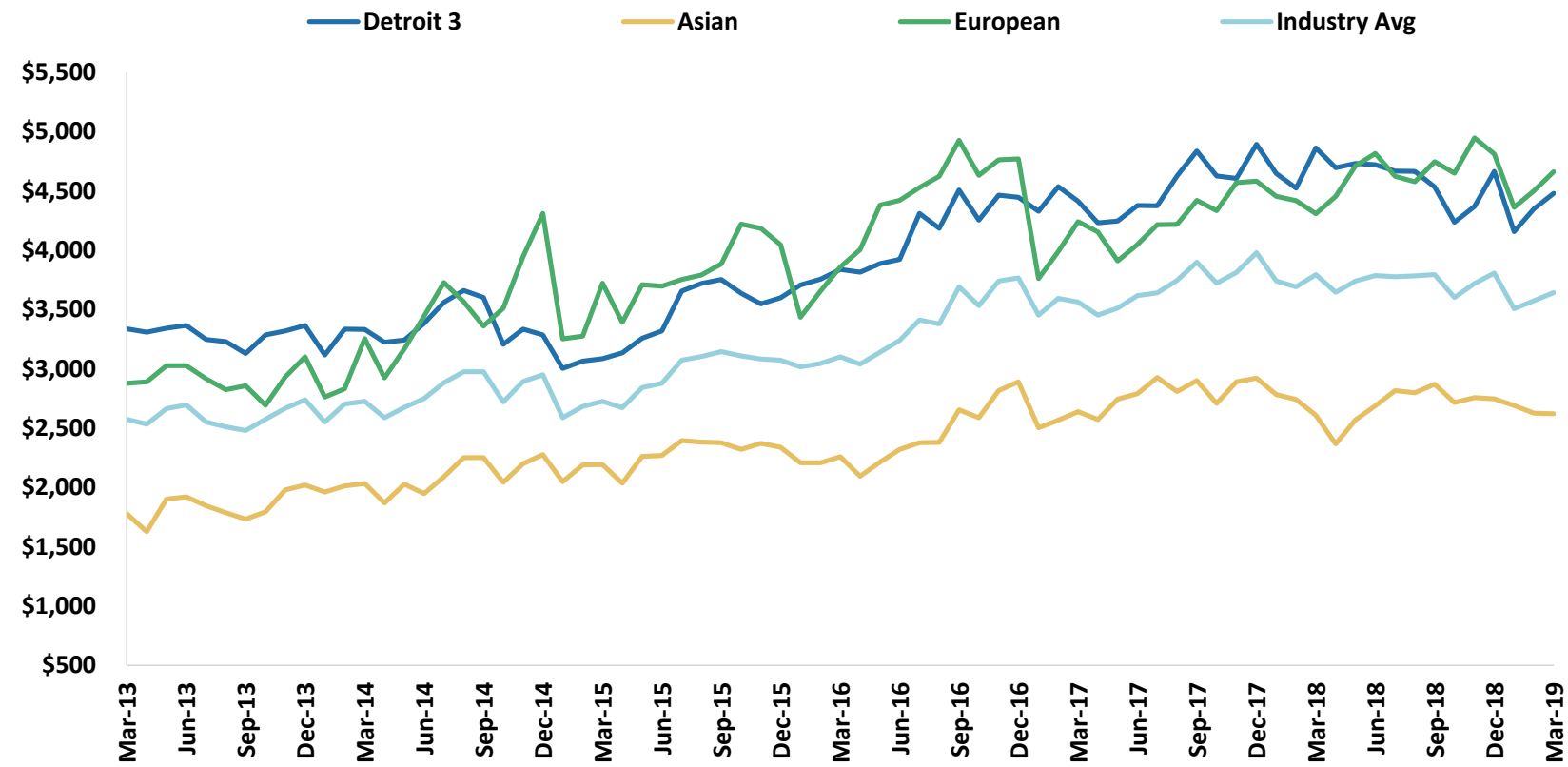
Source: IHS, Morgan Stanley Research

Pickup Truck End Market Demand



Source: IHS, Morgan Stanley Research

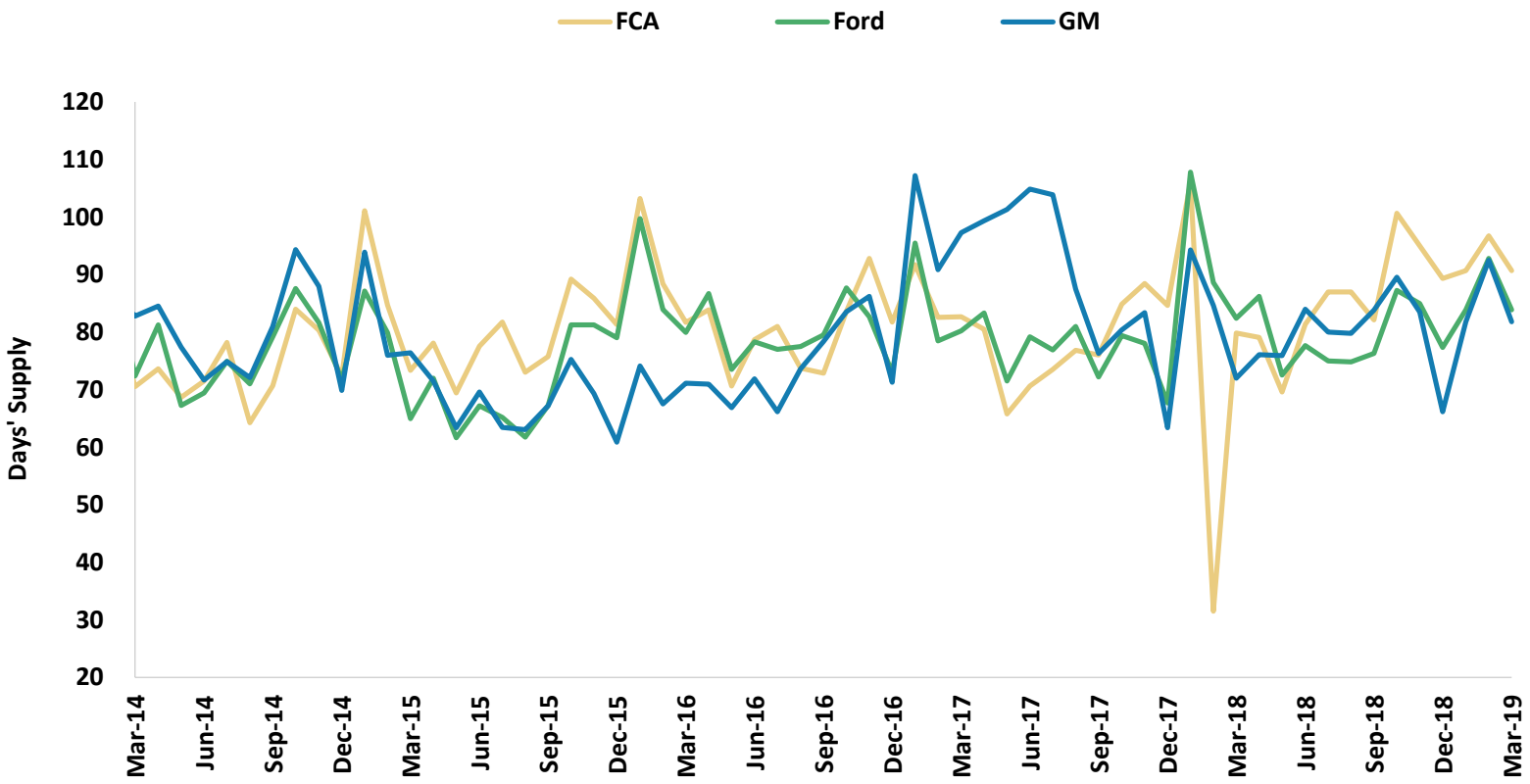
D3 Incentives



Incentives for the Auto OEMs have been steadily rising since 2009

Source: Morgan Stanley Research, Autodata

D3 Inventory

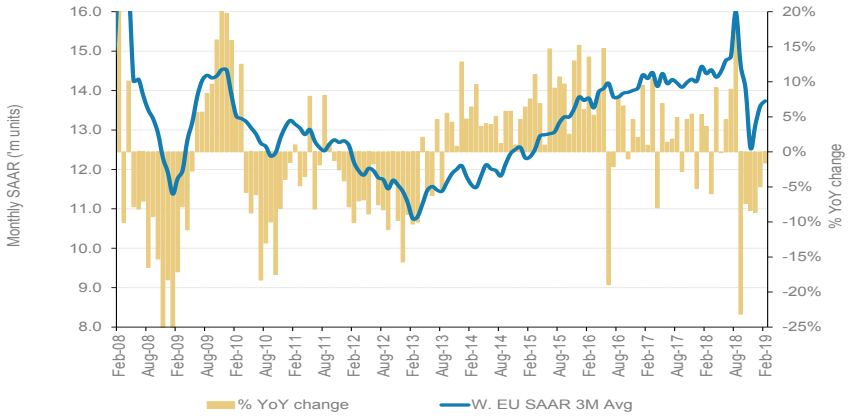


Days Supply is high. FCA's unit inventory is the highest with >85 days supply at ~650,000 units

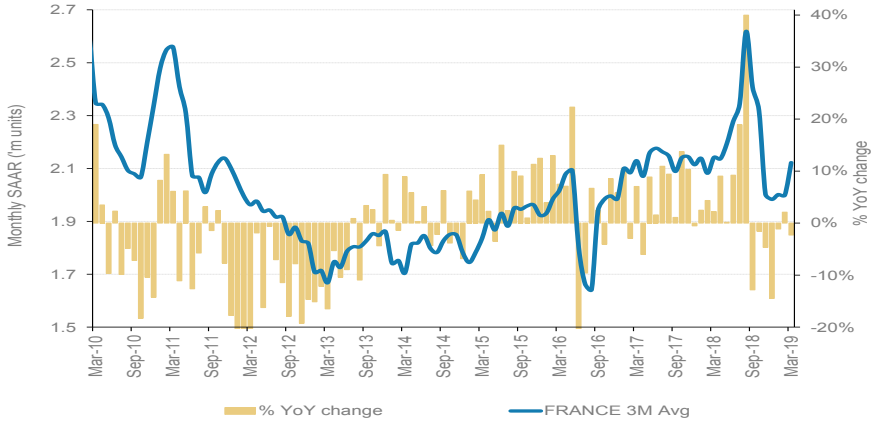
Source: Morgan Stanley Research, Autodata

Europe Sales

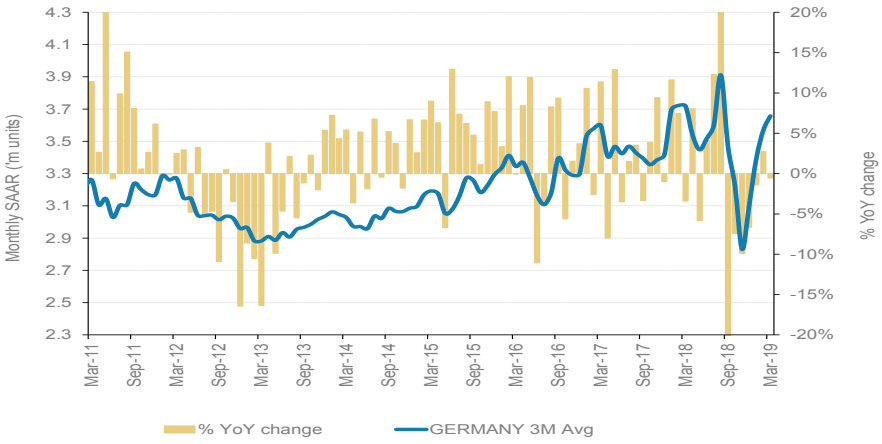
Western Europe Monthly Sales



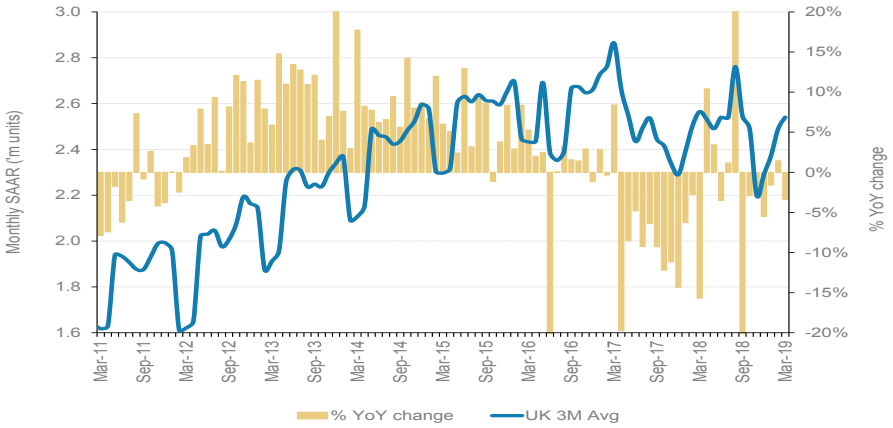
France Monthly Sales



Germany Monthly Sales



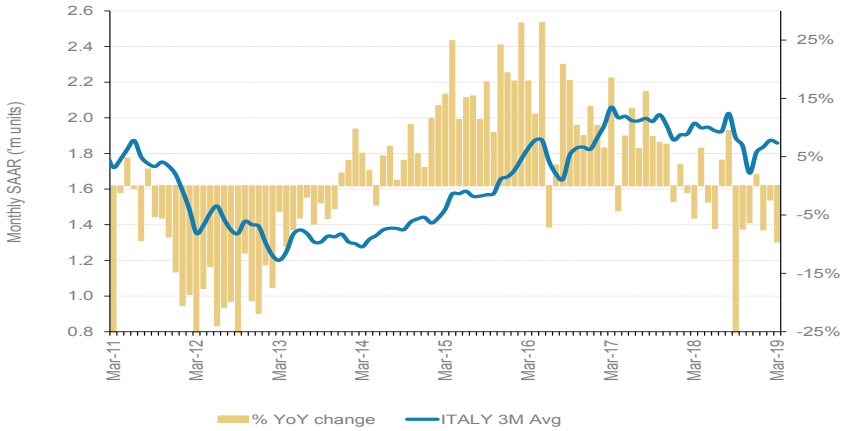
UK Monthly Sales



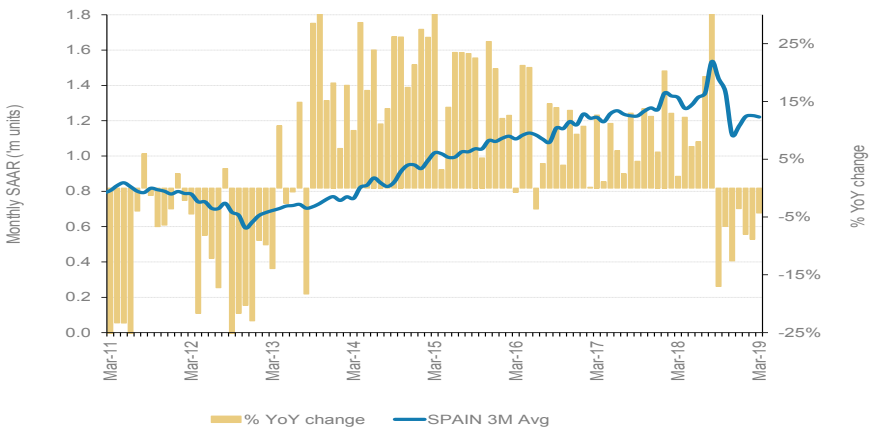
Source: Morgan Stanley Research, ACEA, CCFA, SMMT, KBA

Europe Sales (Cont.)

Italy Monthly Sales



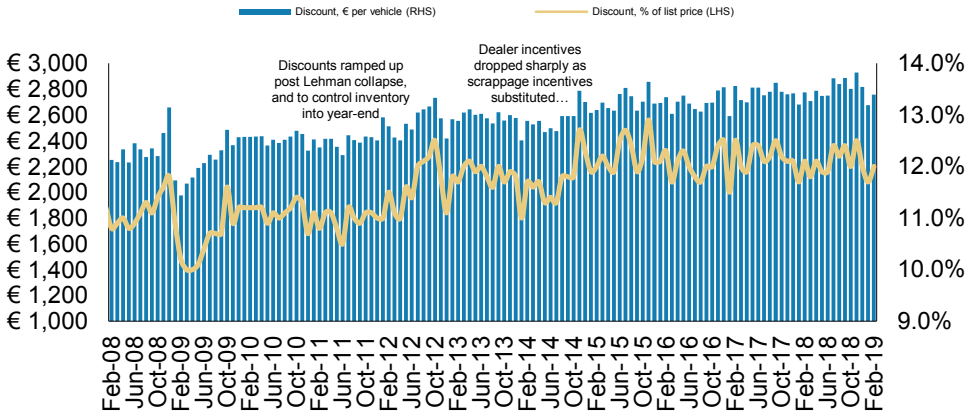
Spain Monthly Sales



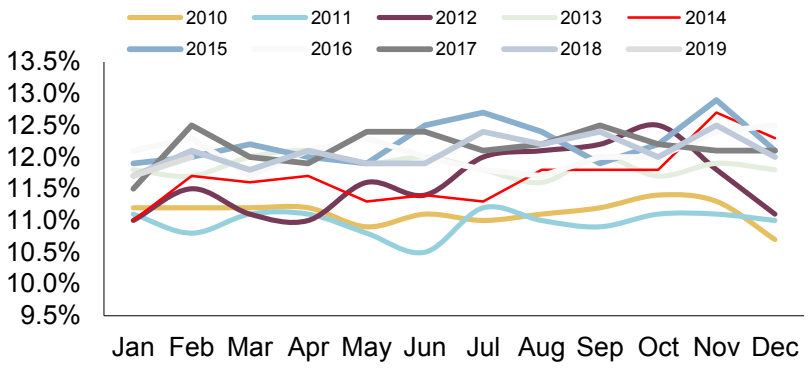
Source: Morgan Stanley Research, UNRAE, ANFAC

German Discounts and Sales Rates

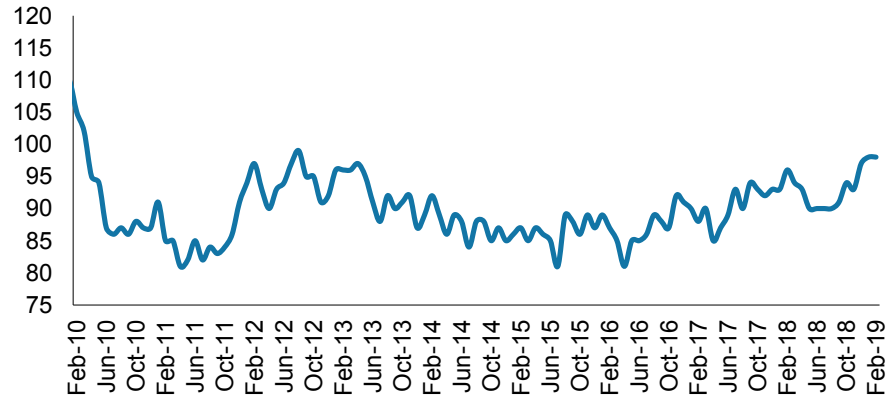
German Discounts Per Vehicle



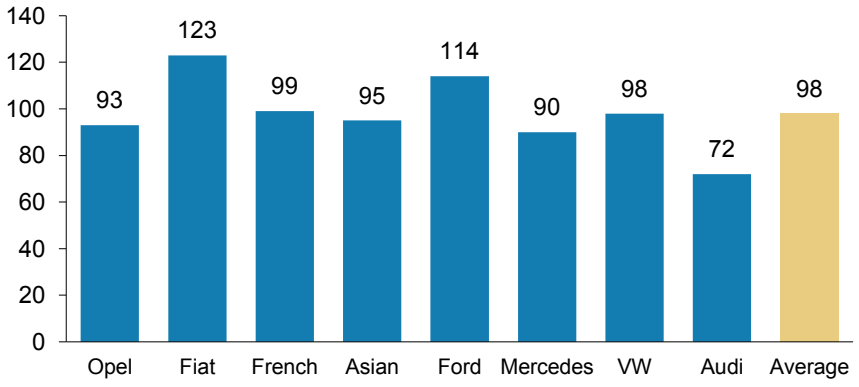
German Discounts as % of List Price



Germany Used Car Standing Time (Days on Lot)



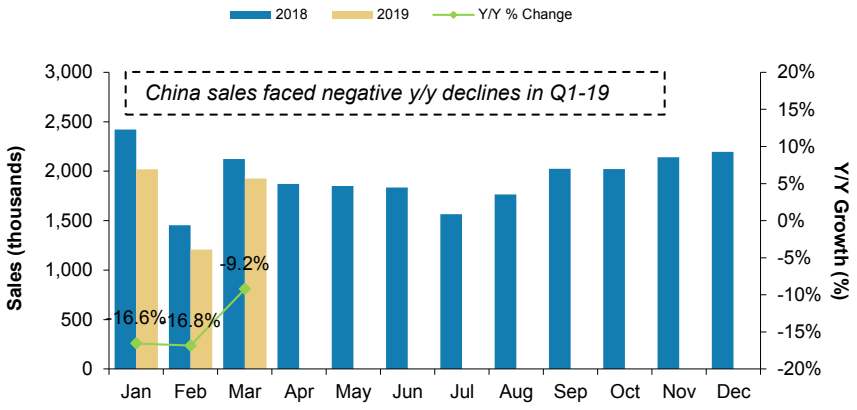
German Used Car Jun Standing Time by OEM (Days on Lot)



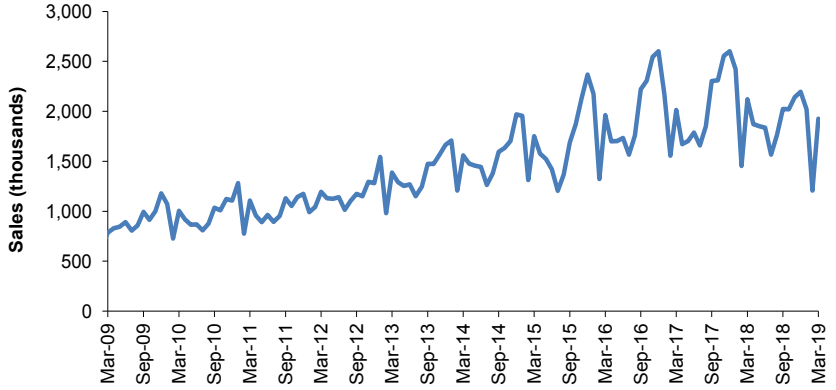
Source: Morgan Stanley Research, Autohaus

China Passenger Vehicle Sales

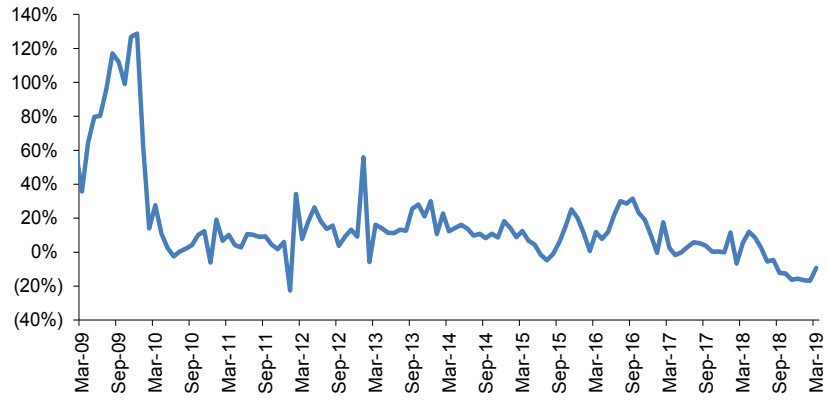
China Monthly Passenger Vehicle Sales Volume



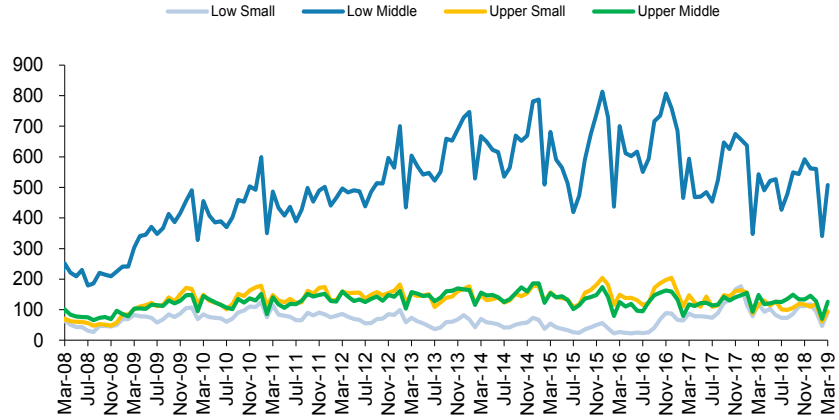
China Monthly Passenger Vehicle Sales Volume Trend



China Monthly Passenger Vehicle Sales YoY Change



China Monthly Passenger Vehicle Sales by Segment



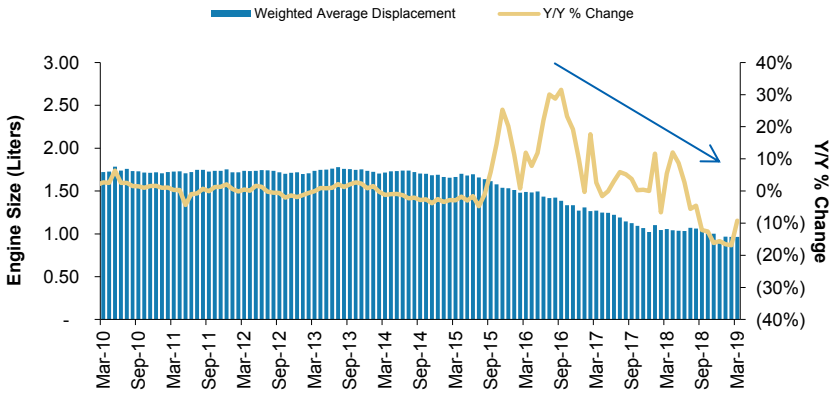
Source: Morgan Stanley Research, China Auto Market

China Passenger Vehicle Segment Data

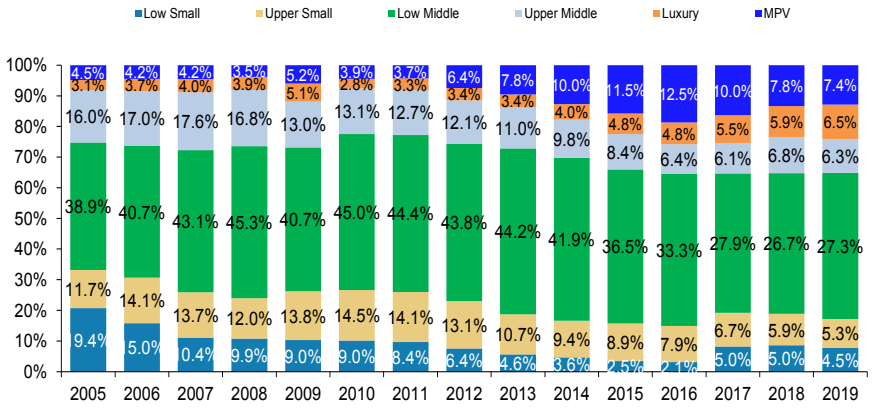
China PV Market MTD Sales by Segment (Mar 2019)

MTD Segments	Units (K)	YoY %	Mkt Share	Growth Contri.	Growth Share
Low Small (A00)	90,586	-23.8%	4.7%	-1.3%	14.5%
Upper Small (A0)	94,893	-18.0%	4.9%	-1.0%	10.7%
Low Middle (A)	507,899	-6.5%	26.4%	-1.7%	18.0%
Upper Middle (B)	125,581	-15.2%	6.5%	-1.1%	11.5%
Luxury	121,729	9.7%	6.3%	0.5%	-5.5%
MPV	153,160	-22.0%	8.0%	-2.0%	22.1%
Low SUV	382,992	-16.1%	19.9%	-3.5%	37.5%
Upper SUV	182,619	5.4%	9.5%	0.4%	-4.7%
Luxury SUV	53,784	-3.1%	2.8%	-0.1%	0.9%
Grand Total	**1,926,092**	**-9.2%**	**100.0%**	**-9.2%**	**100.0%**

China PV Weighted Average Monthly Engine Size



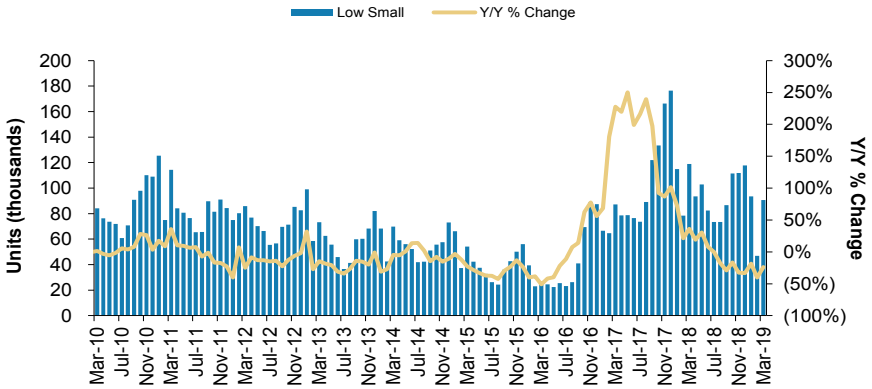
China Passenger Vehicle Market Share by Segment



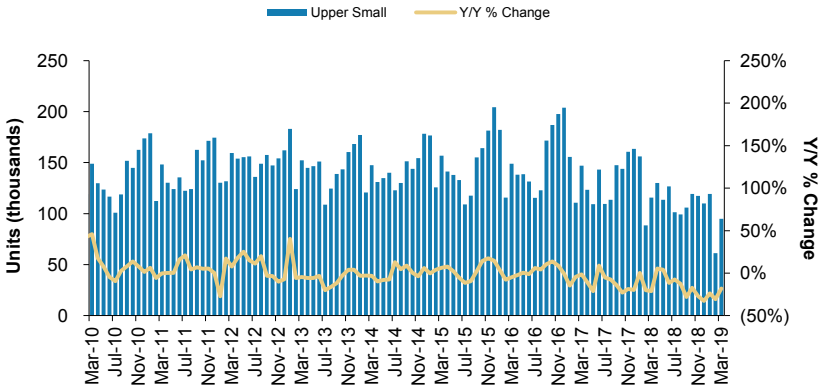
Source: Morgan Stanley Research, China Auto Market

China Passenger Vehicle Sales by Segment

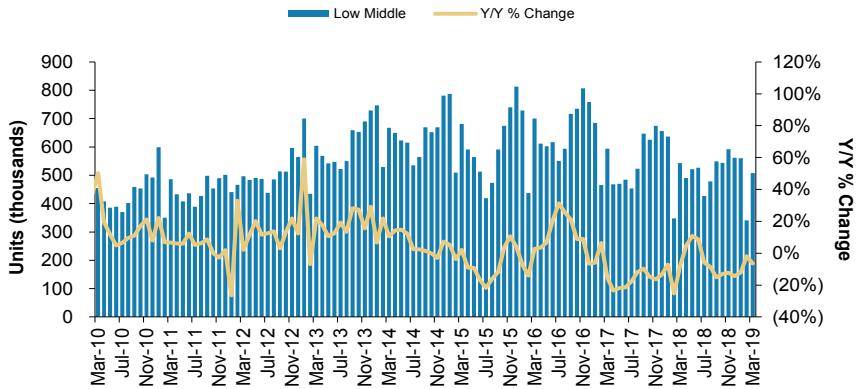
Monthly Passenger Vehicle Sales - Low Small Segment



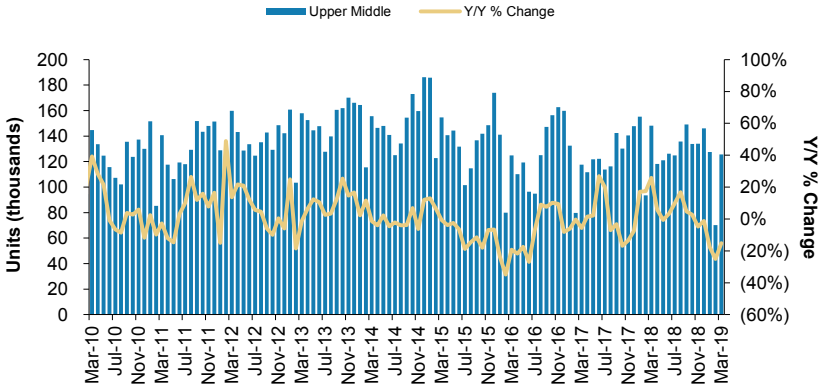
Monthly Passenger Vehicle Sales - Upper Small Segment



Monthly Passenger Vehicle Sales - Low Middle Segment



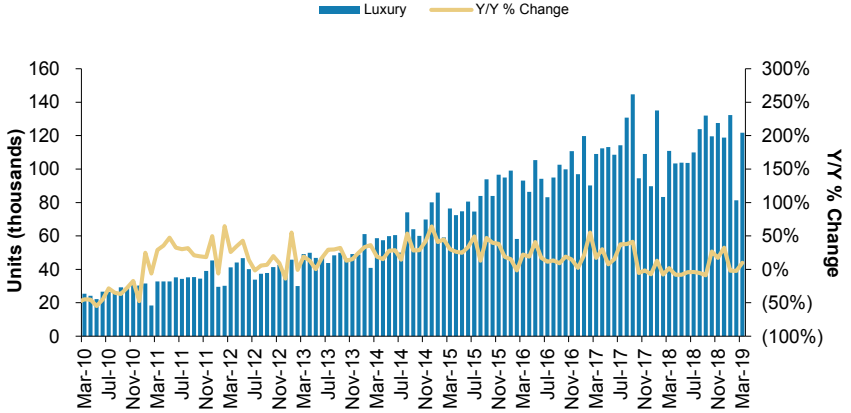
Monthly Passenger Vehicle Sales - Upper Middle Segment



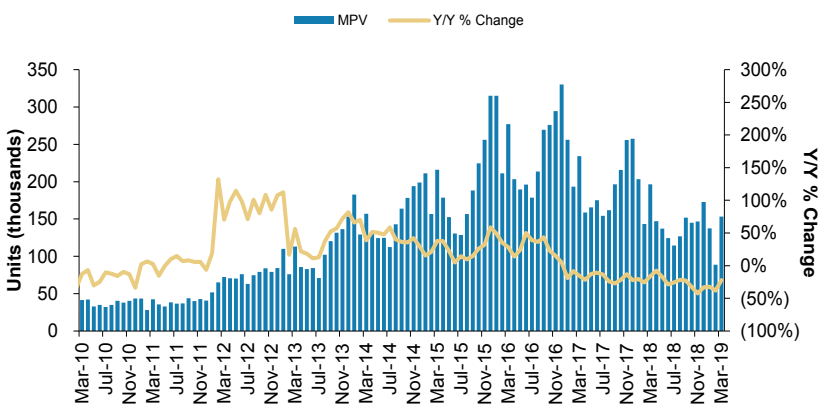
Source: Morgan Stanley Research, China Auto Market

China Passenger Vehicle Sales by Segment

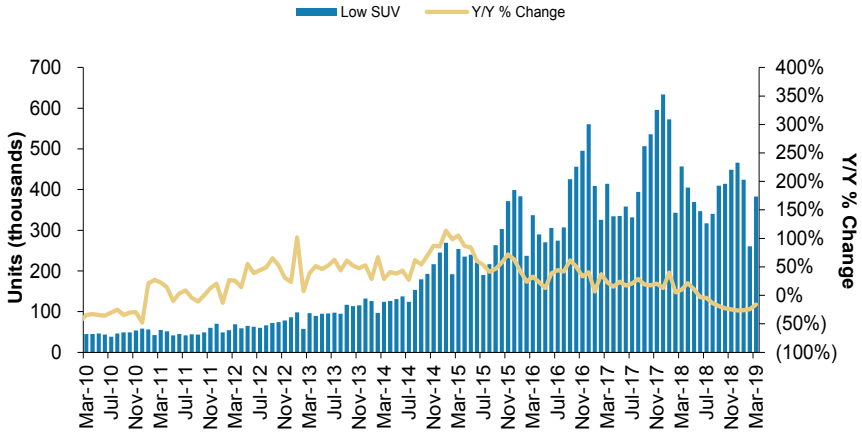
Monthly Passenger Vehicle Sales - Luxury Segment



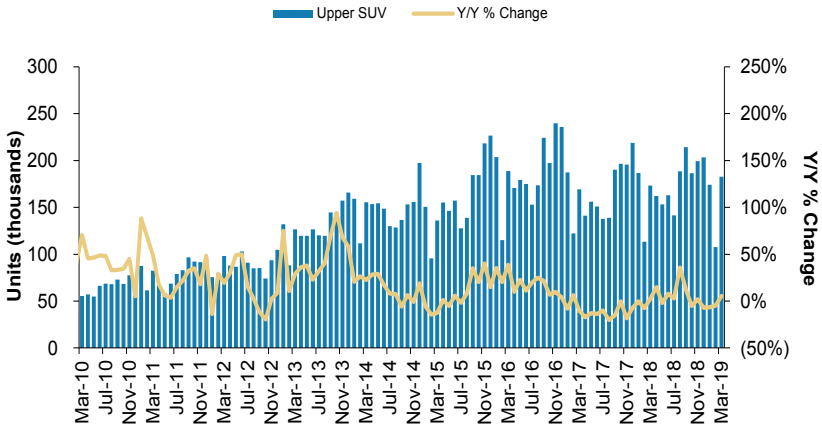
Monthly Passenger Vehicle Sales - MPV Segment



Monthly Passenger Vehicle Sales - Low SUV Segment



Monthly Passenger Vehicle Sales - Upper SUV Segment

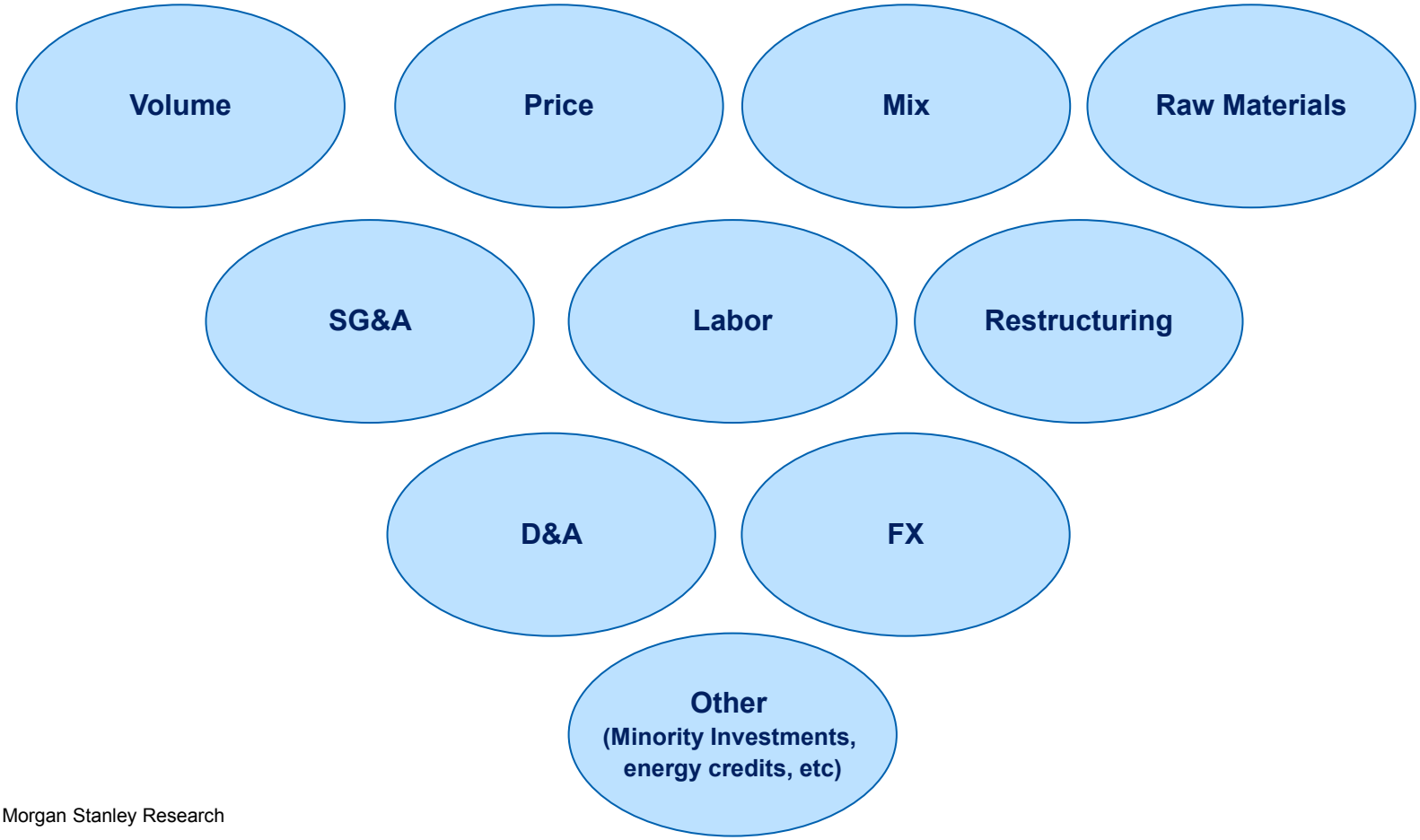


Source: Morgan Stanley Research, China Auto Market

SECTION 3: PROFIT

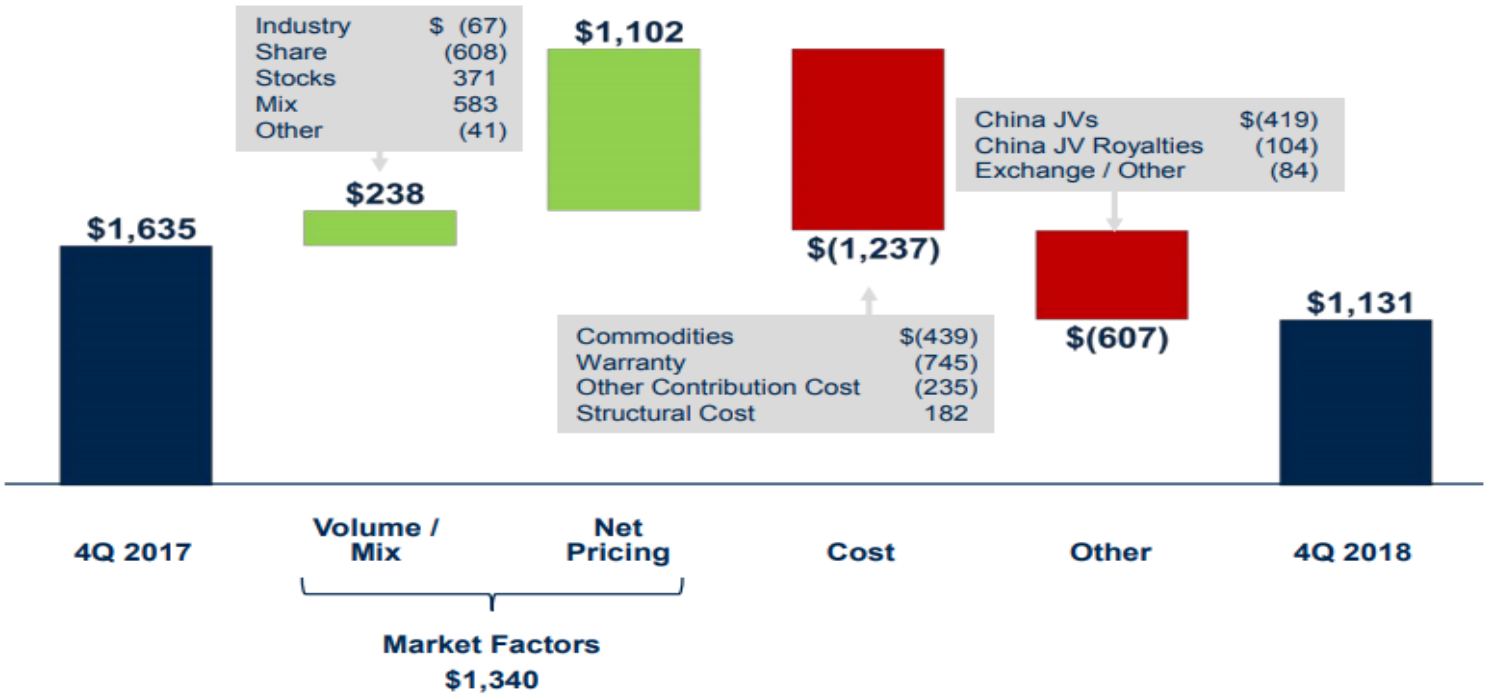
Key Profitability Factors for OEMs

Factors affecting OEM margins include:



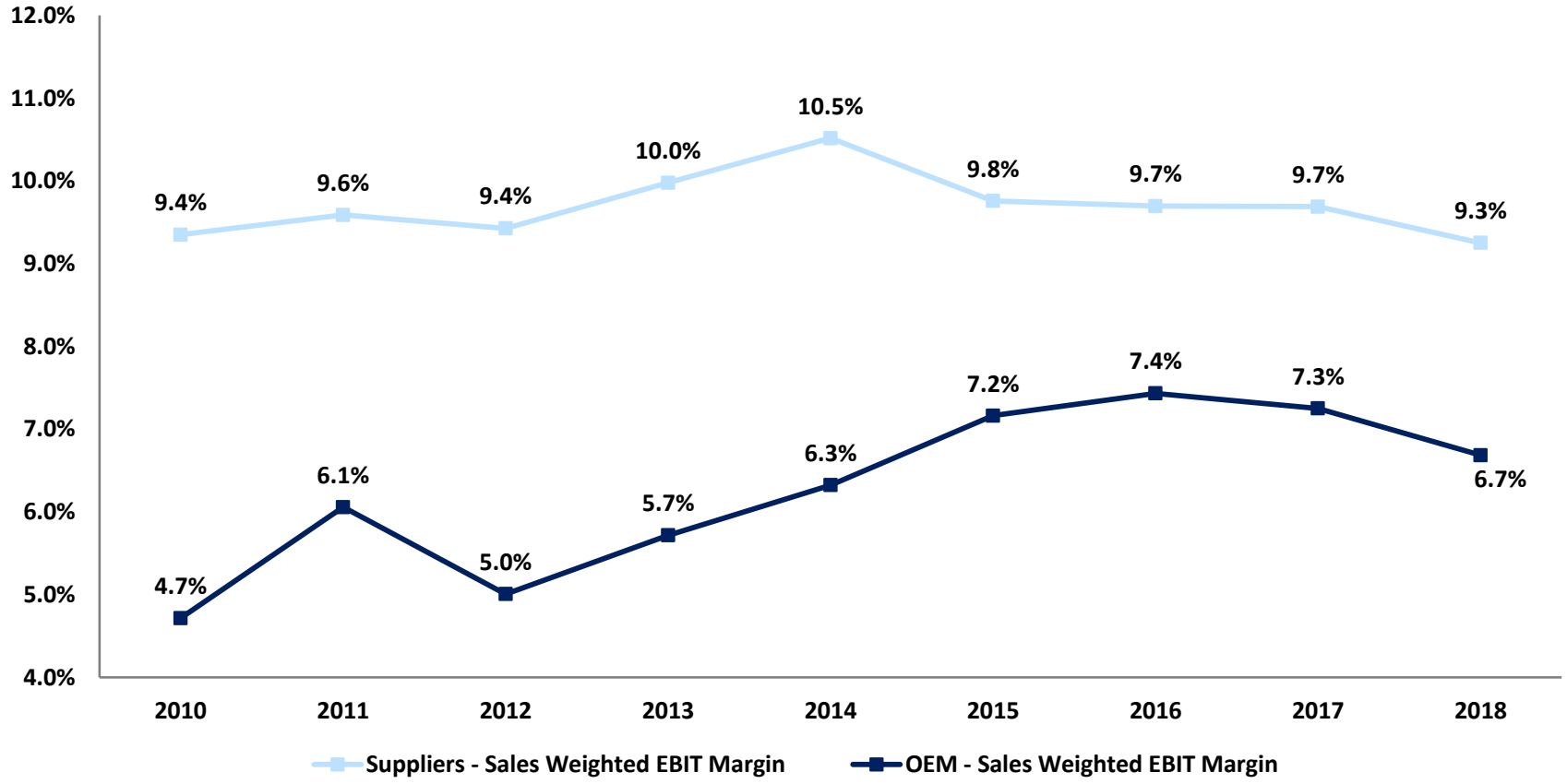
Source: Morgan Stanley Research

Example EBIT Bridge: Ford Motor Company



Source: Ford Motor Company, Morgan Stanley Research

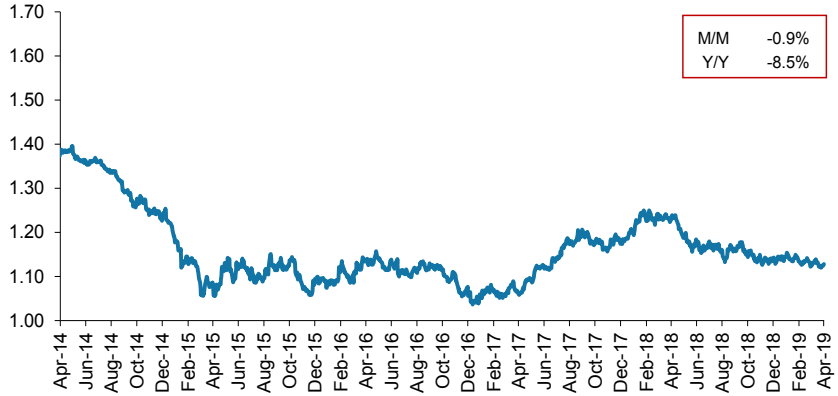
Supplier vs. OEM Sales Weighted EBIT Margins



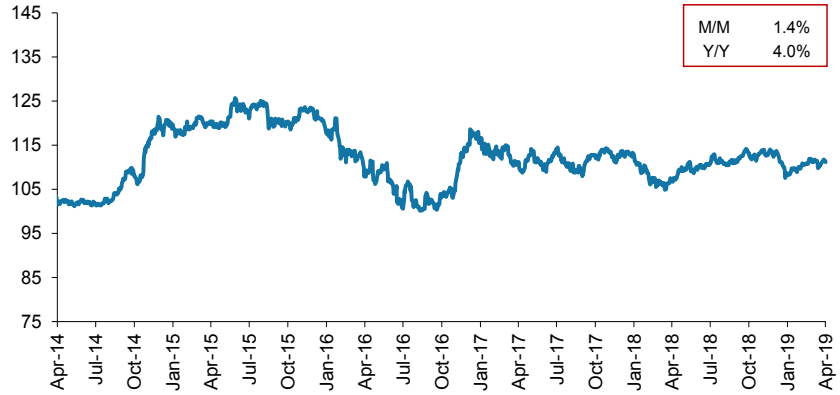
Source: Morgan Stanley Research, Company reports

Key Currencies

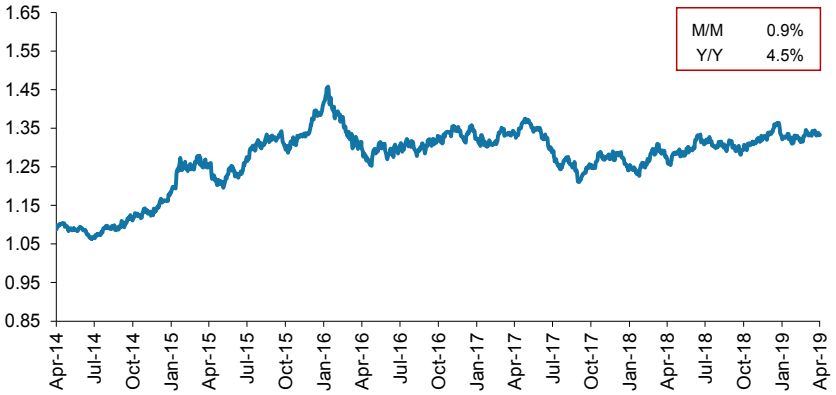
USD/EUR



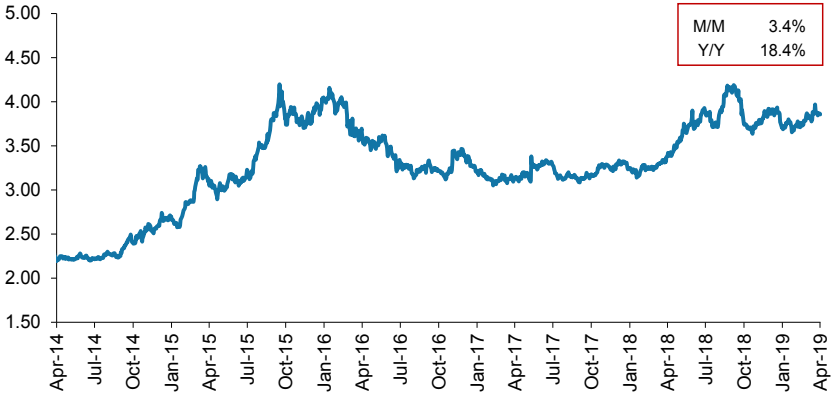
USD/JPY



USD/CAD



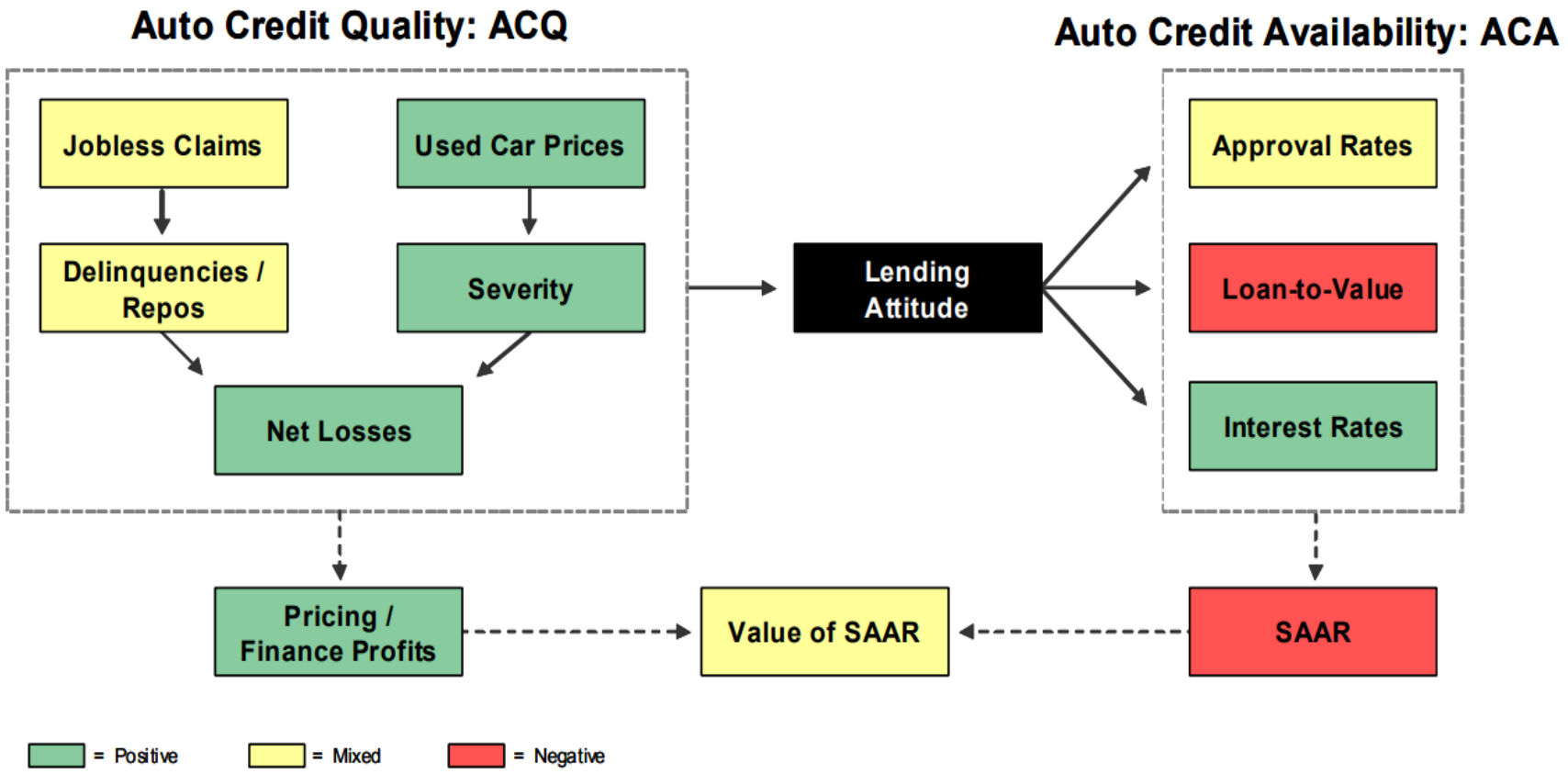
BRL/USD



Source: Morgan Stanley Research, Refinitiv

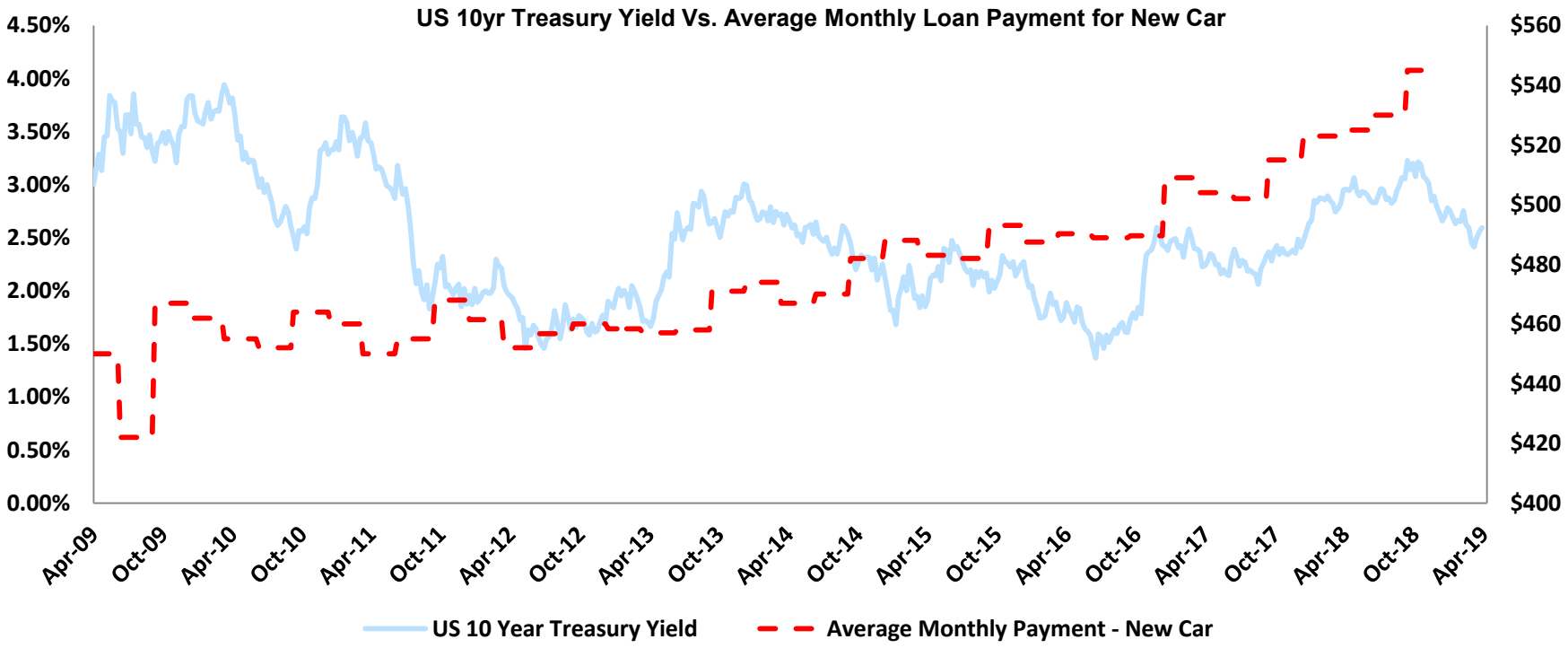
SECTION 4: FINCO

Auto Credit Inter-relationships



Source: Morgan Stanley Research

OEM - Credit: US Auto Credit / The Fed

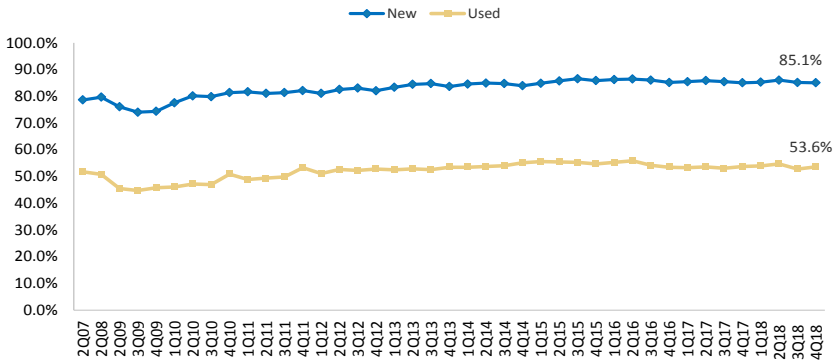


>90% of the value of new car sales is transacted via financial instrument

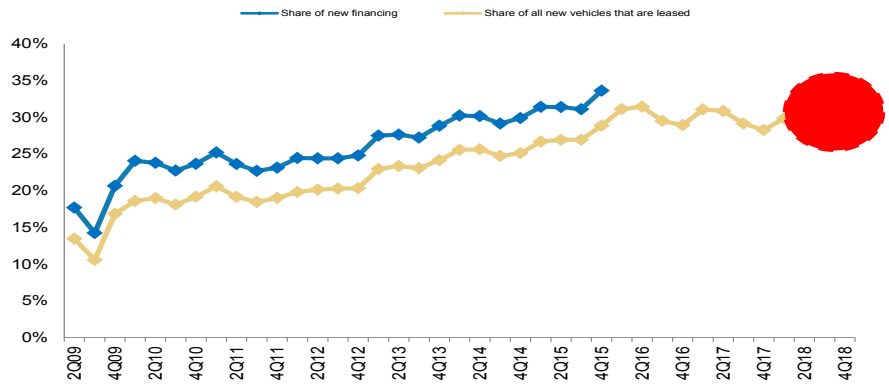
Source: Refinitiv, Experian, Morgan Stanley Research

Auto Credit

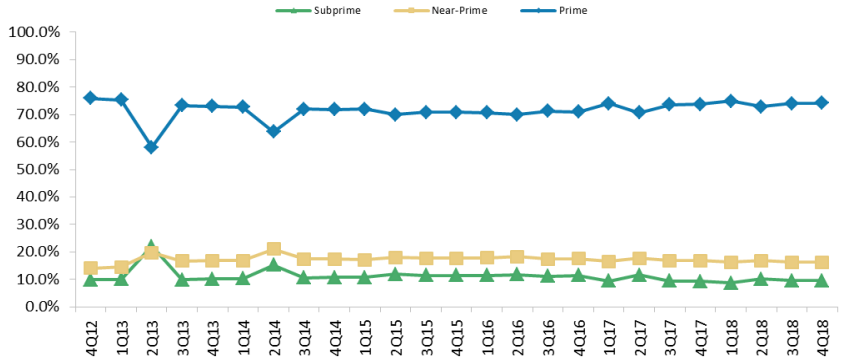
Percentage of vehicles with financing



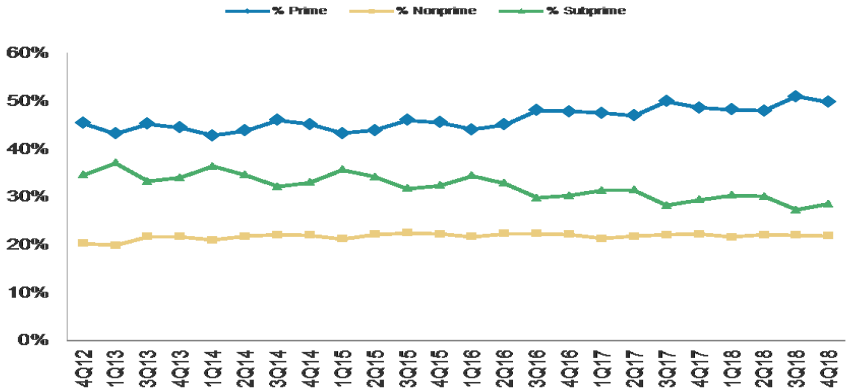
New Lease market share



New Car Loans by Risk Segments



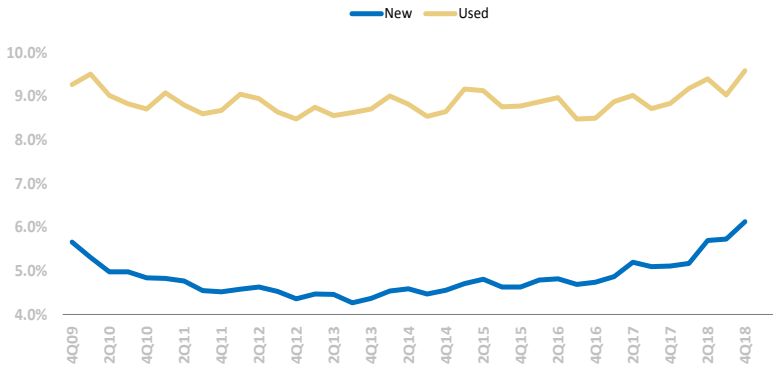
Used Car Loans by Risk Segments



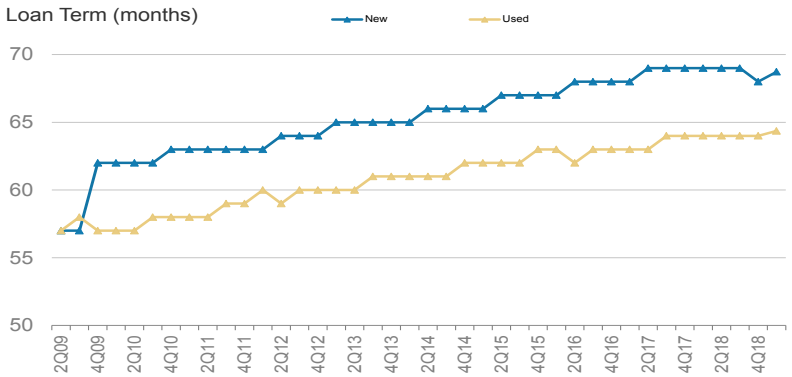
Source: Morgan Stanley Research, Experian

Auto Credit (Cont.)

Average Rate on New & Used vehicle loans

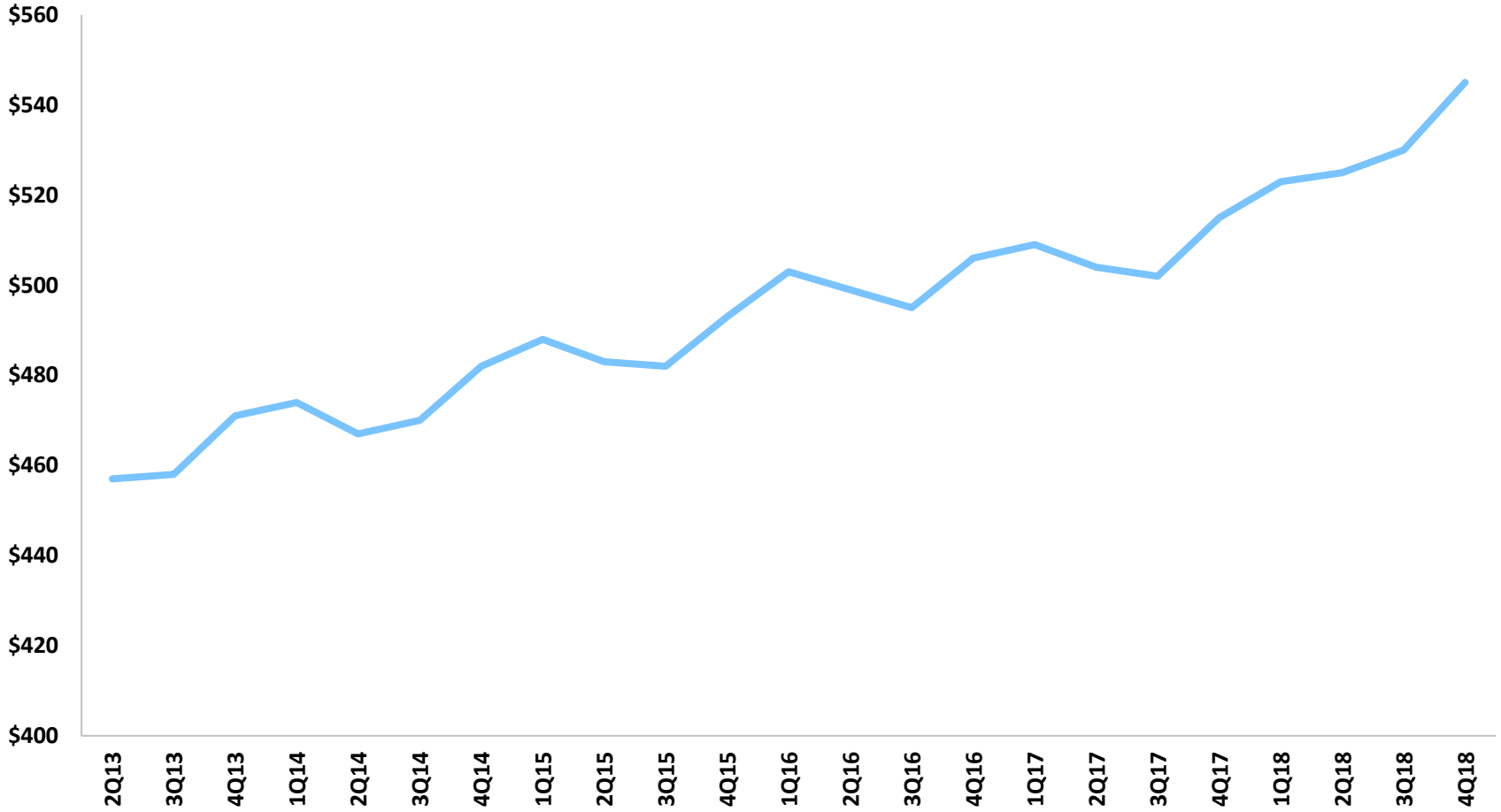


New and Used Financing – Average Term



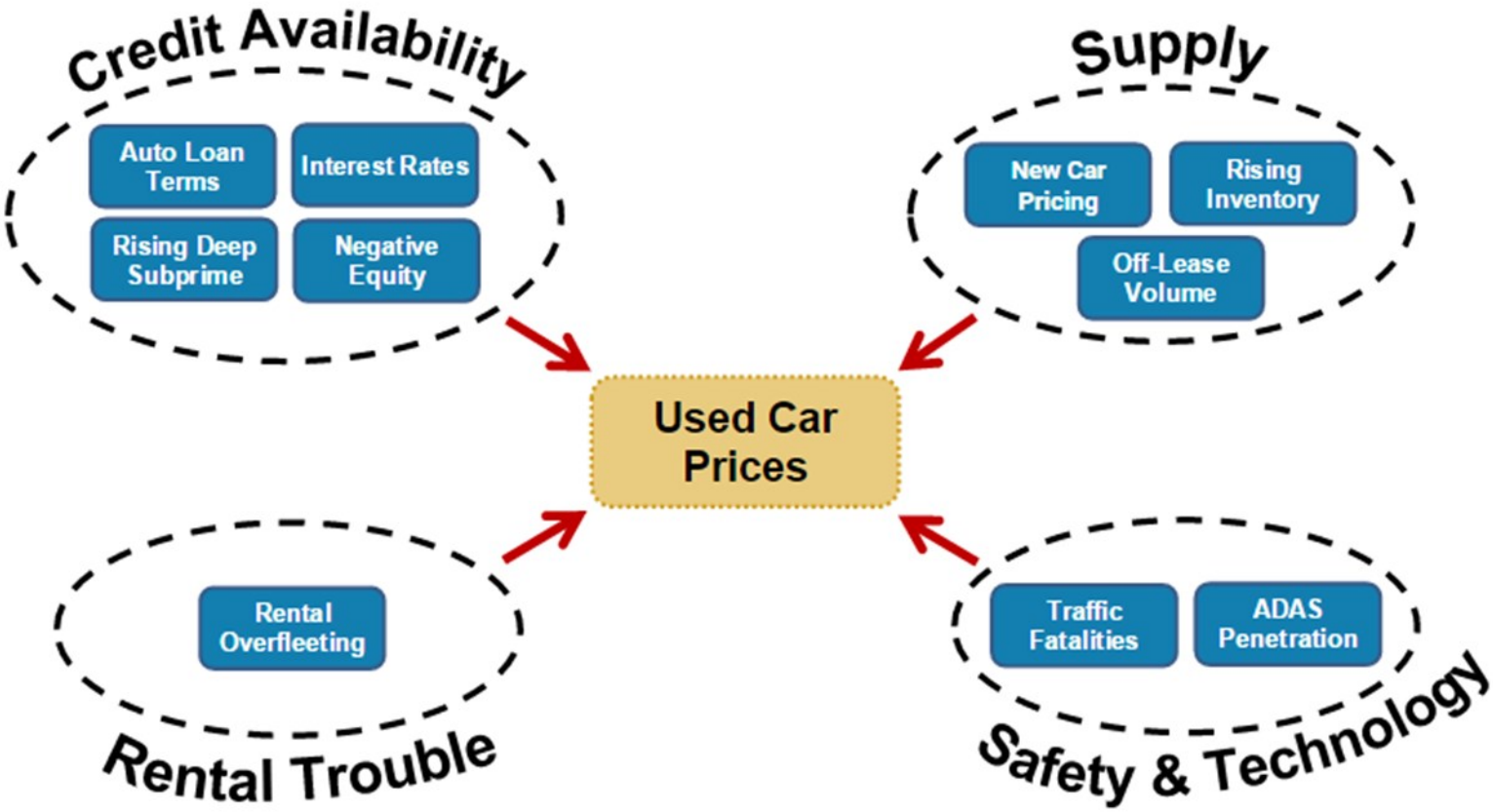
Source: Morgan Stanley Research, Experian

Average Monthly Payment (New Cars)



Source: Experian, Morgan Stanley Research

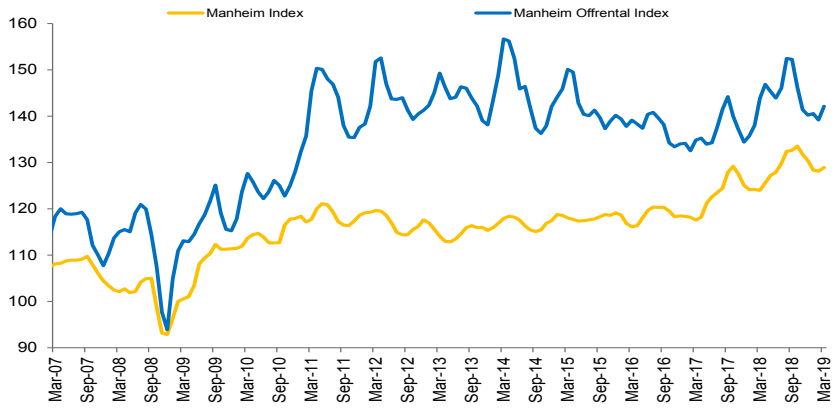
Used Vehicle Prices



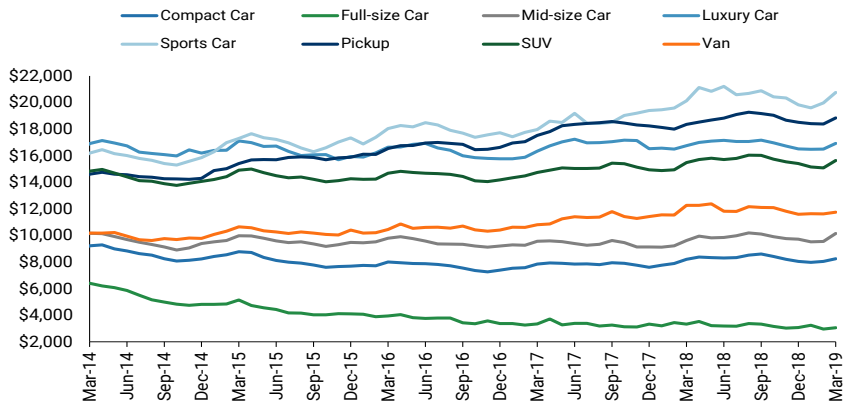
Source: Morgan Stanley Research

Auto Dealers - US Used Car Data

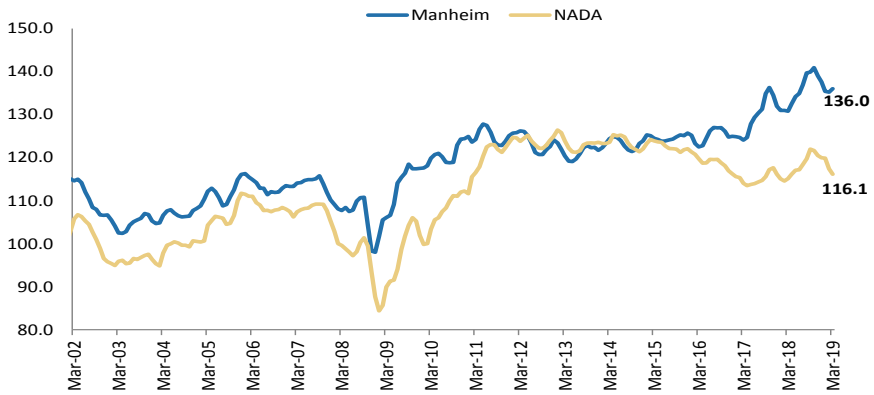
Manheim Index & Off-Rental Index



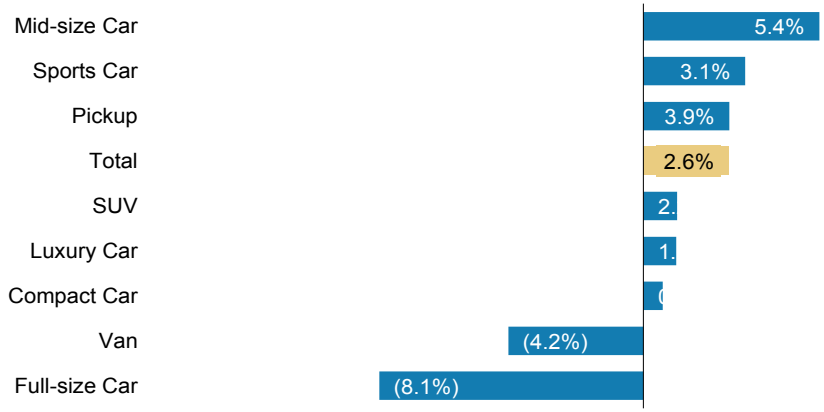
NSA Prices



Manheim Vs NADA Used Vehicles Pricing Index

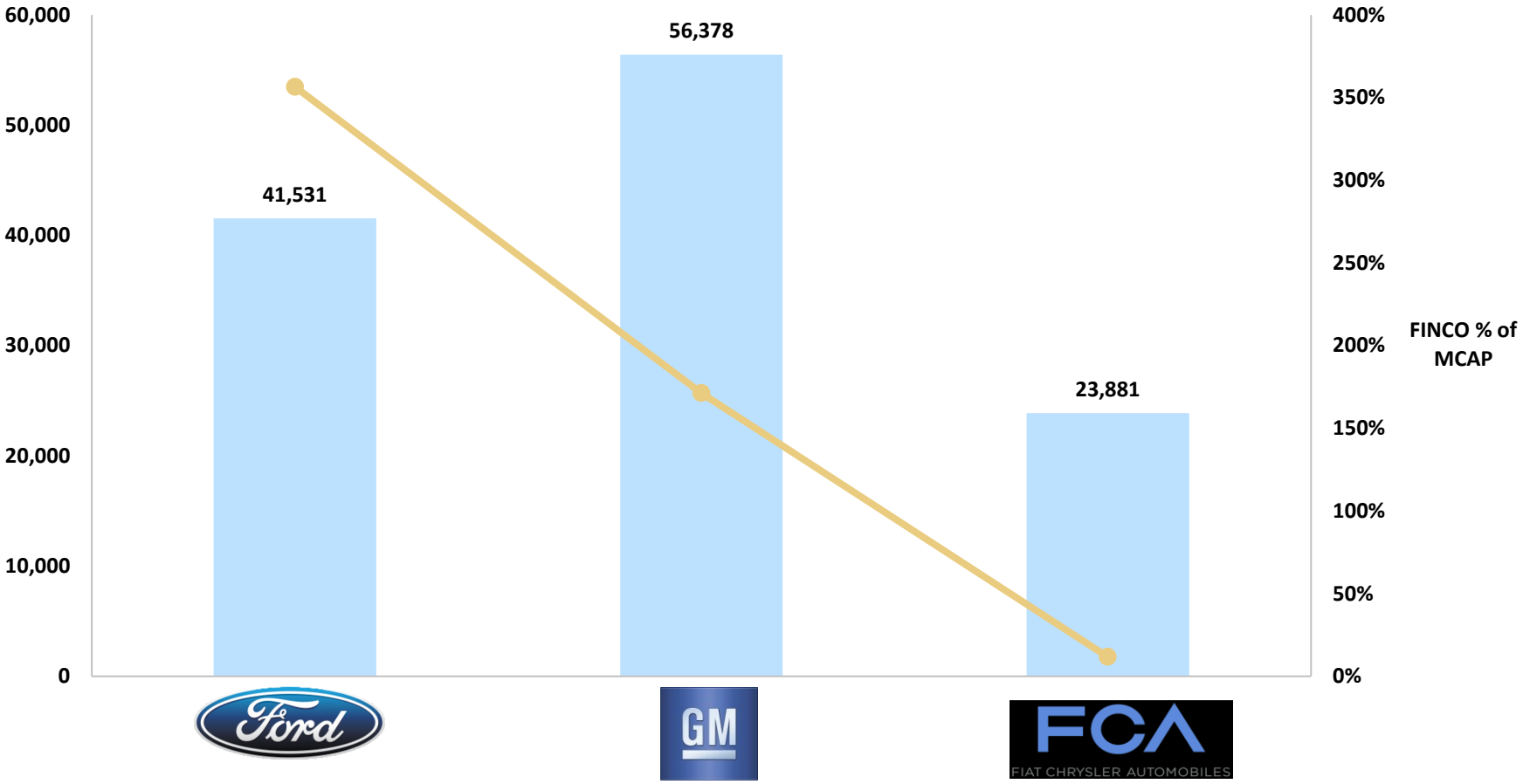


Used Vehicles Prices (Mar 2019 vs. LY)



Source: Morgan Stanley Research, Manheim, NADA

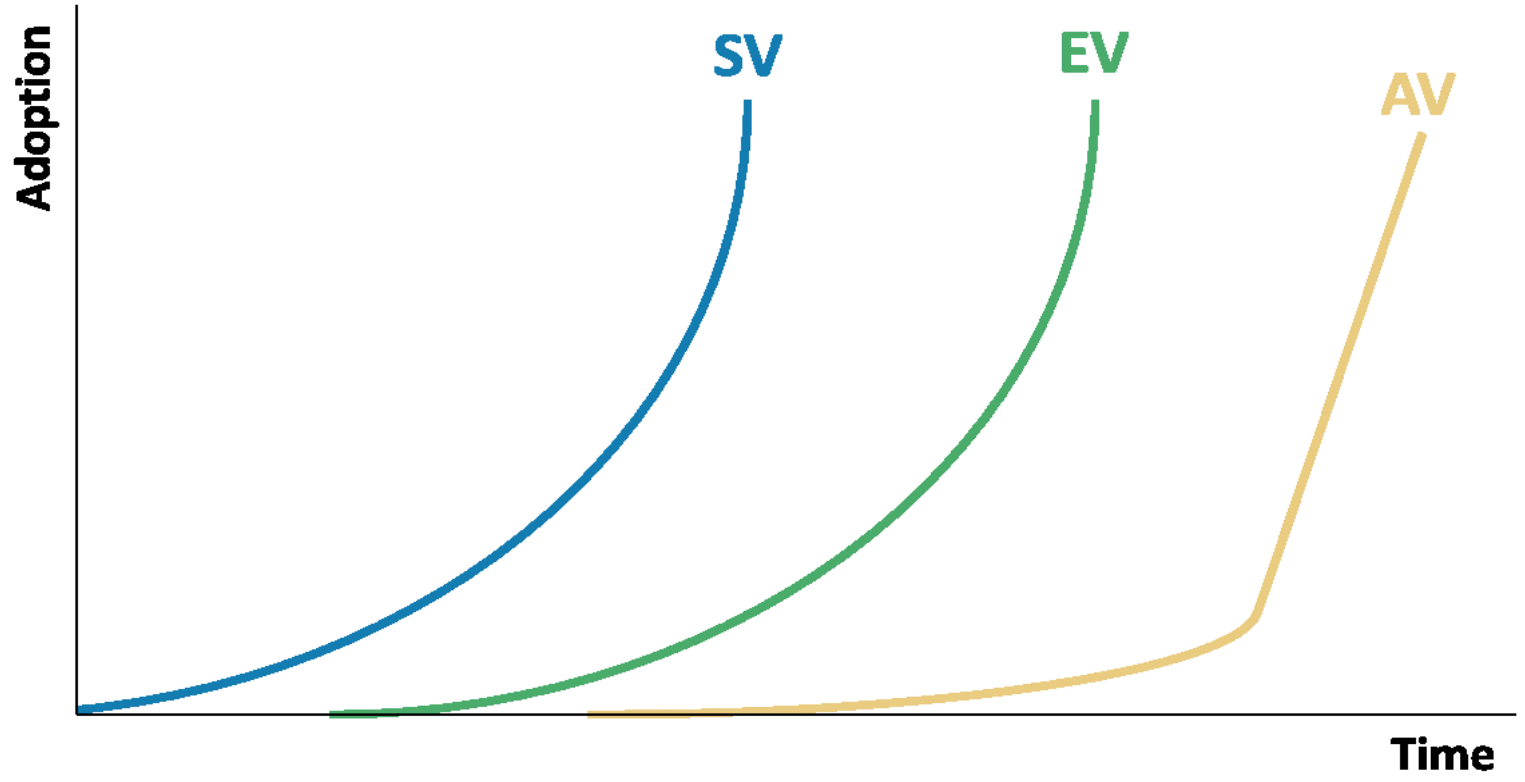
D3 FINCO as % of MCAP



Source: Company data, Morgan Stanley Research

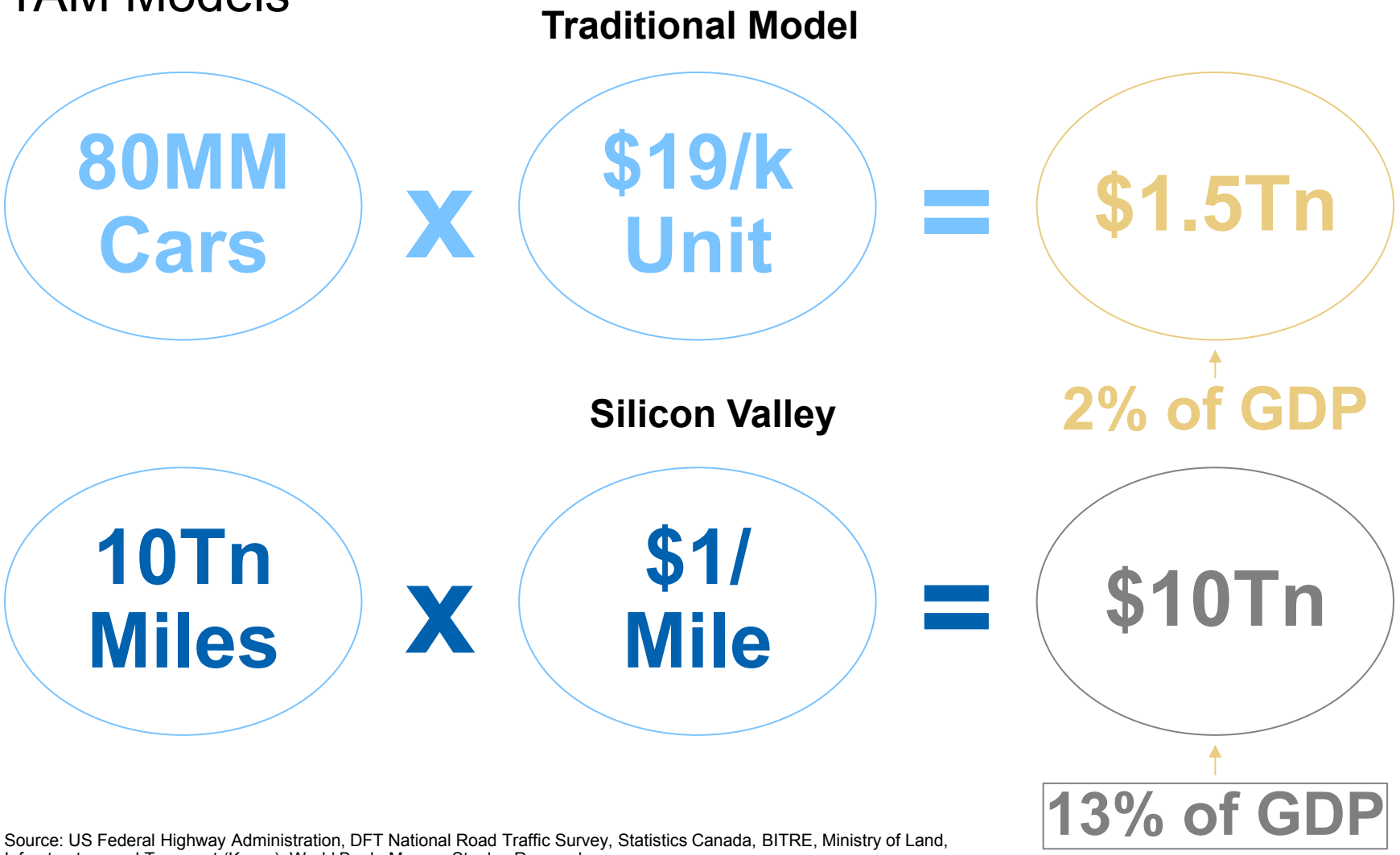
SECTION 5: DISRUPTION

3 Key Drivers of Auto Disruption: Shared, Electric, Autonomous



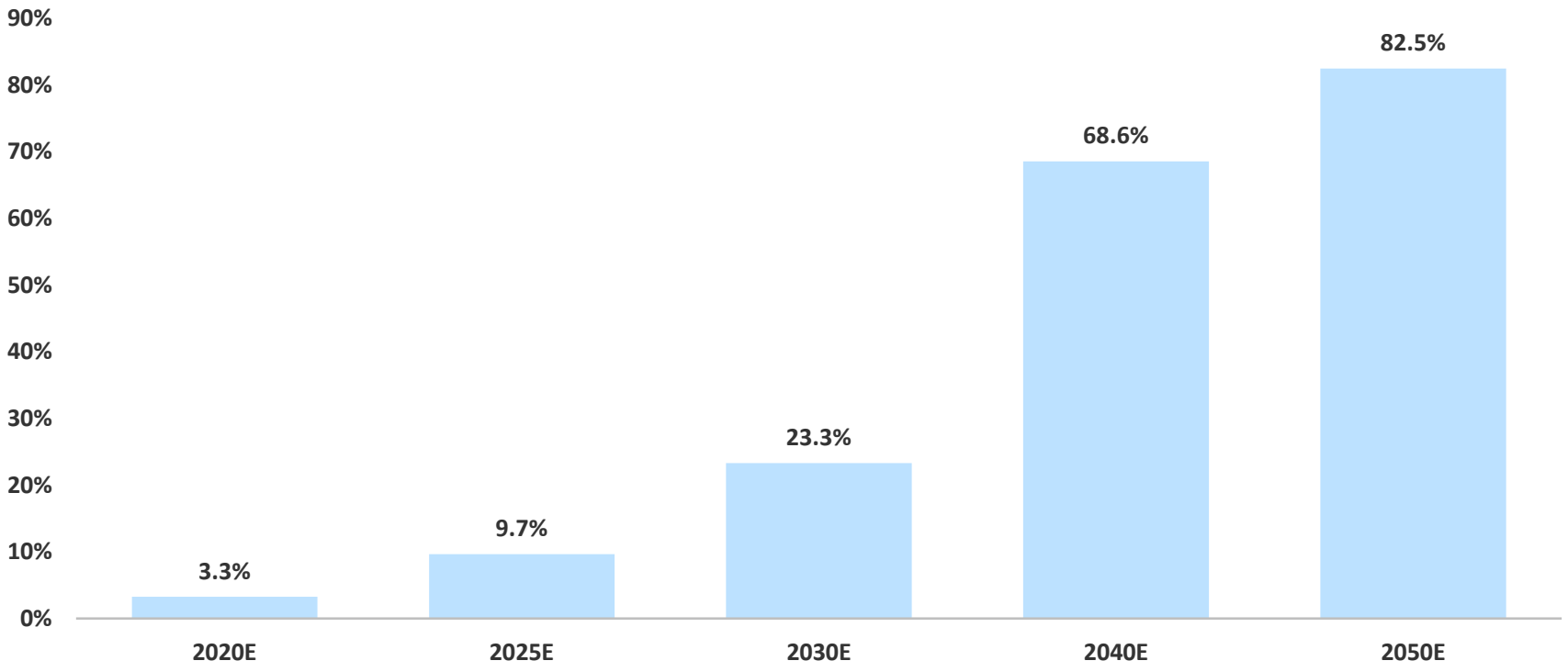
Source: Morgan Stanley Research

TAM Models



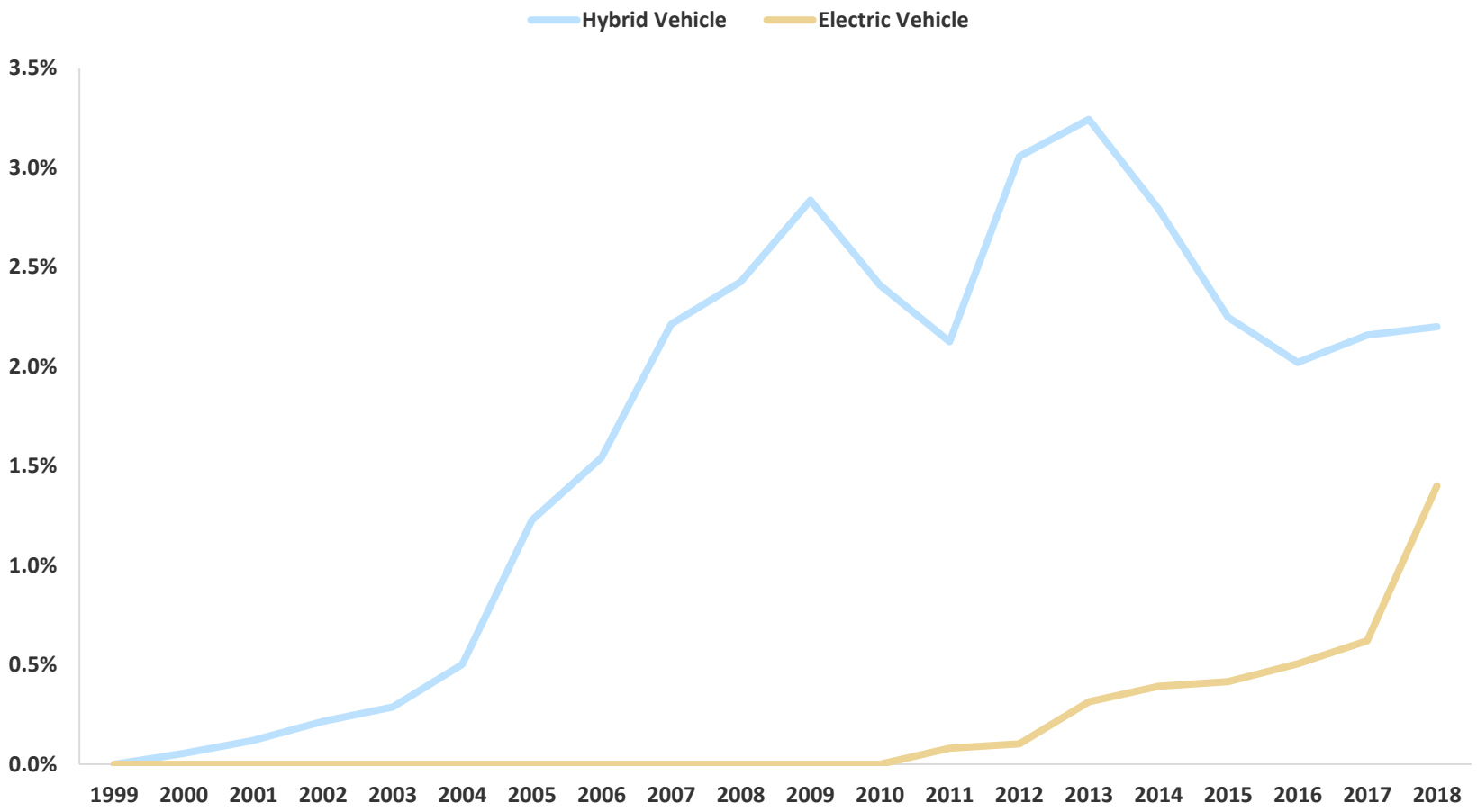
Source: US Federal Highway Administration, DFT National Road Traffic Survey, Statistics Canada, BITRE, Ministry of Land, Infrastructure and Transport (Korea), World Bank, Morgan Stanley Research

Global EV Penetration (% of Sales)



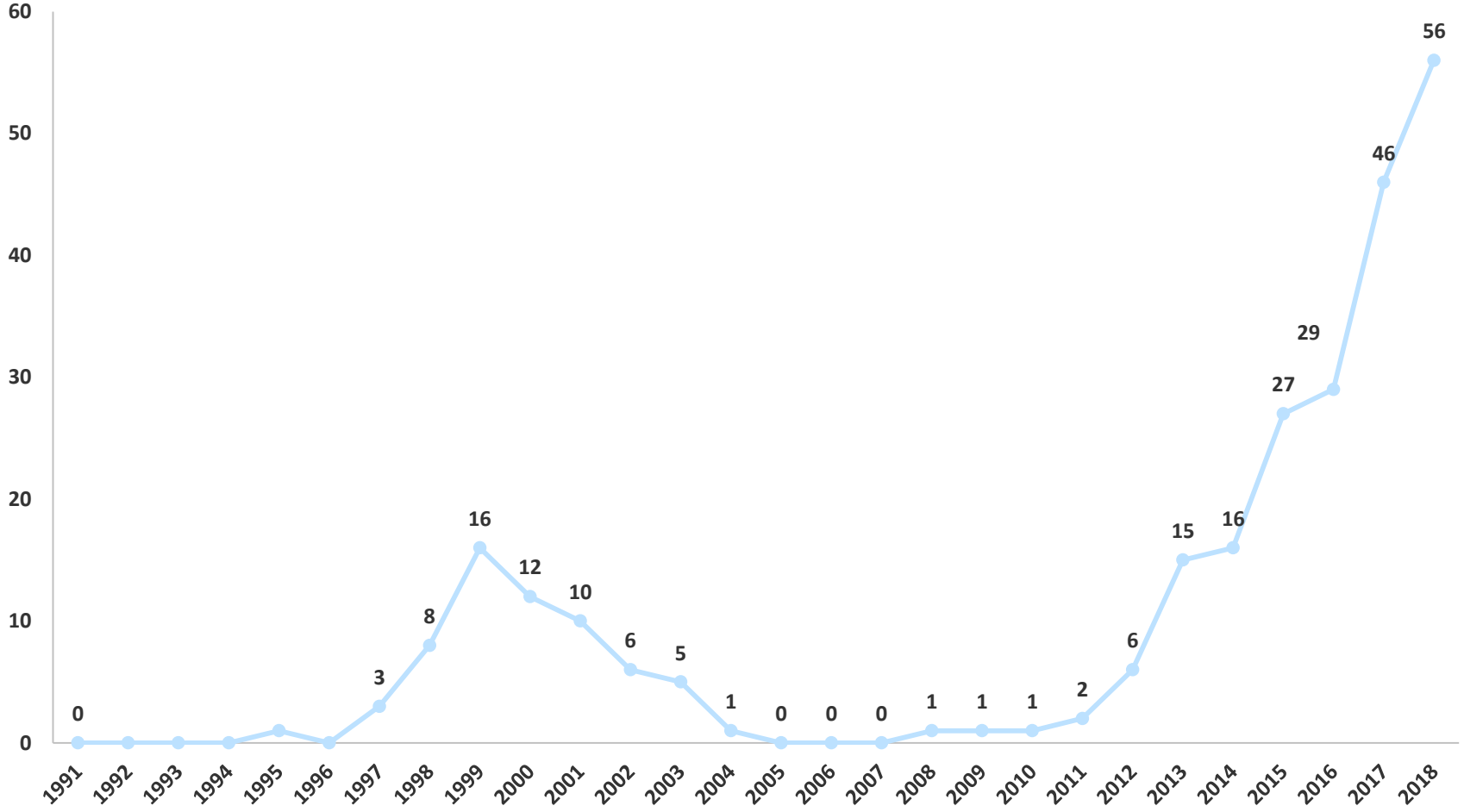
Source: Morgan Stanley Research

Hybrid & Electric as % of Overall LV Sales



Source: Transportation Research Center at Argonne National Laboratory, Morgan Stanley Research

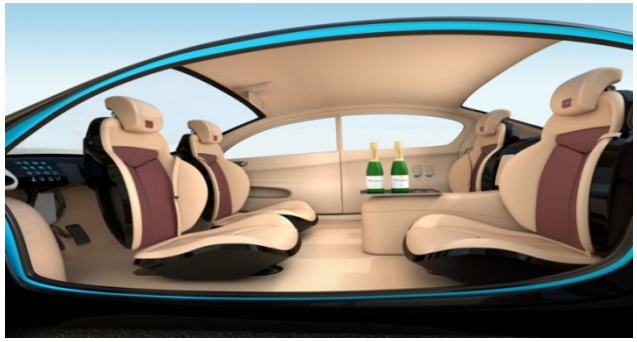
Number of Electric Vehicle Models Available



Source: US Department of Transportation, "Alternative Fuel Vehicle Data," Morgan Stanley Research

EV Payback

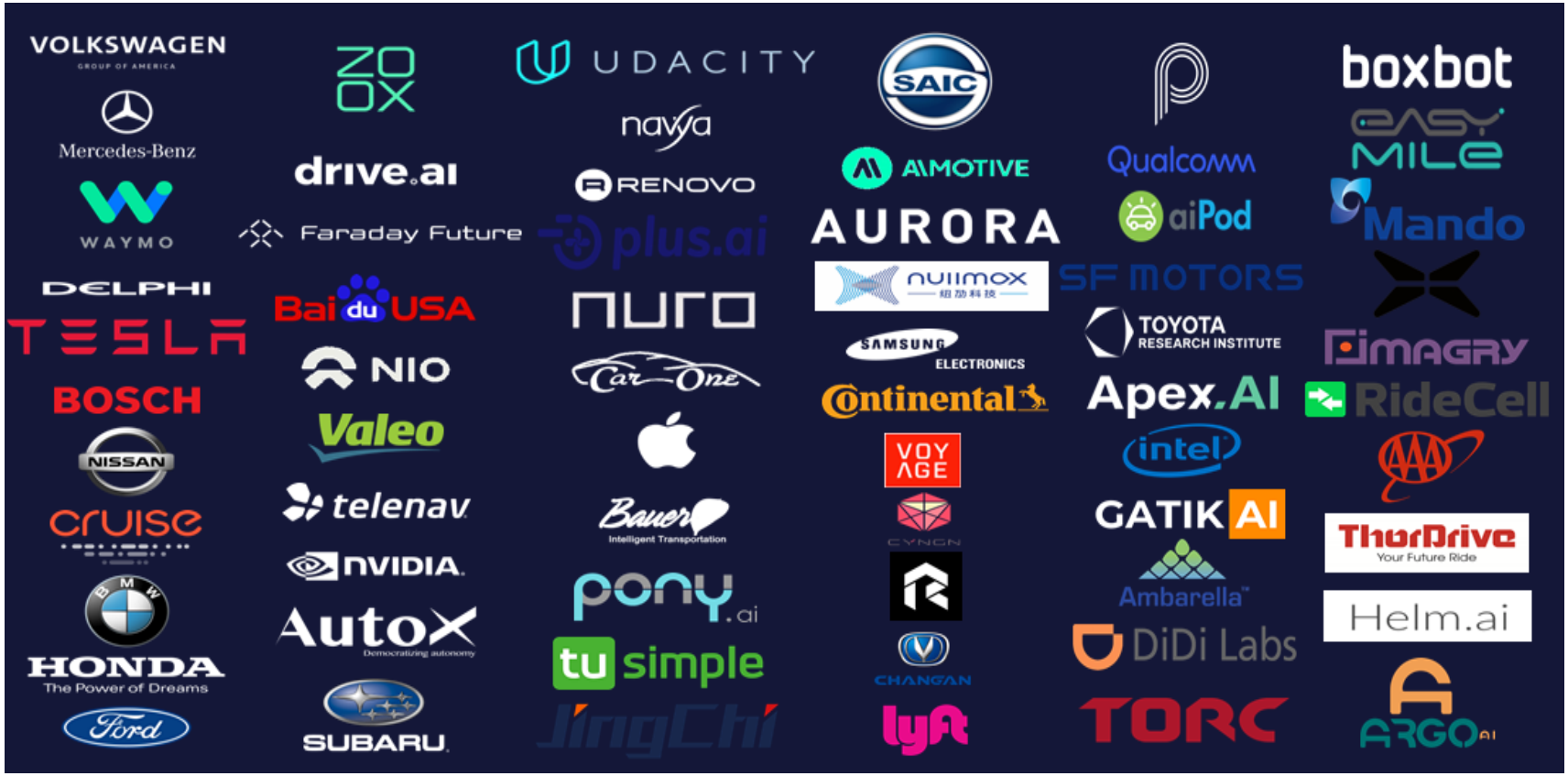
EV PAYBACK	PRIVATELY OWNED	TAXI
Hr/Day	1 hr/day	10 hr/day
Miles/Yr	10k miles/yr	100k miles/yr
Annual Savings	$400/yr	$4,000/yr
Payback	28.5 yrs	< 3 yrs





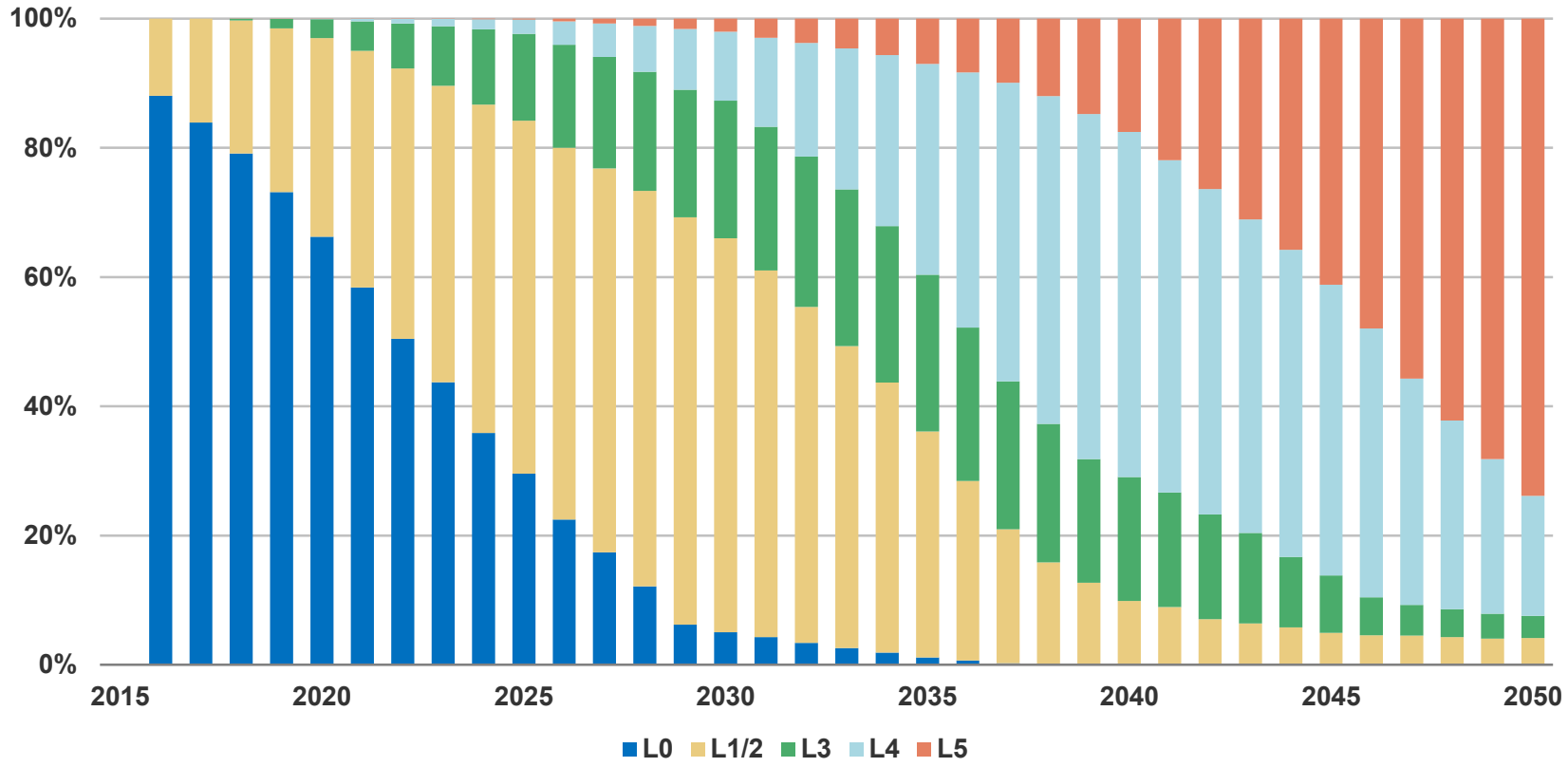
Source: Morgan Stanley Research

California Autonomous Car Licenses



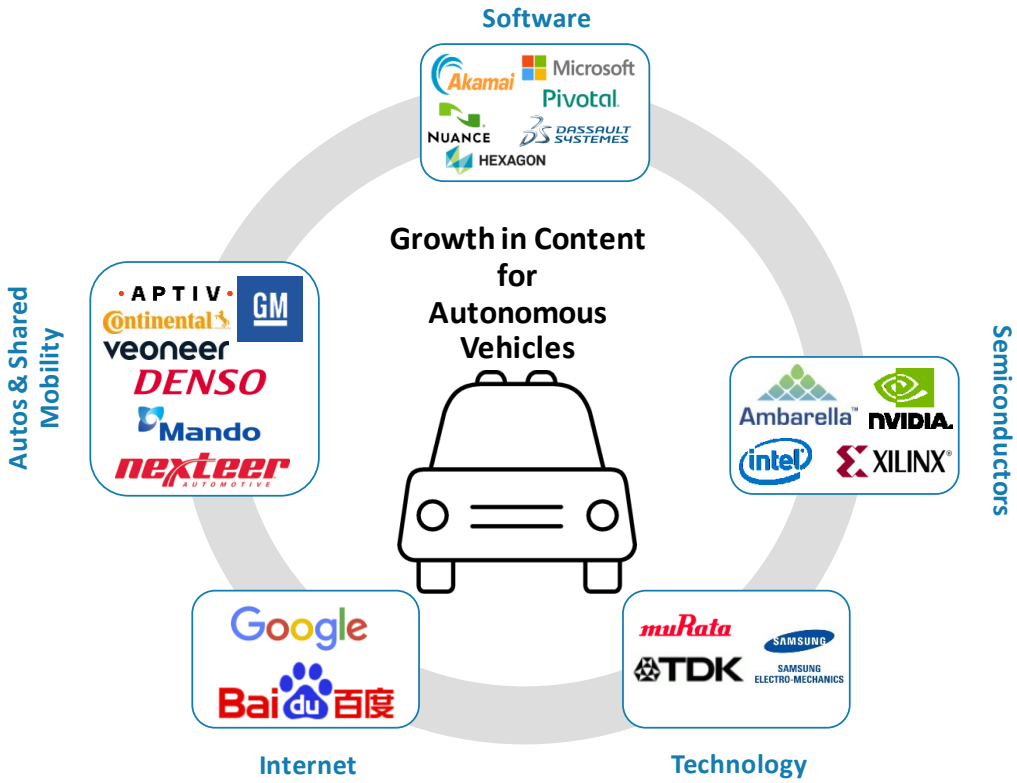
Source: Company websites, Morgan Stanley Research

AV Penetration (% of Sales - MSe)



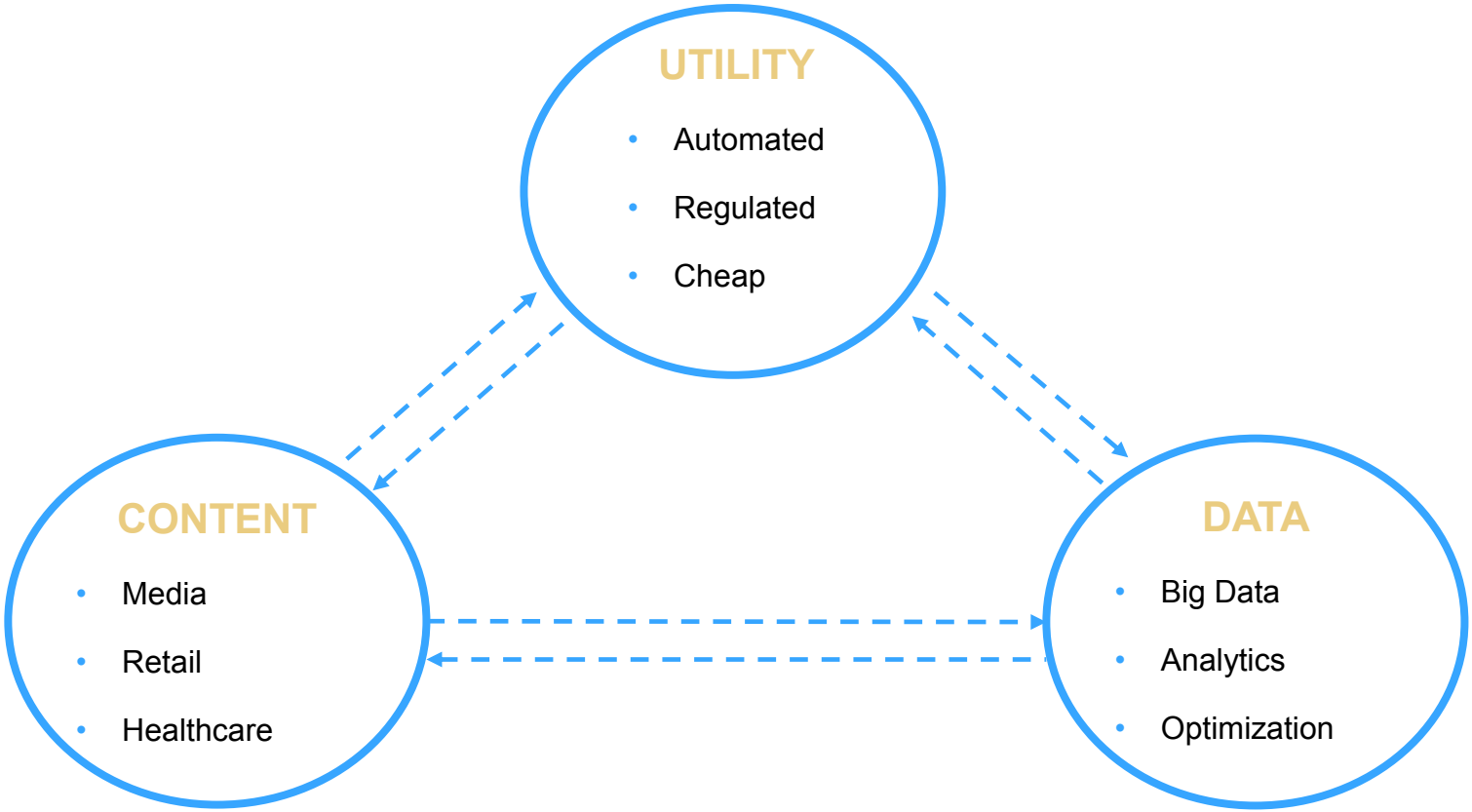
Source: Morgan Stanley Research

Content Opportunity for Autonomous Vehicles



Source: Company websites, Morgan Stanley Research

Future Industry Model



Source: Morgan Stanley Research

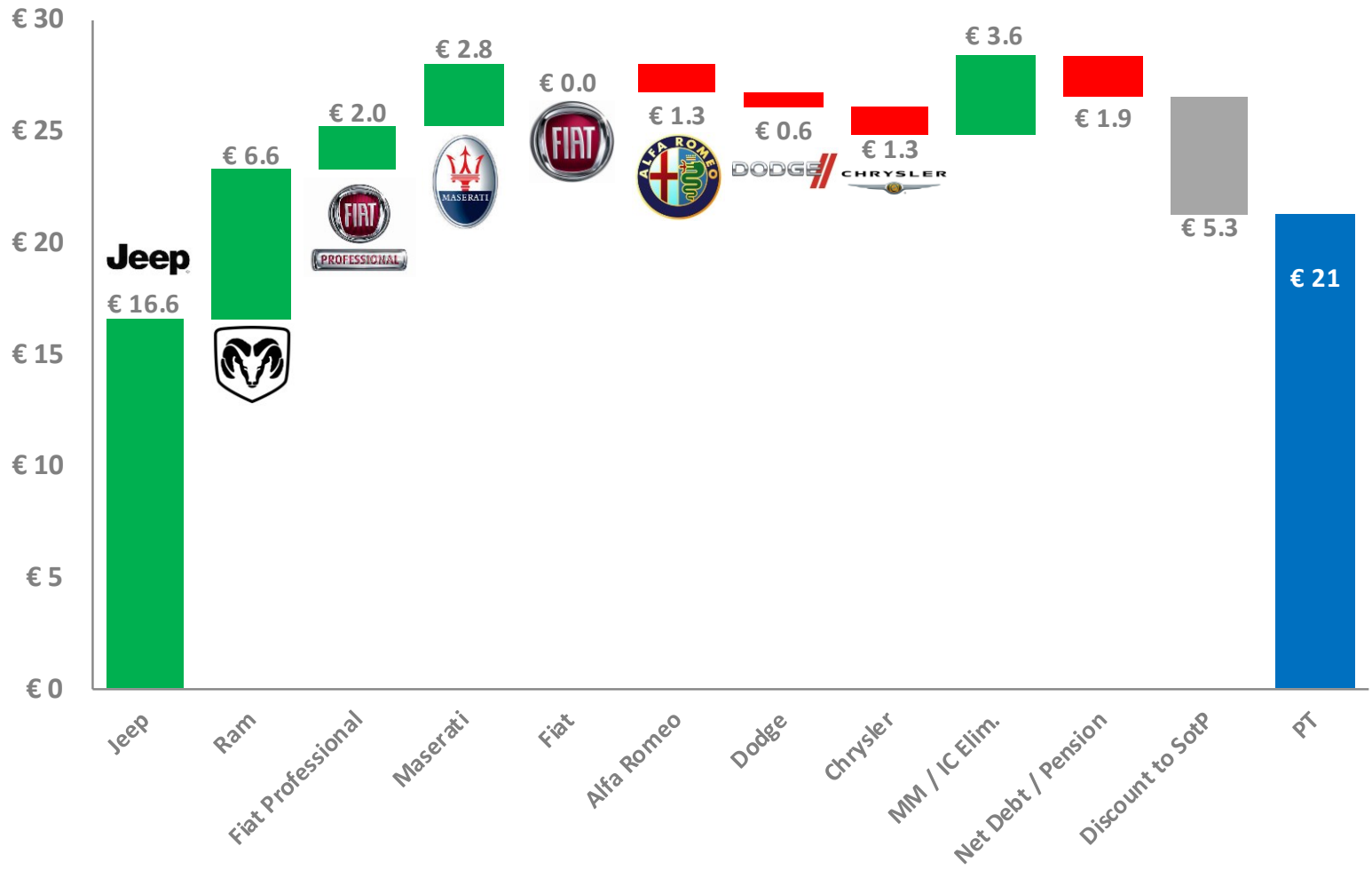
SECTION 6: VALUATION

Valuation Methodologies & Why?

US Autos Valuation Tools

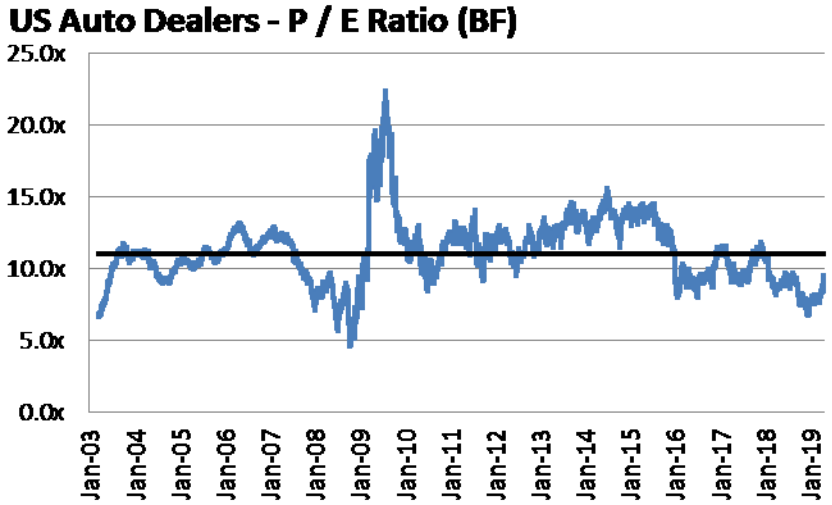
- **SOTP:** FCA, GM, Ford
- **EV/EBITDA**: Suppliers, Select OEMS
- **Price/Earnings:** Dealers
- **LBO:** HOG
- **DCF:** TSLA

Example SOTP: Fiat Chrysler



Source: Company reports, Morgan Stanley Research

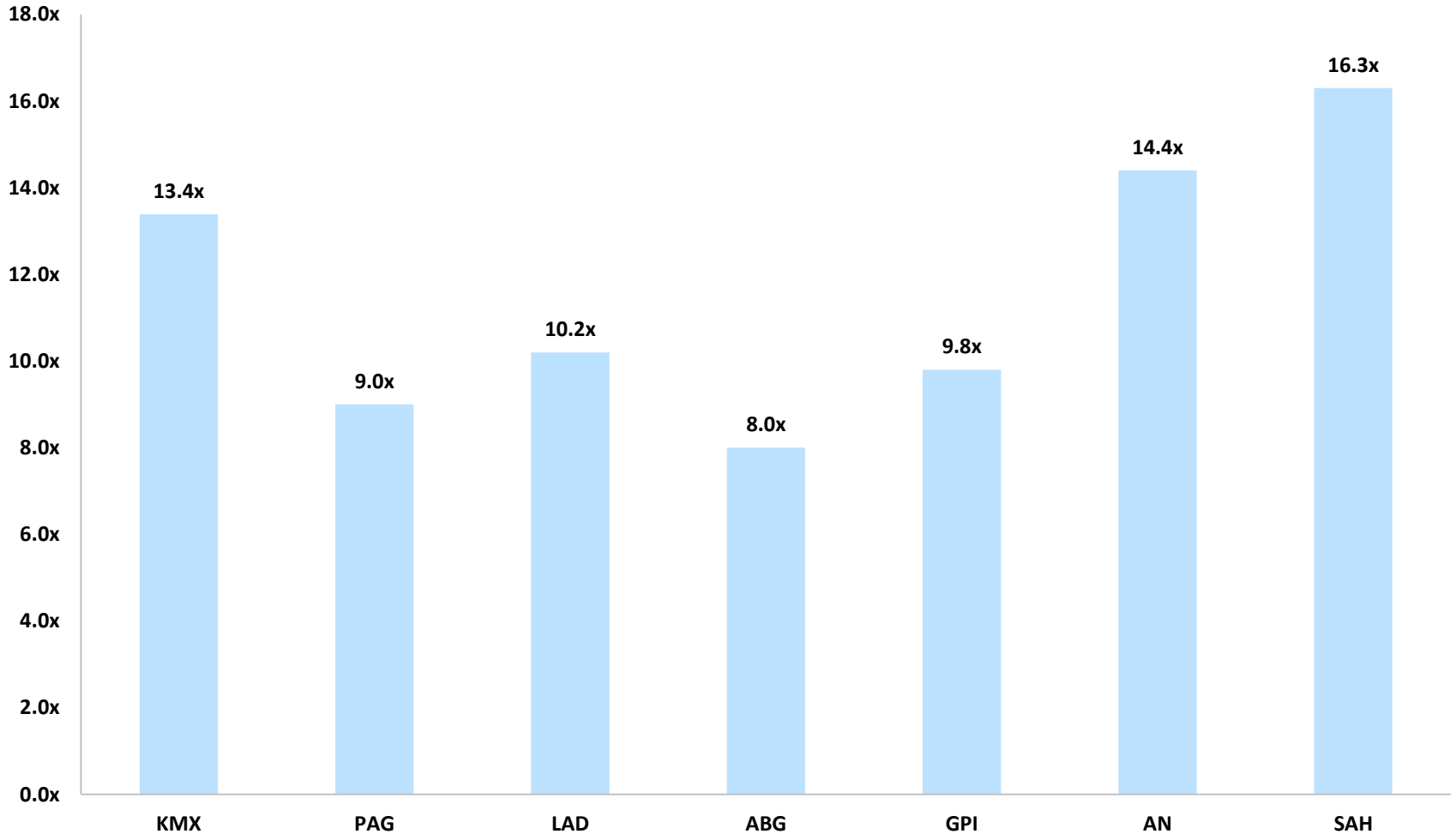
US Auto Dealers: P/E



	Market Cap	Dividend Yield	P / E 2019e	P / E 2020e	EV / EBITDA 2019e	EV / EBITDA 2020e	EV / Unit Sold 2019e	EV / Unit Sold 2020e
ABG	$1,555		8.5x	**8.0x**	7.7x	**7.6x**	$13,395	**$12,984**
AN	$3,774		12.2x	**14.4x**	8.0x	**8.6x**	$10,954	**$10,829**
GPI	$1,431	1.3%	9.5x	**9.8x**	8.6x	**8.5x**	$9,453	**$8,883**
LAD	$2,779	1.1%	10.2x	**10.2x**	8.5x	**8.2x**	$12,446	**$11,532**
PAG	$3,893	3.3%	8.3x	**9.0x**	8.6x	**9.3x**	$11,888	**$12,037**
SAH	$868	1.9%	12.7x	**16.3x**	7.7x	**8.0x**	$7,398	**$7,272**
Average		**1.6%**		**10.0x**		**8.3x**		**$11,181**
KMX	$13,277		14.7x	**13.4x**	10.6x	**9.5x**	$19,220	**$16,703**
CVNA	$10,692			**110.1x**		**31.5x**	$75,785	**$52,557**

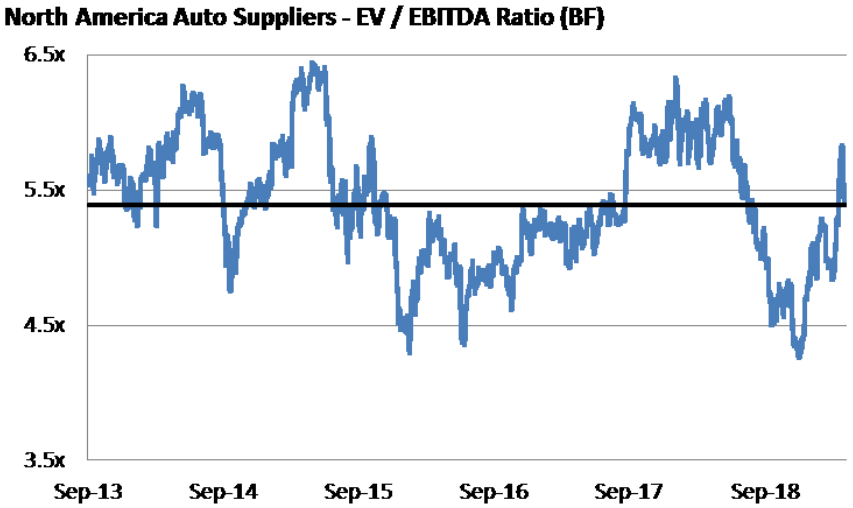
Source: Morgan Stanley Research, Bloomberg

Dealers 2020E P/E Multiples



Source: Morgan Stanley Research, Blooomberg

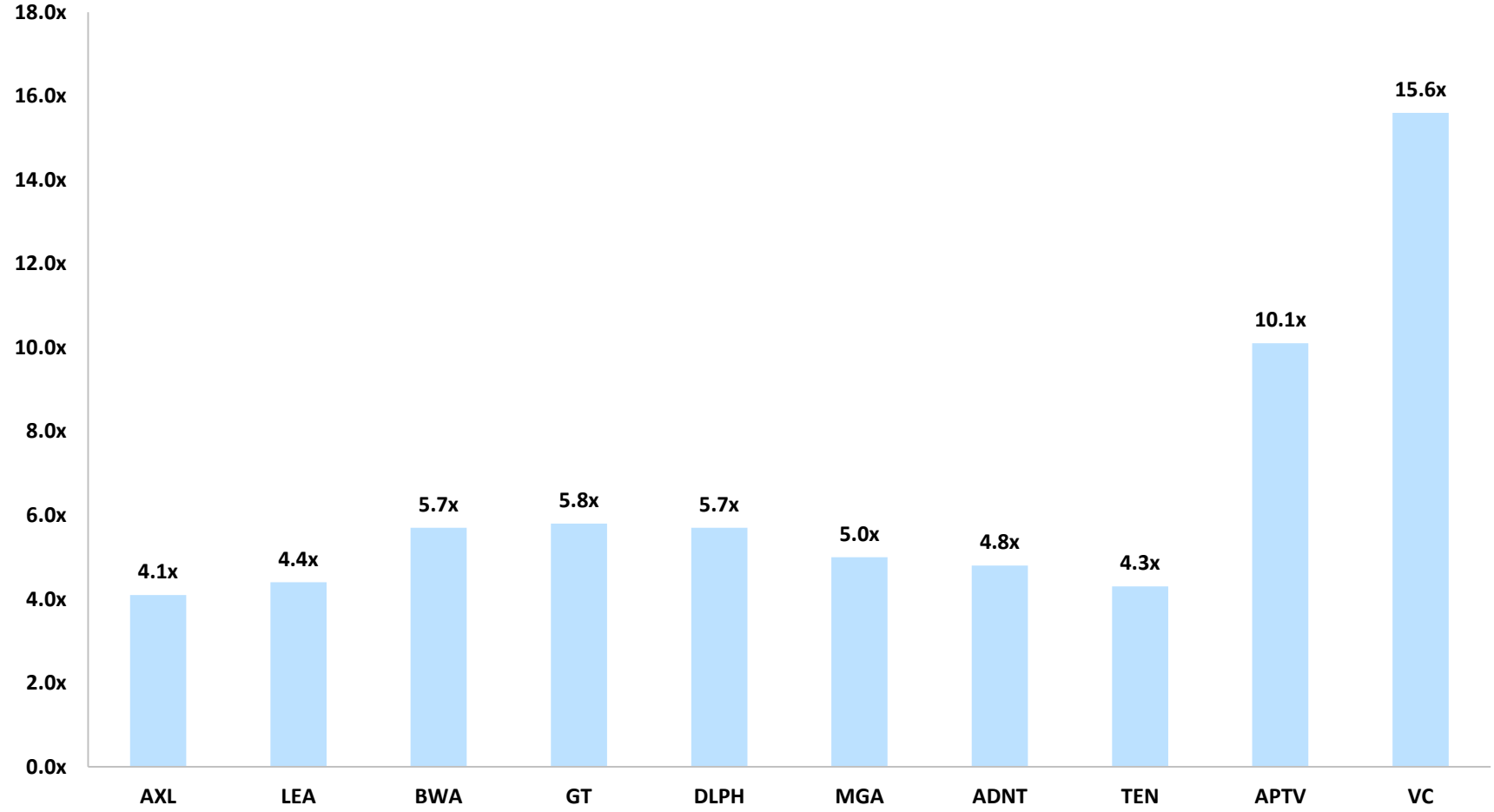
US Auto Suppliers: EV/EBITDA



	Market Cap	Dividend Yield	EV / EBITDA 2019e	EV / EBITDA 2020e	P / E 2019e	P / E 2020e	P / FCF 2019e	P / FCF 2020e
ADNT	$2,160		5.8x	**4.8x**	7.1x	**4.5x**	-11%	**-3%**
APTV	$22,597	1.0%	11.0x	**10.1x**	15.9x	**15.0x**	4%	**6%**
AXL	$1,648		4.3x	**4.1x**	4.8x	**5.0x**	22%	**29%**
BWA	$8,700	1.6%	6.2x	**5.7x**	9.8x	**9.6x**	8%	**9%**
DLPH	$1,961		5.9x	**5.7x**	7.3x	**7.0x**	2%	**10%**
GT	$4,514	3.3%	6.8x	**5.8x**	22.2x	**13.5x**	5%	**-2%**
LEA	$9,240	2.1%	4.7x	**4.4x**	8.1x	**7.6x**	10%	**11%**
MGA	$18,546	2.7%	5.5x	**5.0x**	8.1x	**7.9x**	11%	**10%**
TEN	$1,770	4.4%	4.4x	**4.3x**	4.4x	**4.1x**	3%	**14%**
VC	$1,908		18.0x	**15.6x**	88.1x	**43.9x**	0%	**-7%**
Average		**2.4%**		**5.4x**		**7.7x**		**9%**

Source: Morgan Stanley Research, Bloomberg

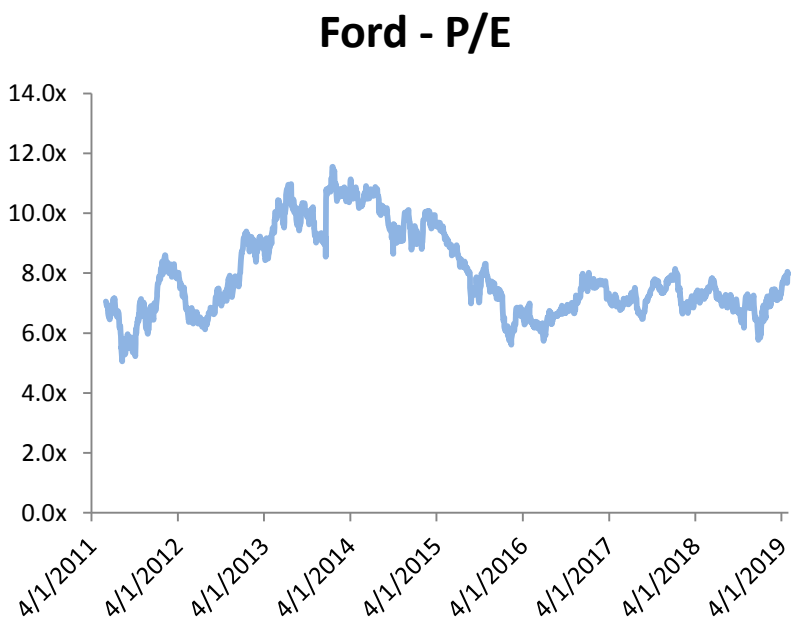
Suppliers 2020E EV/EBITDA Multiples

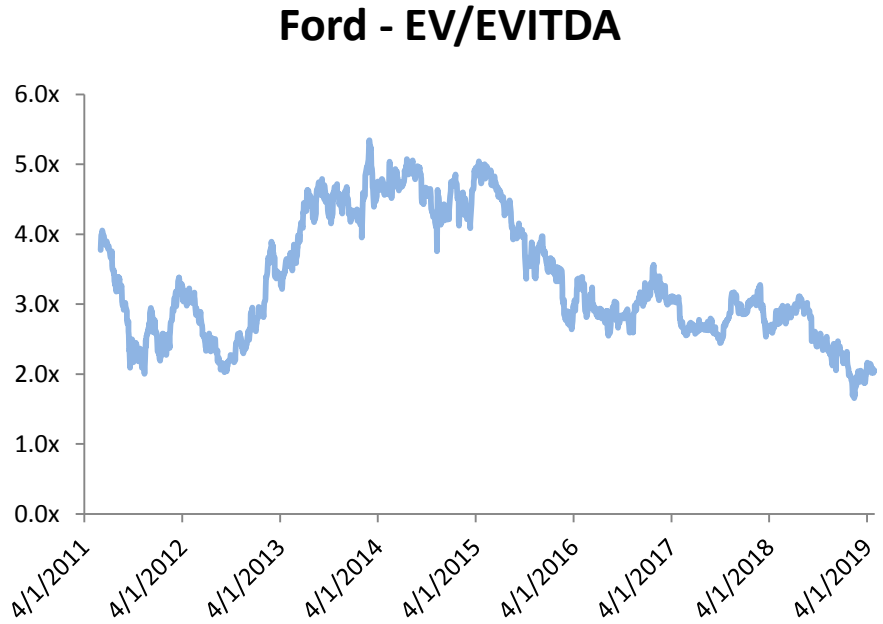


Source: Morgan Stanley Research, Bloomberg

Example OEM Multiples: Ford P/E & EV/EBITDA

- Median EV/EBITDA of US OEMs is ~2x
- Median P/E of US OEMs is ~6x

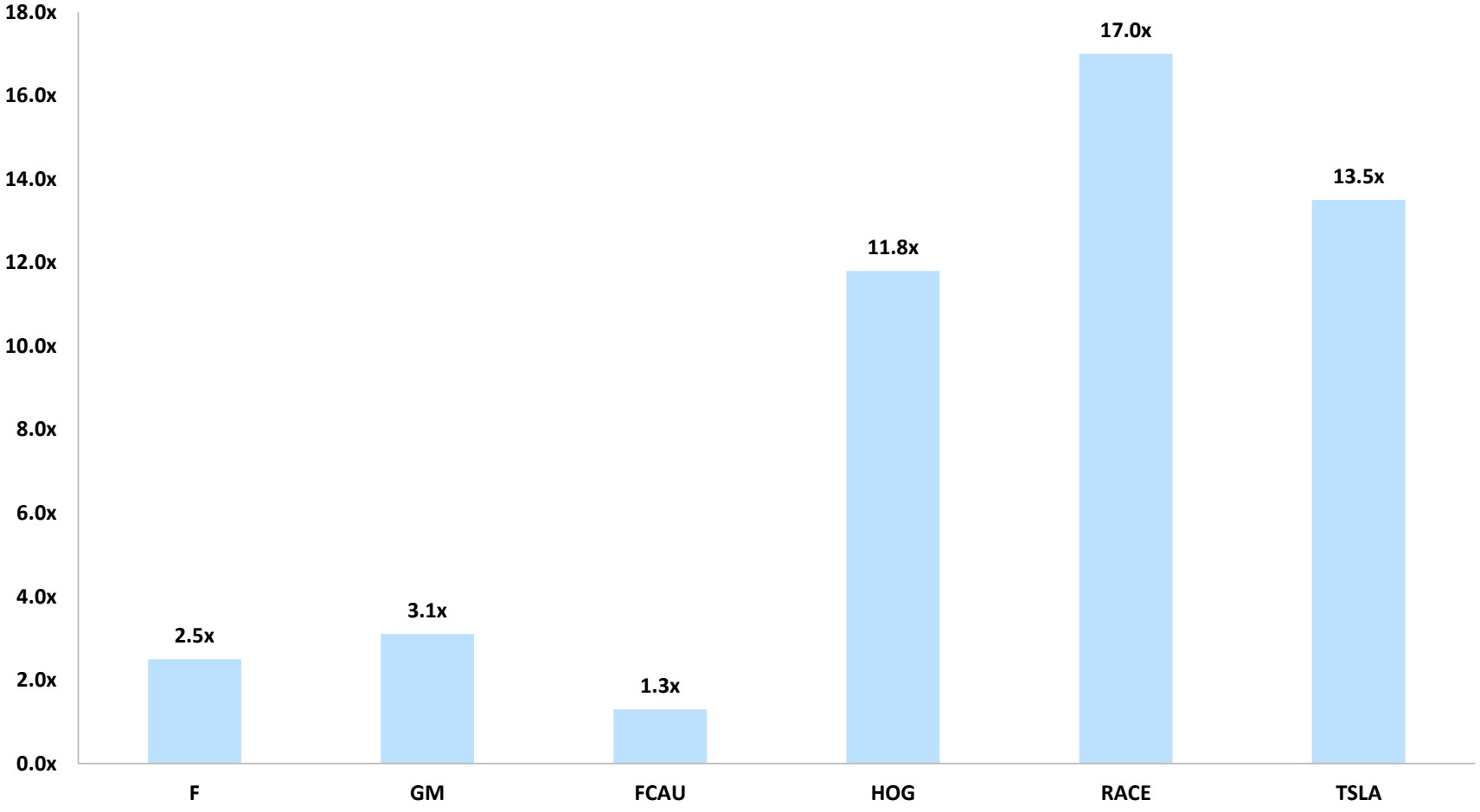




- *Note: Must exclude FinCo debt in EV calculation*

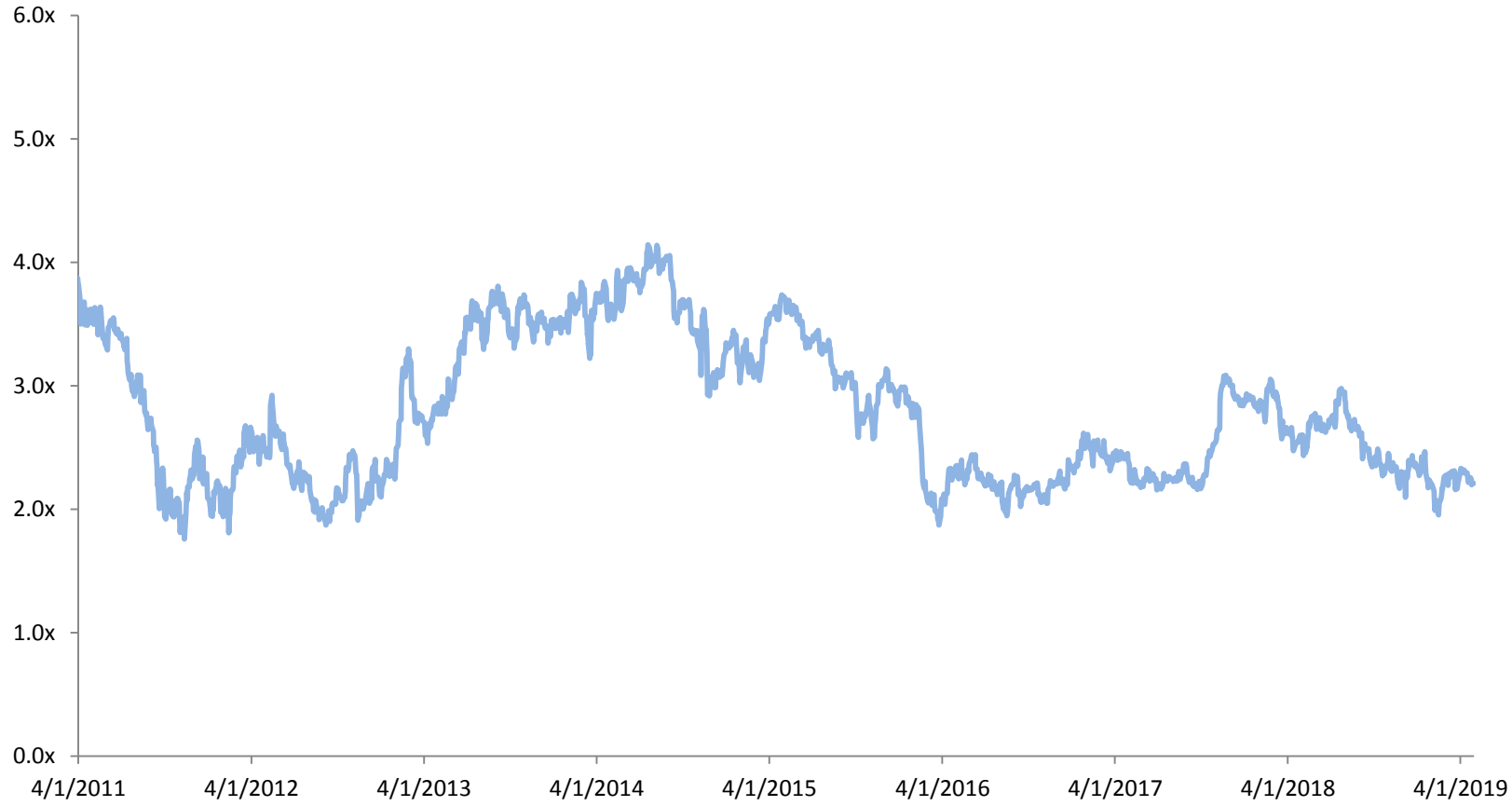
Source: Morgan Stanley Research, Bloomberg

OEM 2019E EV/EBITDA Multiples



Source: Morgan Stanley Research, Bloomberg

OEM Historical Rolling FY1 EV/EBITDA Multiple



Source: Morgan Stanley Research, Bloomberg

LBO: Harley Davidson

Sources	Amount	Percent	Rate
Cash	0	0.0%	3.000%
Equity Stakes	0	0.0%	
New Debt	5,244	70.0%	7.450%
New Equity	2,247	30.0%	
Total Sources	**7,491**	**100.0%**	

Uses	Amount	Percent	Rate
Buy Equity	7,417	99.0%	
Fees/Other	74	1.0%	1.000%
	7,491	**100.0%**	

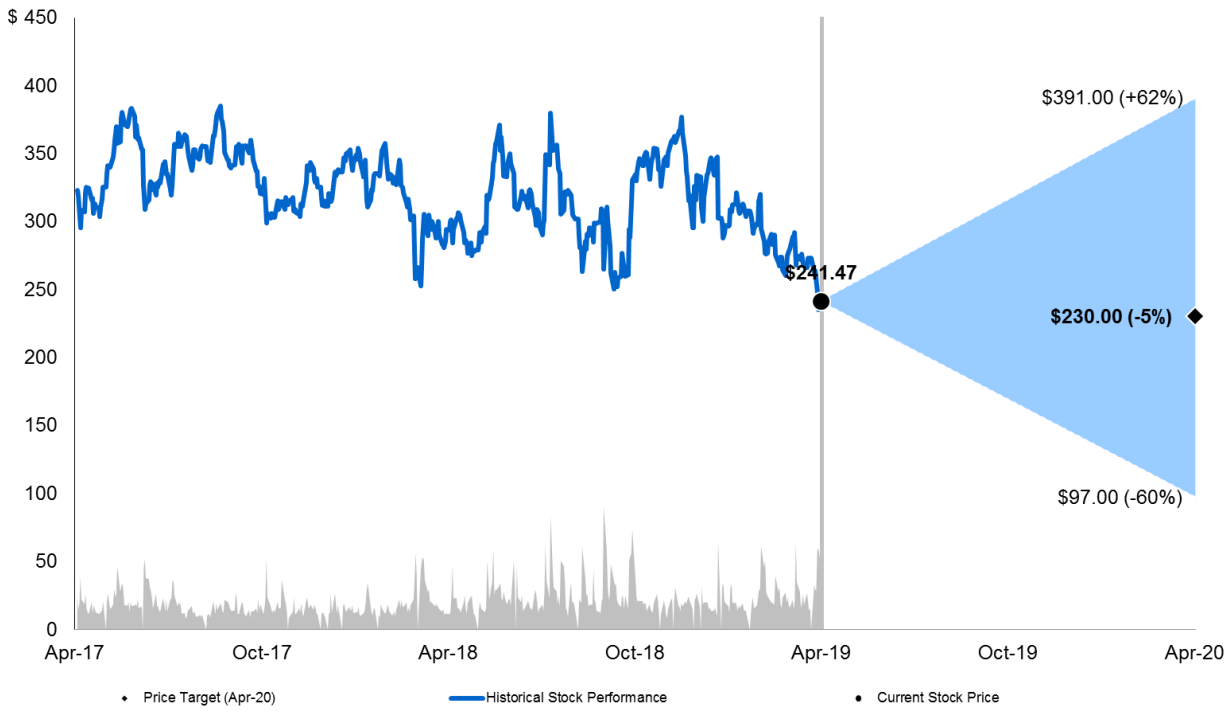
Agg. Consid. Paid	**7,417**
Current Share Price	**$37.55**
Price Paid Per Share	**$46**
Premium to Current Price	21.2%
Aggregate Consideration Multiples	
2018 EBITDA	8.5
2019 EBITDA	8.1
2018 Sales	1.4
2019 Sales	1.4

Exit EBITDA Multiple (x)	Aggregate Value	Equity Value	4-Year Returns
11.5	12,886	9,346	33%
9.5	10,645	7,105	**26%**
7.5	8,404	4,864	17%

	2018	2019	2020	2021	2022	2023	Projected 2024	2025	2026	2027	2028
FINANCIALS											
Sales	5,717	5,402	5,454	5,596	5,773	6,062	6,225	6,393	6,566	6,743	6,925
EBITDA	978	871	897	942	985	1,091	1,121	1,151	1,182	1,214	1,247
Cost Savings/Synergies	-	-	-	-	-	-	-	-	-	-	-
EBIT	714	626	674	712	748	843	865	889	913	937	963
Existing Interest Expense (Income)	31	31	31	31	31	31	31	31	31	31	31
New Interest	391	391	387	371	348	321	287	250	209	165	117
Total Gross Interest	422	422	418	402	379	352	318	281	240	196	148
Pretax Income	292	204	256	311	369	491	547	608	672	741	815
Tax Expense	70	49	61	75	89	118	131	146	161	178	196
Net Income	222	155	195	236	281	373	416	462	511	563	619
D&A	265	245	224	229	237	249	255	262	269	276	284
Chg. in Working Cap.	205	(176)	(56)	(13)	(15)	(15)	(16)	(16)	(17)	(17)	(18)
Capital Expenditures	(214)	(227)	(218)	(213)	(214)	(224)	(230)	(237)	(243)	(249)	(256)
Other	16	59	68	70	73	73	73	73	73	73	73
Free Cash Flow	494	56	212	310	362	455	498	544	593	646	702
Cash	554	554	554	554	554	554	554	554	554	554	554
Working Capital	121	297	353	365	380	395	411	428	444	461	479
Existing Corporate Debt	743	743	743	743	743	743	743	743	743	743	743
New Debt	5,244	5,188	4,976	4,665	4,304	3,849	3,351	2,807	2,214	1,568	866
Total Debt	5,987	5,931	5,719	5,408	5,046	4,592	4,094	3,550	2,957	2,311	1,609
Net Debt	5,433	5,377	5,165	4,854	4,492	4,038	3,540	2,996	2,403	1,757	1,055
Equity	2,247	2,403	2,597	2,833	3,114	3,487	3,903	4,365	4,876	5,439	6,059
Total Capitalization	8,234	8,333	8,316	8,241	8,160	8,079	7,997	7,915	7,833	7,750	7,667
CREDIT STATISTICS											
EBITDA Margin	17.1	16.1	16.5	16.8	17.1	18.0	18.0	18.0	18.0	18.0	18.0
EBIT Margin	12.5	11.6	12.4	12.7	13.0	13.9	13.9	13.9	13.9	13.9	13.9
EBITDA / Interest	2.3	2.1	2.1	2.3	2.6	3.1	3.5	4.1	4.9	6.2	8.4
(EBITDA - Capex) / Interest	1.8	1.5	1.6	1.8	2.0	2.5	2.8	3.3	3.9	4.9	6.7
(EBITDA - Capex - W/C)/ Interest	2.3	1.1	1.5	1.8	2.0	2.4	2.8	3.2	3.8	4.8	6.6
EBIT / Interest	1.7	1.5	1.6	1.8	2.0	2.4	2.7	3.2	3.8	4.8	6.5
Free Cash Flow / Debt (%)	8.3	0.9	3.7	5.7	7.2	9.9	12.2	15.3	20.1	28.0	43.6
Net Debt / EBITDA (x)	6.2	6.2	5.8	5.2	4.6	3.7	3.2	2.6	2.0	1.4	0.8
Net Debt / Book Cap (%)	66.0	64.5	62.1	58.9	55.1	50.0	44.3	37.9	30.7	22.7	13.8

Source: Morgan Stanley Research, Company Reports

DCF: Tesla



Bull Case	
Tesla Auto (Core)	$278
Tesla Mobility	$83
Tesla Energy	$16
SCTY Value	$14
Total	$391

Base Case	
Tesla Auto (Core)	$185
Tesla Mobility	$45
Tesla Energy	$0
SCTY Value	$0
Total	$230

Bear Case	
Tesla Auto (Core)	$97
Tesla Mobility	$0
Tesla Energy	$0
SCTY Value	$0
Total	$97

Source: Morgan Stanley Research, Bloomberg

Select Comps: Autos OEMs

Company	Currency	Price at 30-Apr	MS Price Target	Upside to PT (%)	MS Rating	Market Cap LC	Market Cap US$	MS EPS 2019e	MS EPS 2020e	Consensus EPS 2019e	Consensus EPS 2020e	Dividend Yield	P / E 2019e	P / E 2020e	EV / EBITDA [3] 2019e	EV / EBITDA [3] 2020e	EV / Sales [3] 2019e	EV / Sales [3] 2020e	P / B 2019e	P / B 2020e
Europe [1]																				
Volkswagen	EUR	155.76	170.00	9%	EW	79.3	88.4	26.15	25.45	27.64	28.83	2.5%	6.0x	6.1x	1.5x	1.4x	0.2x	0.2x	0.6x	0.6x
Daimler	EUR	58.30	60.00	3%	OW	62.4	69.5	7.32	6.96	7.64	7.72	5.0%	8.0x	8.4x	2.9x	2.8x	0.3x	0.3x	0.7x	0.7x
BMW	EUR	76.20	75.00	(2%)	EW	45.9	51.1	8.99	8.44	9.32	10.03	4.6%	8.5x	9.0x	2.4x	2.5x	0.3x	0.3x	0.8x	0.8x
Renault	EUR	60.91	75.00	23%	OW	18.0	20.1	13.67	12.68	12.86	13.54	6.0%	4.5x	4.8x	0.8x	0.8x	0.1x	0.1x	0.5x	0.5x
PSA Peugeot	EUR	23.27	16.00	(31%)	UW	21.1	23.5	3.26	3.00	3.76	4.00	2.3%	7.1x	7.8x	1.8x	1.9x	0.2x	0.2x	1.2x	1.1x
Europe Weighted Average												3.9%	7.0x	7.4x	2.0x	2.0x	0.2x	0.2x	0.7x	0.7x
North America																				
General Motors	USD	39.67	44.00	11%	OW	56.4	56.4	6.05	4.79	6.54	6.30	3.9%	6.6x	8.3x	3.1x	3.3x	0.3x	0.3x	1.1x	0.9x
Ford Motor	USD	10.44	10.00	(4%)	EW	40.8	40.8	0.95	0.72	1.24	1.36	6.4%	10.9x	14.5x	2.5x	2.8x	0.2x	0.2x	1.1x	1.1x
FCA	EUR	13.86	21.00	52%	OW	21.5	23.9	2.74	2.58	2.82	3.16	4.7%	5.1x	5.4x	1.3x	1.2x	0.1x	0.1x	0.8x	0.7x
North America Weighted Average												4.9%	7.7x	9.8x	2.5x	2.7x	0.3x	0.2x	1.0x	0.9x
China																				
SAIC Motor	CNY	26.58	30.00	13%	EW	310.5	46.1	3.06	3.17	3.18	3.41	6.7%	8.7x	8.4x	7.2x	6.7x	0.3x	0.2x	1.2x	1.2x
Geely	HKD	16.04	8.00	(50%)	UW	145.6	18.6	1.28	1.23	1.48	1.67	2.2%	12.5x	13.0x	6.0x	5.7x	1.0x	1.0x	2.3x	2.0x
BYD	HKD	53.50	30.00	(44%)	UW	49.0	6.2	1.11	1.12	1.34	1.53	0.7%	48.1x	48.0x	10.6x	9.8x	1.4x	1.3x	2.1x	2.1x
Sinotruk	HKD	17.04	9.00	(47%)	UW	47.0	6.0	0.89	0.76	1.51	1.53	4.1%	19.2x	22.3x	7.1x	7.7x	0.6x	0.7x	1.6x	1.5x
Brilliance	HKD	8.72	12.00	38%	OW	44.0	5.6	1.32	1.40	1.38	1.56	1.3%	6.6x	6.2x	6.1x	5.7x	6.7x	6.5x	0.9x	0.8x
Zhengzhou Yutong Bus C	CNY	14.42	12.50	(13%)	EW	31.9	4.7	0.99	1.01	1.11	1.17	3.2%	14.6x	14.3x	9.2x	8.6x	1.0x	0.9x	1.8x	1.7x
Weichai Power	HKD	12.90	8.10	(37%)	UW	25.1	3.2	0.70	0.62	1.05	1.10	4.0%	18.3x	21.0x	4.9x	4.6x	0.7x	0.7x	2.1x	2.0x
Dongfeng	HKD	7.63	10.50	38%	OW	21.8	2.8	1.57	1.67	1.57	1.58	5.4%	4.9x	4.6x	1.0x	0.4x	0.2x	0.1x	0.4x	0.4x
FAW Car Company	CNY	10.72	7.00	(35%)	UW	17.4	2.6	0.15	0.33	0.15	0.33	0.2%	73.9x	32.5x	15.0x	11.4x	0.6x	0.5x	2.2x	2.1x
Great Wall	HKD	6.50	6.00	(8%)	EW	20.1	2.6	0.64	0.68	0.57	0.62	3.2%	10.1x	9.5x	8.9x	8.2x	0.9x	0.9x	0.9x	0.8x
Guangzhou	HKD	8.80	12.00	36%	OW	27.3	3.5	1.42	1.56	1.18	1.31	5.6%	6.2x	5.6x	7.4x	6.0x	0.9x	0.7x	0.7x	0.7x
Anhui Jianghuai	CNY	6.27	5.00	(20%)	UW	11.9	1.8	0.77	1.08	0.25	0.38	1.1%	8.2x	5.8x	0.9x	NM	0.0x	NM	0.7x	0.6x
BAIC Motor	HKD	5.60	8.00	43%	OW	14.1	1.8	0.75	0.92	0.74	0.85	2.1%	7.5x	6.1x	1.5x	1.2x	0.3x	0.2x	0.8x	0.7x
Chongqing Changan	HKD	4.27	6.00	41%	OW	3.9	0.5	0.85	0.91	0.82	0.52	N/A	5.0x	4.7x	1.5x	0.7x	0.1x	0.1x	0.3x	0.3x
Jiangling Motors	HKD	9.93	8.00	(19%)	UW	3.4	0.4	0.57	0.35	0.63	0.70	N/A	17.4x	28.1x	8.5x	9.8x	0.3x	0.3x	0.6x	0.7x
China Weighted Average												4.4%	14.1x	13.2x	7.0x	6.6x	0.9x	0.9x	1.5x	1.4x

Source: Refinitiv, Morgan Stanley Research

Cyclicality Issues and Constraints

Points to keep in mind on autos valuation:

- Auto stocks are extremely **cyclical**
- Buy when the stock seems “expensive”, **sell when “cheap”**
- Autos are in a **phase of disruption** with Electric Vehicles, Autonomous Vehicles, Shared Mobility etc.
- Auto stocks are **prone to restructuring** and negative EPS…leads to valuation on EV/EBITDA and if EBITDA is negative, Price/Sales

SECTION 7: OTHER

US Sector Risks

1. The US Cycle is nearly 10 years old
2. China is moving from a source of demand, to supply
3. Used car values at all-time highs
4. Peak Truck?
5. Secular headwinds from EVs, SVs, and AVs

Source: Morgan Stanley Research

US Sector Opportunities

1. Cost reductions from restructuring
2. Cost reductions from collaboration and M&A
3. Cost reduction from re-design/de-complexification
4. Spin-off/carve-outs of key brands to tech
5. Ownership and monetization of data/subscription model

Source: Morgan Stanley Research

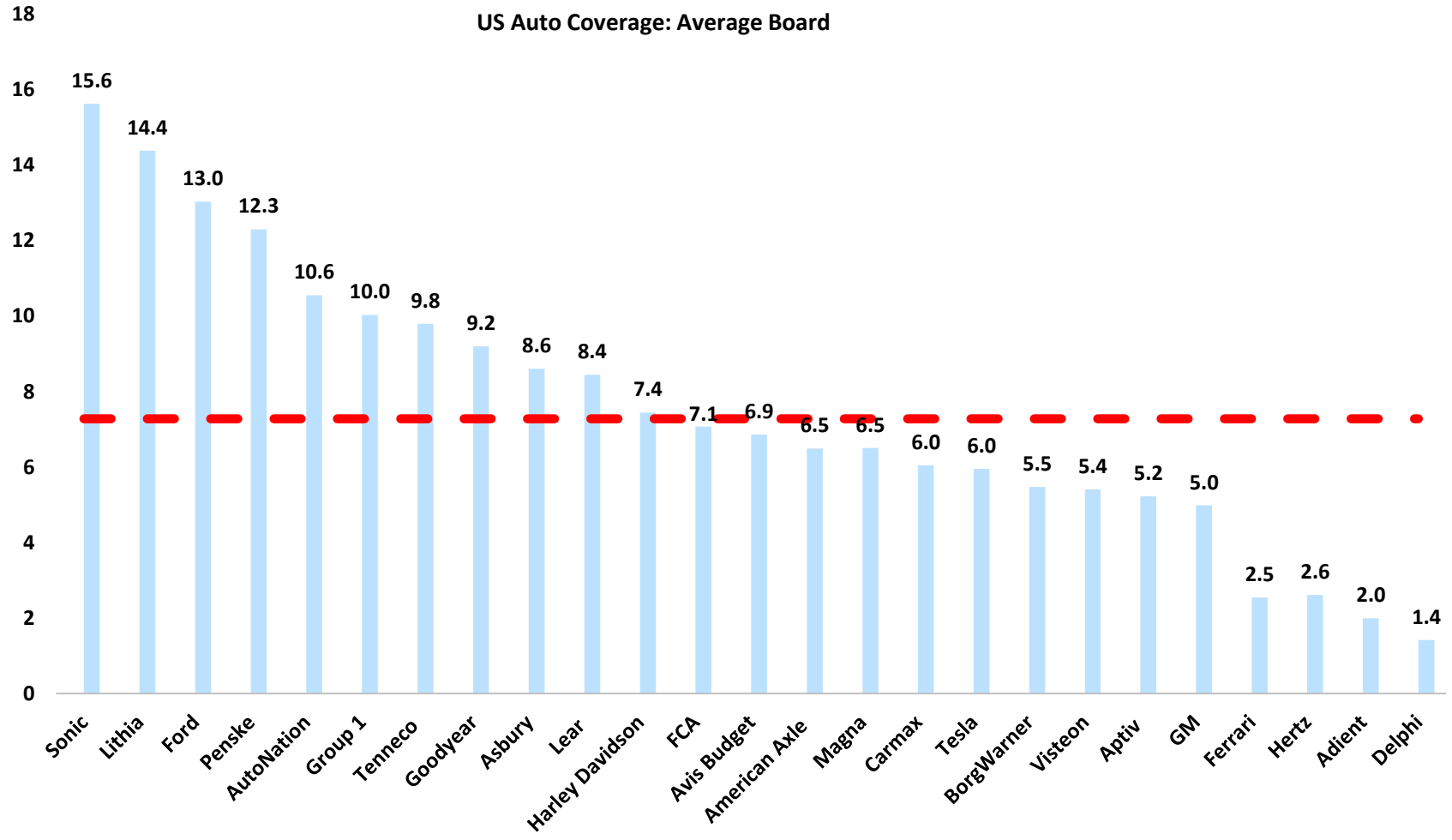
Cash Flow Considerations

Many factors impact earnings quality in autos:

- **Capex/D&A ratio** (typically well over 110%)
- **Working capital** swings (negative trade cycle)
- **Pension accounting** (return on plan assets vs actual, interest vs service cost)
- **Equity affiliate earnings** (China JV income Vs dividends)
- **Restructuring** items vs. cash out
- **Deferred tax** assets/NOLs

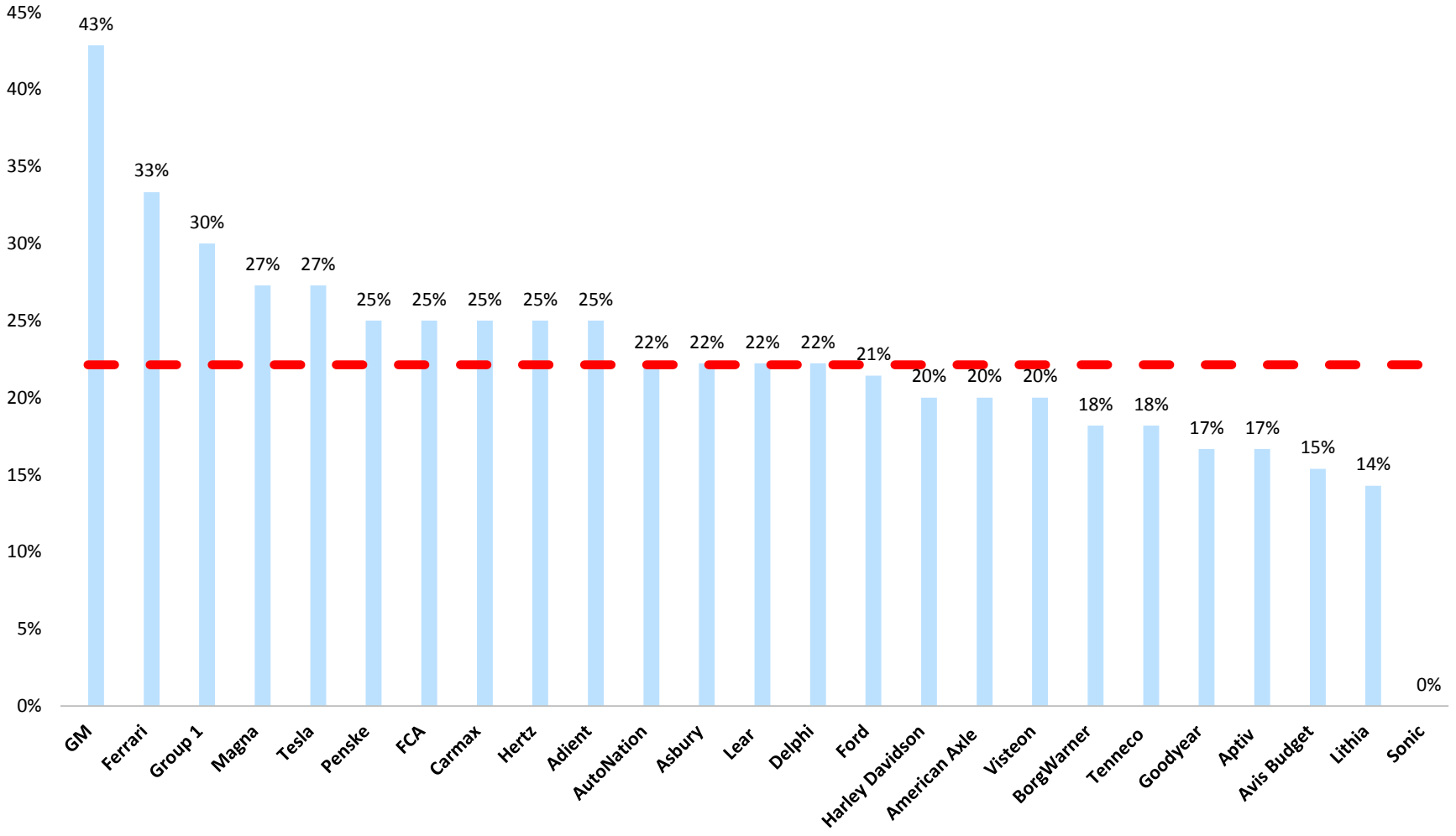
Source: Morgan Stanley Research

Other Considerations: The Board



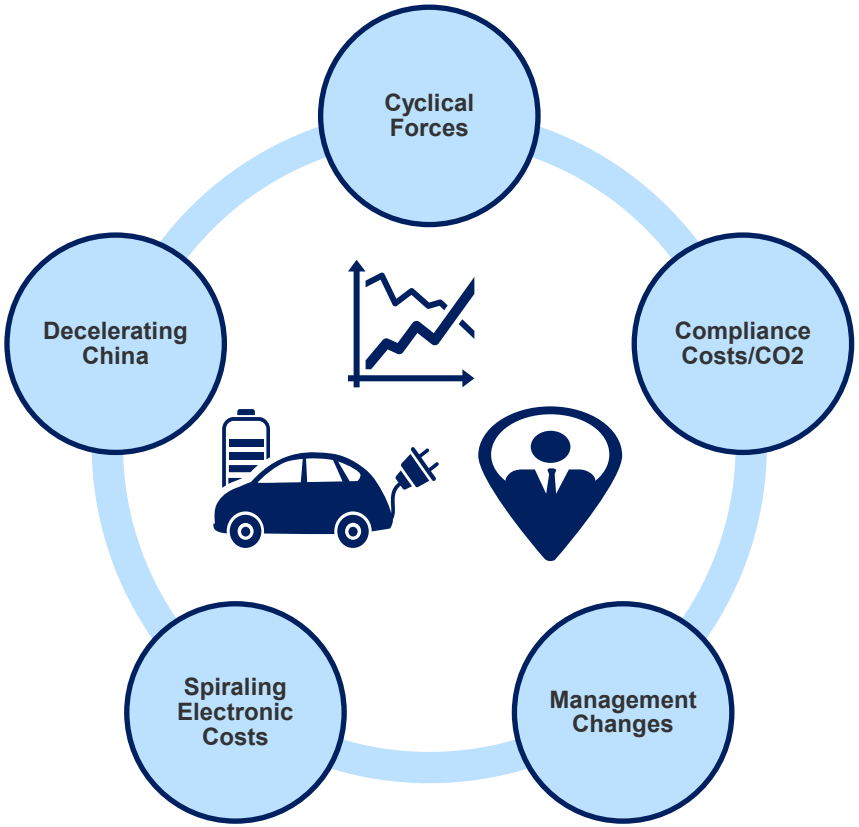
Source: Morgan Stanley Research Note: Last updated Jan. 2019

US Auto Coverage: Women as % of Board



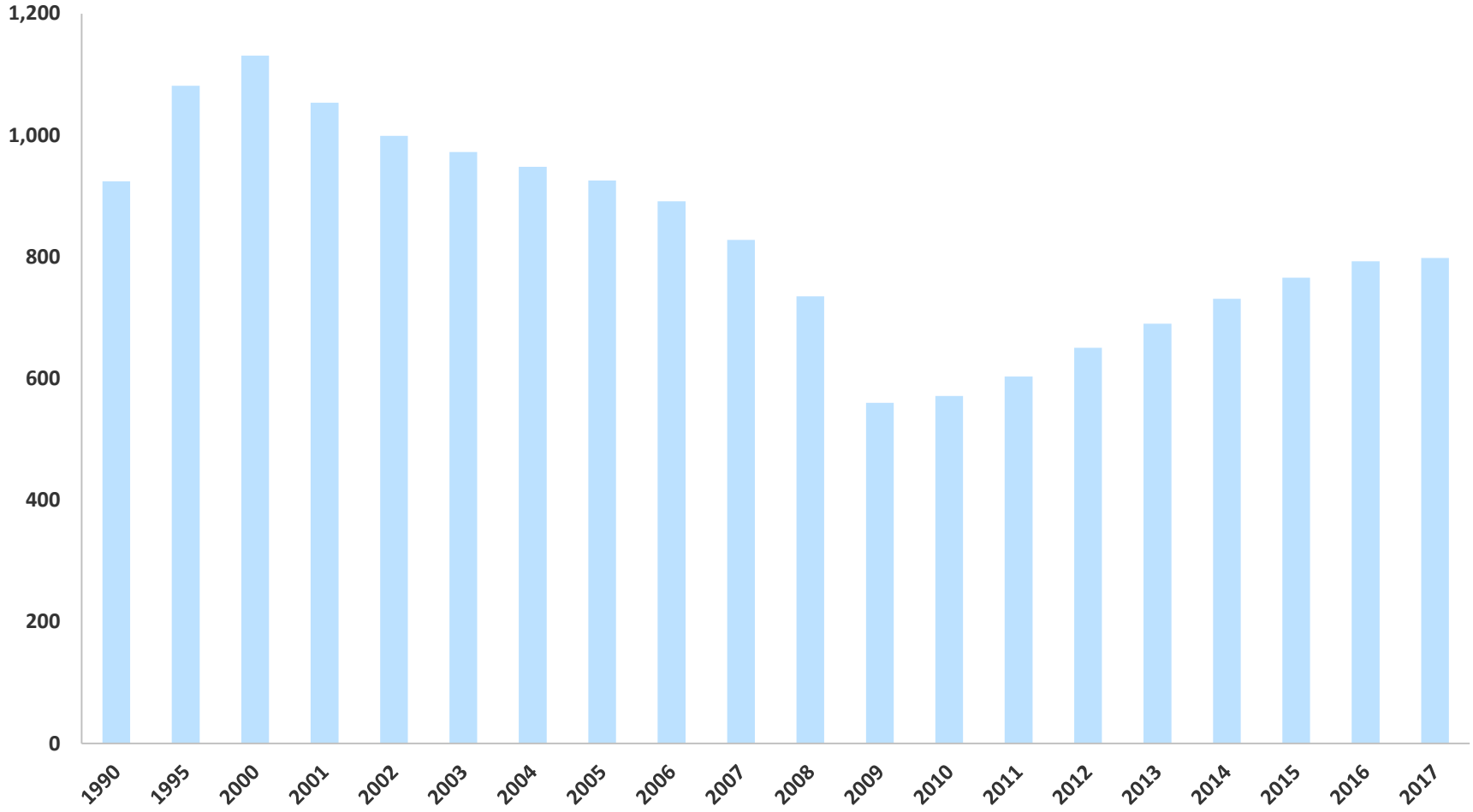
Source: Morgan Stanley Research Note: Last updated Jan. 2019

Other Considerations: M&A, Partnerships



Source: Morgan Stanley Research

Total Employees Motor Vehicles and Parts (000s)



Source: US Department of Labor, Bureau of Labor Statistics, Current Employment Statistics, Morgan Stanley Research

Global OEM Partnerships

FCA FIAT CHRYSLER AUTOMOBILES
TESLA

JAC MOTORS

DAIMLER

DAIMLER
GEELY

Panasonic
TOYOTA



Ford

Ford
Mahindra

HONDA
GENERAL MOTORS

Panasonic
TESLA

Source: Morgan Stanley Research

Other Considerations: Politics & Labor

- *Autos employs > 10 million people globally*
- *USA, Canada, EU, Brazil, Japan, Korea have unionized labor*
- *Cost to cut job = **$100/k/worker** in mature markets*
- *EVs require 30%+ less labor Vs ICE*

Source: Morgan Stanley Research

Other Considerations: Family Ownership

Many large auto companies are family controlled entities.

- *Ford (Family has 2% of capital, 40% of votes)*
- *FCA (Agnelli family/Exor controls the company)*
- *Tesla (Musk)*
- *BMW, PSA, VW are family controlled*
- *Renault (French State)*
- *Toyota (Akio Toyoda)*

Source: Morgan Stanley Research

Key Sector + Stock Calls

1. We are cautious on US Autos
2. We prefer OEMs to suppliers
3. FCA is our top OEM, AXL is our top supplier
4. We're just beginning to see what happens when the China strategy stops growing
5. Stocks will move on central bank and China trade policy

A Policy Driven Auto Cycle

Source: Morgan Stanley Research

Key Sector + Stock Calls

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A Policy Driven Auto Cycle

Source: Morgan Stanley Research

In Case You Missed It



Global
Urban Air Mobility: Flying Cars: Investment Implications of Autonomous Urban Air Mobility
December 2, 2018



North America
Space: Investment Implications of the Final Frontier
October 12, 2017



Global
Autos & Shared Mobility, Global Telcos, Tech, SRI: Autonomous Cars & Telcos: We're gonna need a bigger (5G) Pipe
May 7, 2018



Global
Autos & Shared Mobility: Autonomous Driving: Who Is Best Positioned to Monetize the Content Opportunity?
October 3, 2018

Morgan Stanley

FOUNDATION

May 2019

Industrials Spring Training Teach-In

Freight Transportation

MORGAN STANLEY RESEARCH

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For analyst certification and other important disclosures, refer to the Disclosure Section, located at the end of this report.

Stock recommendations and disclosures in this report are as of May 3, 2019; stock prices as of April 30, 2019, unless otherwise noted.

Freight Transportation Overview

Ravi Shanker Coverage Universe

Rails

Canadian National Railway Co. (CNR)
Canadian Pacific Railway Co. (CP)
CSX Corporation (CSX)
Kansas City Southern (KSU)
Norfolk Southern Corp. (NSC)
Union Pacific Corp. (UNP)
Genesee & Wyoming Inc. (GWR)

Logistics

C.H. Robinson Worldwide Inc. (CHRW)
Echo Global Logistics Inc (ECHO)
Expeditors International of Washington (EXPD)
Hub Group Inc (HUBG)
J.B. Hunt Transport Services Inc. (JBHT)
Landstar System Inc (LSTR)
XPO Logistics, Inc. (XPO)

Parcel / Airfreight

FedEx Corporation (FDX)
United Parcel Service (UPS)

Less-Than-Truckload

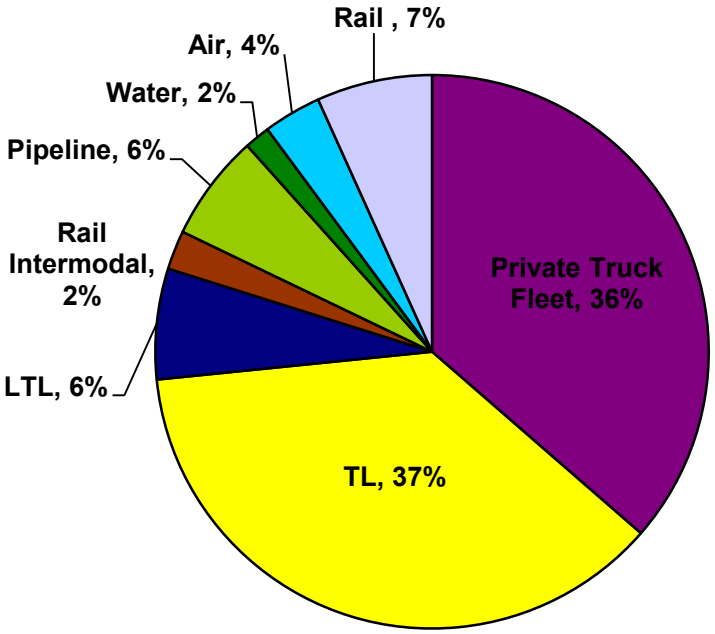
ArcBest Corp (ARCB)
Old Dominion Freight Line Inc (ODFL)
Saia, Inc. (SAIA)

Truckload

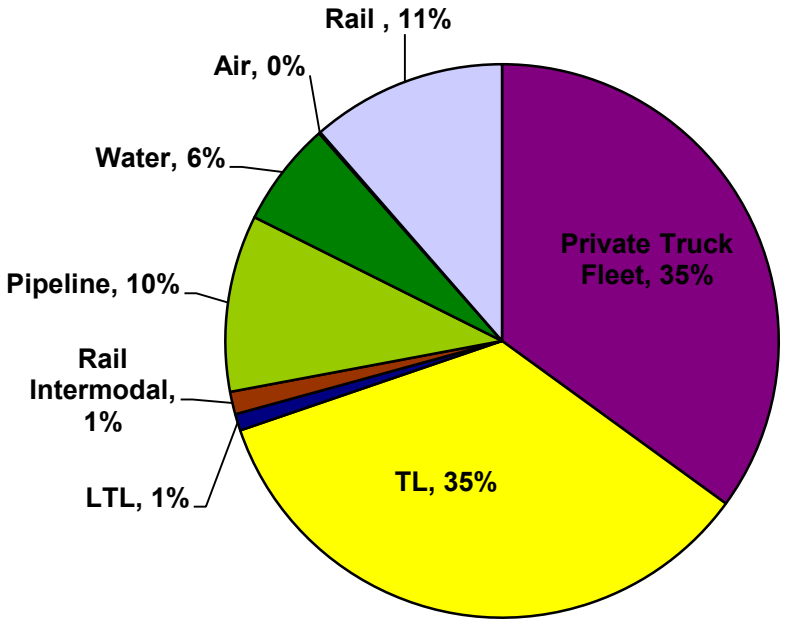
Heartland Express Inc. (HTLD)
Schneider National (SNDR)
Werner Enterprises (WERN)
Knight Transportation Inc. (KNX)
U.S. Xpress Enterprises Inc. (USX)

Domestic Freight Transportation Market Size

Domestic Freight Transportation Market by Revenue (~$900B in Total)



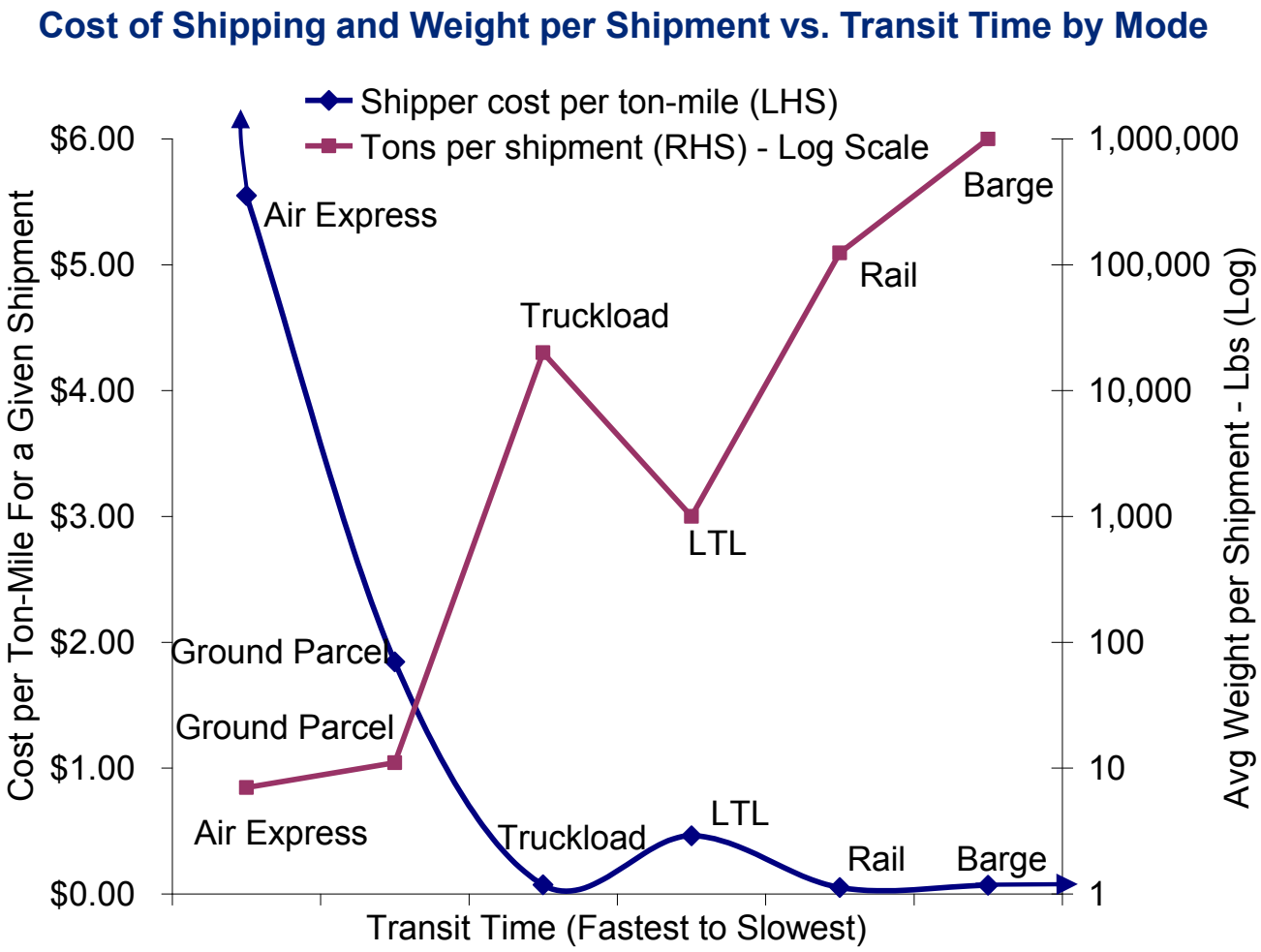
Domestic Freight Transportation Market by Volume (~15B tons in Total)



The US freight transportation market is ~$800-1,000B in total revenue, with truck accounting for ~80% of the market share

Source: Morgan Stanley Research; ATA US Freight Transportation Forecast to 2028; **Note:** Data as of 2017

Distance, Cost, and Time to Deliver



Source: Morgan Stanley Research; Note: Ton-Miles based on company disclosures; Barge ton-miles may include backhaul

Rail Industry Key Characteristics

Competition / Industry Structure

- 8 Large Rails in North America in 4 major regions; BNSF (owned by Berkshire Hathaway) and UNP in the west, CNR and CP in Canada, CSX and NSC in the east, KSU and Ferromex in Mexico
- Significant barriers to entry (irreplaceable networks built 100+ years ago)

Revenue

- Over 50% of Class I rail traffic is comprised of economically sensitive traffic (merchandise/IM)
- Industry is concentrated and has a relatively inelastic customer base
- When fuel prices fall / rise, surcharges pass them through with a 2-month lag

Cost / Margin

- Low cost mode relative to closest surface modal competitor (trucks); more fuel efficient than truck or parcel
- Some ability to take out cost in real time but still a high fixed cost business

Capital Needs

- Asset heavy with capex averaging ~17% of revenue for the last 20 years
- Maintenance capex remains high, growth capex now diverging amongst the Rails

Cycle Dynamics

- Majority of Class I traffic is economically sensitive freight, thus overall demand is highly correlated to US / global business cycles
- Pricing power has given rails a secular edge over the last 10 years – but we see this as an area of debate going forward

Source: Morgan Stanley Research

Truckload (TL) Industry Key Characteristics

Competition / Industry Structure

- Highly fragmented market (100,000+ carriers) with low barriers to entry and exit
- 96% of carriers have 20 or fewer trucks. Publicly traded carriers operate only ~10% of industry fleet when measured in tractors

Revenue

- Due to significant competition within this fragmented market, carriers have little-to-no control over pricing (i.e., they are price takers)
- Higher exposure to consumer goods over industrials

Cost / Margin

- Most costs for TLs are incurred on a per mile basis. Regulation and industry changes driving both pricing power and cost inflation for the industry
- Mid-teens EBIT margin quite good for a relatively defensive high variable cost structure

Capital Needs

- TL carriers have relatively low capital needs (mainly tractors / trailers) as compared to other transport verticals; TLs ride mainly on public infrastructure (highways)
- Terminals and other operating facilities are a small percentage of plant, property & equipment on a TL carrier's balance sheets

Cycle Dynamics

- Tonnage tends to mirror the US business cycles
- The highly variable cost structure and higher consumer exposure makes them more defensive in a downcycle

Source: Morgan Stanley Research

Less-Than-Truckload (LTL) Industry Key Characteristics

Competition / Industry Structure	■ More concentrated competition than TL; market consists of 5-7 large carriers and smaller carriers continue to consolidate ■ High capital investment for terminal networks creates high barriers to entry
Revenue	■ More concentrated industry structure and generally poor industry ROIC helps support price discipline among LTLs, but price wars have occurred ■ After a price war in 2009/2010, LTL General Rate Increases (GRIs) have averaged at 3-6% over the past few years
Cost / Margin	■ Fixed cost networks provide mature incumbents with significant operating leverage ■ Unionized carriers with pensions exist, creating significant cost differences among carriers which can lead to irrational pricing as competitors seek to push high cost carriers out of markets
Capital Needs	■ CapEx higher than TL due to network/terminal investments ■ Real Estate a significant portion of asset base
Cycle Dynamics	■ Tonnage tends to mirror the US business cycles ■ LTLs exhibit more cyclical exposure than TL given higher fixed cost structure

Source: Morgan Stanley Research, US Census

Logistics Industry Key Characteristics

Competition / Industry Structure	■ Domestic 3PL / freight brokerage market is highly fragmented ■ Low barriers to entry, and thus very high intra-vertical competition. Most shippers use multiple 3PLs
Revenue	■ Brokers thrive in an unstable, choppy business environment. Stability is bad for business ■ Competition is growing with new entrants in multiple areas. Secular trends may also be a headwind
Cost / Margin	■ Gross margins for brokers are under pressure given increasing competition, structural supply trends and new technologies creating greater pricing transparency ■ Operating margin pressured by IT investments and will need headcount reduction for stability
Capital Needs	■ Brokers have a highly variable cost structure with minimal capex requirements (though working capital needs are high); ROIC is higher vs. other transport verticals ■ Capex is mainly spent on IT platform improvements
Cycle Dynamics	■ The highly variable cost structure leads to the resiliency of brokers' business models, and thus are considered most defensive in a downturn, though secular/structural headwinds intensifying

Source: Morgan Stanley Research

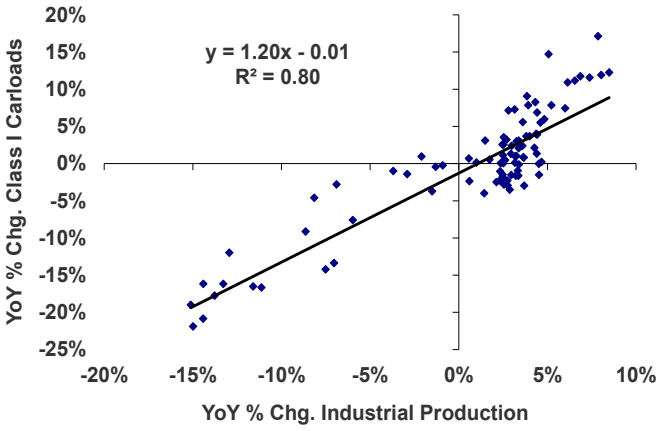
Parcel Industry Key Characteristics

Competition / Industry Structure	■ Oligopolistic Competition: a few major players dominate in each global region, especially developed markets ■ Indirect competition from last-mile start-ups and insourcing at large customers
Revenue	■ B2C is a mixed blessing – volume growth offset by negative flywheel of no pricing power yet needing high network investment
Cost / Margin	■ Trade down from premium products, mix, FX and fuel can all distort reported yield trends ■ Growth in B2C volume poses a mix challenge due to lower density and contribution per package than higher-price ground service offerings
Capital Needs	■ Asset heavy, long-lived assets, mature domestic networks limit growth capex needs ■ Air is much more capital intensive than ground, international investment are still a heavy burden ■ Capital investment is increasing due to E-commerce growth in recent years
Cycle Dynamics	■ Cycles tend to mirror US / global business cycles although parcel exhibits early cycle traits ■ Density is a key driver of profitability and returns given low marginal cost per unit

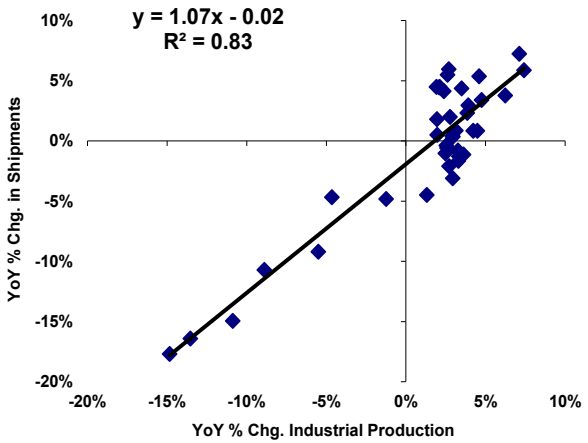
Source: Morgan Stanley Research

Demand Trends: Correlations with Industrial Production

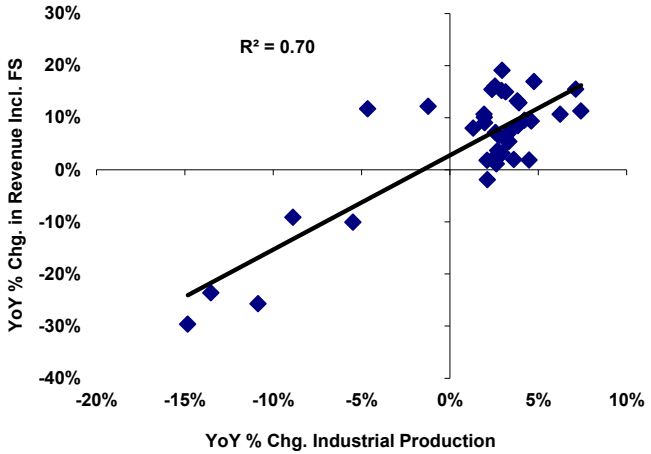
Rail Traffic – Industrial Production



Total LTL Shipments – Industrial Production



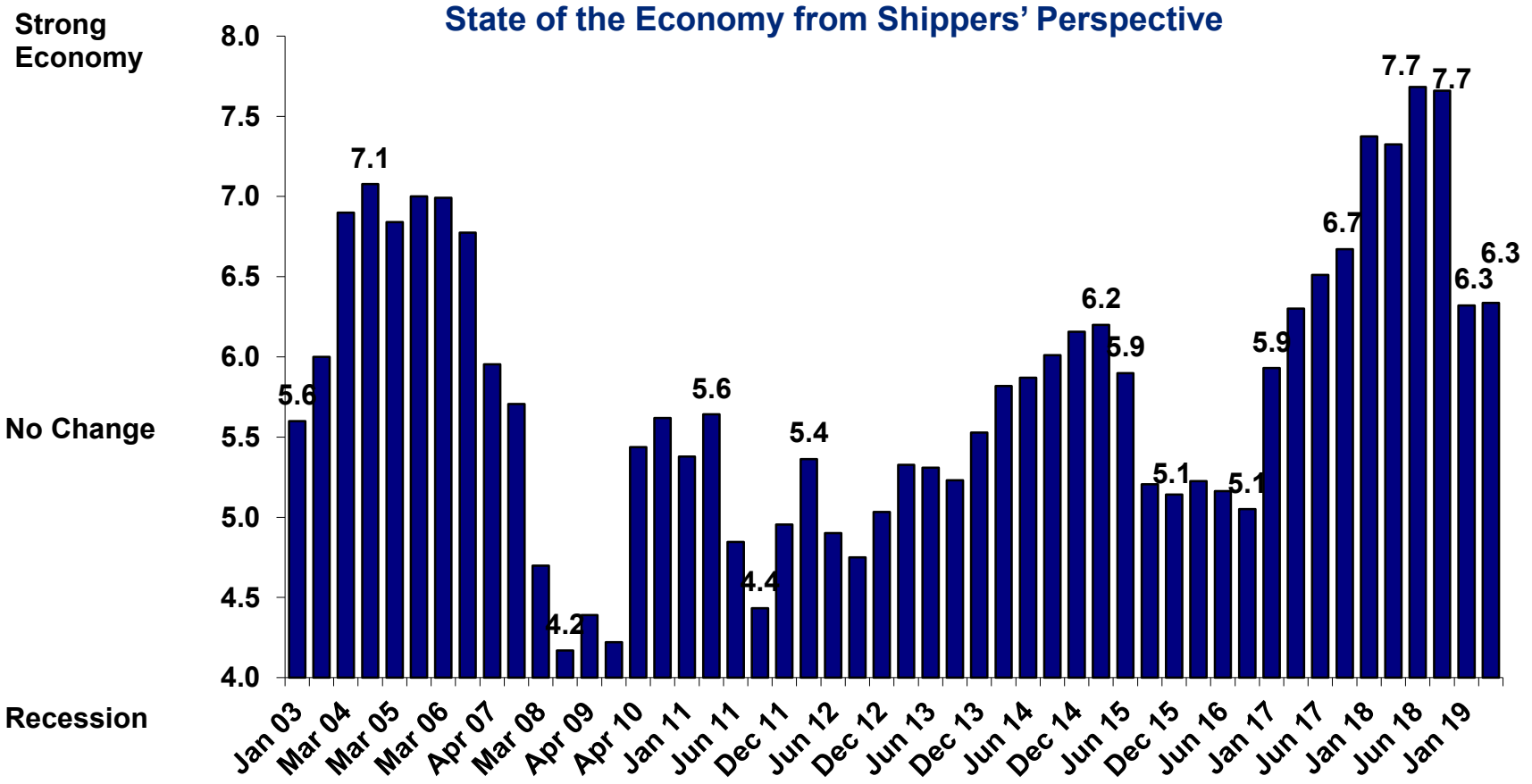
TL Revenue Incl. FS – Industrial Production



Railroad traffic, LTL shipments, and TL revenue have strong correlations with industrial production

Source: Morgan Stanley Research, AAR, Federal Reserve; Rail Correlation Note: We correlate monthly YoY growth rates in rail traffic with monthly YoY growth rates in various economic data points; in instances where economic data points are reported on a quarterly basis, we assume monthly data points are equal to the full quarter; LTL Correlation Note: Correlations based on relationship between YoY % chg. in variables (2Q05-4Q14); Total shipments include ABF Freight, CNW Freight, ODFL, FDX Freight, UPS Freight, SAIA, VTNC and YRCW (Regional & Freight); TL Correlation Note: Correlations based on relationship between YoY % chg. in variables (1Q05-4Q14) Truck revenue = JBHT+HTLD +KNX+SWFT+WERN+CGI+MRTN+USAK+CVTI+PTSI; SWFT does not provide revenue breakdown prior to 2010

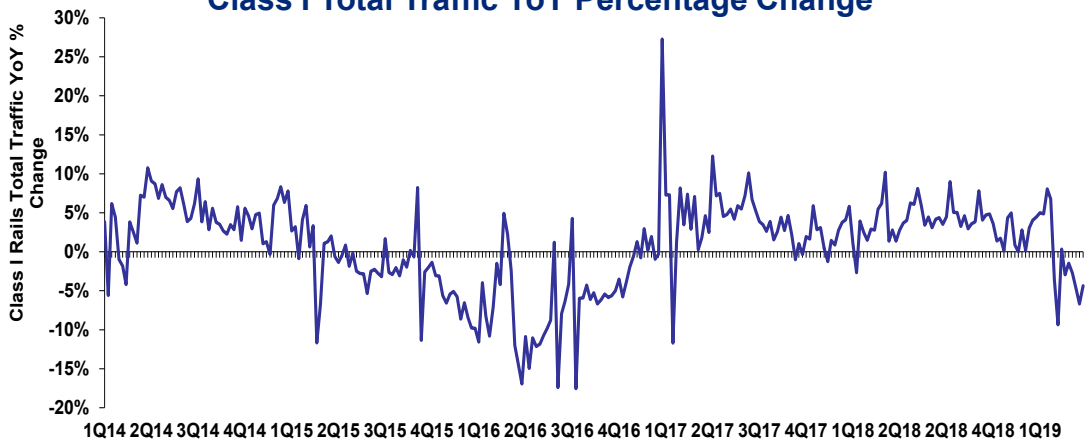
MS Shipper Survey: Shippers' Economic Outlook Remains Stable from Previous Update



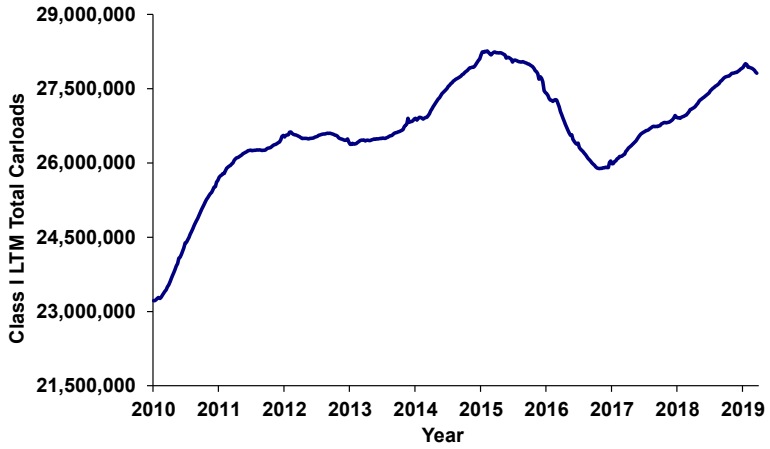
Source: Morgan Stanley Freight Pulse Surveys

Rails: Carload Data Remains Weak for Cyclical and Secular Reasons

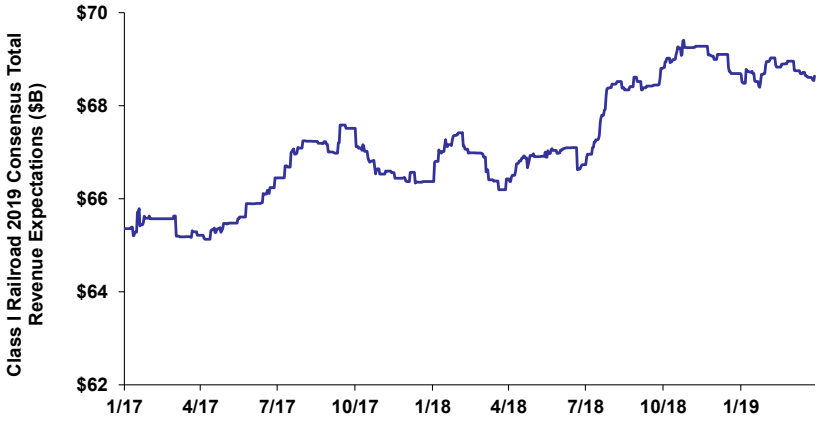
Class I Total Traffic YoY Percentage Change



Class I LTM Total Carloads



Class I Railroad 2019 Cons. Revenue Expectations ($B)

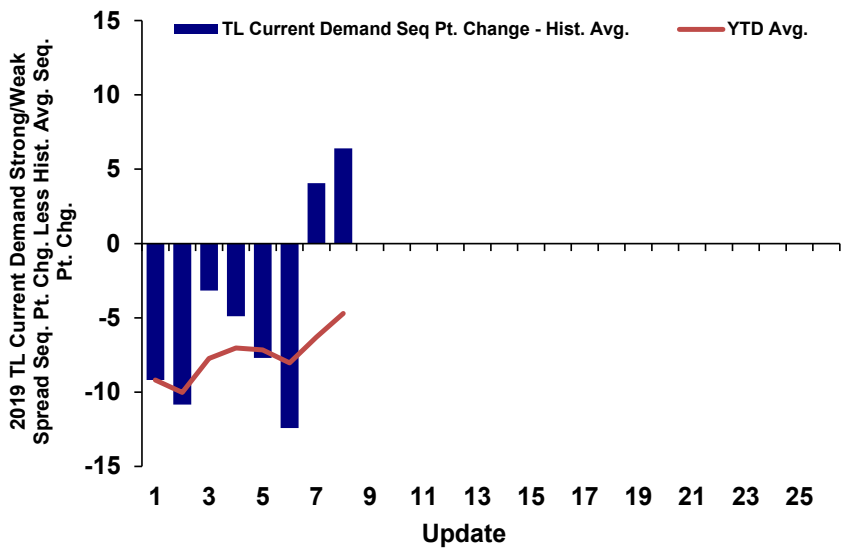


Source: Top graph: AAR; Bottom left graph: Company Data, Morgan Stanley Research Estimates; Note: We use the sum of CNR, CP, CSX, KSU, NSC, and UNP carloads to represent N.A. Class I railroads; Bottom right graph: Thomson Reuters, Morgan Stanley Research; Note: Data show the sum of consensus 2019 revenue expectations for CP, CNR, UNP, KSU, NSC, and CSX, with CNR and CP consensus revenue estimates in USD

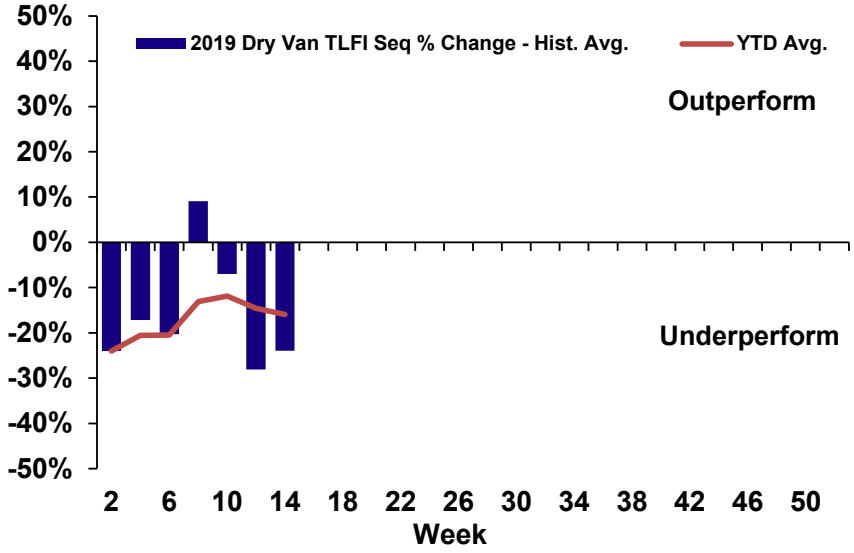
Trucking & Logistics: At a Critical Point in the Cycle

Cycle data points still weak (near freight recession lows) but potential structural tailwinds (ELD, driver shortage) should keep pricing afloat.

TLSS vs. Seasonality



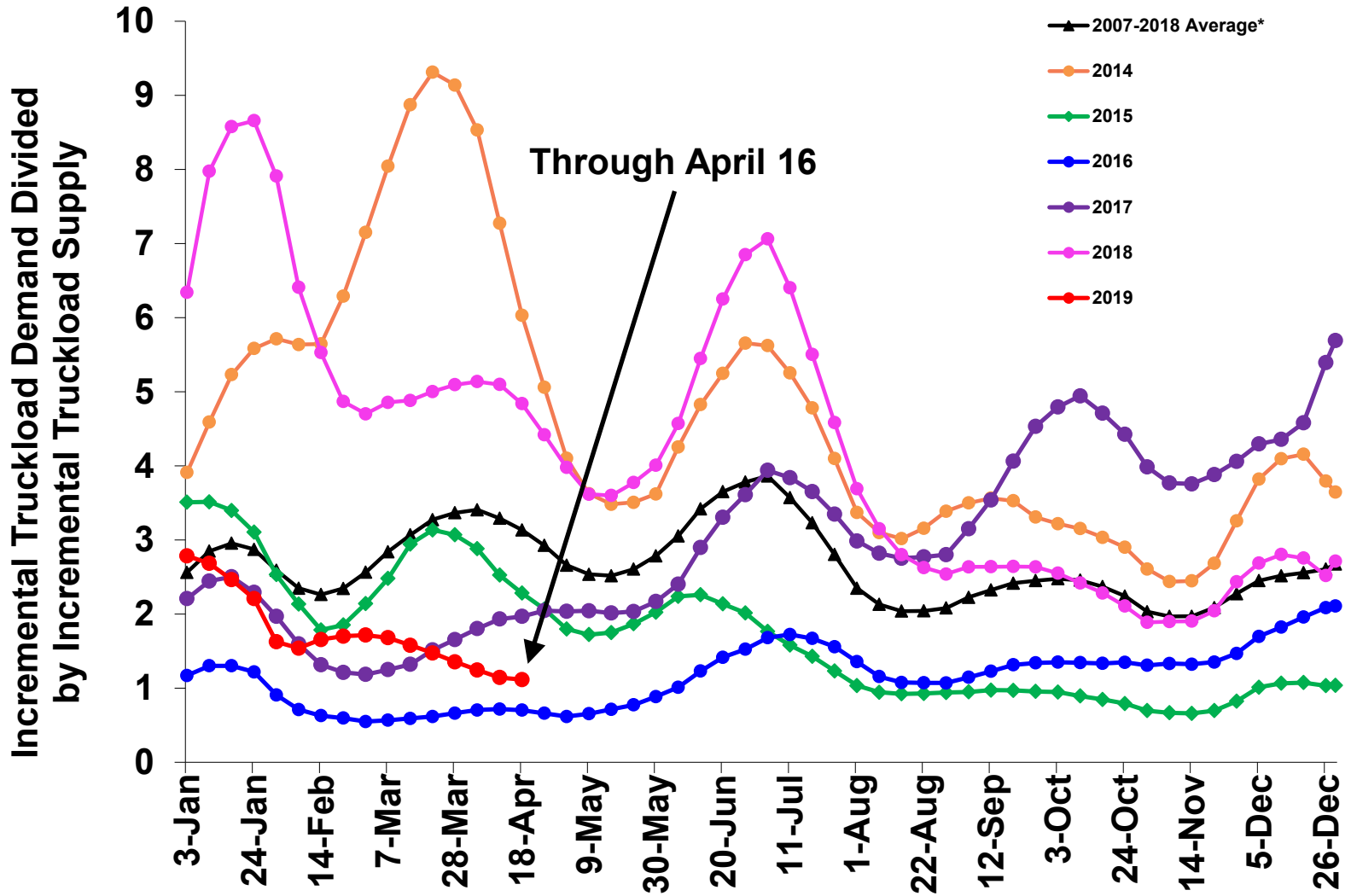
TLFI vs. Seasonality



Despite this, Trucking stocks have underperformed Transportation peers

Source: Morgan Stanley Research

Trucking & Logistics: Morgan Stanley Truckload Freight Index (TLFI)

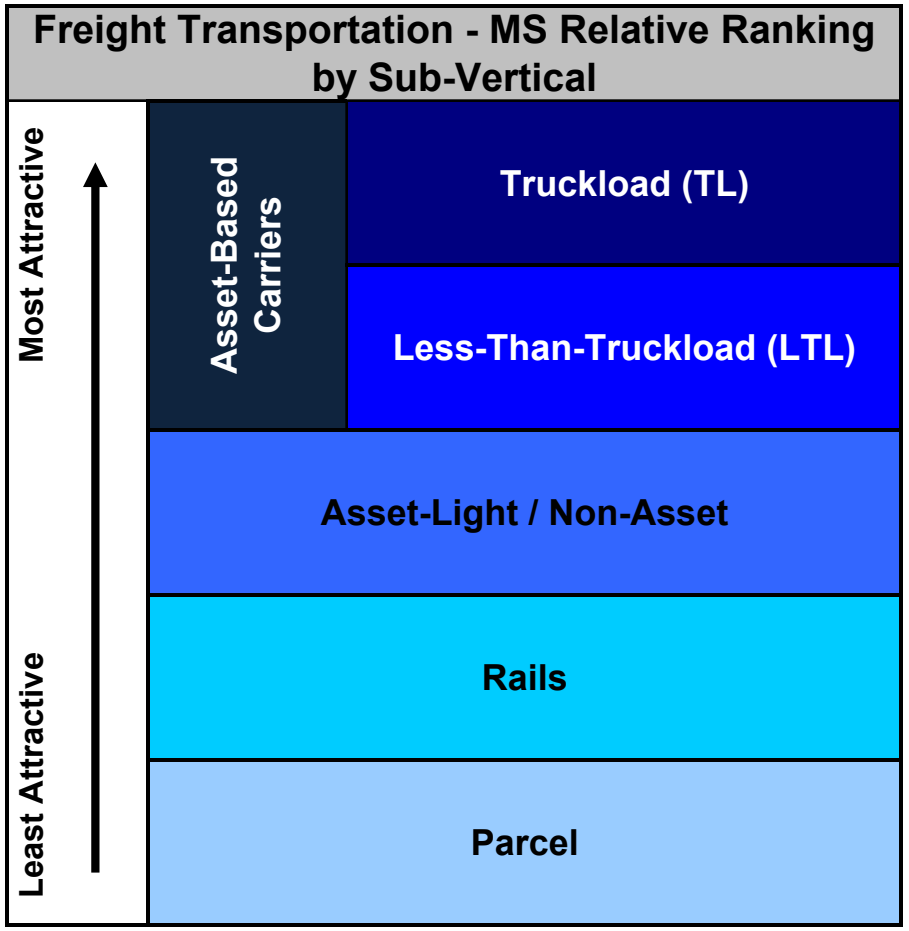


Source: Morgan Stanley Research

Freight Transportation: Our Positioning

Truckload is our favorite vertical within Freight, followed by LTL

3PL, Rail and Parcels are our least preferred verticals within Freight



Source: Morgan Stanley Research

Disruption in Freight Transportation

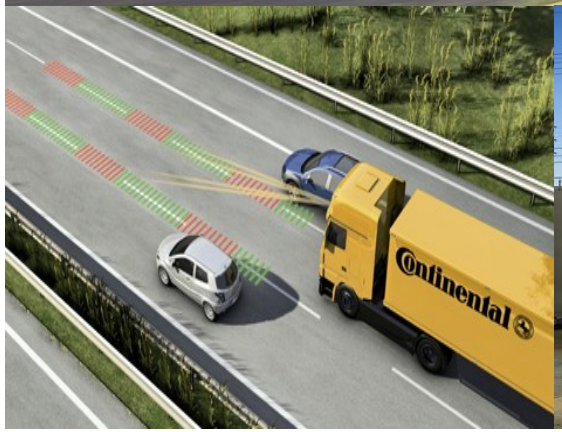
The freight transportation space is on the cusp of a generational shift driven by disruptive technologies like intelligent trucks and drones and emerging players from Silicon Valley. Change appears imminent and powerful. We explore the disruptive impact of these forces on the incumbent players and business models.

Source: Morgan Stanley Research

Trucking









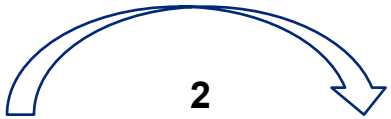


Source: Nikola, Samsung, Company Websites, https://www.tesla.com/semi, https://electrek.co/2018/08/21/vw-massive-order-all-electric-trucks/, http://www.continental-automotive.com/www/linkableblob/automotive_de_de/6774430/data/ldw_lks_uv-data.jpg, https://www.digitaltrends.com/cars/thor-trucks-electric-semi-truck/ https://www.trucks.com/2018/06/06/daimler-unveils-electric-freightliner-cascadia/, Morgan Stanley Research

Trucking: An Intelligent Revolution Is Coming

More importantly, we see new technologies collectively driving as much as a 30-50% reduction in trucking operating costs in the next 10 years

- Intelligent trucks: ADAS (advanced driver assistance systems), platooning and autonomous driving
- Fuel efficiency regulation
- Fleet management systems



Phase	1	2	3	4	5
	ADAS (YOU ARE HERE)	Platooning	Autonomous Platoons	Autonomous + Electric Platoons	Fully Autonomous + EV
Autonomous Level	1/2	3	4	4	5
Timing of Implementation	Immediate	2018	2020	2020	2025 - 2030
Implementation Cost	$150-500 per truck	$500-1000 up front	$10,000 per truck	$30,000 per truck	$20,000 per truck (net of cab cost reductions)
Benefits	• 30-50% Insurance Savings	• 5-15% fuel efficiency improvement	• 30-50% overall op. cost reduction • 2x productivity • Industry consolidation	• 60-70% overall op. cost reduction • 2x productivity • Industry consolidation	• 80% op. cost reduction • 2x productivity • Industry consolidation • Savings are easier to achieve
Payback Period	~2 months	~1 month	~3 months	~5 months	~4 months

Source: Morgan Stanley Research Estimates; Note: Please see Debate 1 in *Trucking & Logistics: An Intelligent Revolution is Coming* report for calculations and assumptions on intelligent truck technology; Payback period calculation is based on after-tax cost savings using WERN financials.

We have seen many developments in the past year that reinforce the timeline

Daimler is delivering a fleet of all-electric trucks to Lisbon

Volkswagen Gets Order For 1,600 Electric Truck From Ambev

VOLVO DELIVERS FIRST ELECTRIC TRUCKS TO CUSTOMERS IN SWEDEN

Tesla Semi reservation holder says deliveries are expected in 2020

Renault Unveils New Electric Truck Lineup

VW to Invest $50 Billion in Autonomous, Electric Cars

Amazon Is Hauling Cargo in Self Driving Trucks Developed by Embark

Daimler Adds Two Electric Trucks in Race Against Tesla, VW

Volvo Trucks to Demonstrate Volvo VNR Electric Models in 2019 and Commercialize in 2020

Self-driving trucks to begin daily commercial deliveries in China

Tesla Semi made it 'across the country alone' with only Supercharger network and an extension cord, says Elon Musk

Thor Trucks to Launch New Entry in Battery-Electric Class 8 Market

Ontario Drives Ahead with Public Road Testing of Autonomous Vehicles

Daimler Trucks Demonstrates Truck Platooning

Volvo Unit Eyes Autonomous Trucks to Ease Japan Driver Shortage

VW And Toyota Team Up To Develop Self-Driving Trucks With 'Sense Of Urgency'

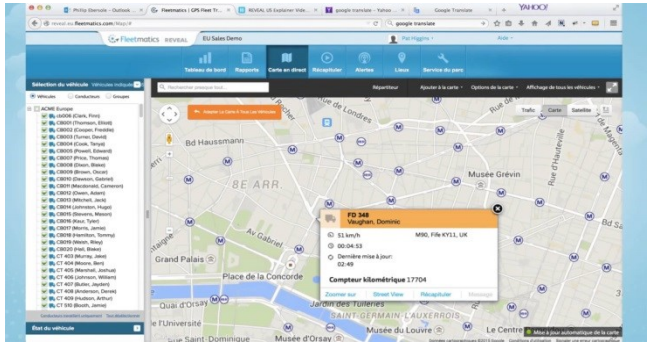
GAO issues recommendations addressing autonomous trucks

Volvo's first commercial self-driving trucks will be used in mining

Source: Morgan Stanley Research; Monthly TechTrack Feature

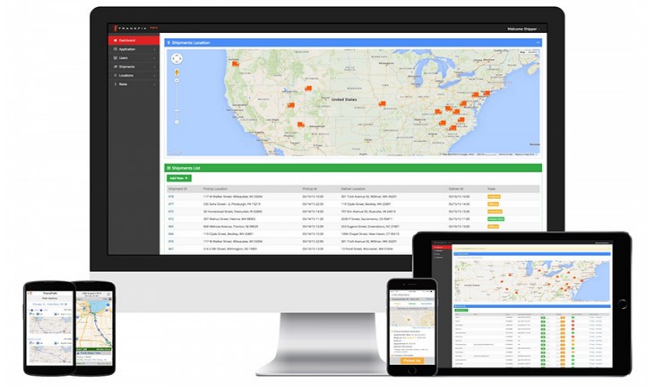
Logistics

CONVOY
LOGISTICS PROVIDERS LTD.



omnitracs
innovation. driven.

TRANSFIX





Source: Morgan Stanley Research Estimates

TECHNOLOGY

- Telematics
- Autonomous Trucks
- Freight Management Systems
- Blockchain

INSOURCING

- Large Shippers (AMZN, Alibaba)
- Asset Owners (SWFT, WERN, KNX, XPO)
- OEMs

3PL

- Truck Brokerage
- Freight Forwarding
- CHRW, EXPD

START-UPS

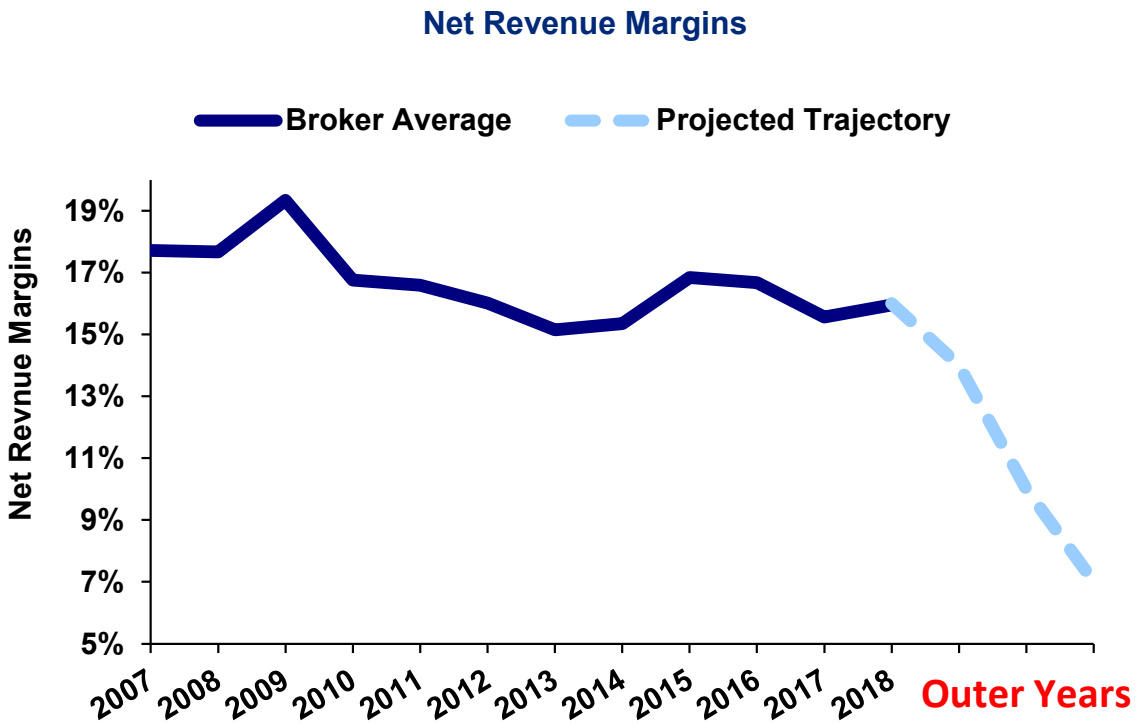
- "Digitization of Freight" (Convoy, Transfix, Trucker Path, etc)



- Net Margins of 0-5% (vs. 15 - 20% today)
- Intense Competition
- Industry Consolidation

Source: Morgan Stanley Research

Secular Pressure on Long-Term Net Revenue Margins



We believe the days of large incumbent brokers earning 15-20% net revenue margins are over. From our conversations with new 3PL entrants as well as a flurry of media reports, we believe 0-5% net margins could be the new normal

Source: Company Data, Morgan Stanley Research; Note: broker average incl. CHRW transportation, ECHO, JBHT ICS, and LSTR

Logistics headlines in the past year have highlighted the upcoming competition

Amazon Expands Into Ocean Freight

Amazon's Pitch to Woo Shippers: Fewer Fees Than FedEx, UPS

Postmates raises last-mile stakes by adding 100 more cities

Deliv now offers same-day delivery for Shopify retailers

Logistics startup Flexport just raised a SoftBank-led round at a reported $3.2 billion valuation

Logistics Tech Provider project44 Raises $35 Million in New Funding

DoorDash More Than Doubles Valuation to $4 Billion

Hong Kong's GoGoVan raises $250M from investors including Alibaba's logistics subsidiary

Amazon to Launch Delivery Service That Would Vie With FedEx, UPS

Convoy closes $185M Series C to reach unicorn valuation

Freightera Logistics Secures Investment From Decathlon Capital Partners

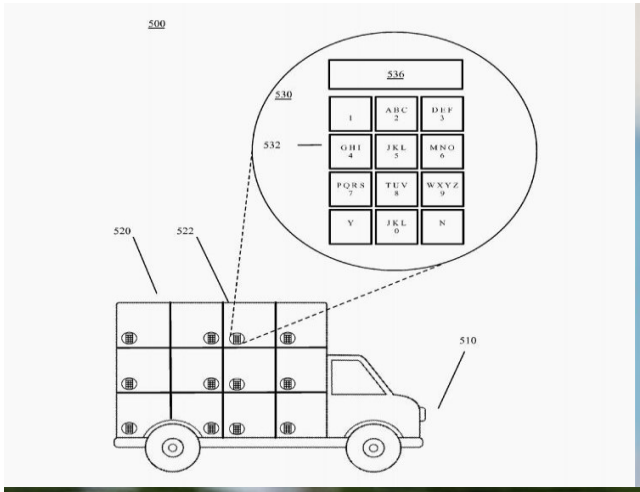
Temasek and Kuehne + Nagel to fund hi-tech logistics & supply chain start-ups

Amazon Air to add 737-800BCFs

TRUCKING STARTUP CONVOY INKS ITS BIGGEST DEAL WITH UNILEVER

Source: Morgan Stanley Research; Monthly TechTrack Feature

Parcel









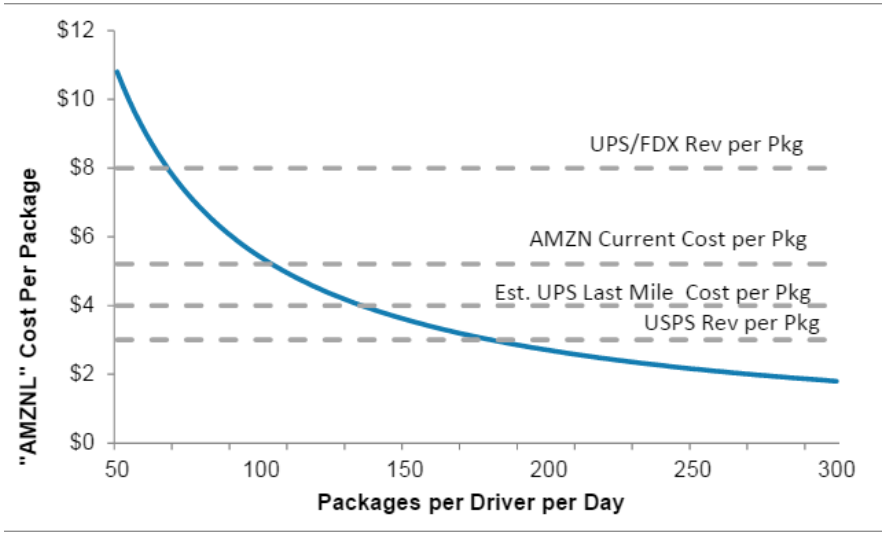
Source: US patent and Trademark Office, Company Websites, Morgan Stanley Research

Parcel: We See Twin Competitive Threats to the Parcels' B2C Business

Selective Insourcing by e-Commerce Giants

- eCommerce giants (especially Amazon but others as well) making initial attempts to vertically integrate into the delivery business
- While initially serving as a support function, our analysis (in conjunction with Morgan Stanley Internet analyst Brian Nowak) shows that an emerging eCommerce logistics network should be able to at least match the last mile economics of a legacy parcel carrier at $4-5 per package in dense areas. **We see three scenarios for AMZN.**
- Though this may be limited in scope to begin with, removing the most dense volumes could significantly erode the per-unit economics for the remaining B2C business at the Parcels

Cost Per Package Sensitivity Analysis



eCommerce has been a strong growth driver for the parcel stocks in recent years, with business-to-consumer (B2C) driving over 100% of Parcel volume growth in the past decade and now accounting for roughly half of the domestic/Ground business

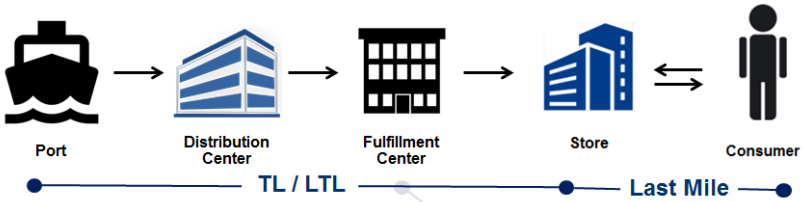
Source: Company Data, Morgan Stanley Research

Parcel: We See Twin Competitive Threats to the Parcels' B2C Business

Omni-channel shift enabling last mile competition

- Emerging start-ups threaten to crowdsource last-mile delivery at a local level by leveraging the growth of omni-channel retailing
- Omni-channel retailing refers to a shift in buying patterns from a predominantly physical, store based experience in the past to multi-channel offerings (store and internet as distinct and separate purchasing channels) in the present to omni-channel (mix and match across channels, i.e., purchase on mobile, pick up in store, return online for a single transaction) in the future
- The future may even be autonomous delivery. Drones, bots, autonomous delivery trucks all on the road to commercialization

Omni-channel Retailing



New Possible Winners

1. TL / LTL both have the opportunity to take advantage
2. TLs have a more natural consumer customer today
3. Last mile logistics providers now more important, but less lucrative
4. XPO, SNDR, ARCB, and ODFL all poised to gain from the supply shift

New Takers?

1. AMZN could enter the logistics business themselves
2. XPOs history makes it the most likely candidate for M&A activity

Parcel Startups

deliv
Kanga
zipments
piggyback
connecting people to goods
POSTMATES
DOORDASH
delightful delivery
Rideship
Instacart

Source: Company Data; day2now.com

While drones have been dominating recent Parcel headlines, insourcing and the omni-channel shift are the real threats

Mercedes Benz completes largest ever test of drone delivery system

Shipt and Target launch same-day delivery in Florida

Target's same-day delivery reaches 1,100+ stores, Drive Up to reach 1,000 by year-end

China's JD.com tests drone delivery in Indonesia in first overseas pilot

Drone Delivery Canada Unveils Its Largest and Farthest Range Cargo Delivery Drone, The 'Condor'

Amazon buying video doorbell company Ring

Boeing Builds Delivery Drone Capable of Carrying 500 pounds of Cargo

Mercedes Benz completes largest ever test of drone delivery system

DoorDash is reportedly raising $500M at a $6B+ valuation

IBM HAS SECURED A PATENT FOR A COFFEE DRONE

Forget People, Elroy's Self-Flying Drone Hauls Heavy Cargo

Walgreens, FedEx team up on next-day prescription drug deliveries

UPS partners with drone startup Matternet for medical sample deliveries

China's on the Fast Track to Drone Deliveries

Walmart and Ford to Test Grocery Delivery with Self-Driving Cars

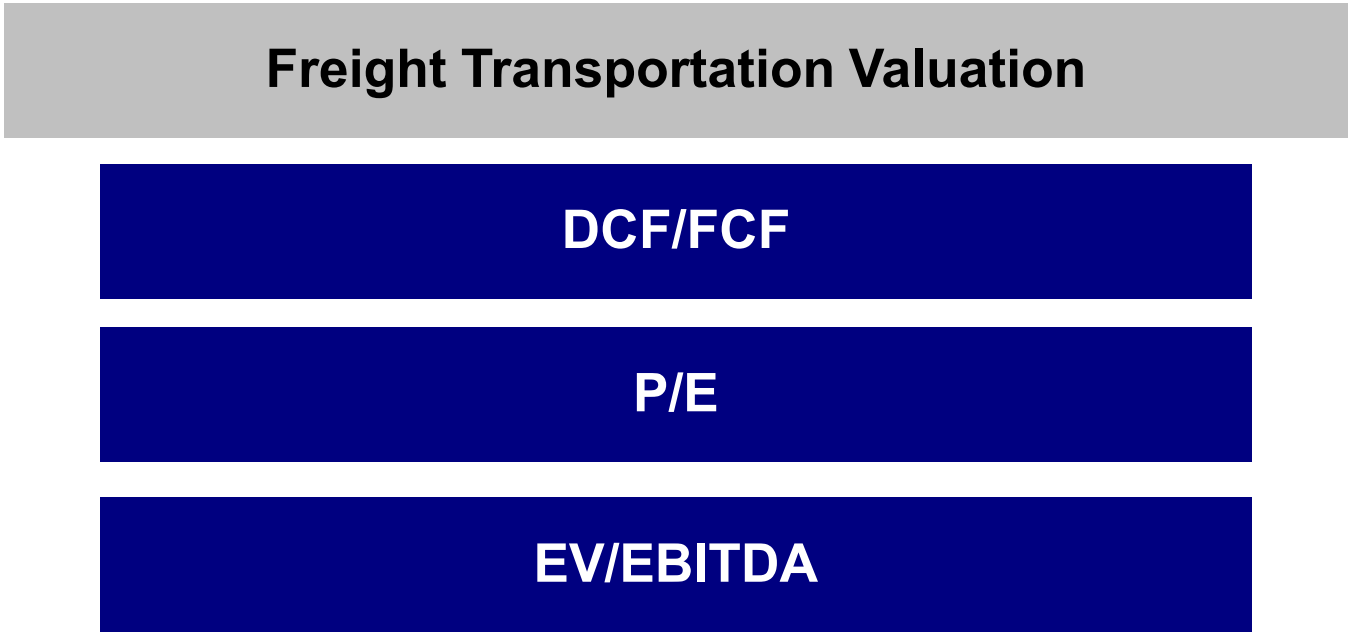
Autonomous delivery drone startup Matternet raises $16 million round led by Boeing's venture arm

China's largest courier is starting drone deliveries

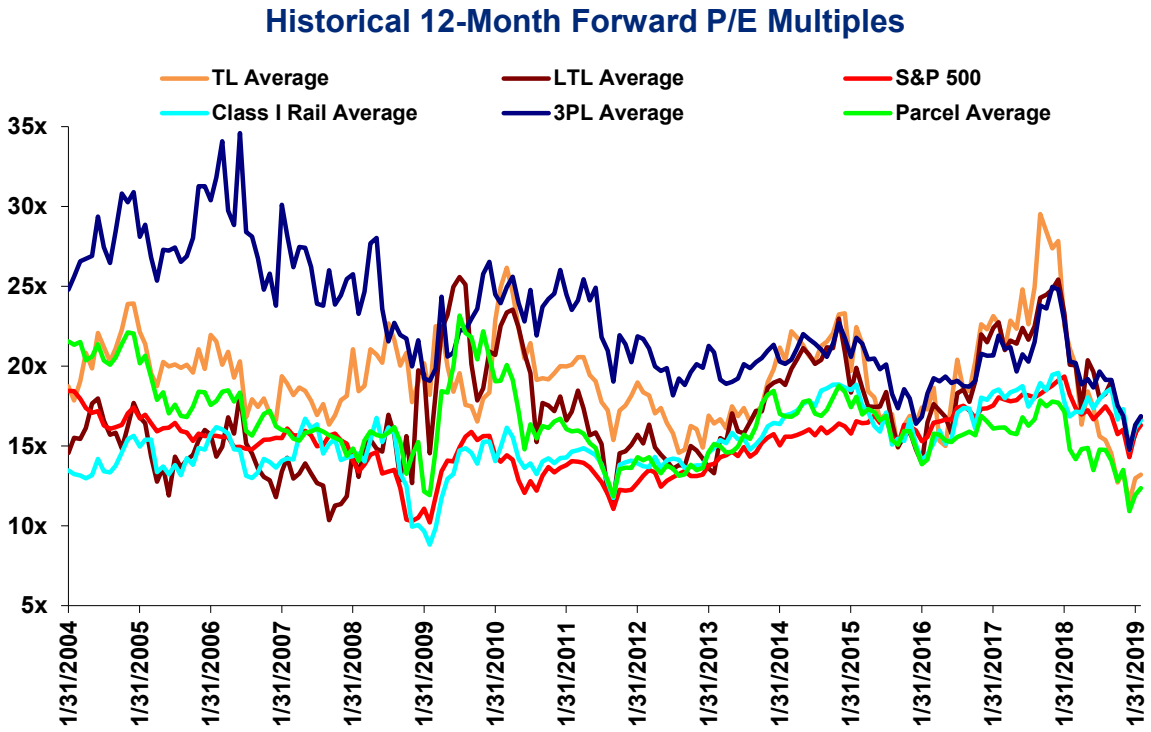
Kroger launches Nuro unmanned vehicles to delivery groceries to customers in Arizona

Source: Morgan Stanley Research; Monthly TechTrack Feature

Freight Transportation Valuation



Price / Earnings Multiple Valuation Across Transport Verticals

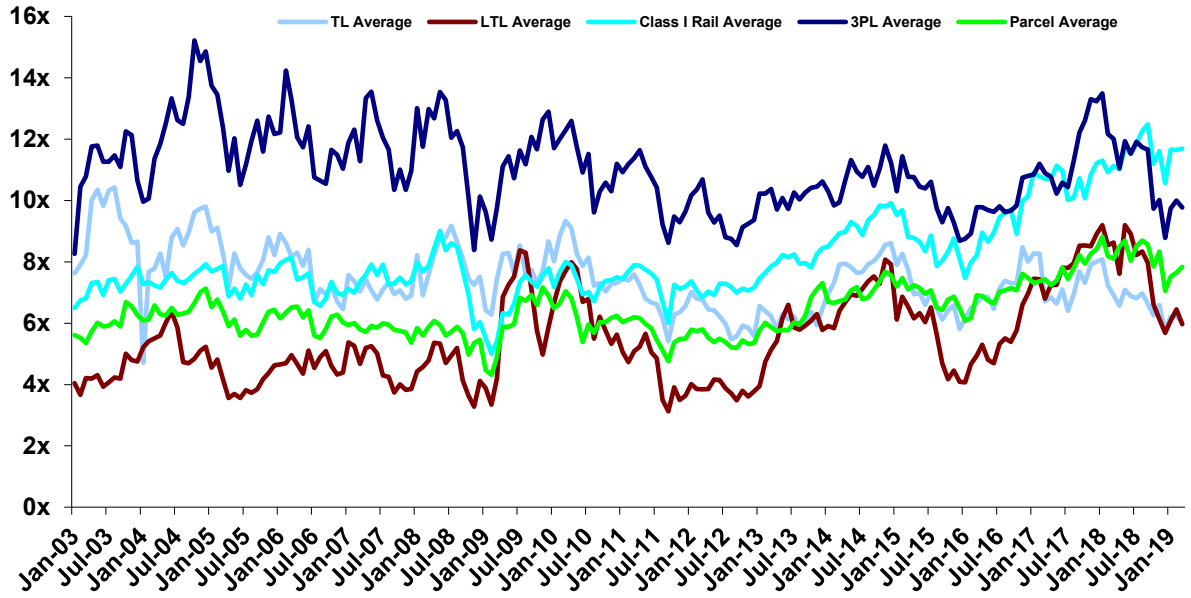


Looking across transport verticals, TLs and 3PLs have historically traded at a premium to Parcel and Class I Rail names on 12-month forward P/E

Source: Morgan Stanley Research, Thomson Reuters; **Note:** Data as of market close 4/15//2018; LTL aggregate multiple is the median average of ARCB, ODFL, SAIA; TL aggregate multiple is the median average of HTLD, KNX, WERN; Parcel aggregate multiple is the median average of FDX and UPS; Class I rail aggregate multiple is the median average of CP, CNI, CSX, NSC, and UNP; 3PL aggregate multiple is the median average of CHRW, ECHO, EXPD, HUBG, JBHT, LSTR

Enterprise Value / EBTIDA Valuation Across Transport Verticals

Historical 12-Month Forward EV/EBITDA Multiples



Looking across transport verticals, LTLs have historically traded at the lowest 12-month forward EV/EBITDA multiples

Source: Thomson Reuters, Morgan Stanley Research; **Note:** Data as of market close 4/23/2018; LTL aggregate multiple is the median average of ARCB, ODFL, SAIA; TL aggregate multiple is the median average of HTLD, KNX, and WERN; Parcel aggregate multiple is the median average of FDX and UPS; Class I rail aggregate multiple is the median average of CP, CNI, CSX, NSC, and UNP; 3PL aggregate multiple is the median average of CHRW, ECHO, EXPD, HUBG, JBHT, LSTR

US Coverage Rankings

		Company	Market Cap ($bn)	Current Price	MS PT	Upside to PT (%)	EPS (2019e) MS	EPS (2019e) Cons	Valuation (2019e) P/E	Valuation (2019e) EV/EBITDA	Consensuality OW	Consensuality EW	Consensuality UW
1 Truckload	OW	KNIGHT TRANSPORTATION	6.0	35.24	50	42%	$2.59	$2.68	13.6x	5.7x	71%	29%	0%
		U.S. XPRESS, INC.	0.3	6.87	24	249%	$1.42	$1.33	4.8x	1.6x	86%	14%	0%
		SCHNEIDER	0.0	21.68	34	57%	$1.73	$1.69	12.6x	4.5x	67%	25%	8%
		WERNER	2.4	35.75	46	29%	$2.60	$2.62	13.7x	4.9x	39%	50%	11%
	UW	Heartland Express	1.6	20.28	15	(26%)	$0.92	$0.97	22.1x	7.9x	0%	50%	50%
2 Less-than-Truckload	EW		12.4	153.87	146	(5%)	$8.26	$7.99	18.6x	10.5x	31%	69%	0%
		ArcBest	0.8	31.57	39	24%	$3.76	$3.66	8.4x	3.5x	8%	77%	15%
	UW	SAIA	1.7	66.13	55	(17%)	$4.50	$4.63	14.7x	6.7x	64%	27%	9%
3 Asset-Light / Non-Asset	EW	XPOLogistics	0.1	67.83	70	3%	$3.44	$3.42	19.7x	8.8x	85%	15%	0%
		J.B. HUNT	10.5	98.32	95	(3%)	$5.21	$5.74	18.9x	10.3x	41%	55%	5%
		Expeditors	13.5	79.28	59	(26%)	$3.53	$3.59	22.4x	15.2x	14%	71%	14%
		Hub Group	1.5	42.42	44	4%	$3.30	$3.21	12.9x	8.4x	44%	50%	6%
		ECHO	0.6	24.05	25	4%	$1.80	$1.79	13.2x	6.6x	73%	27%	0%
	UW	LANDSTAR	4.6	116.42	94	(19%)	$6.45	$6.42	18.1x	11.5x	19%	63%	19%
		C.H. ROBINSON	12.2	87.76	67	(24%)	$4.69	$5.04	18.7x	13.1x	24%	67%	10%
4 Rails	OW	CN	68.0	127.37	116	(9%)	CAD 6.19	CAD 6.22	20.6x	14.1x	33%	67%	0%
		CP	31.1	299.15	277	(7%)	CAD 16.37	CAD 16.41	18.3x	13.3x	83%	17%	0%
	EW		12.4	124.51	115	(8%)	$6.86	$6.86	18.1x	10.6x	61%	39%	0%
	UW		124.2	177.22	134	(24%)	$8.82	$9.09	20.1x	14.1x	59%	37%	4%
			4.9	88.25	69	(22%)	$4.28	$4.38	20.6x	10.8x	15%	69%	15%
		CSX	63.6	79.17	57	(28%)	$4.15	$4.38	19.1x	12.6x	48%	48%	4%
		NS NORFOLK SOUTHERN	53.9	204.14	138	(32%)	$10.64	$10.81	19.2x	12.5x	52%	40%	8%
5 Parcel	EW	FedEx	49.2	184.04	148	(20%)	$14.72	$16.23	12.5x	7.7x	68%	29%	4%
	UW	ups	90.3	103.95	85	(18%)	$7.30	$7.53	14.2x	10.6x	35%	58%	8%

For valuation methodology and risks associated with any price targets, ratings or recommendations referenced in this research report, please contact the Client Support Team as follows: US/Canada +1 800 303-2495; Hong Kong +852 2848-5999; Latin America +1 718 754-5444 (U.S.); London +44 (0)20-7425-8169; Singapore +65 6834-6860; Sydney +61 (0)2-9770-1505; Tokyo +81 (0)3-5424-4349. Alternatively you may contact your investment representative or Morgan Stanley Research at 1585 Broadway, (Attention: Research Management), New York, NY 10036 USA. Stock Price as of 4/26/19; Source: Company Data, Thomson Reuters, Morgan Stanley Research

Comp Sheet

Company	Currency	Price at 26-Apr	MS PT	Upside to PT (%)	MS Rating	Market Cap LC	Market Cap US$	MS EPS 2019e	MS EPS 2020e	MS EPS Growth Rate 2019e	MS EPS Growth Rate 2020e	Consensus EPS 2019e	Consensus EPS 2020e	Dividend Yield
Rails														
Canadian National Railway Co.	CAD	127.37	116	(8.9%)	OW	92.2	68.5	6.19	6.81	13%	10%	6.22	6.93	1.7%
Canadian Pacific Railway Ltd.	CAD	299.15	277	(7.4%)	OW	41.8	31.1	16.37	18.13	13%	11%	16.41	18.54	0.9%
CSX Corporation	USD	79.17	57	(28.0%)	UW	64.1	64.1	4.15	4.50	8%	8%	4.38	4.81	1.2%
Genesee & Wyoming Inc.	USD	88.25	69	(21.8%)	UW	5.0	5.0	4.28	4.85	11%	13%	4.38	5.01	N/A
Kansas City Southern	USD	124.51	115	(7.6%)	EW	12.5	12.5	6.86	7.42	15%	8%	6.86	7.79	1.2%
Norfolk Southern Corp.	USD	204.14	138	(32.4%)	UW	54.3	54.3	10.64	11.52	12%	8%	10.82	12.30	1.7%
Union Pacific Corp.	USD	177.22	134	(24.4%)	UW	125.4	125.4	8.82	9.44	12%	7%	9.09	10.35	2.0%
3rd Party Logistics														
C.H. Robinson Worldwide Inc.	USD	87.76	67	(23.7%)	UW	12.1	12.1	4.69	4.63	-1%	-1%	5.04	5.33	2.3%
Echo Global Logistics Inc	USD	24.05	25	4.0%	EW	0.7	0.7	1.80	1.91	-4%	6%	1.79	1.91	N/A
Expeditors International of Washin	USD	79.28	59	(25.6%)	EW	13.6	13.6	3.53	3.76	2%	6%	3.59	3.81	1.1%
Hub Group Inc	USD	42.42	44	3.7%	EW	1.5	1.5	3.30	3.45	138%	5%	3.21	3.43	N/A
J.B. Hunt Transport Services Inc.	USD	98.32	95	(3.4%)	EW	10.7	10.7	5.21	6.06	-1%	16%	5.74	6.47	1.1%
Landstar System Inc	USD	116.42	94	(19.3%)	UW	4.7	4.7	6.45	6.20	4%	-4%	6.42	6.70	0.6%
XPO Logistics, Inc.	USD	67.83	70	3.2%	EW	0.1	0.1	3.44	4.50	8%	31%	3.42	4.34	N/A
Truckload														
Heartland Express Inc.	USD	20.28	15	(26.0%)	UW	1.7	1.7	0.92	0.83	4%	-9%	0.97	1.01	0.4%
Knight Transportation Inc.	USD	35.24	50	41.9%	OW	6.1	6.1	2.59	2.83	1%	9%	2.68	2.83	0.7%
Schneider National Inc.	USD	21.68	34	56.8%	OW	5.9	5.9	1.73	1.91	N/A	11%	1.69	1.76	1.1%
US Xpress Enterprises, Inc	USD	6.87	24	249.3%	OW	0.3	0.3	1.42	1.95	-15%	37%	1.33	1.51	N/A
Werner Enterprises	USD	35.75	46	28.7%	OW	2.5	2.5	2.60	2.66	8%	2%	2.62	2.67	1.0%
LTL														
ArcBest Corp	USD	31.57	39	23.5%	EW	0.8	0.8	3.76	3.75	-3%	0%	3.66	3.79	1.0%
Old Dominion Freight Line Inc	USD	153.87	146	(5.1%)	EW	12.5	12.5	8.26	8.68	12%	5%	7.99	8.61	0.4%
Saia, Inc.	USD	66.13	55	(16.8%)	UW	1.7	1.7	4.50	4.51	13%	0%	4.63	5.09	N/A
Parcel														
FedEx Corporation	USD	184.04	148	(19.6%)	EW	48.0	48.0	14.72	16.14	1%	8%	15.78	17.94	1.4%
United Parcel Service	USD	103.95	85	(18.2%)	UW	89.3	89.3	7.30	7.35	1%	1%	7.53	8.15	3.7%

Source: Morgan Stanley Research; Thomson Reuters; Stock Price as of 4/26/19

Comp Sheet

Company	P / E			EV / EBITDA			EV / Sales			FCF Yield	
	2019e	2020e	10-Yr. Avg.	2019e	2020e	10-Yr. Avg.	2019e	2020e	10-Yr. Avg.	2019e	2020e
Rails											
Canadian National Railway Co.	20.6x	18.7x	16.4x	14.1x	13.2x	10.1x	7.0x	6.6x	4.8x	2.2%	3.1%
Canadian Pacific Railway Ltd.	18.3x	16.5x	16.7x	13.3x	12.4x	9.9x	6.5x	6.2x	4.1x	2.5%	2.9%
CSX Corporation	19.1x	17.6x	14.7x	12.7x	12.3x	7.9x	6.6x	6.5x	3.0x	4.6%	5.1%
Genesee & Wyoming Inc.	20.6x	18.2x	18.4x	10.8x	9.9x	9.5x	3.2x	3.0x	3.0x	5.5%	5.6%
Kansas City Southern	18.1x	16.8x	19.3x	10.6x	10.0x	10.2x	5.3x	5.1x	4.2x	2.7%	3.7%
Norfolk Southern Corp.	19.2x	17.7x	14.4x	12.5x	11.8x	8.0x	5.7x	5.6x	3.0x	3.1%	3.6%
Union Pacific Corp.	20.1x	18.8x	15.4x	14.1x	13.8x	8.4x	6.9x	6.9x	3.4x	4.2%	4.0%
3rd Party Logistics											
C.H. Robinson Worldwide Inc.	18.7x	18.9x	21.0x	13.0x	13.0x	12.8x	0.8x	0.7x	0.9x	5.2%	5.2%
Echo Global Logistics Inc	13.4x	12.6x	21.1x	6.9x	6.4x	9.1x	0.3x	0.3x	0.4x	4.1%	6.0%
Expeditors International of Washin	22.4x	21.1x	22.4x	15.3x	15.2x	11.8x	1.5x	1.5x	1.2x	3.5%	4.2%
Hub Group Inc	12.9x	12.3x	18.8x	8.5x	7.9x	9.9x	0.4x	0.3x	0.4x	4.5%	3.2%
J.B. Hunt Transport Services Inc.	18.9x	16.2x	20.7x	10.5x	9.5x	9.1x	1.5x	1.3x	1.4x	NM	3.8%
Landstar System Inc	18.0x	18.8x	19.7x	11.6x	11.8x	11.0x	1.0x	0.9x	0.9x	4.9%	3.7%
XPO Logistics, Inc.	NM	NM	NM	8.8x	8.0x	9.9x	0.8x	0.8x	NM	6.5%	7.3%
Truckload											
Heartland Express Inc.	22.1x	24.5x	21.5x	8.0x	7.7x	7.6x	2.7x	2.5x	2.2x	3.2%	4.1%
Knight Transportation Inc.	13.6x	12.5x	20.3x	5.8x	5.5x	7.4x	1.1x	1.1x	1.7x	3.2%	1.7%
Schneider National Inc.	12.6x	11.3x	18.3x	4.5x	3.8x	N/A	0.6x	0.6x	N/A	13.1%	6.9%
US Xpress Enterprises, Inc	4.8x	3.5x	6.4x	1.6x	0.6x	N/A	0.2x	0.1x	N/A	25.5%	46.2%
Werner Enterprises	13.7x	13.4x	17.8x	5.1x	4.6x	5.1x	1.0x	0.9x	0.8x	3.4%	6.7%
LTL											
ArcBest Corp	8.4x	8.4x	14.9x	3.6x	3.2x	4.7x	0.3x	0.2x	0.3x	6.2%	14.1%
Old Dominion Freight Line Inc	18.6x	17.7x	18.5x	10.6x	10.1x	8.2x	2.8x	2.7x	1.5x	3.3%	3.7%
Saia, Inc.	14.7x	14.6x	16.2x	6.7x	6.5x	5.6x	1.1x	1.0x	0.6x	NM	0.7%
Parcel											
FedEx Corporation	12.5x	11.4x	14.8x	7.7x	7.2x	5.9x	0.9x	0.9x	0.8x	2.3%	1.9%
United Parcel Service	14.2x	14.1x	17.2x	10.5x	10.4x	5.9x	1.5x	1.4x	1.2x	1.6%	0.7%

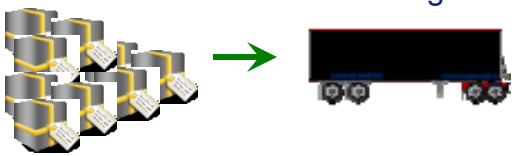
Source: Morgan Stanley Research; Thomson Reuters; Stock Price as of 4/26/19

APPENDIX

Truckload Business Model

As the name suggests, one shipment fills the whole truck

1. Shipper prepares shipment: Multiple items consolidated into one large trailer

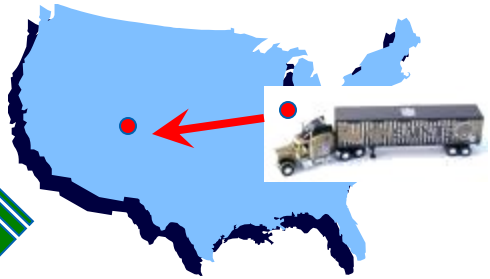


2. Carrier picks up trailer from shipper

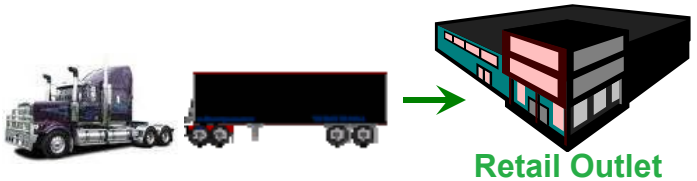


3. Point-to-point:
Same truck / drivers utilize public highways / roads to drive to destination

No network or sorting of freight



4. Final Delivery:
Drop off trailer at destination (distribution center, store, etc.)



Retail Outlet

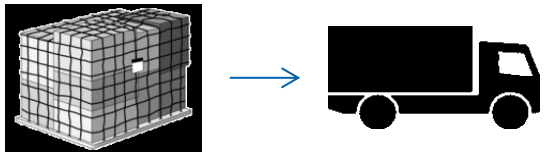
5. Driver drives to next pick-up location for next load (deadhead)



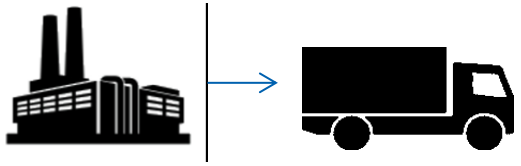
Source: Morgan Stanley Research

Less-Than-Truckload Business Model

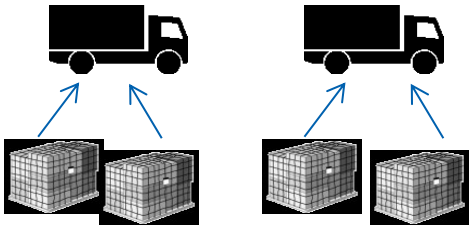
1. Pickup and Delivery driver picks up local shipments, usually palletized freight



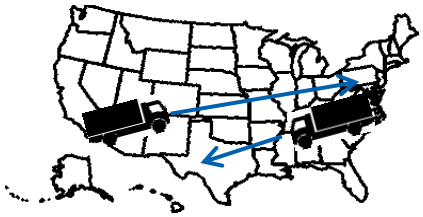
2. Shipments delivered to local terminal



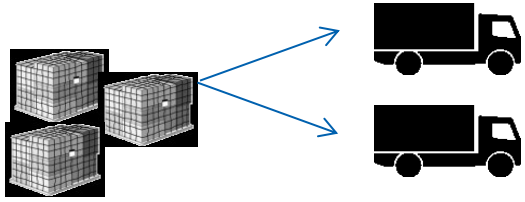
3. Sort shipments for line haul: Shipments sorted and loaded onto trailers by destination



4. Line haul shipments to local terminal



5. Shipments resorted onto local pickup and delivery trucks



6. Local pickup and delivery delivers shipment on route



Source: Morgan Stanley Research

Truck Broker Business Model

Truck broker serves as the intermediary between asset-based carriers and shippers

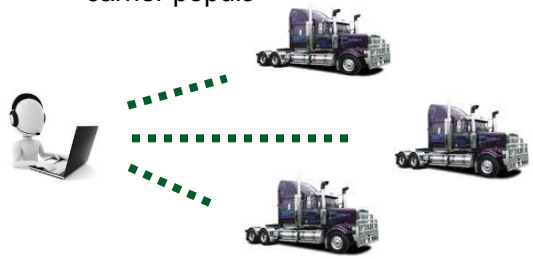
1. Shippers submit truck requests to Broker

- Requests sent via phone, web, or Enterprise Resource Planning (ERP)



2. Broker provides list of carriers and/or rates

- Large database provides access to quotes from large carrier population



3. Broker procures capacity

- Prior to receiving payment from shipper
- Goal is to gain profit on spread of price paid to carrier vs. received from shipper



4. Shipper and carrier are matched

- Web based interface allows for easy and streamlined view of carrier
- Transactions are either contractual or transactional



5. Broker coordinates shipment and payment

- Transmit shipper information
- Arrange payment
- Shipper can track shipments and analyze spend

6. Point-to-Point and Final Delivery

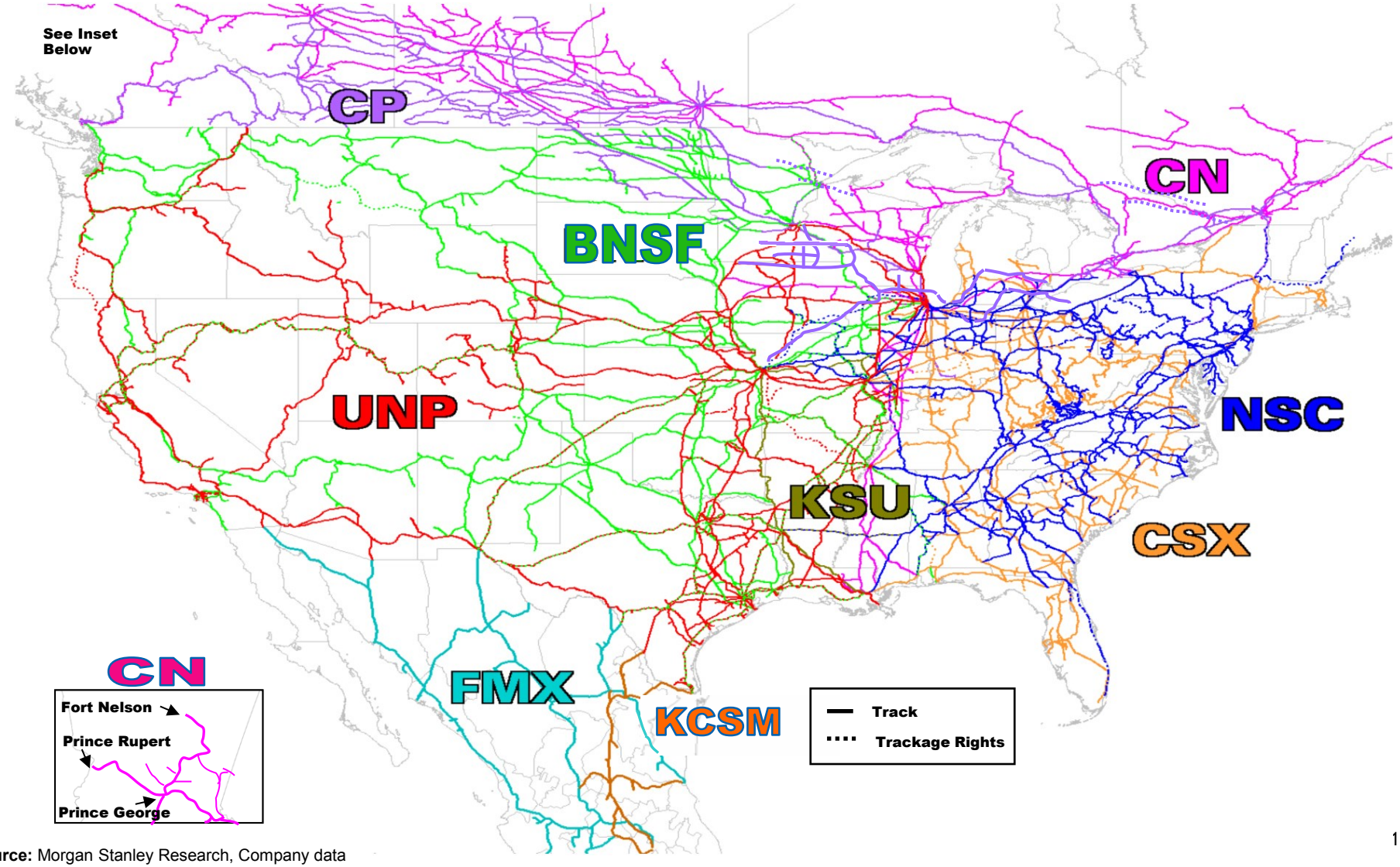
- Carrier picks up trailer from shipper
- Drop off trailer at destination (distribution center, store, etc)



Retail Outlet

Source: Morgan Stanley Research

Class I Railroad Map



Source: Morgan Stanley Research, Company data

Morgan Stanley

FOUNDATION

May 2019

Industrials Spring Training Teach-In

Airlines and Aerospace & Defense

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For analyst certification and other important disclosures, refer to the Disclosure Section, located at the end of this report.

Stock recommendations and disclosures in this report are as of May 3, 2019; stock prices as of April 30, 2019, unless otherwise noted.

US / Canadian Airlines

Major US Airlines



Source: Company Data, Morgan Stanley Research

Airline Characteristics

Legacy Carriers vs. Lower-Cost Carriers

Legacy Carriers

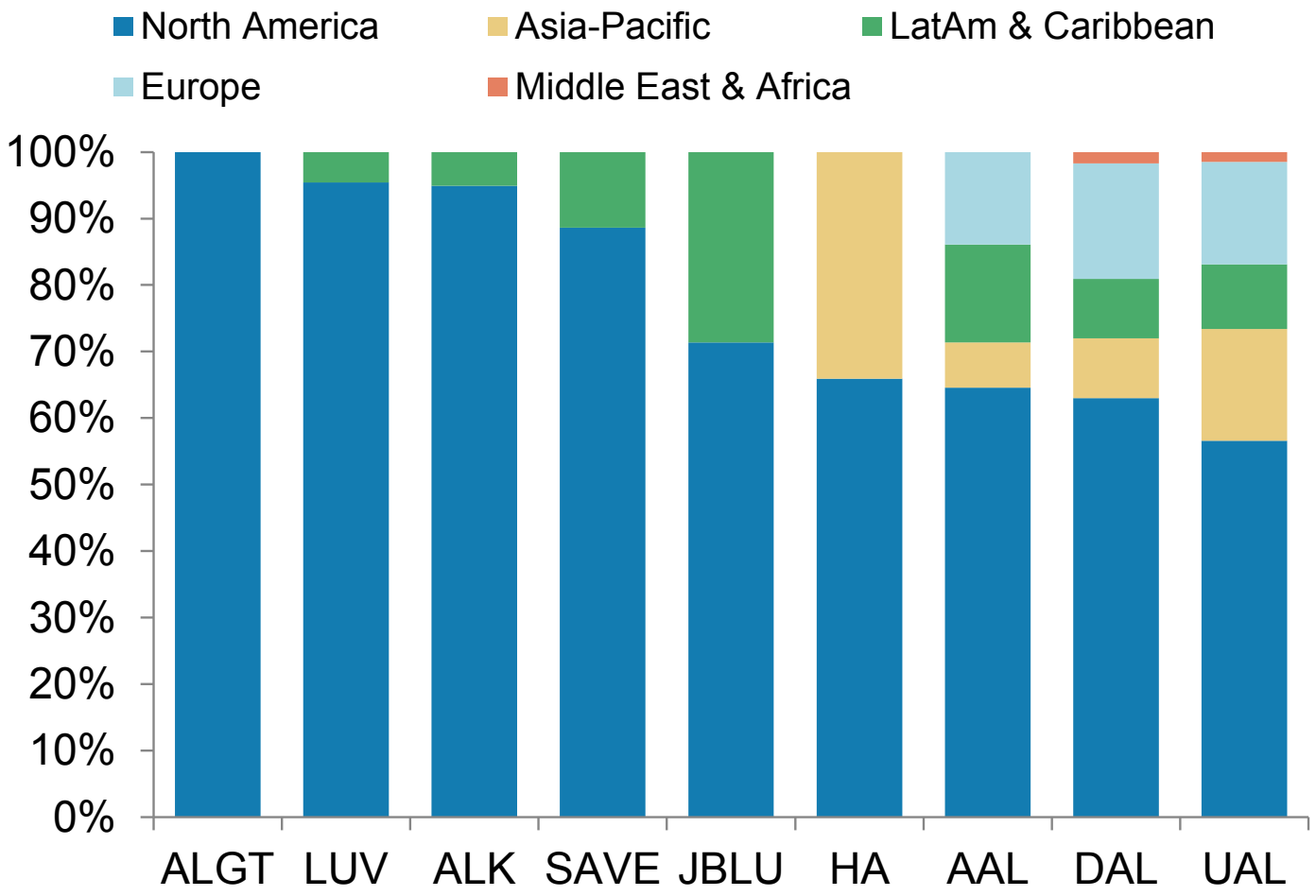
- First Class / Business Class Seating
- Substantial Corporate Travel Exposure
- Hub-and-Spoke Networks
- Wide Range of Origins & Destinations via Short and Long Haul Flights
- Higher International Exposure
- Typically Operate a Wide Variety of Aircraft
- Use of Main Airports with Exclusive Lounges

Lower-Cost Carriers

- Low Fares
- Point-to-Point Flying
- High Flight Frequencies
- Single Passenger Class
- Unbundled Fare Structure, More "Ancillary" Revenue Sources
- Most Operate a Single Type of Aircraft
- Shorter Haul Flights
- Use of Secondary Airports

Source: Morgan Stanley Research

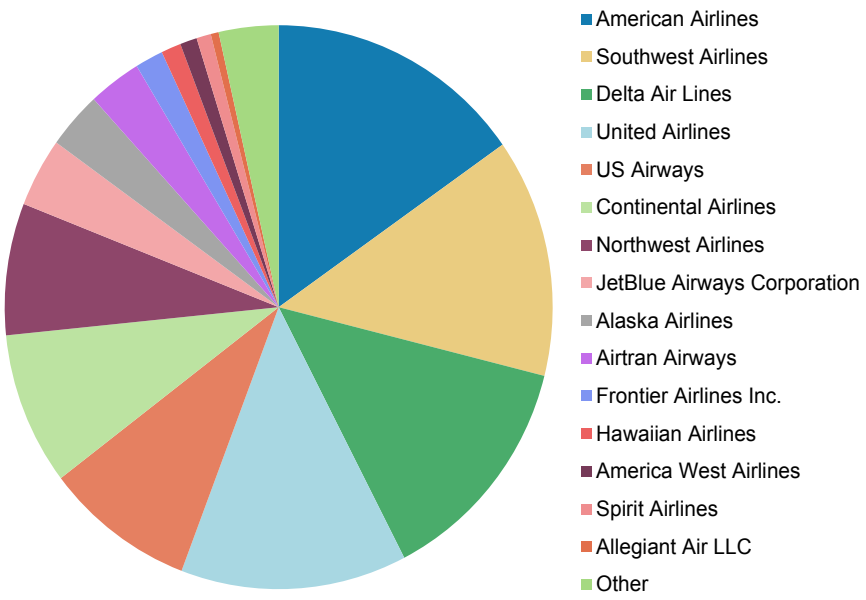
Capacity Exposure by Geographic Region



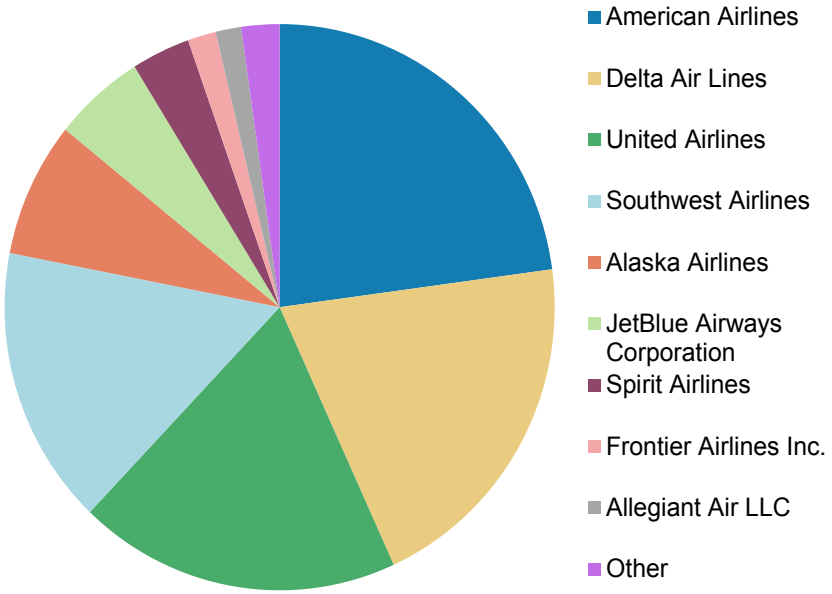
Source: OAG, Morgan Stanley Research. Based on 2018 data.

Industry Structure Is More Concentrated Today

2007 Domestic Capacity Market Share

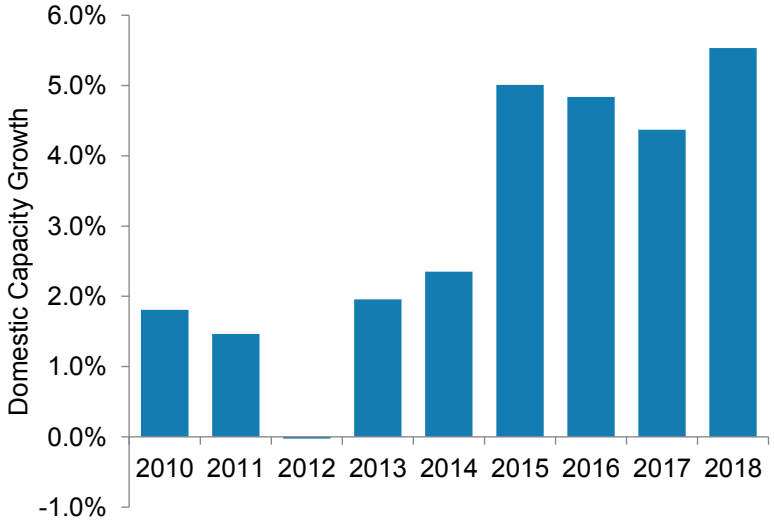


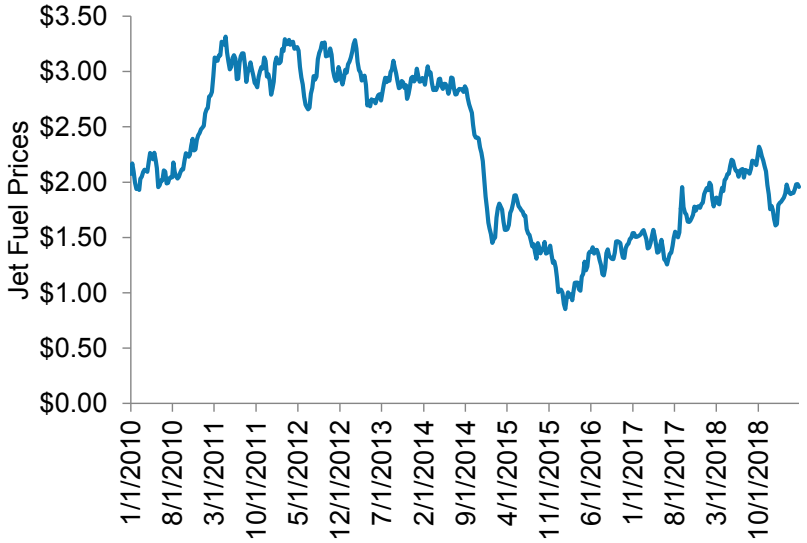
2018 Domestic Capacity Market Share



Source: Company Data, OAG, Morgan Stanley Research.

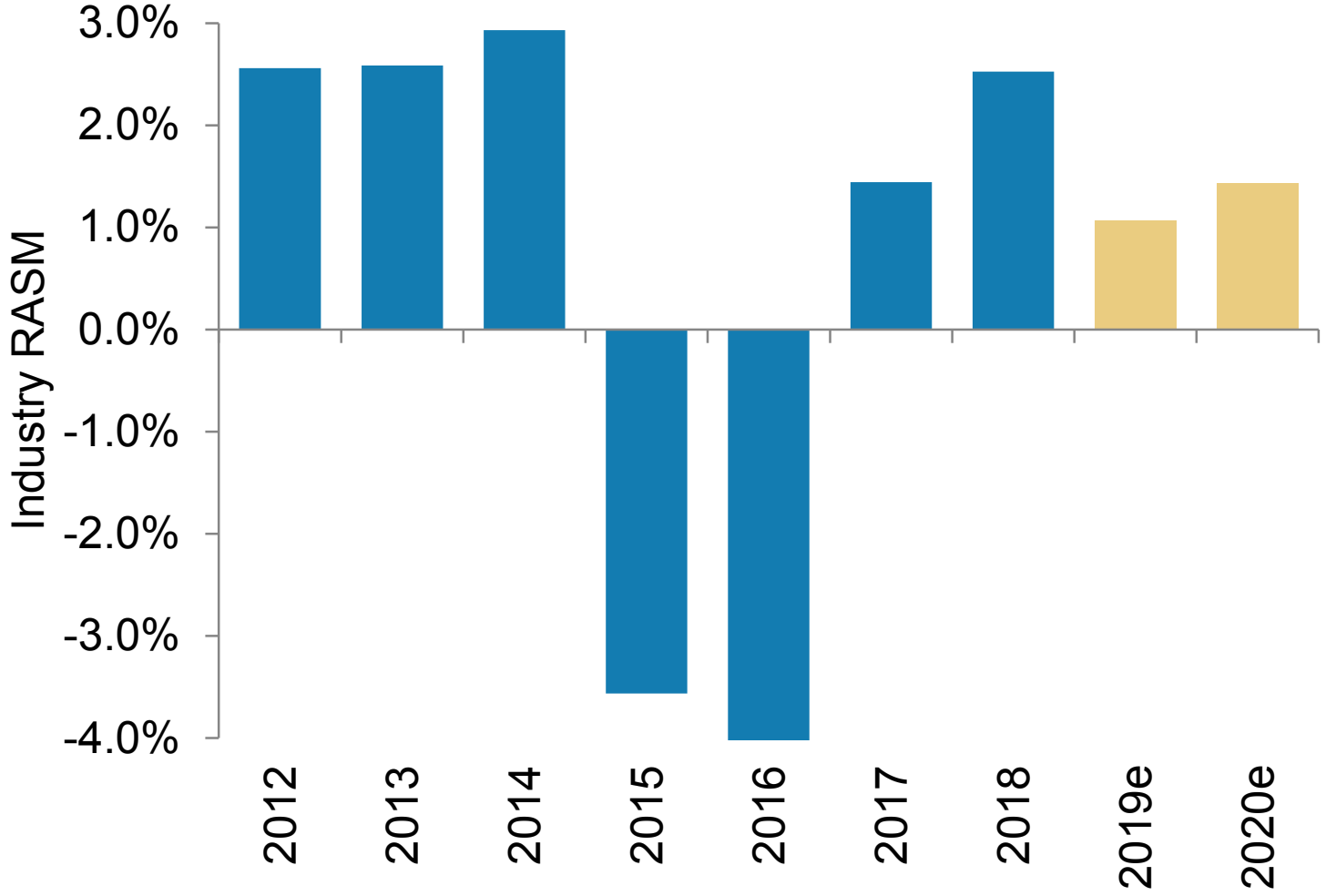
Capacity Has Become Elevated as Fuel Declined





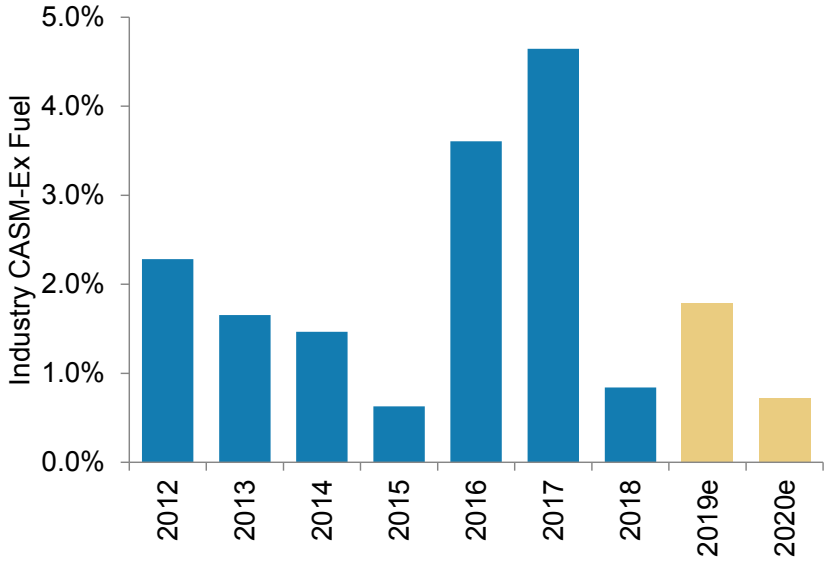
Source: Company Reports, Morgan Stanley Research, OAG, EIA, Thompson Reuters

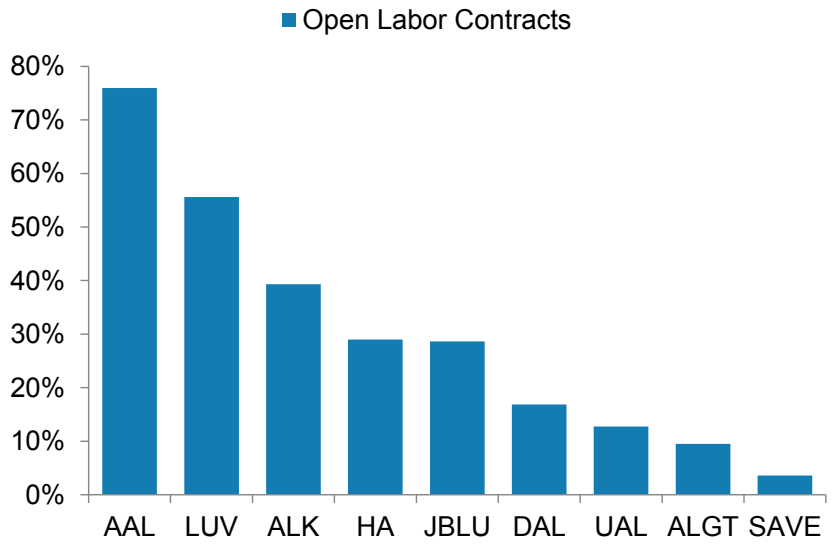
Unit Revenues Have Been Subdued



Source: A4A Cost Index, Morgan Stanley Research

Cost Pressures Are Evident



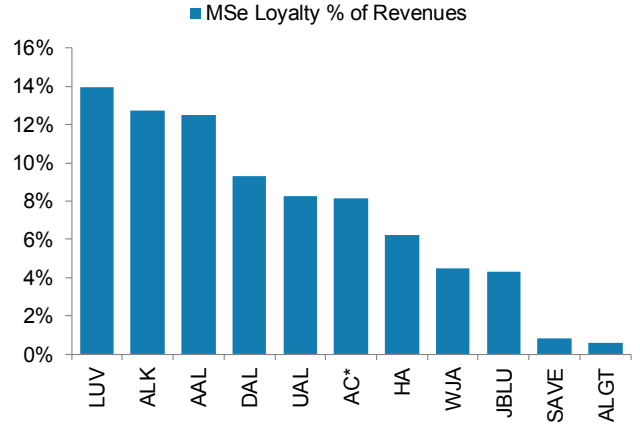


Source: Company Reports, Morgan Stanley Research

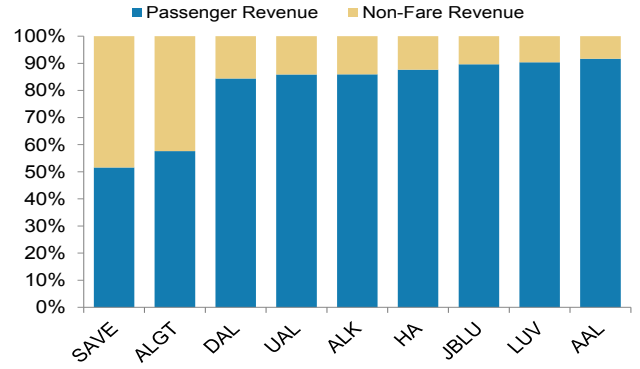
Sources of Revenue

- Passenger Ticket Fares
- Carry-on Bag / Checked Baggage
- Change / Cancellation Fee
- Frequent Flyer Program
- Preferred Boarding
- Seat Choice / Preferred Seats, Comfort / Space
- Entertainment, Internet / Wi-Fi, Movies
- Meals, Snacks, and Beverages
- Credit Card Program
- Cargo Revenue

Airline Loyalty Revenue Contribution



Passenger and Non-Fare Revenue Breakout



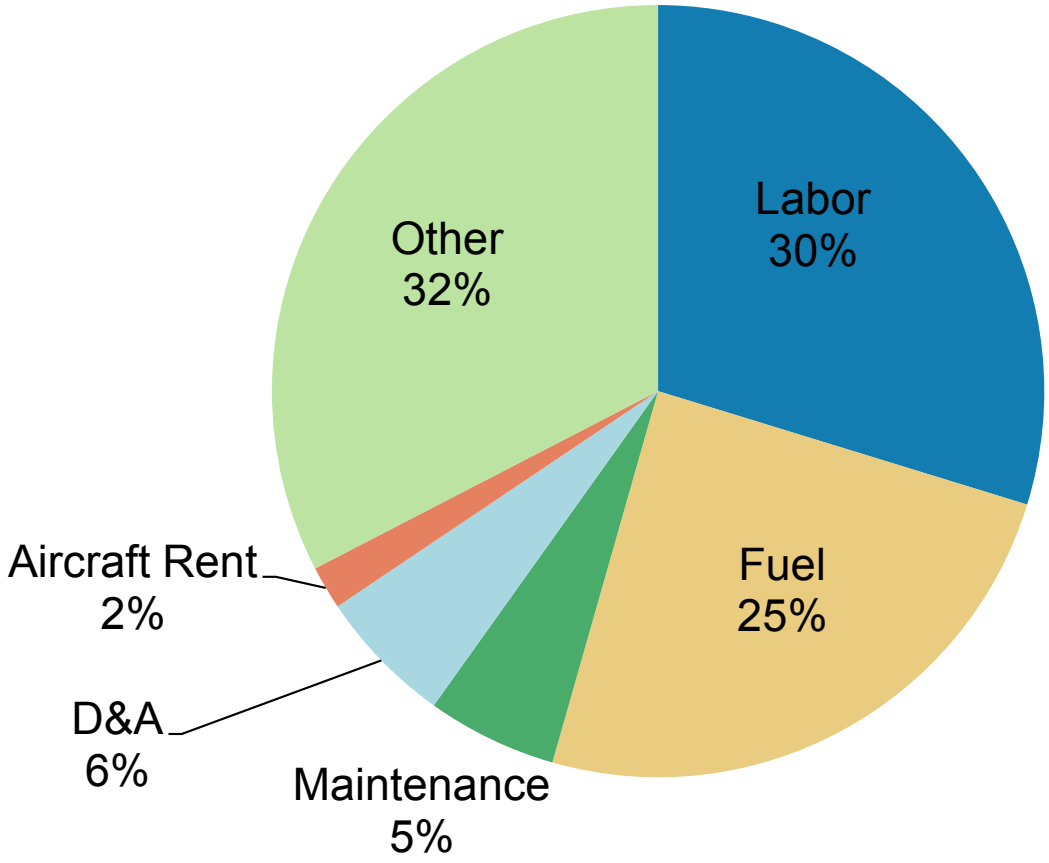
Legacy carriers charge a higher ticket price which include “extras” that low-cost carriers generally do not include in their ticket price. Ultra low-cost carriers have an “unbundled” fare structure

Source: Company Data, Morgan Stanley Research.

Note: Fare and non-fare revenues based on 2017 data due to recent accounting rule changes requiring certain ancillary revenue sources originally in other revenue to be moved into passenger revenue

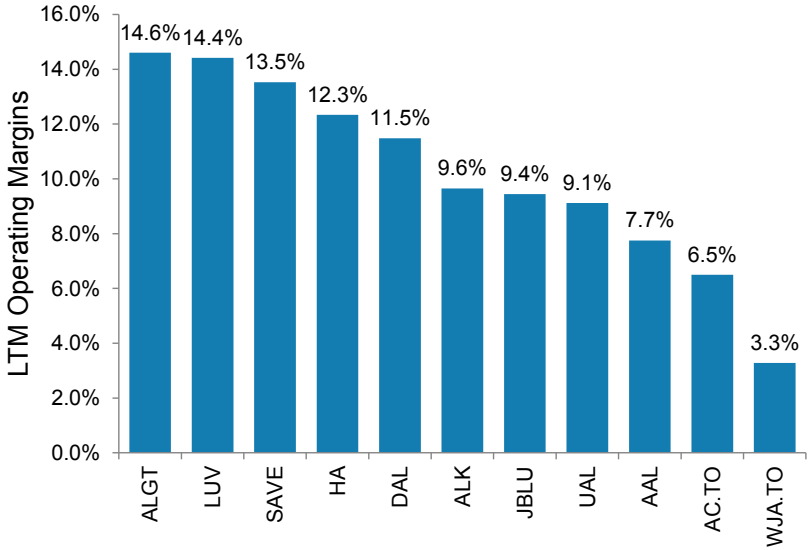
* AC Assumes 2019 revenue estimates given recent loyalty program acquisition

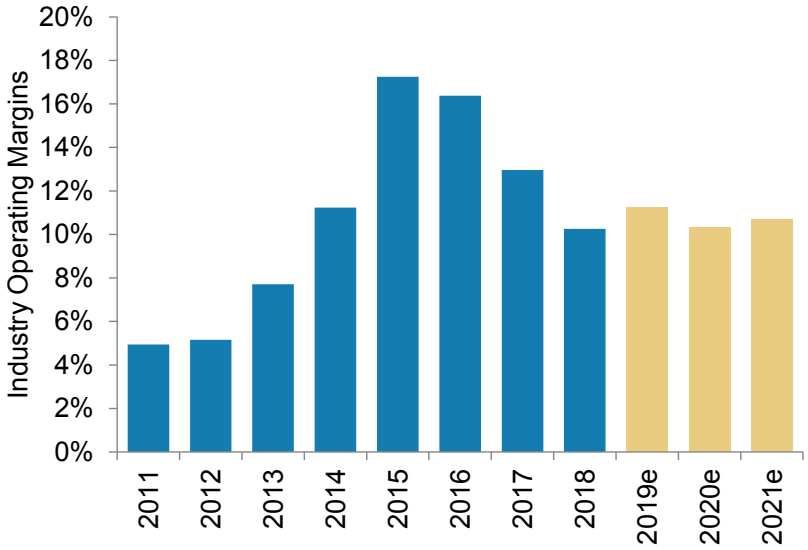
Cost Structure – Fuel and Labor Are the Largest Component of Costs



Source: Company Data, Morgan Stanley Research.
Note: Based on 2018 results. Other includes distribution expenses, sales and marketing, landing fees, and other various expenses.

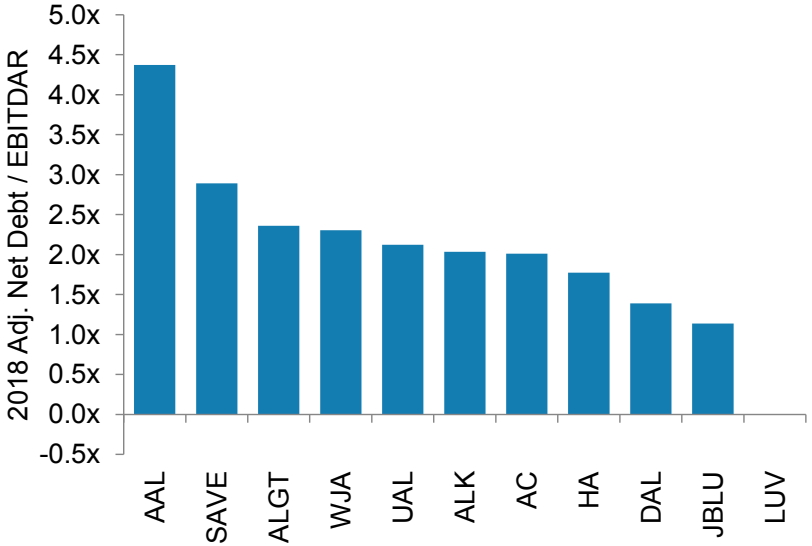
Airline Margin Comparisons

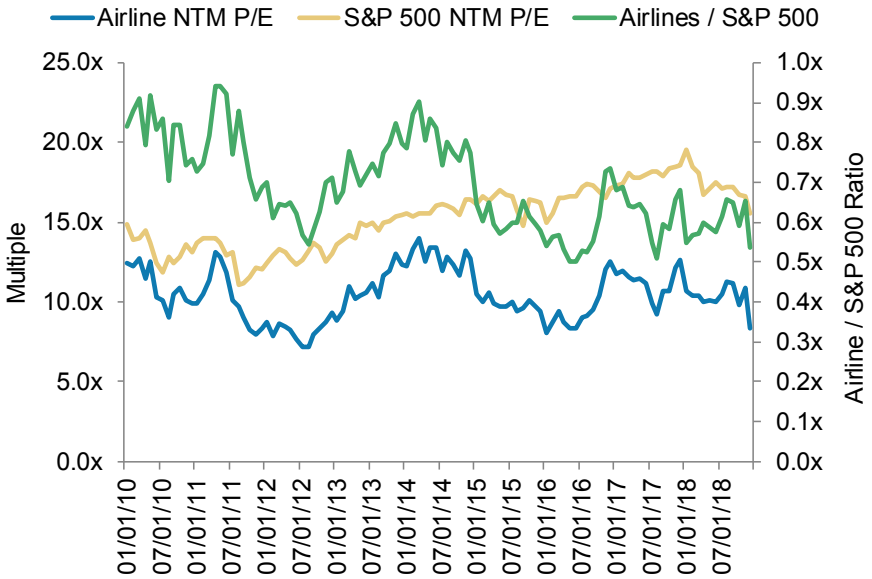




Source: Company Data, Morgan Stanley Research. LTM as of 4Q18.

Airline Leverage and Valuation Metrics

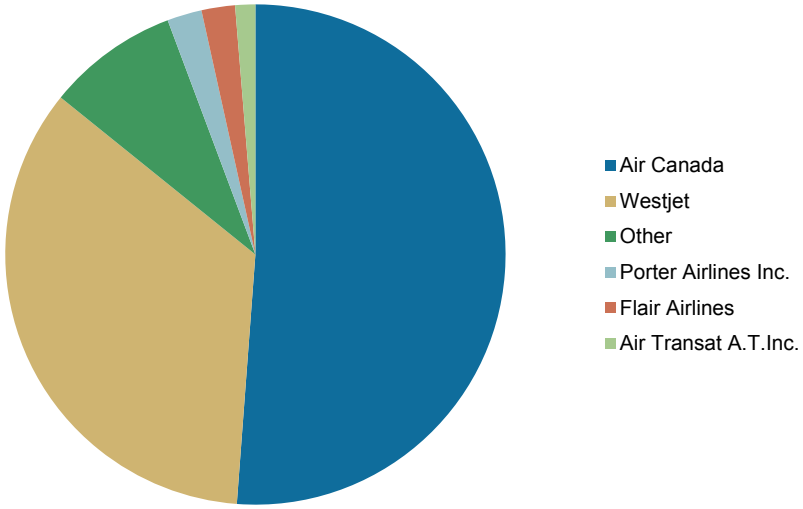




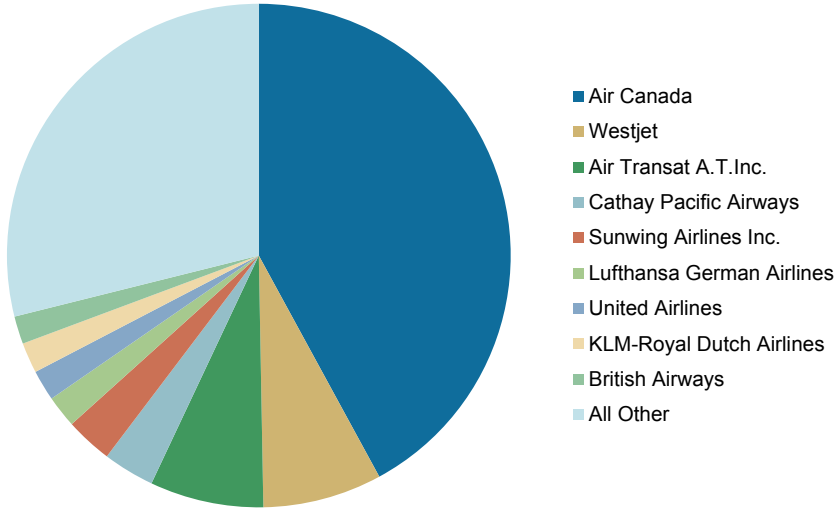
Source: Company Data, Morgan Stanley Research, Thompson Reuters

Where Do Canadian Airlines Come into Play?

Domestic Canada Market Share



Total Canada Market Share



Source: Company Data, Morgan Stanley Research, OAG, Based on 2018 Data

Commercial Aerospace

Major Aerospace Companies

Commercial OEMs

Commercial Aerospace Original Equipment Manufacturers designing and manufacturing commercial aircraft

BOEING
AIRBUS
EMBRAER
BOMBARDIER

Business Jet OEMs

Business Jet Original Equipment Manufacturers designing and manufacturing business / regional jets

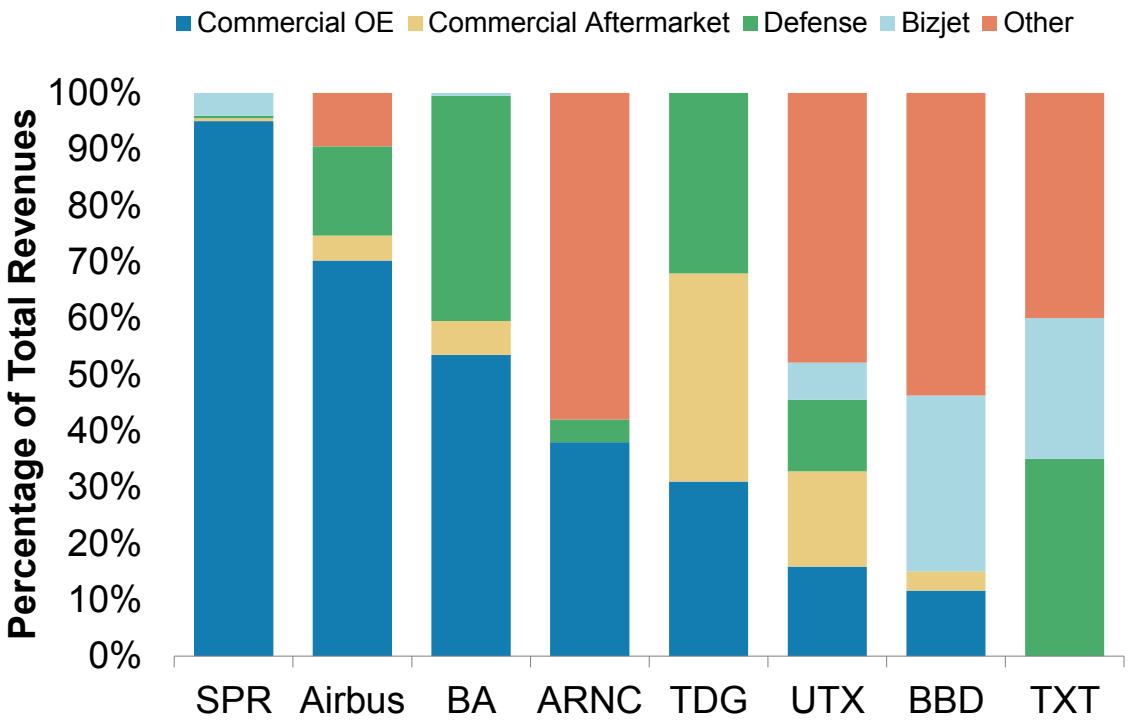
GENERAL DYNAMICS
DASSAULT AVIATION
EMBRAER
TEXTRON
BOMBARDIER

Suppliers

Provide parts and services to Commercial & Business Jet OEMs

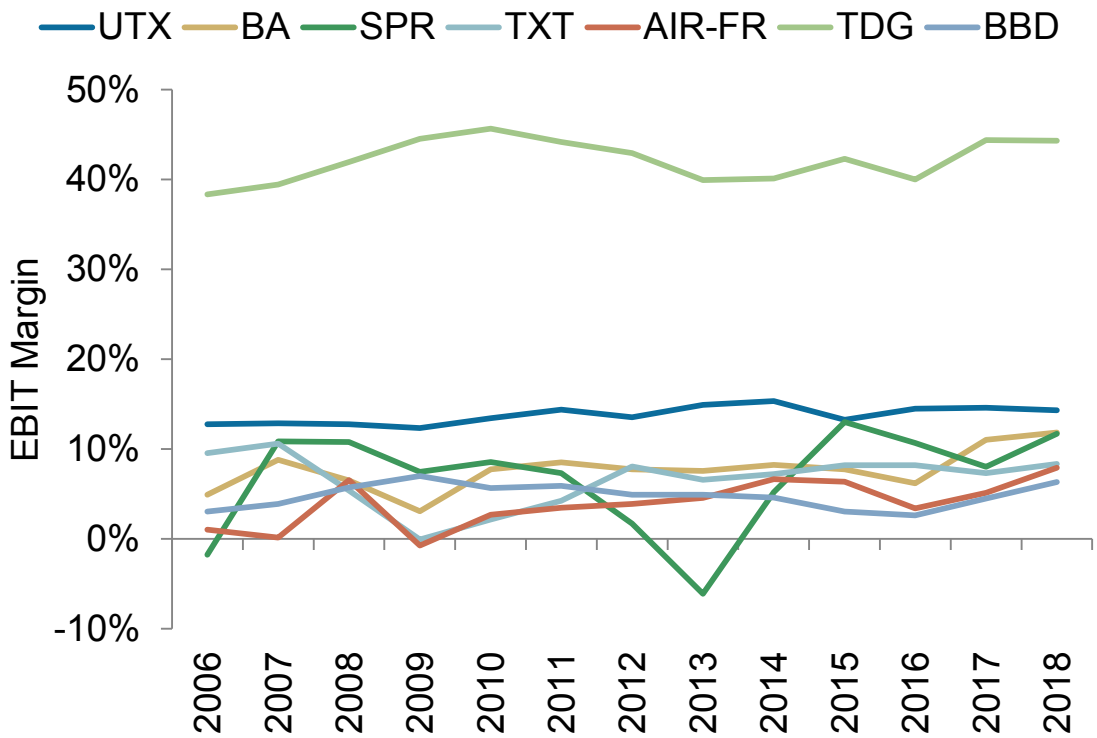
Honeywell Aerospace
Collins Aerospace
Triumph Group
ARCONIC Innovation, engineered.
TRANSDIGM GROUP INC.
GE Aviation
SAFRAN
HEXCEL
MTU Aero Engines
SPIRIT AEROSYSTEMS

Exposure Is Varied Across OEM, Aftermarket, and Bizjet End Markets



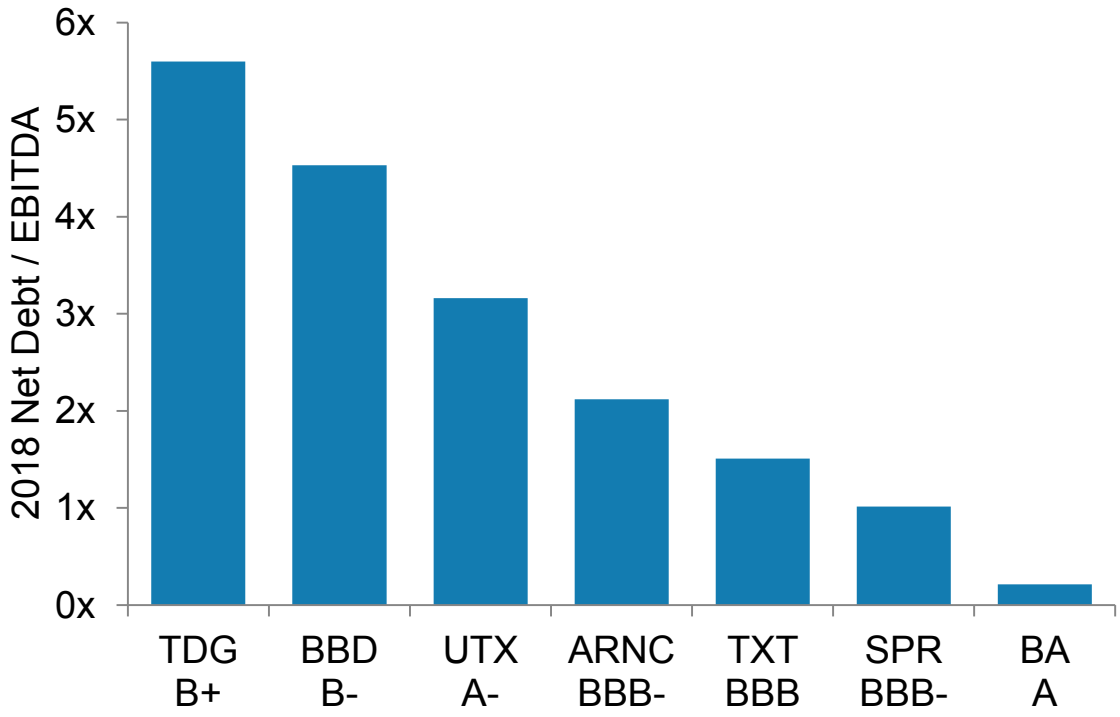
Source: Company data, Morgan Stanley Research.
E = Morgan Stanley Research estimates.

Margins Vary Widely, but Steady vs. History



Source: Company data, Morgan Stanley Research.
E = Morgan Stanley Research estimates.

Balance Sheets Are Broadly Healthy – but There Are Outliers



Source: Company data, Morgan Stanley Research.

Original Equipment Manufacturer (OEM) End Market

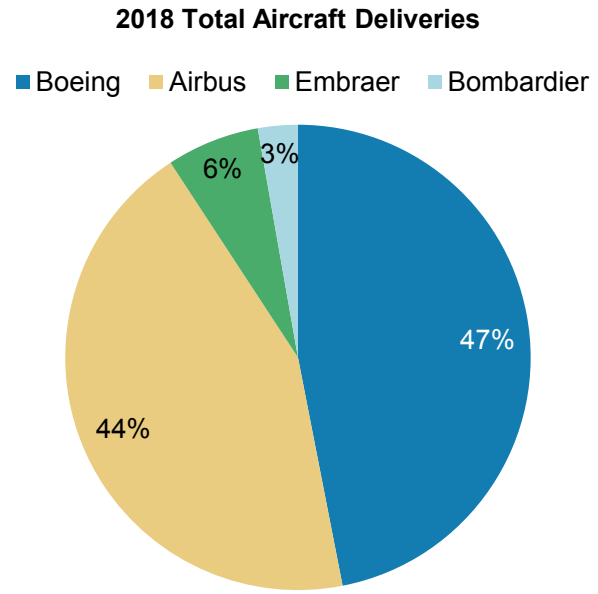
Who Are the Key Players?

BOEING

AIRBUS

EMBRAER

BOMBARDIER



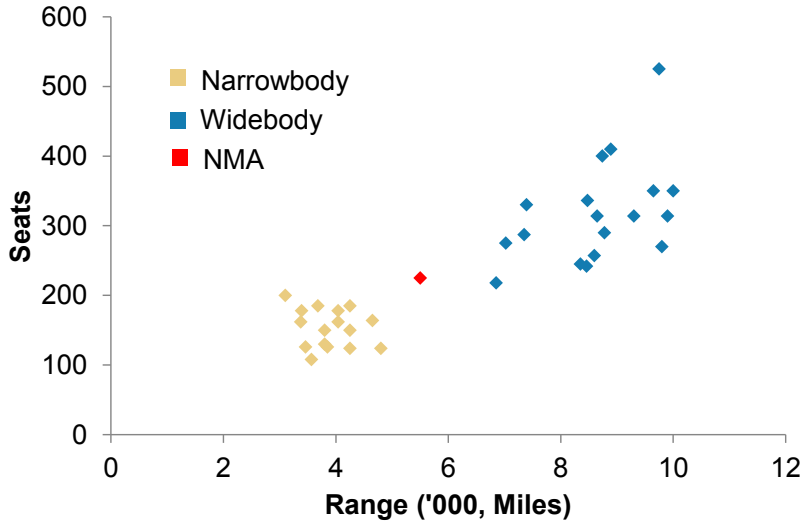
Source: Ascend, Morgan Stanley Research. Note: Boeing (BA, Rajeev Lalwani), Airbus (AIR-FR, Andrew Humphrey), Bombardier (BBD.B-T), Embraer (ERJ, Josh Milberg).

Narrowbody / Widebody Aircraft Are the Key Products

Narrowbody / Widebody Models (i.e. Single-Aisle / Twin-Aisle)

OEM	Narrowbody	Widebody
Boeing	737NG 737MAX	767 777 777X 787 747-8
Airbus	A320ceo A320neo A220	A330 Family A350 XWB A380

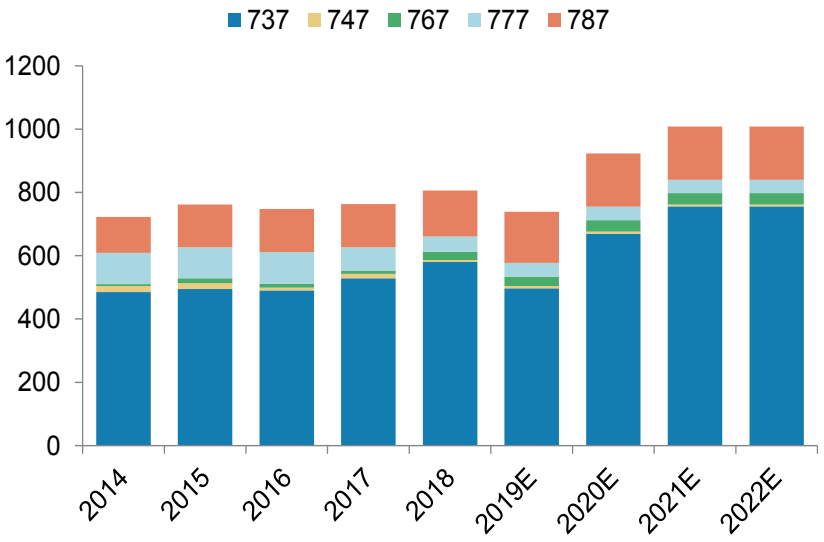
Narrowbody vs. Widebody by Features



Source: Airline Monitor, Ascend, Company Data, Morgan Stanley Research. Note: Typical seats are standard two class seating for narrowbody aircraft and three class seating for widebody aircraft.

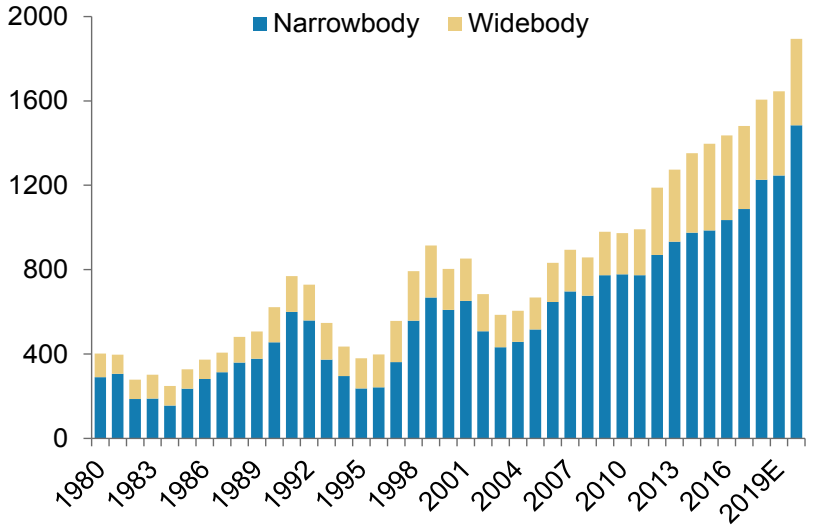
Production Rates Have Risen to Record Levels as Next Generation Programs Ramp

Boeing Monthly Production Rates



Source: Company data, Morgan Stanley Research.
E = Morgan Stanley Research estimates.

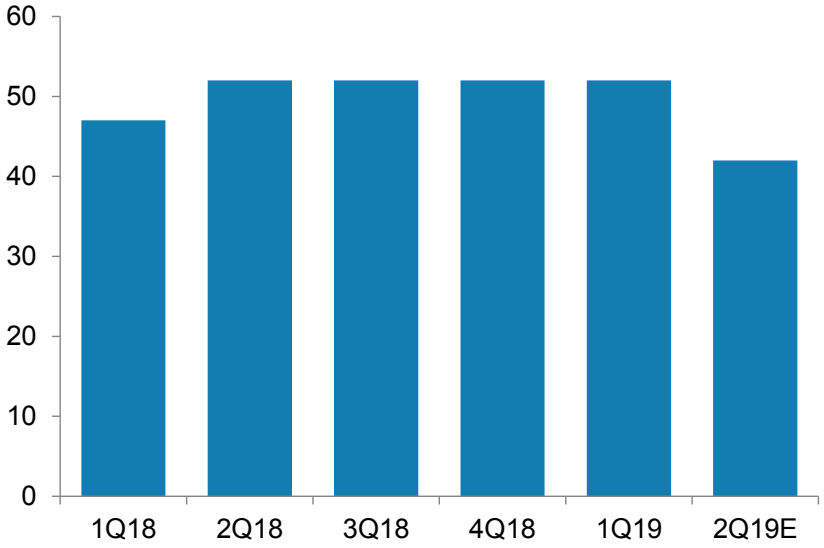
Deliveries by Aircraft Type



Source: Company data, Morgan Stanley Research.
E = Morgan Stanley Research estimates.

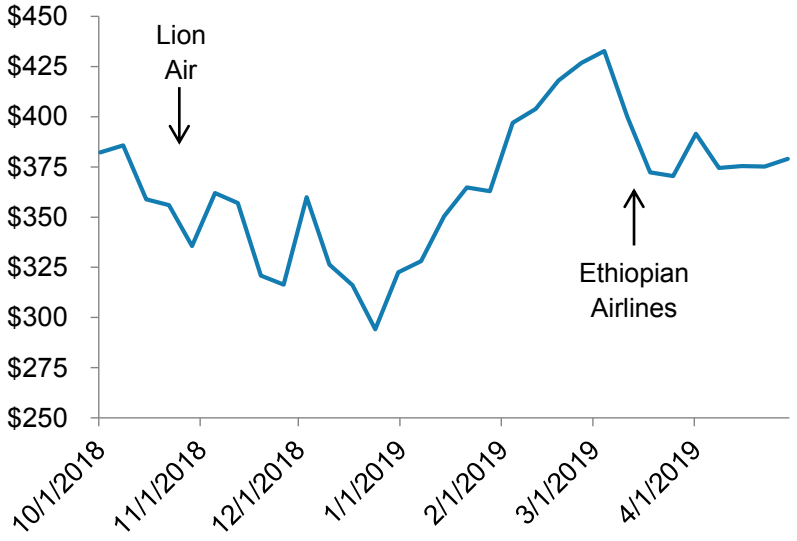
What Happened with the MAX?

737 Production Rate (Monthly)



Source: Company data, Morgan Stanley Research.
E = Morgan Stanley Research estimates.

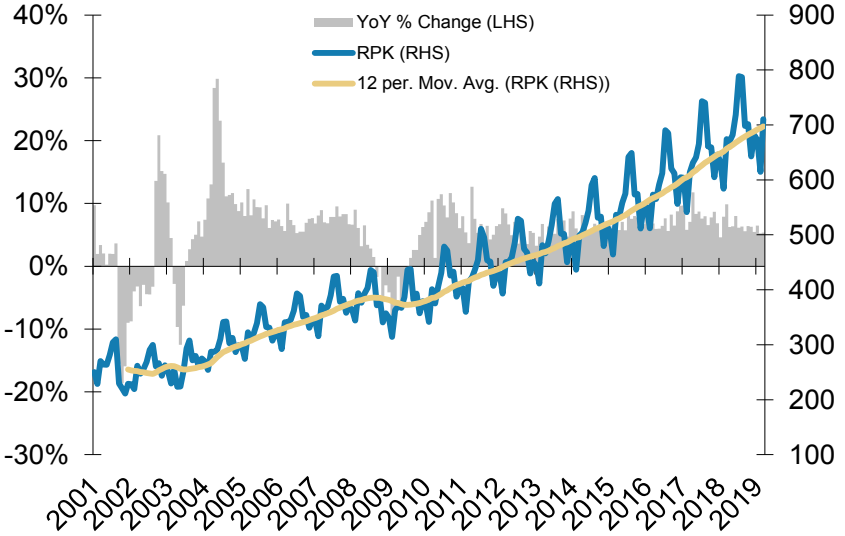
BA Share Price



Source: Company data, Morgan Stanley Research.
E = Morgan Stanley Research estimates.

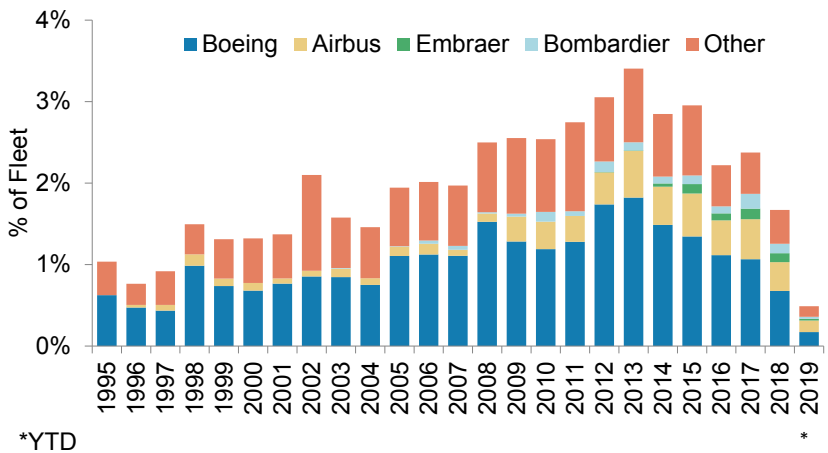
Air Traffic Trends and Retirements Drive Aircraft Demand and Healthy Activity Exists

Global Traffic Growth



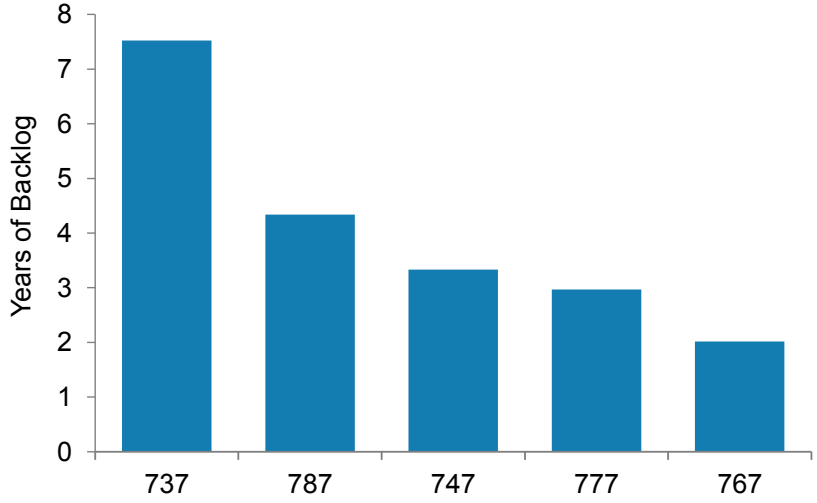
Source: IATA, Company data, Morgan Stanley Research.
E = Morgan Stanley Research estimates.

Retirement as a % of Fleet by OEM

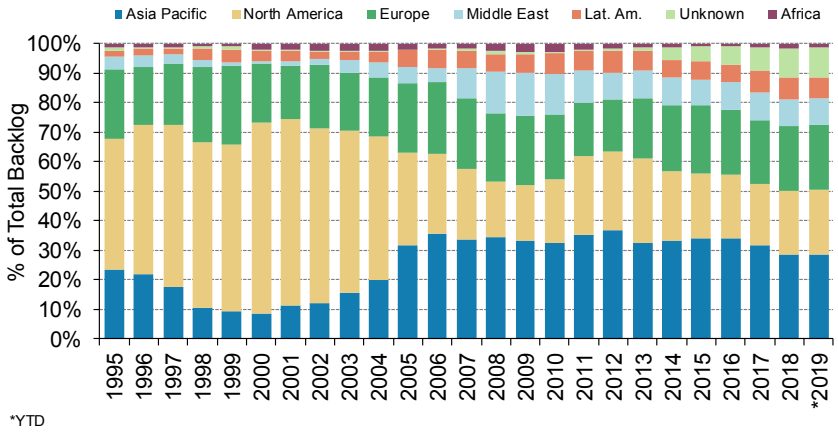


Source: Ascend, Morgan Stanley Research. Note: data for jets (western built) including Passenger, Freight/Cargo, Combi/Mixed, and Corporate/Executive usage

Diverse Geographic Exposures Insulate the Large Backlog from Risk



Source: Ascend Fleet Analyzer, Company data, Morgan Stanley Research. Note: 777 includes 777X
E = Morgan Stanley Research estimates.



Source: Company data, Morgan Stanley Research.
E = Morgan Stanley Research estimates.

Aftermarket End Market

Who Are the Key Players?

Discretionary:

1) Retrofits and upgrades
2) Mostly related to Interior of the aircraft
3) Improve product experience for customers at a reasonable cost
4) Fleet commonality a consideration in retrofits
5) Airline profitability important given non-essential to aircraft performance or safety
6) Likely to be deferred in leaner times

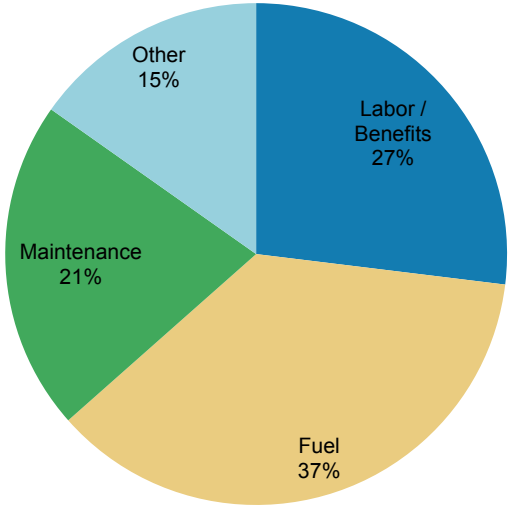
Non-Discretionary:

1) Usage Related
2) Typical Maintenance
3) Parts get worn out and need replacement
4) “Consumables” such as landing gears, breaks, engine parts
5) Largely tied to air traffic growth rates and utilization
6) Aircraft age a consideration
7) Retirements and parts-recycling can negatively impact

Honeywell Aerospace
Collins Aerospace
SPIRIT AEROSYSTEMS
ARCONIC Innovation, engineered.
TRANSDIGM GROUP INC.
SAFRAN
GE Aviation
HEXCEL
Triumph Group
MTU Aero Engines

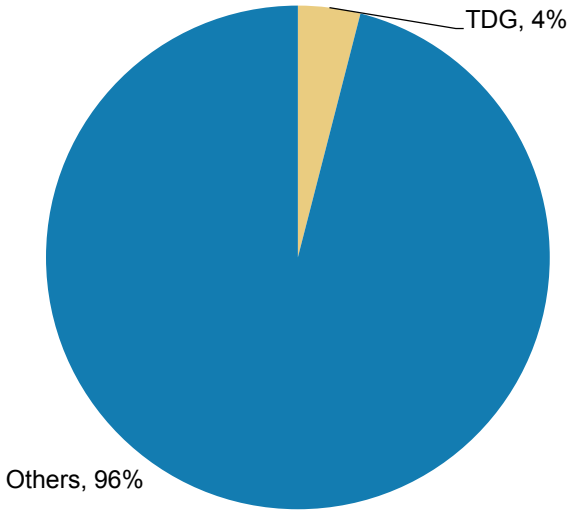
Market Is Highly Fragmented…

Global Airline Operating Expense by Category



Source: Airline Monitor, Company data, Morgan Stanley Research.
E = Morgan Stanley Research estimates.

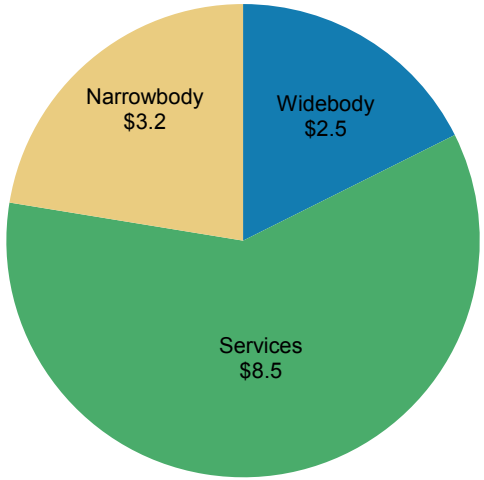
2018 TDG Share of Global Aftermarket



Source: Company data, Morgan Stanley Research.
E = Morgan Stanley Research estimates.

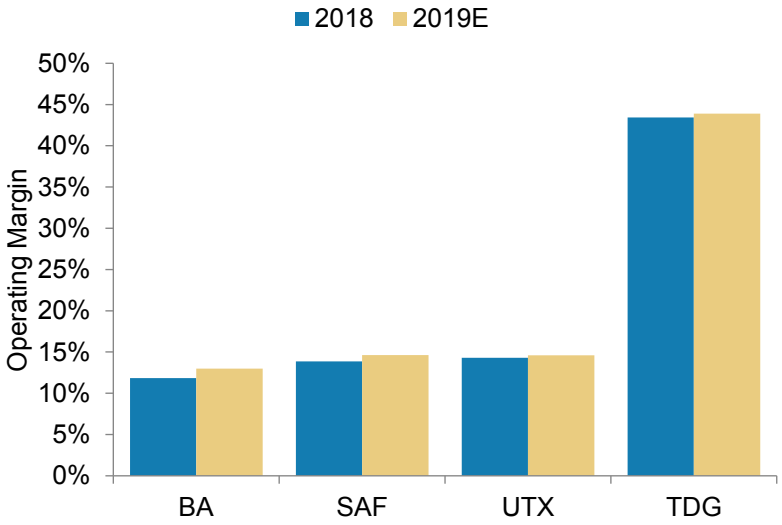
…With OEMs Looking to Take Share as Margins Tend to Be Higher

20-Year Current Market Outlook ($T)



Source: Boeing Current Market Outlook / Services Market Outlook, Morgan Stanley Research.
E = Morgan Stanley Research estimates.

Operating Margins (MSe)



Source: Company data, Morgan Stanley Research.
E = Morgan Stanley Research estimates.

Business Jets (“Bizjet”) End Market

Who Are the Key Players?

TEXTRON

EMBRAER

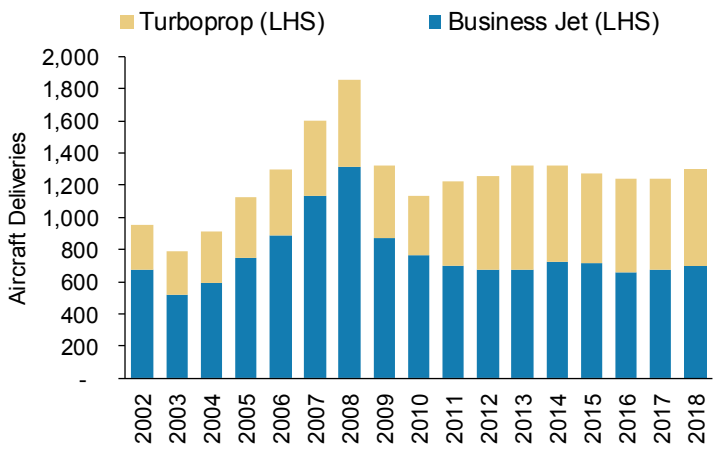
GENERAL DYNAMICS

BOMBARDIER

DASSAULT AVIATION

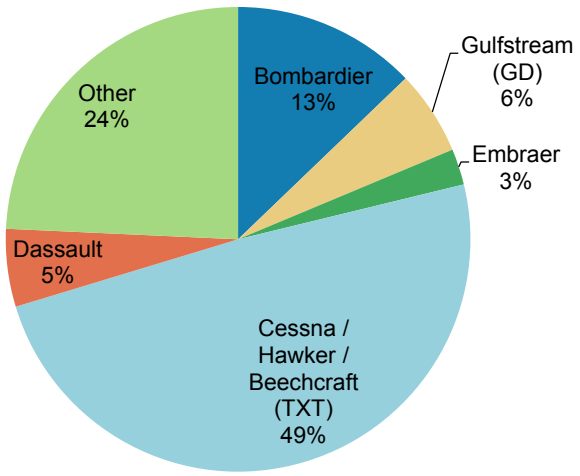
Bizjet Deliveries Remain Well Off Peak Levels

Annual Deliveries



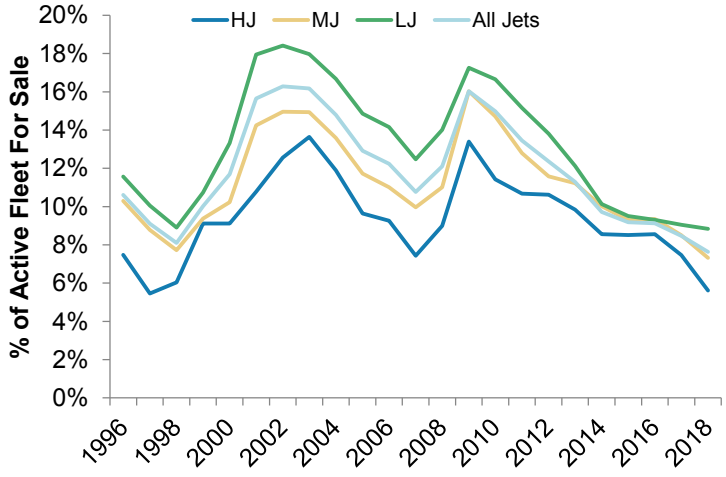
Source: GAMA, Company data, Morgan Stanley Research.
E = Morgan Stanley Research estimates.

In Service Fleet

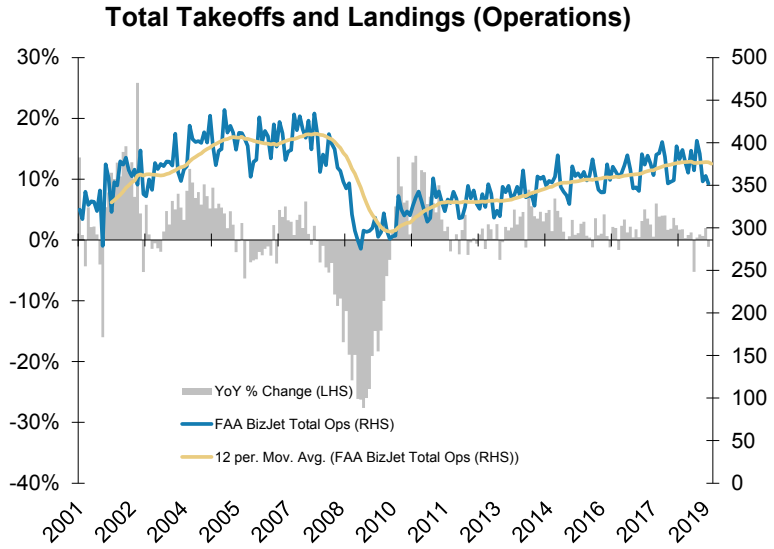


Source: Ascend Fleet Analyzer, Company data, Morgan Stanley Research.
E = Morgan Stanley Research estimates.

Secondary Market Trends and Operations Are Important Factors to Monitor



Source: AMSTAT, Company data, Morgan Stanley Research.
E = Morgan Stanley Research estimates.



Source: FAA, Company data, Morgan Stanley Research.
E = Morgan Stanley Research estimates.

Defense

Industry Structure Parsed by Size and Solution

"Primes"

Directly contract with end-customers to build major systems such as aircraft, ships and weapons

LOCKHEED MARTIN

Raytheon

NORTHROP GRUMMAN

GENERAL DYNAMICS

"Subs"

Supply the "Primes" with sub-systems and components or directly contract with end-customers in niche areas

HARRIS

L3 Technologies

Huntington Ingalls Industries

BWXT
BWX Technologies, Inc.

Government Services

Provide services to end-customers in areas such as MRO, systems engineering, information technology, and intelligence analysis

leidos

Booz | Allen | Hamilton

SAIC

CACI
EVER VIGILANT

perspecta

ManTech
International Corporation

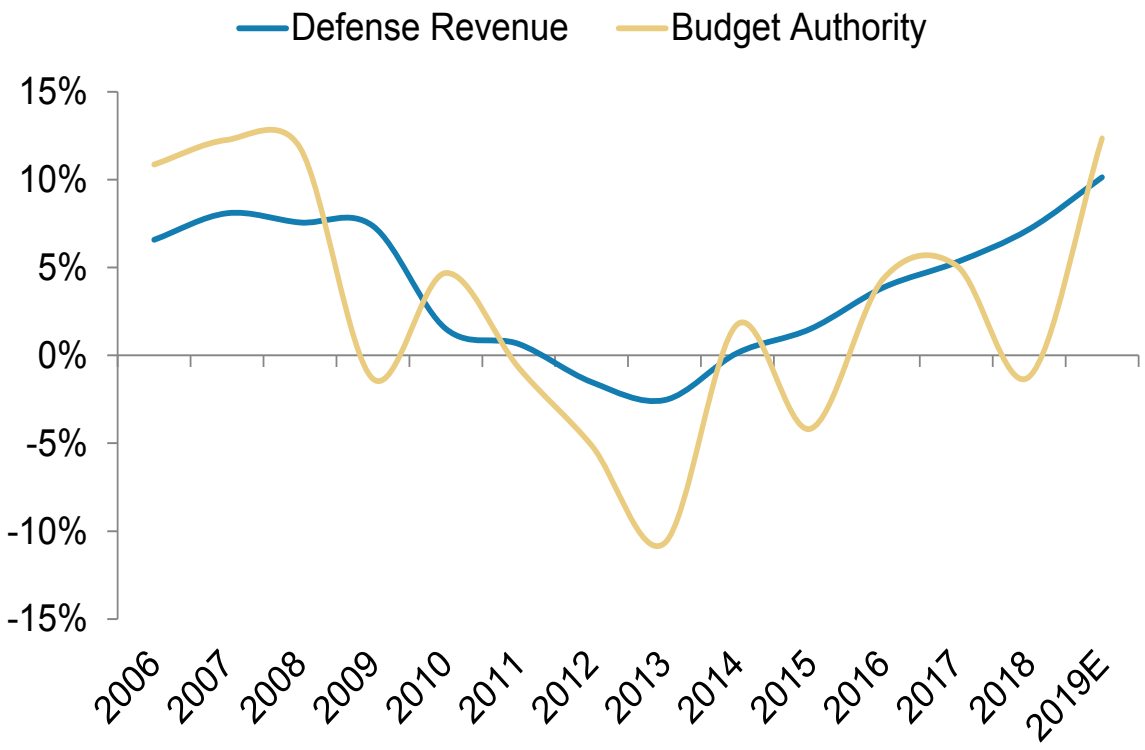
Source: Company Data, Morgan Stanley Research.

Company Capabilities Span a Host of Technologies, Domains, and Mission Areas

Core Capabilities	GENERAL DYNAMICS	LOCKHEED MARTIN	NORTHROP GRUMMAN	Raytheon
Aircraft	✓	✓	✓	
Ships	✓			
Ground Vehicles	✓			
Missiles/Weapons		✓	✓	✓
C4ISR	✓	✓	✓	✓
Space		✓	✓	
Cyber	✓		✓	✓
Services	✓		✓	✓

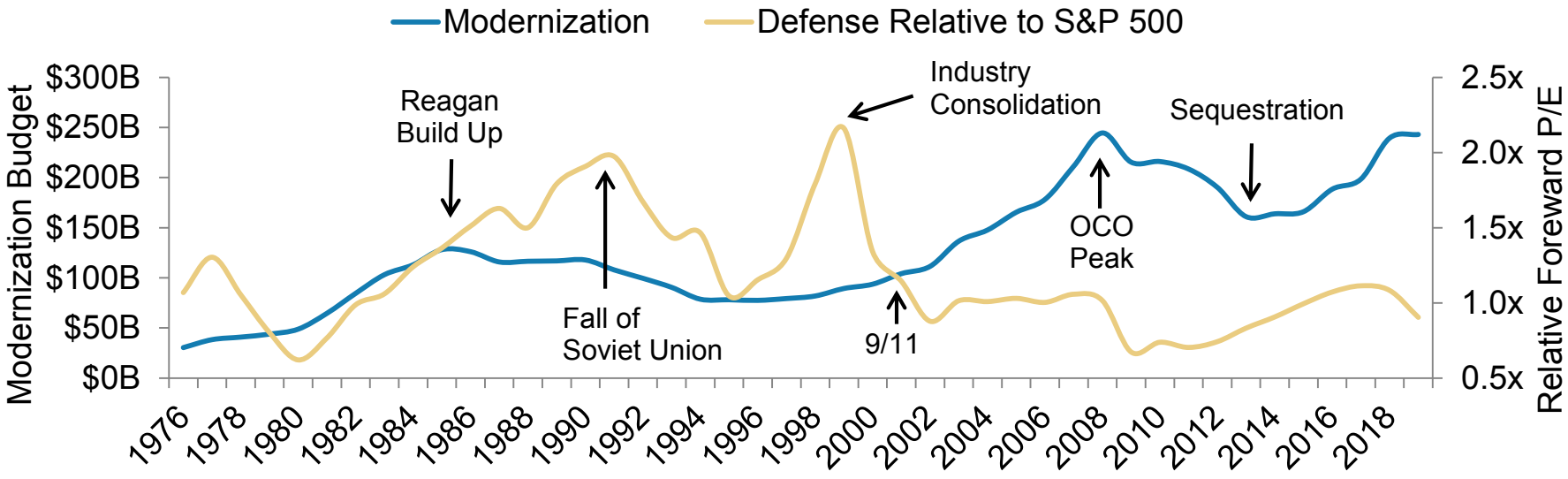
Source: Company Data, Morgan Stanley Research.

Revenues Generally Track Closely with Domestic Defense Budgets



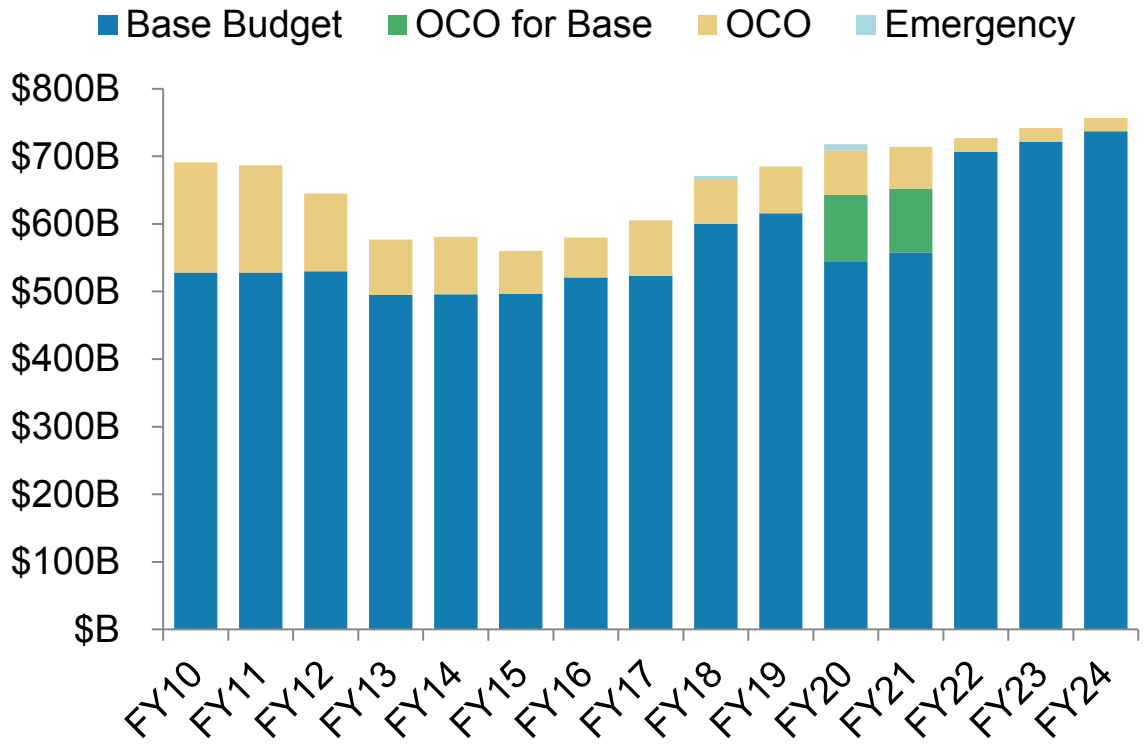
Source: DoD, Congress, Company Data, Morgan Stanley Research.

High Threat Environments Support Defense Budgets and Elevated Valuations Amongst the Group



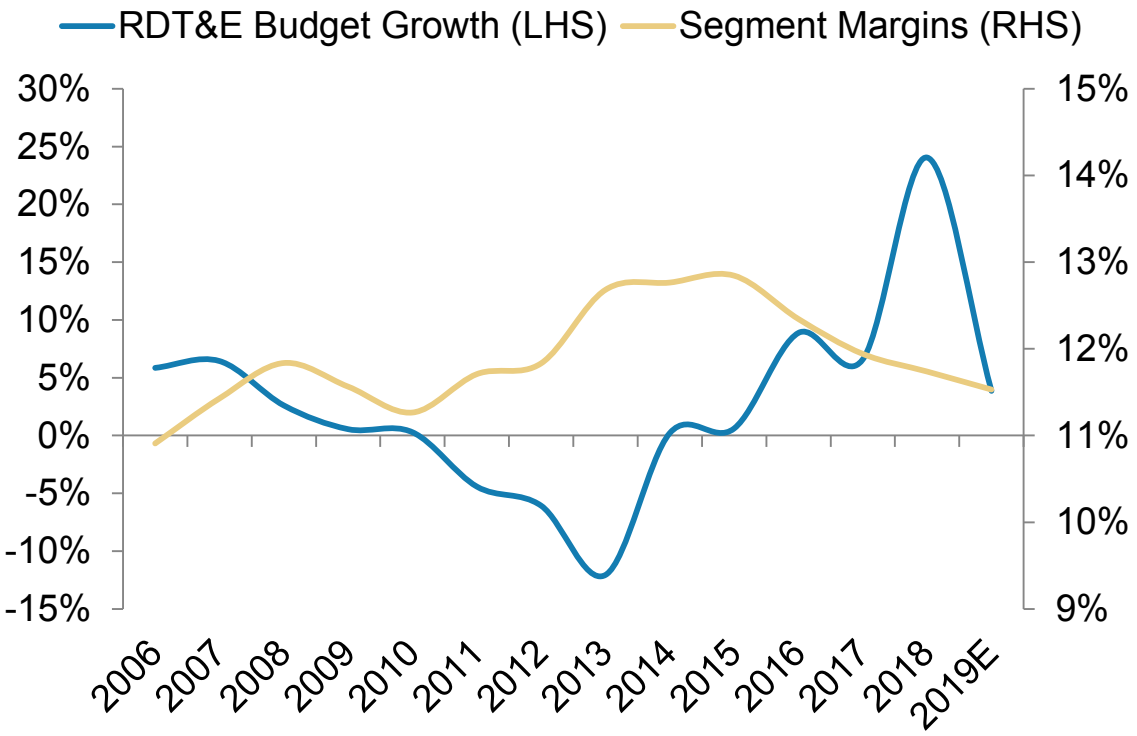
Source: DoD, Congress, Thomson Reuters, Morgan Stanley Research.

~5% Growth in the FY20 DoD Budget Should Support MSD Topline Industry Growth for Several Years



Source: Congress, DoD, Morgan Stanley Research.

Margins Have Eased Due to Mix



Source: Congress, DoD, Thomson Reuters, Morgan Stanley Research.

What Are the Key Debates Out There?

- Are the Commercial Suppliers in Trouble?
- What Disrupts the Aerospace Cycle?
- When Will Bizjet Recover?
- Can Defense Stocks Recapture Premiums?
- Will Consolidation Continue?

Morgan Stanley

FOUNDATION

May 2019

Industrials Spring Training Teach-In

Electrical Equipment and Multi-Industry

MORGAN STANLEY RESEARCH
North America

Morgan Stanley & Co. LLC



Josh Pokrzywinski
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Source: Shutterstock

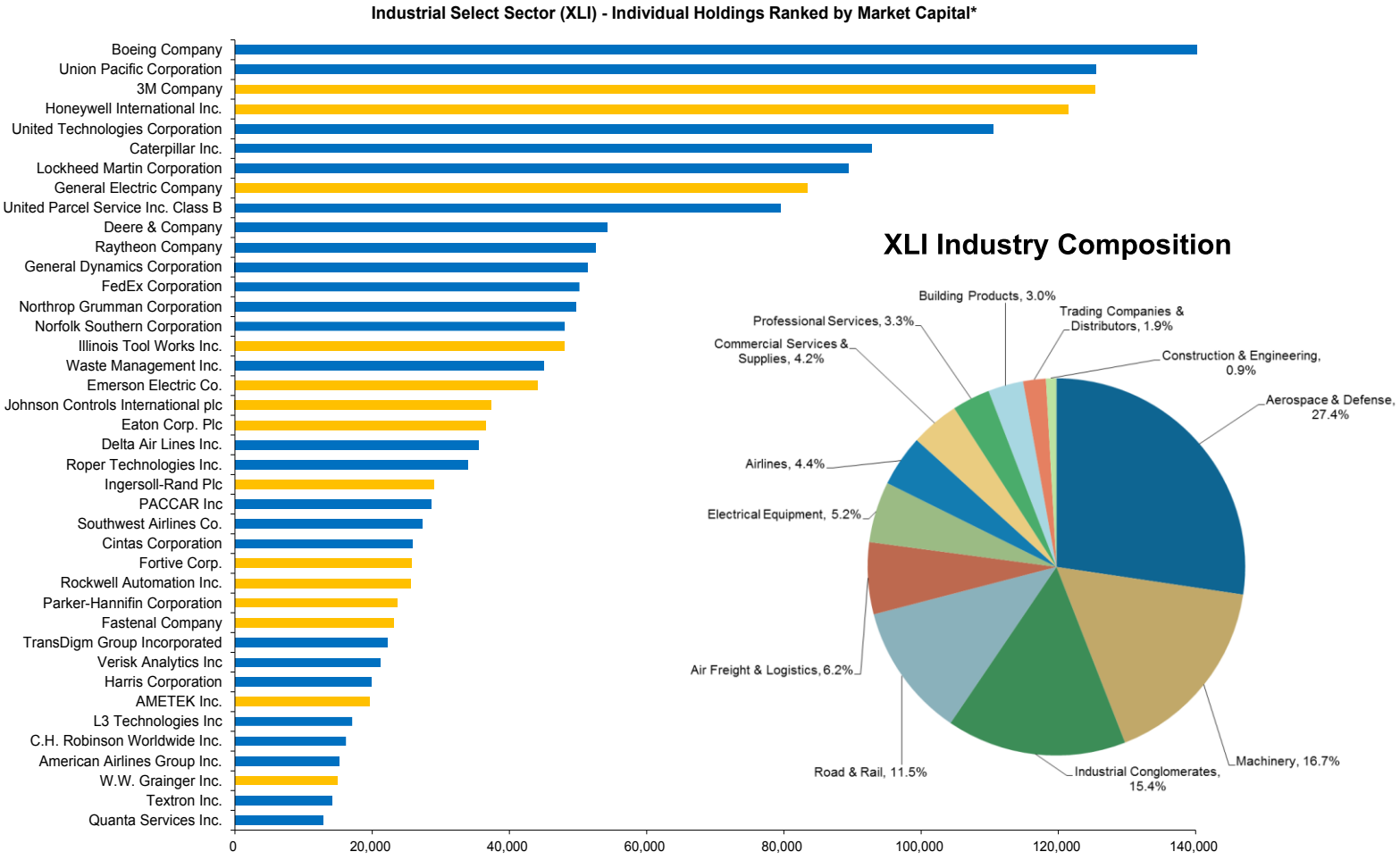
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For analyst certification and other important disclosures, refer to the Disclosure Section, located at the end of this report.

Stock recommendations and disclosures in this report are as of May 3, 2019; stock prices as of April 30, 2019, unless otherwise noted.

What Is the Multi-Industry Group?

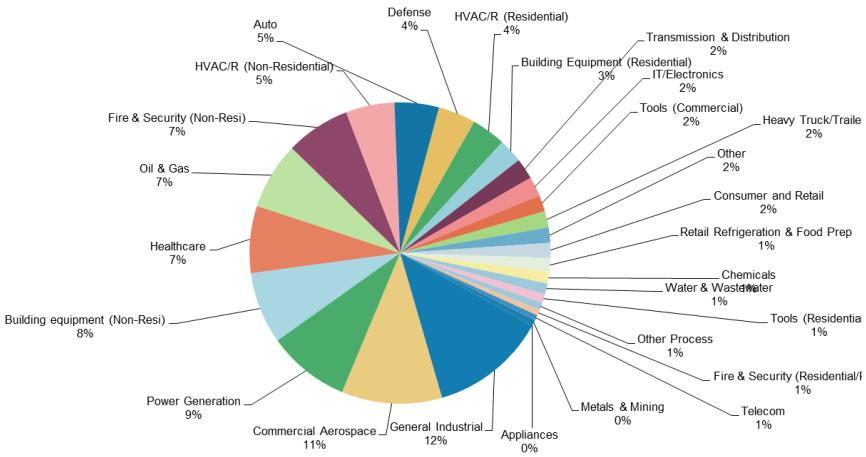
Multi-Industry Stocks Are Among the Largest US Industrials



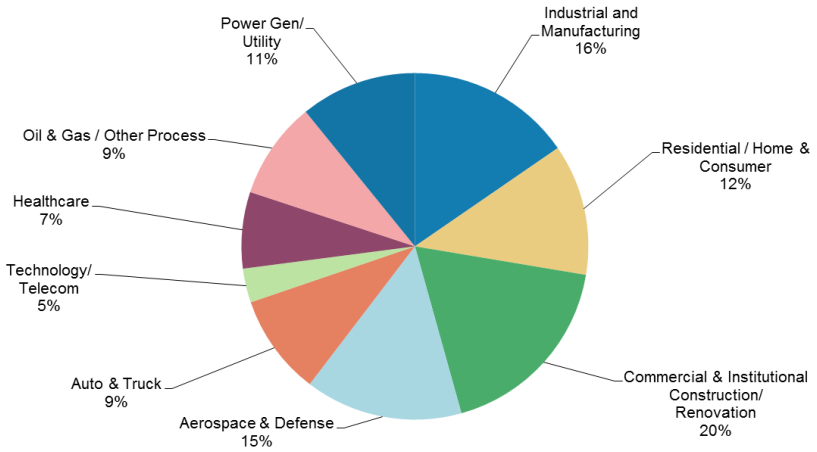
Source: Standard & Poor's Financial Services LLC, Morgan Stanley Research. Data as of 04/29/2019. Yellow denotes traditional EE/MI company.

Multi-Industry End Market and Cycle Exposures

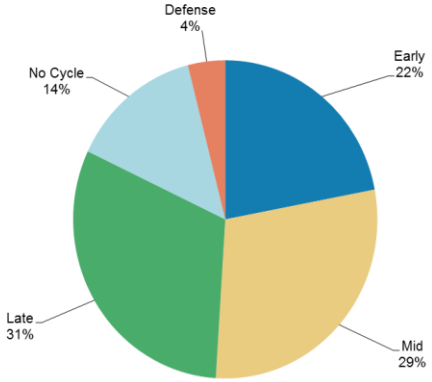
Detailed End Market Exposure



Consolidated End Market Exposure



Cycle Exposure



Source: Company Data, Morgan Stanley Research.

What Drives Multi-Industry Revenue?

Multi-Industry Sales Are Driven by Global GDP

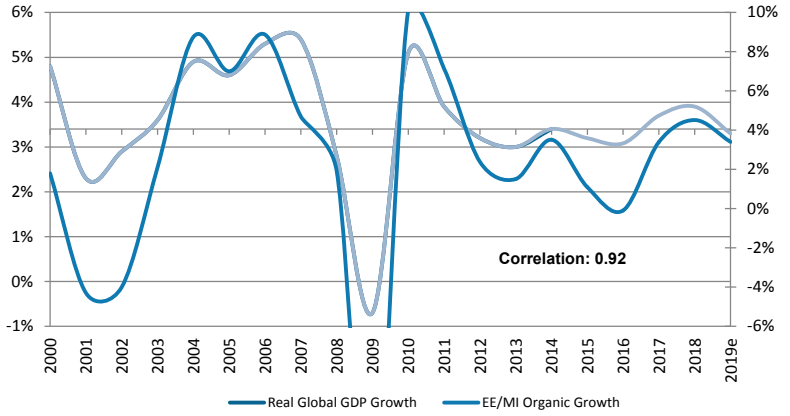
Global Growth Outlook

The global economy entered 2019 on a firm footing, though MS Economics expects deceleration through the year.

The MS Global Economics Team forecasts 3.4% global GDP growth in 2019, with growth decelerating slightly from 2017/2018 peaks. The deceleration is expected across both EMs and DMs.

Real GDP (%Q, SAAR)	2014	2015e	2016	2017	2018	2019e	2020e	2018-20e
Global*	**3.4%**	**3.4%**	**3.1%**	**3.7%**	**3.7%**	**3.4%**	**3.5%**	**3.5%**
G10	1.7%	2.0%	1.6%	2.2%	2.2%	1.5%	1.7%	1.8%
US	2.4%	2.5%	1.6%	2.3%	2.9%	2.1%	2.2%	2.4%
Euro Area	0.9%	1.4%	1.7%	2.5%	1.8%	1.0%	1.3%	1.4%
Japan	0.0%	1.0%	1.0%	1.6%	0.8%	0.8%	0.6%	0.7%
UK	2.8%	2.7%	1.8%	1.7%	1.4%	1.2%	1.5%	1.4%
EM	**4.8%**	**4.4%**	**4.2%**	**4.7%**	**4.8%**	**4.7%**	**4.8%**	**4.8%**
China	7.4%	7.0%	6.7%	6.9%	6.6%	6.3%	6.1%	6.3%
India	7.2%	7.7%	7.9%	6.3%	7.3%	7.2%	7.5%	7.3%
Brazil	0.1%	-1.5%	-3.6%	0.7%	1.1%	2.3%	2.5%	2.0%
Russia	0.6%	-5.0%	-0.2%	1.5%	2.3%	1.5%	1.6%	1.8%

Since 2000, the Multis group has shown a 0.92 correlation to Global GDP growth, with a higher level of cyclicality (1.3x average multiplier).

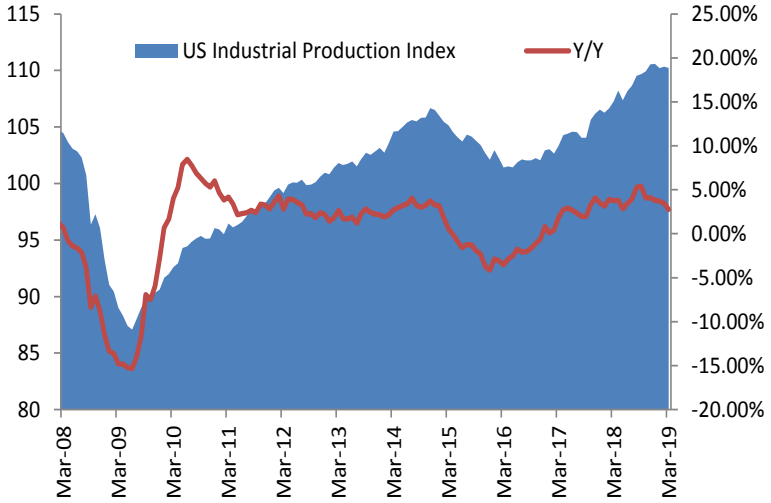


Source: Morgan Stanley Research and forecasts as of 4/24/2017; IMF

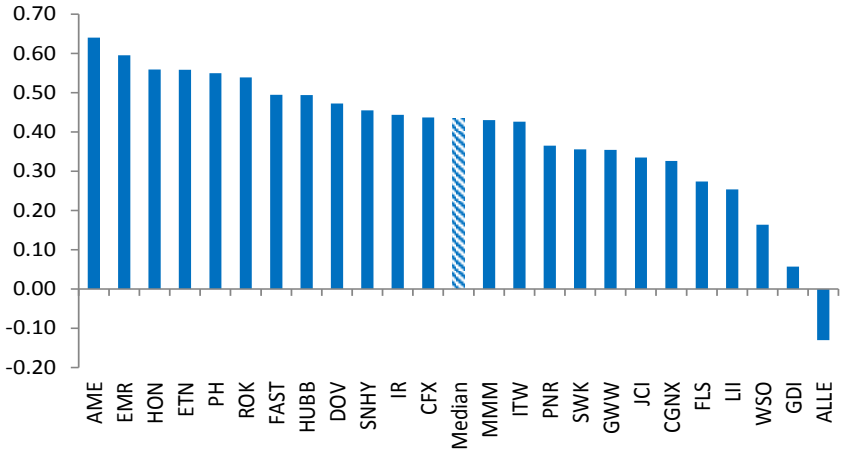
US Industrial Production Is Another Important Proxy

Industrial production: *a measure of output in the industrial sector of the economy, which includes manufacturing, mining, electric and gas industries. The industrial sector, together with construction, accounts for the bulk of the variation in national output over the course of the business cycle. The US IP index measures real output of the industrial economy and is expressed as a percentage of real output in a base year, currently 2007.*

Growth in US Industrial Production remained robust throughout 2018



Broadly, the group shows a high degree of correlation to US Industrial Production (0.43, last 20 Years), with greatest correlation at AME, EMR, HON, ETN.



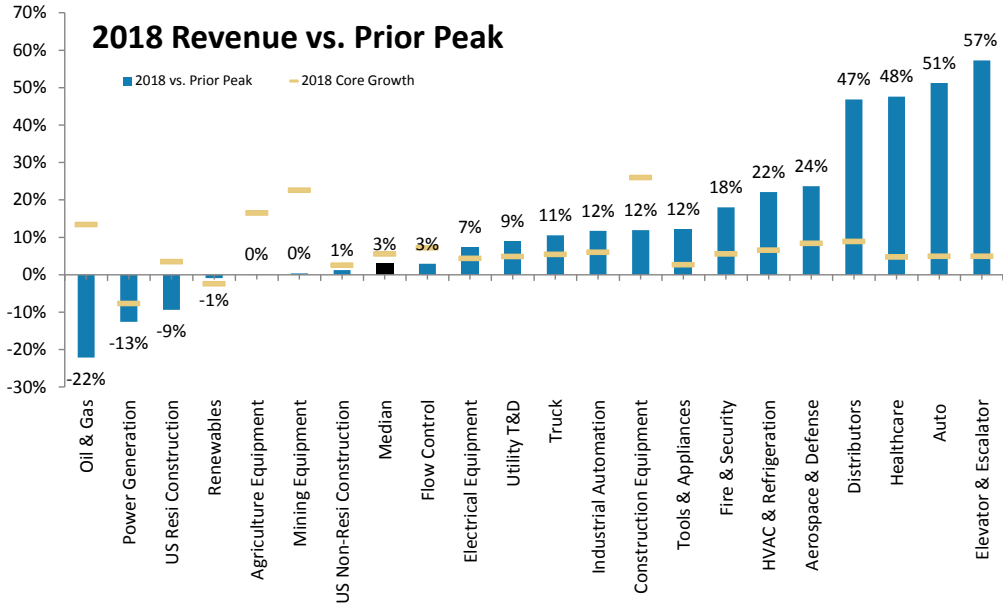
Source: Morgan Stanley Research, Federal Reserve, Thomson Reuters.

End Market Demand Levels vs. Prior Peak Levels

The rationale for the diversified business structure is to provide stable growth across the cycle by maximizing growth and minimizing volatility. Ways to do this include diversified end market exposures as well as greater mix of MRO and service revenue stream

End market balance is critical to delivering revenue stability as can be seen here: Consumer exposures are generally well ahead of prior cycle peaks, while Heavy Industries are just off troughs.

Looking across EE/MI end markets, we see Auto, Healthcare, E&E, and Distributors well ahead prior peak levels, while Oil & Gas, Power Generation, and Resi Construction are below prior peaks.

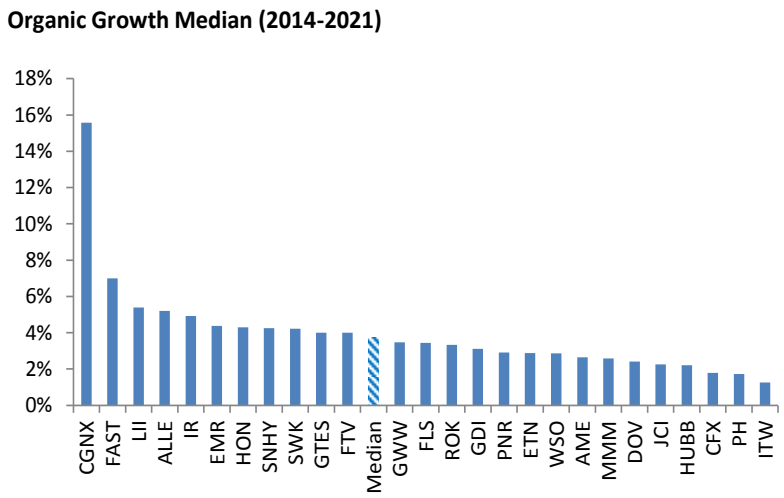


Source: Company Data, Morgan Stanley Research.

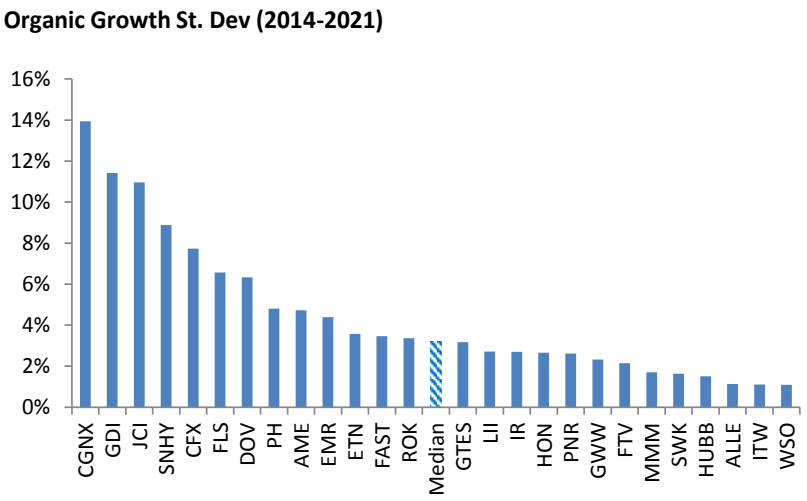
How Well Diversified is your Industrial?

Generally larger industrials show lower volatility of revenue growth. Companies like HON have large exposure to stable service streams, while 3M and ITW are more consumables driven..

From 2014-2021 Organic Growth sits at +3.7% for the group, with best growth at CGNX, FAST, and LII.



Standard Deviation in organic sales highlights low volatility at WSO, ITW, and ALLE.



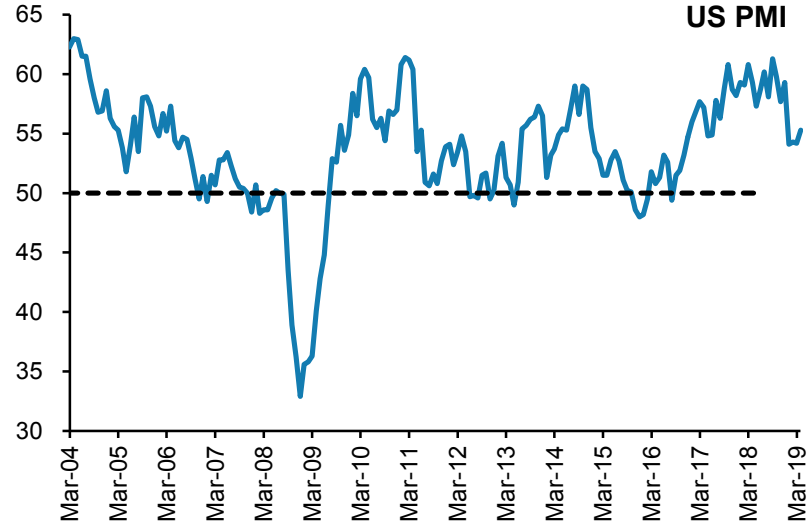
Source: Company Data, Morgan Stanley Research.

PMIs Are Closely Tracked as a Barometer of Future Sales

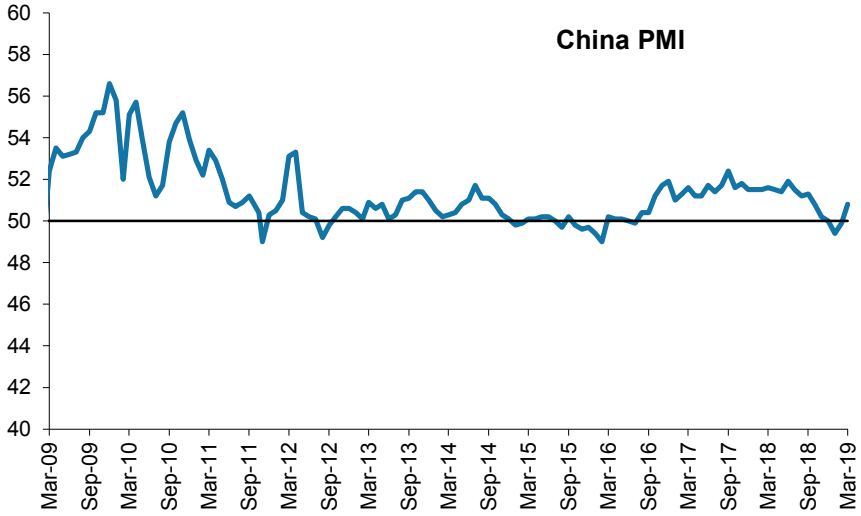
ISM / Purchasing Managers Index (PMI): *Data for the US ISM are collected from more than 300 purchasing and supply executives from across the country, who respond to a monthly questionnaire designed to elicit fact, not opinion, about changes in production, new orders, new export orders, imports, employment, inventories, prices, lead-times, and the timeliness of supplier deliveries, comparing the current month to the previous month.*

The PMI is constructed as a diffusion index, which has the properties of a leading indicator and shows the prevailing direction of an indicator change and the scale of that change. A PMI reading >50% indicates that the manufacturing economy is generally expanding; <50%, it is generally declining.

US PMI: Off recent cycle highs, now at 55.3



China PMI: Recovering From Stagnation, Now At 50.8



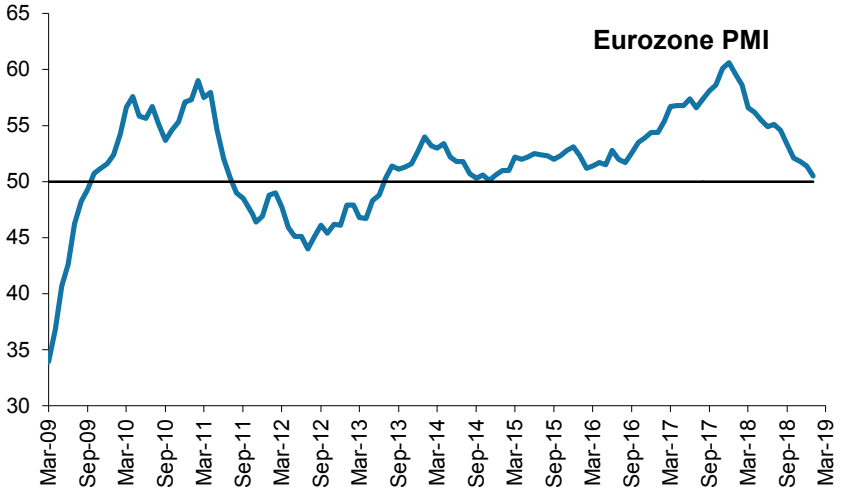
Source: Morgan Stanley Research, ISM, Thomson Reuters.

PMIs Are Closely Tracked as a Barometer of Future Sales

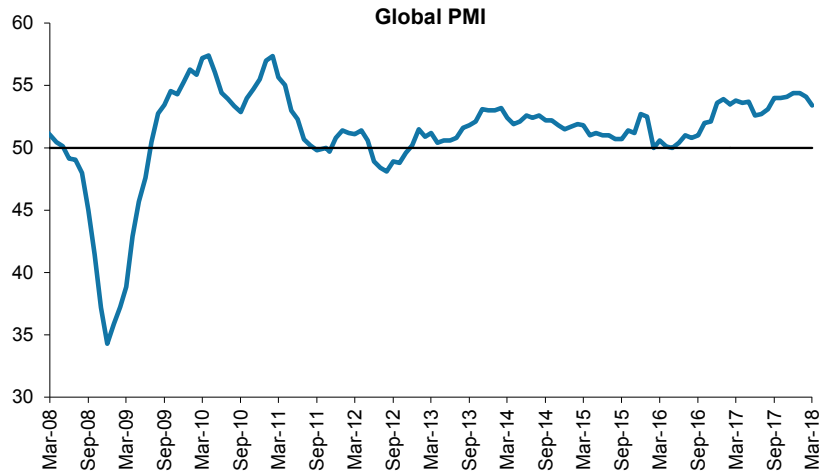
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Eurozone PMI: Decelerating from Post Recession Highs



Global PMI: Showing Strong Acceleration to 53.5



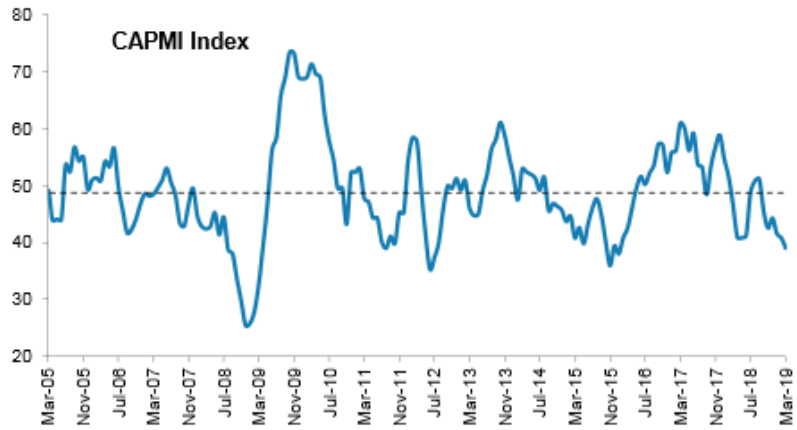
Source: Morgan Stanley Research, ISM, Thomson Reuters.

But We Prefer Our Proprietary CAPMI as a Lead Indicator

The Morgan Stanley Capital Goods Momentum Index (CAPMI) *is a diffusion index that measures the month-over-month momentum of 48 key global macro and industry indicators. Overall, the index composition is largely consistent with our companies' geographic exposure, with 42% from North America, 19% Europe, 19% APAC and 21% Global. It also includes KPI's for the major end markets to which our companies are exposed, including Aerospace, Automotive, Construction, Oil & Gas, HVAC, Power and Technology.*

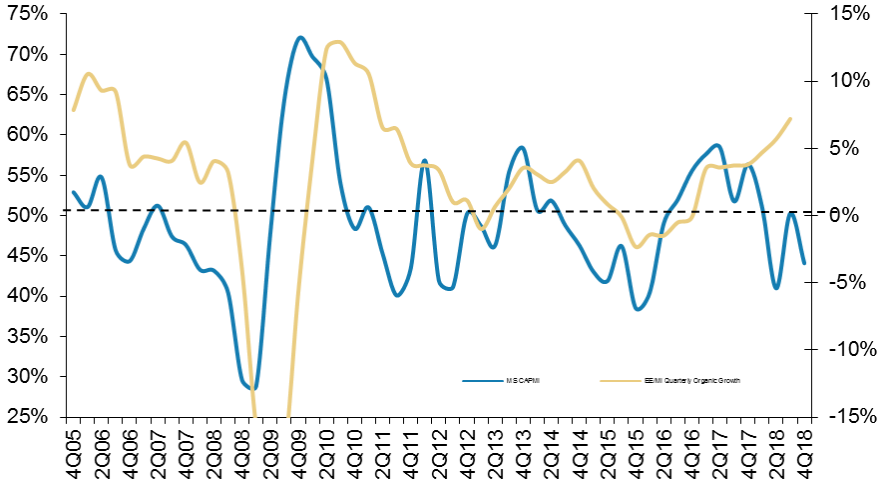
The index has a central value of 50; *a reading of 50 indicates that the overall trend is stable on a monthly sequential basis. A reading over 50 indicates accelerating growth, while a reading below 50 indicates decelerating growth. However, we prefer to look at the second derivative of the index: i.e. a clear upward trend in the diffusion index below 50 is often a more powerful indicator than a downward trend below 50 – it's really all about acceleration and deceleration of the index.*

CAPMI came in at 45 in April, after seven months of consecutive readings below parity.



Source: Morgan Stanley Research

CAPMI tends to lead EE/MI organic growth by 6/9 months. Continued deceleration suggests there is more room for industrial momentum to slow in 2019.



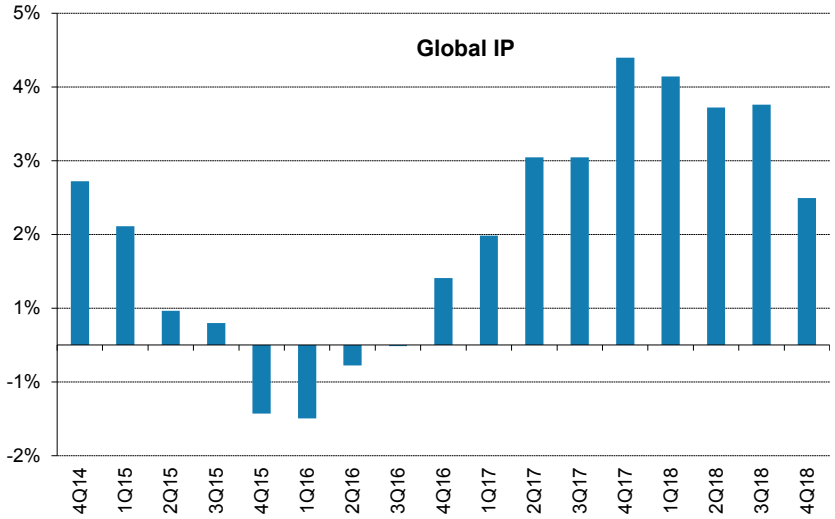
Where Are We in the Global Cycle?

Where Are We in the Industrial Cycle?

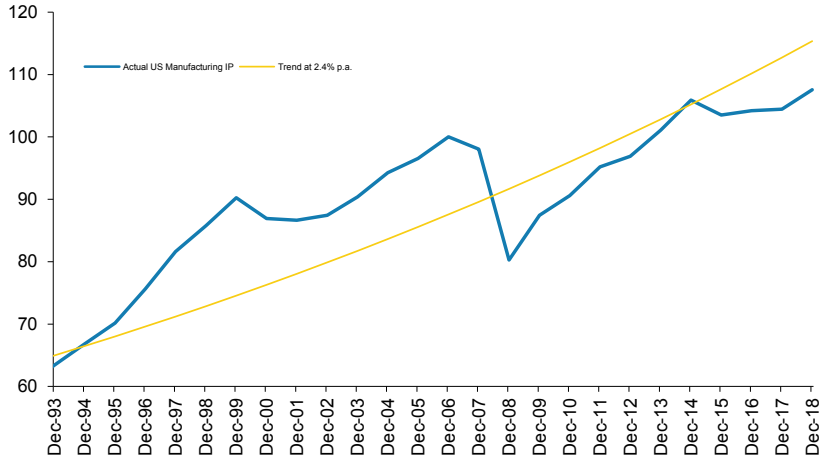
Global Industrial Production accelerated through 2017 but subsequently slowed through 2018.

The US is nearing peak Industrial Cycle. *We've seen growth accelerate significantly post 2016 and now we are starting to see indicators that growth may be slowing. Notably, the US is ~6% below its trend line, which is consistent with levels post-recession. We believe there are secular shifts taking place that will temper growth on a sustained basis.*

Global Industrial Production has decelerated since peaking in 4Q17



While US Industrial output has recovered, it still sits ~6.7% below trend.

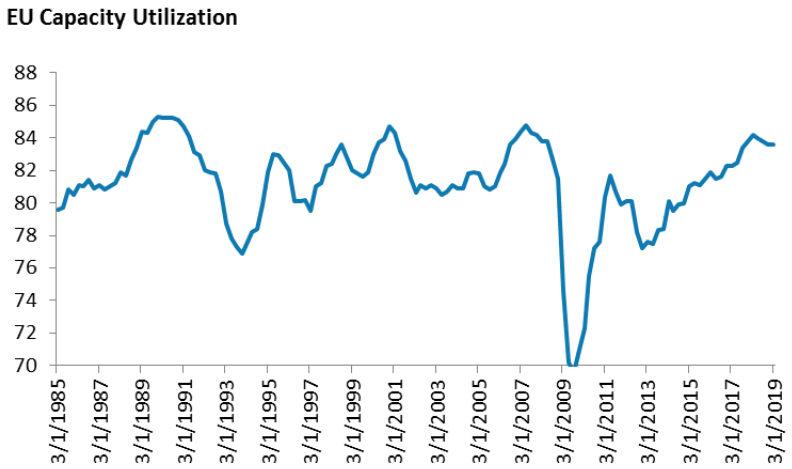


Source: Morgan Stanley Research, ISM, Thomson Reuters.

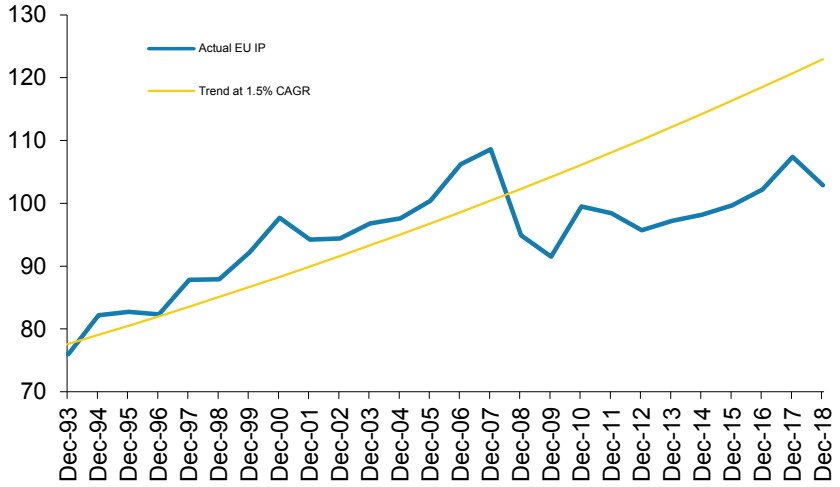
European Cap Utilization Sees Steady Growth; IP Inflects Negative

Europe. *European Industrial Production remains ~11% below trend levels, but has been seeing steady growth in recent years after double-dipping following the financial crisis. Additionally, we've seen continued strength in European Capacity Utilization as the index has remained broadly above the key 80% level since a post-recession monetary crises plagued the region in 2012-2013.*

EU Capacity Utilization Continues To Extend Above the Key 80% Level



European Industrial Production has been growing steadily but has remained well below trend levels since the 2008 recession.

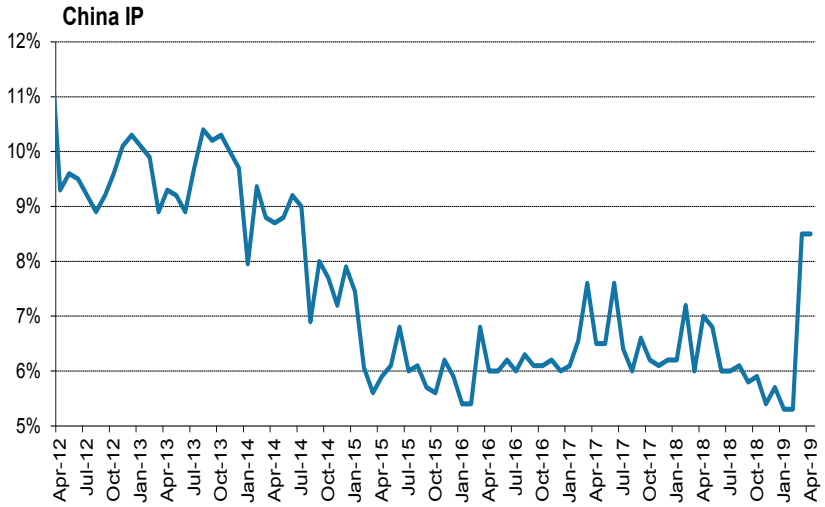


Source: Thomson Reuters, Morgan Stanley Research

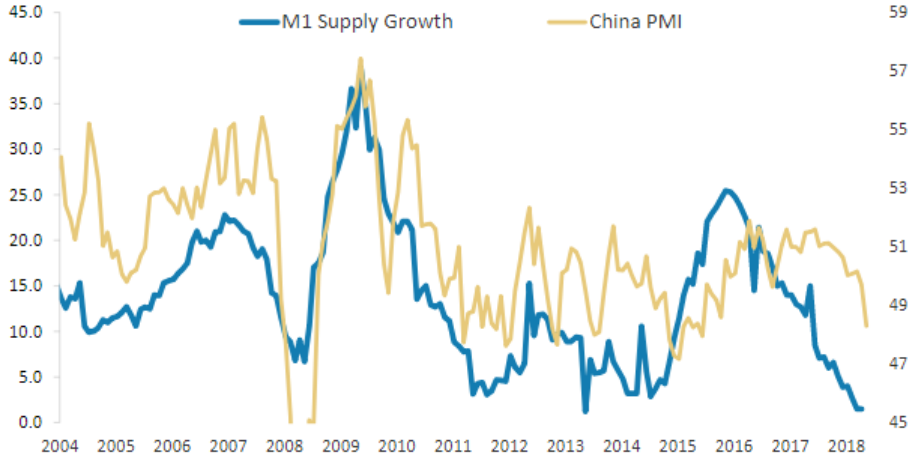
China Resettling Around 6% Post-Stimulus

China. *We saw China growth accelerate to the ~7% zone in early 2017 as a result of government-driven stimulus. However, more recently we've seen growth again settle in the ~6% zone through the remainder of 2017.*

China Industrial Production

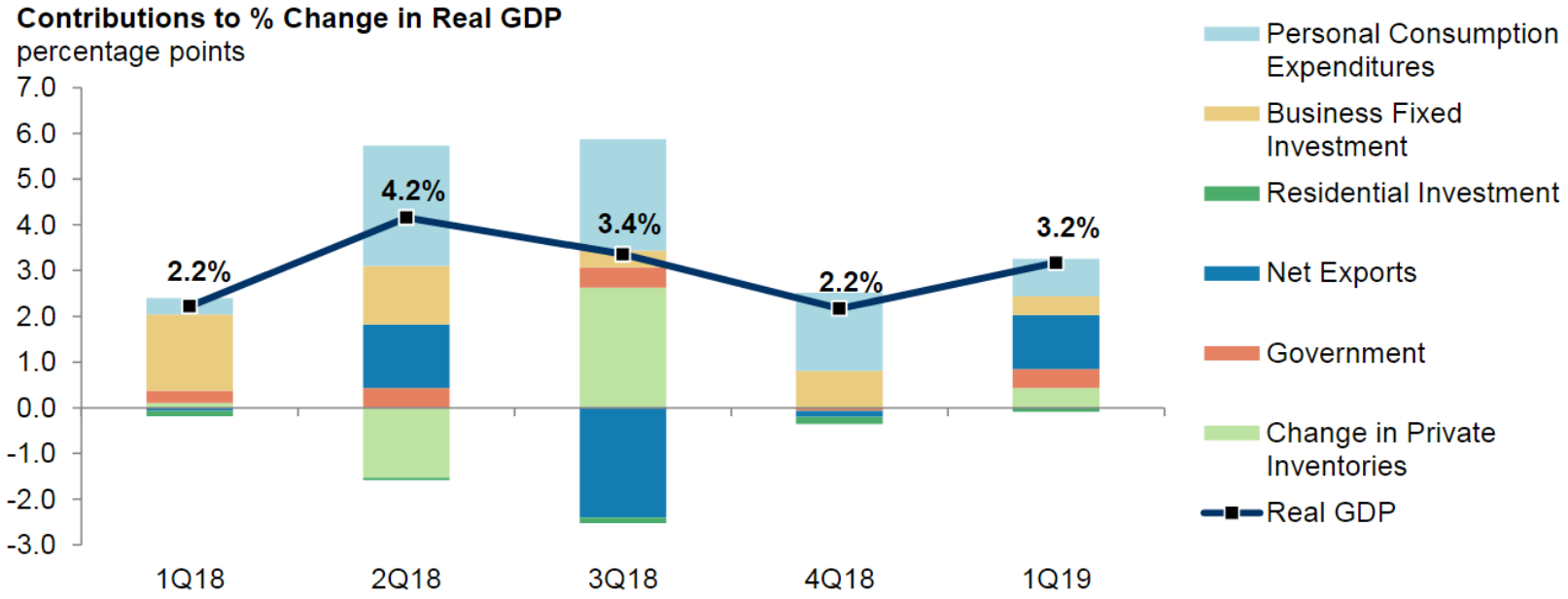


China M1 Money Supply vs. PMI



Source: Thomson Reuters, Morgan Stanley Research

Inventory Levels Remain A Swing Factor For Growth

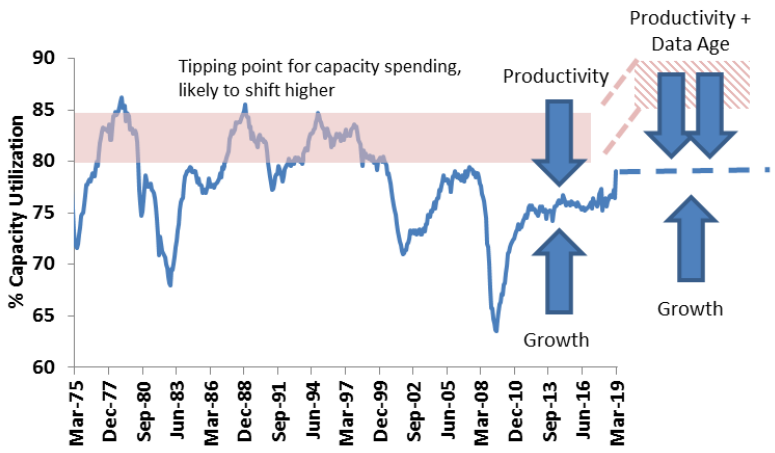


Source: Morgan Stanley Research, Bureau of Economic Analysis

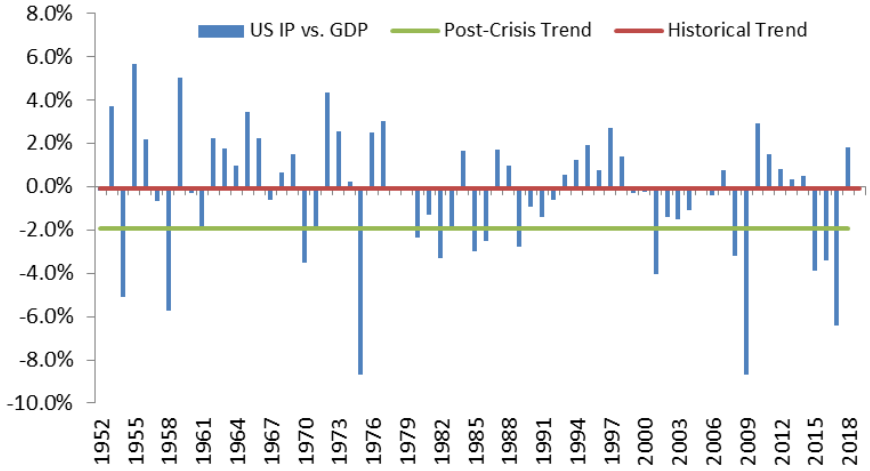
The End of the Metal Bending Age

We believe technology and productivity initiatives are shifting demand for new capacity. Essentially software and tech are competing for capital with traditional fixed assets. We believe the focus on productivity and capital conservation is partly to blame for subtrend IP growth post-2009

US Manufacturing Capacity Utilization



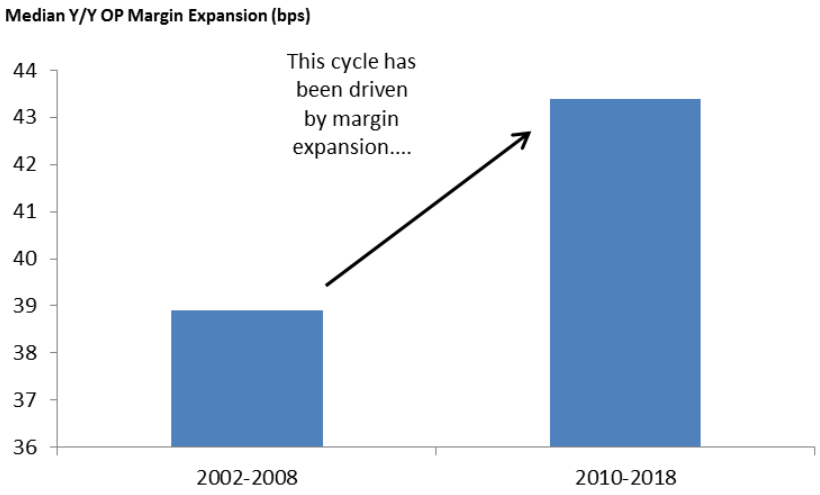
US Industrial Production vs. GDP



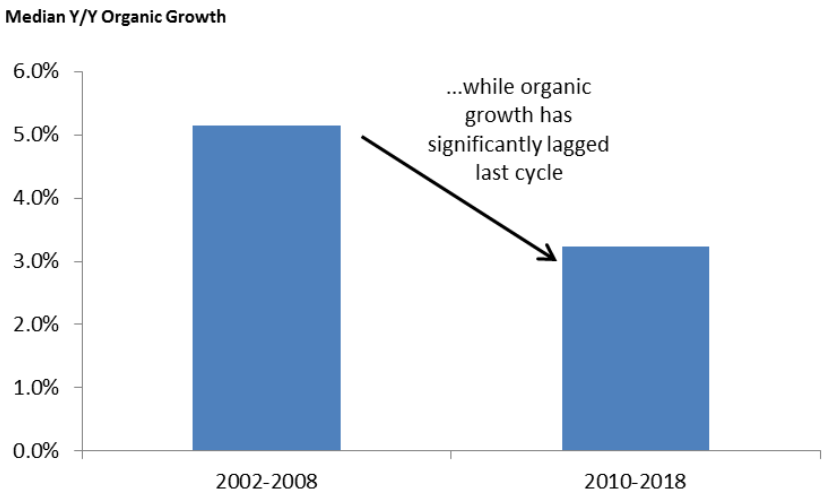
Source: Morgan Stanley Research, Federal Reserve

Productivity and Capital Conservation Impact Multis Too

Multi-Industry Cycle to Cycle Margin Expansion



Multi-Industry Cycle to Cycle Growth



Source: Company Data, Morgan Stanley Research

Where Are We in the Non-Resi Construction Cycle?

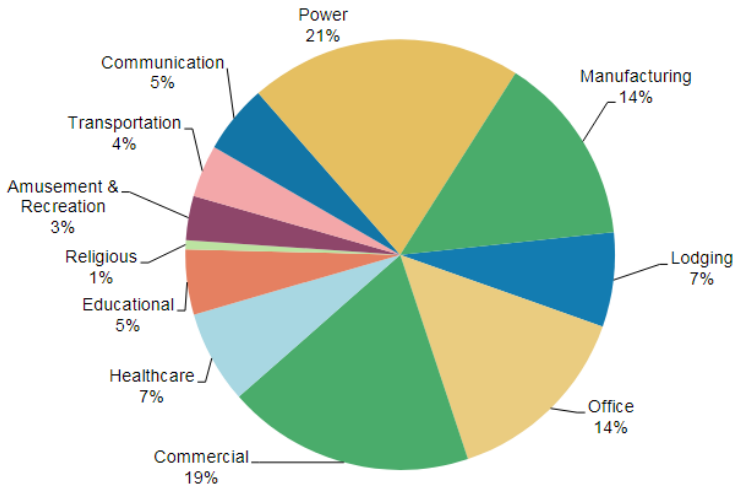
Non-Residential Exposure Details by Stock

	(% of total sales)			Exposure/Product Detail
	Non-Resi	US	RoW	
ALLE	70%	51%	19%	Door closers and controls, Electronic security products, Exit devices, Time, attendance and workforce productivity systems, Doors and door systems, Electronic, biometric and mobile access control systems, Locks, locksets, portable locks, key systems and services
JCI	55%	28%	27%	Commerical HVAC Chillers, Air Handlers, Control Systems, Air Conditioning and Heating Equipment and Products. Security monitoring services, security management services, fire alarm system design, installation and support services; anti-theft systems and detection accessories. Products include fire detection panels, water sprinklers, valves, intrusion detectors, security management software, video hardware, RFID tags, air purification masks.
IR	47%	31%	16%	Unitary heating and air conditioning equipment, applied systems (chillers, air handling systems, terminal devices), controls, installation and service of commercial heating and cooling equipment.
HUBB	30%	30%	0%	Broad electrical products used in non-residential applications, including cables, cable fittings, connectors, tooling, floor boxes, grounding devices, wiring devices, switches, lighting fixtures, LED components, sensors and fans.
LII	25%	19%	6%	Unitary heating and air conditioning equipment, controls, installation and service of commercial heating and cooling equipment, predominantly in North America.
PNR	20%	13%	7%	Commercial pool equipment and accessories including pumps, filters, heaters, lights, automatic controls, automatic cleaners, maintenance equipment, and pool accessories. Filtration solutions for commercial applications. Water treatment, wastewater handling, fluid delivery, and circulation & transfer pumps.
ETN	18%	10%	8%	Low-voltage electrical components: circuit breakers, single-phase UPS, lighting fixtures and controls, enclosures, wiring devices, switches, meters, sensors, relays and inverters. Power distribution & power quality products.
HON	18%	9%	9%	HVAC control systems, lighting and building control & optimization systems; Fire and gas detection, safety products; access control, video surveillance; Energy & security building solutions, fire & security product distribution.
SWK	17%	9%	9%	Professional power tools, hand tools and tools storage. Fasteners and accessories. Commercial electronic security installations, service and monitoring. Automatic doors and commercial hardware
WSO	15%	15%	0%	Commercial air conditioning and heating equipment and systems ranging from 1-1/2 to 25 tons.
EMR	13%	8%	5%	Air conditioning compressors, thermostats, monitoring equipment, heating system controls, gas valves for furnaces water heaters; Hand and power tools, pipe working tools, shelving systems, office organizers, cabinets, workstations.
PH	10%	6%	4%	Motors, seals, packings, fittings, hose, air preparation units, hydraulic motors and pumps, CO2 controls, electronic controllers, filter drieres, hand shut-off valves, heat exchangers, hoses & fittings, precision cooling, valves, refrigerant distributors, thermostatic expansion valves.
MMM	6%	2%	4%	Graphics for: Buildings, Transportation, Food & Beverage, Banking, Bomb blast resistant window films, Fire Mitigation Products, Roofing Granules, Algae Block system for asphalt shingles, pool linings, Architectural surface and lighting solutions
ITW	6%	2%	4%	Fasteners, anchors & related tools for wood, metal & concrete applications; metal plate truss components & related equipment/software; packaged hardware. Adhesives for construction applications
GWW	5%	4%	1%	Safety and Security equipment, metalworking tools, hand tools, MRO supplies, power tools, electrical and HVAC equipment
Average	**24%**	**16%**	**8%**	

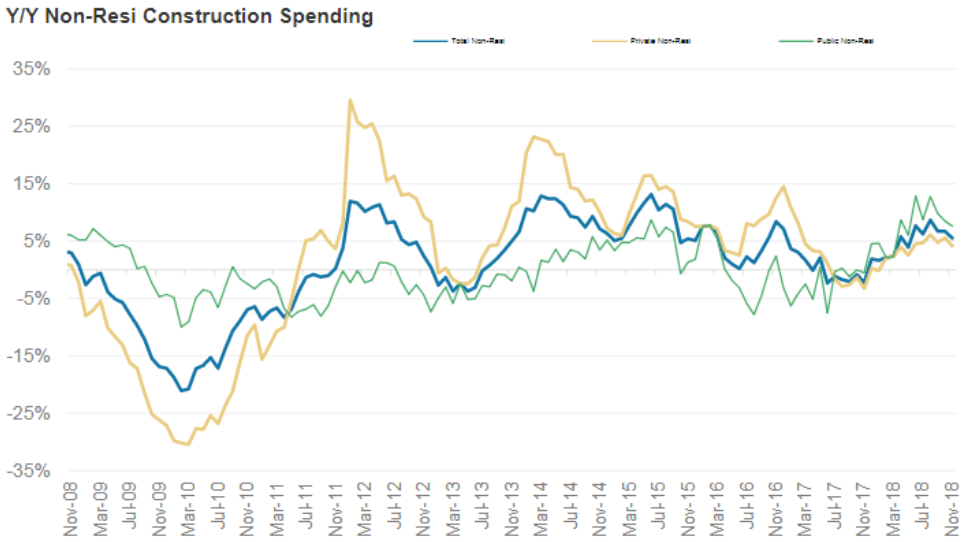
Source: Company Data/Documents, Morgan Stanley Research; includes estimates – only stocks under coverage with >5% estimated sales exposure.

Where Are We in the Non-Resi Construction Cycle?

Private Spending Mix



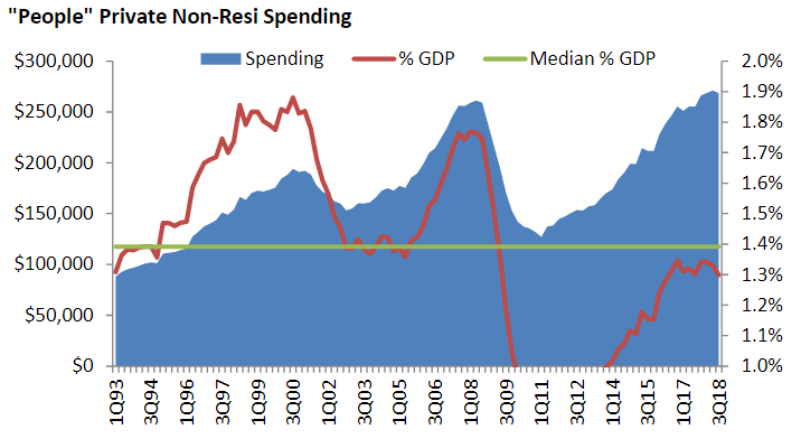
Non-Resi by Vertical



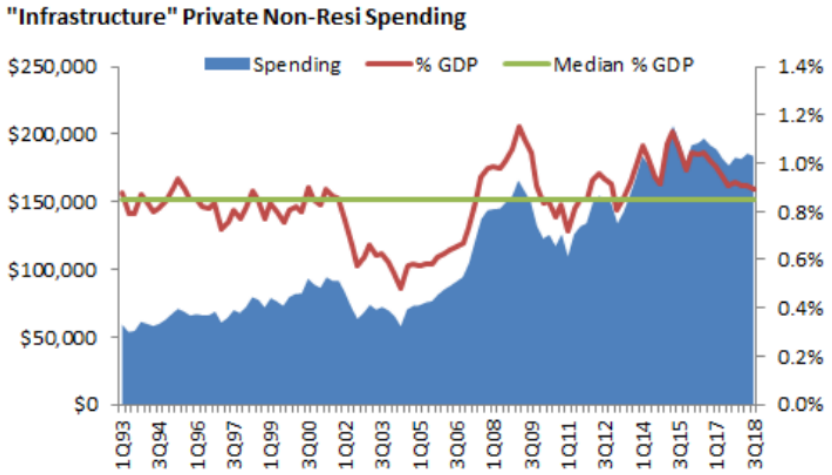
Source: Company Data, Census Bureau, Morgan Stanley Research.

Where Are We in the Non-Resi Construction Cycle?

People Private Non-Resi Spending - Room to Run



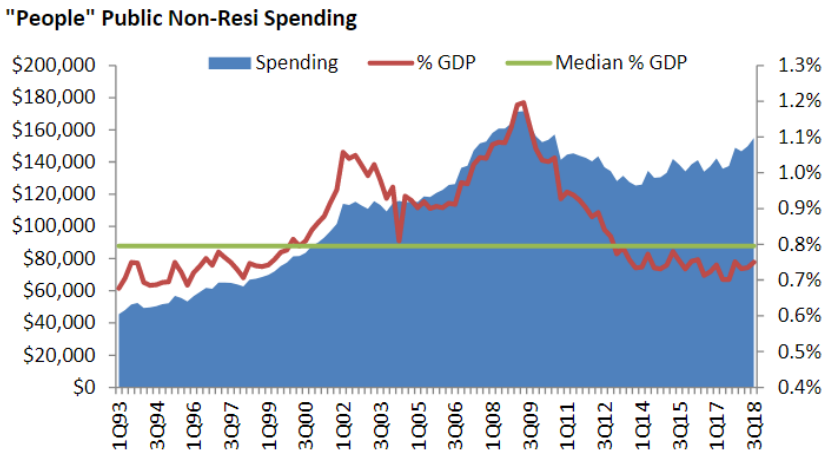
Infrastructure Private Non-Resi Spending - At Healthy Levels



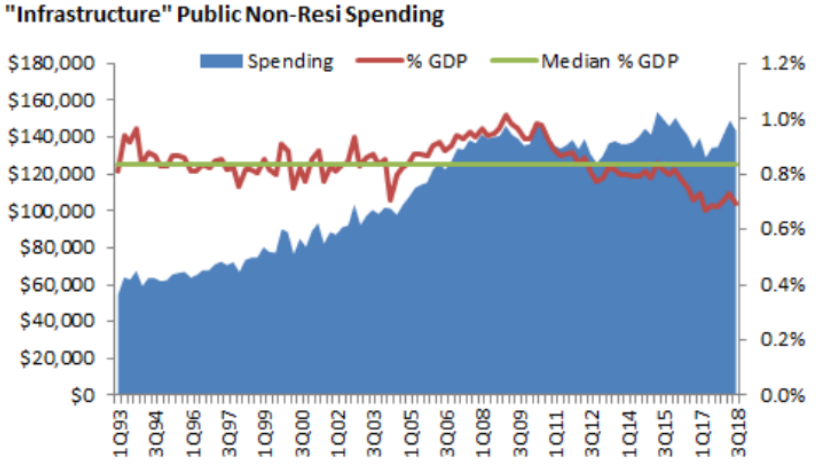
Source: Company Data, Census Bureau, Morgan Stanley Research.

Where Are We in the Non-Resi Construction Cycle?

People Public Non-Resi Spending - Well Below Prior Peak, Even if Last Cycle GDP% is Not Repeatable



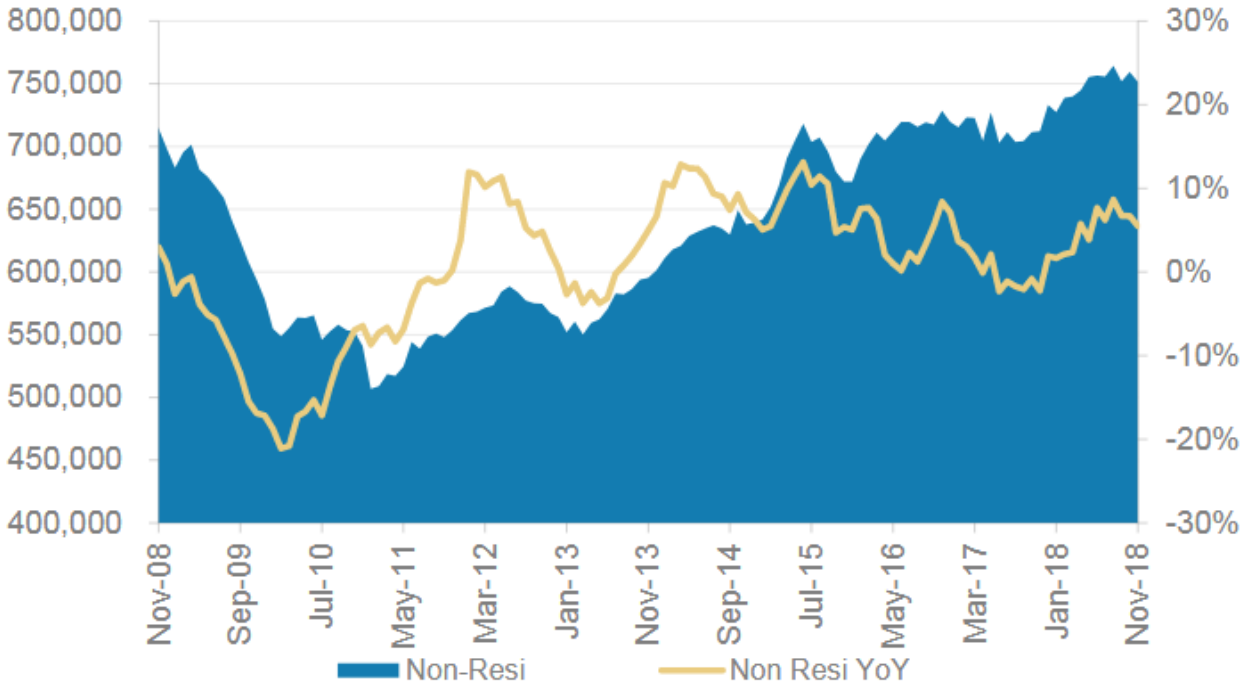
Infrastructure Public Non-Resi Spending - Unsustainably Low



Source: Company Data, Census Bureau, Morgan Stanley Research.

Where Are We in the Non-Resi Construction Cycle?

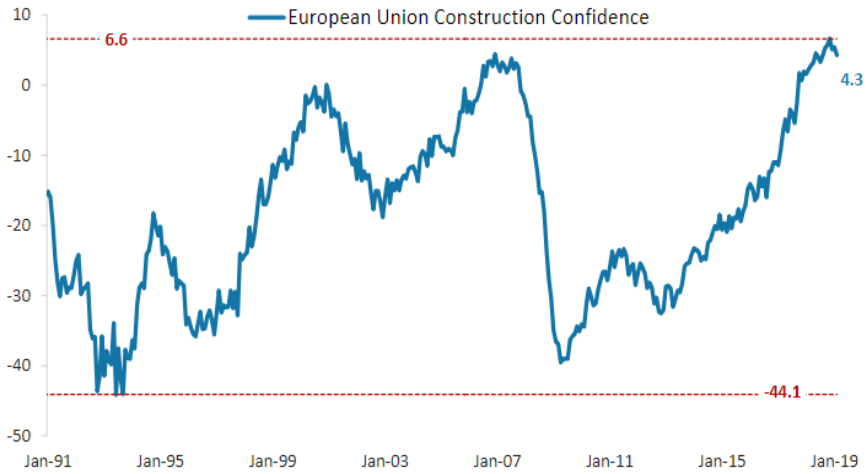
Prior peak is less relevant than % of GDP. We hear companies and investors reference current spending by vertical as a percentage of prior peak, which ignores both the severity of the downturn (i.e., underinvestment) and growth in the overall economy. On the other hand, the last peak, both on a nominal basis and as a % of GDP may be aspirational for some markets - although we believe further declines in spending on a % of GDP basis represents an overly draconian scenario, given the already poor condition of US infrastructure assets and continued signs of acceleration within private spending.



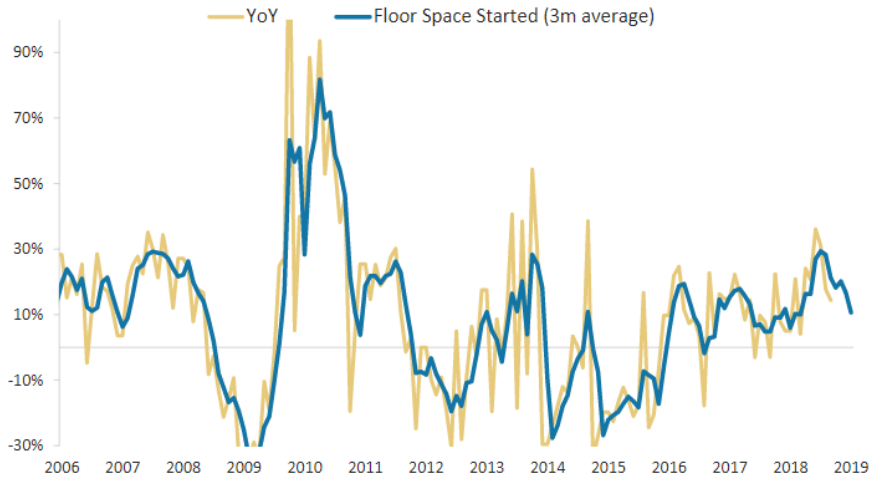
Source: Company Data, Census Bureau, Morgan Stanley Research.

Where Are We in the Non-Resi Construction Cycle?

European Construction Confidence



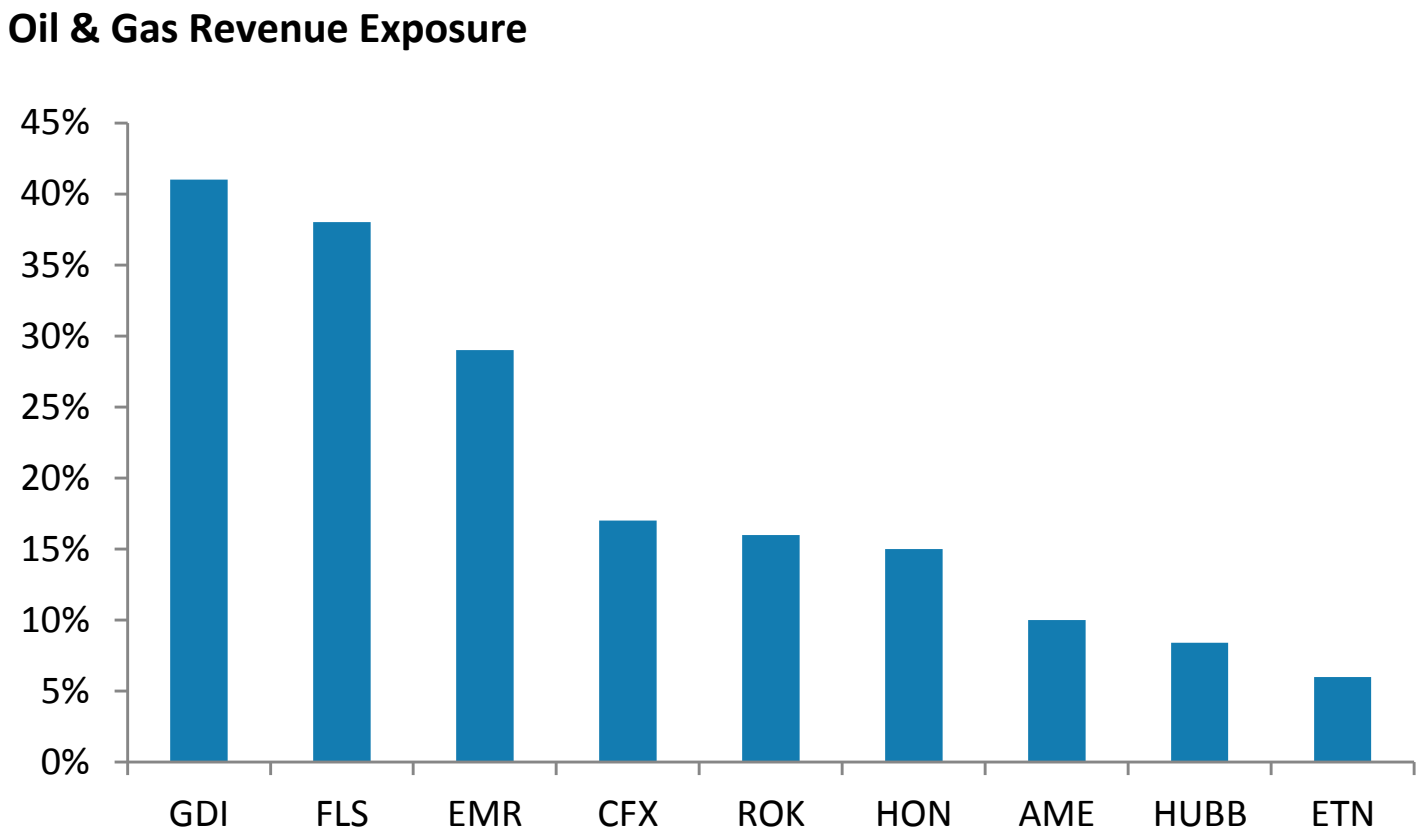
China Monthly Floor Space Started



Source: EuroStat, NBS, Morgan Stanley Research.

Where Are We in the Oil & Gas Cycle?

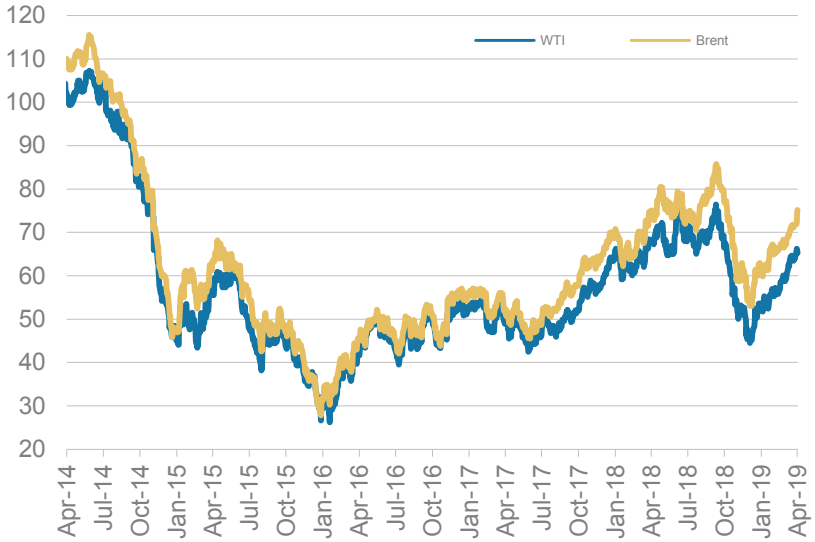
Oil & Gas Exposure by Stock



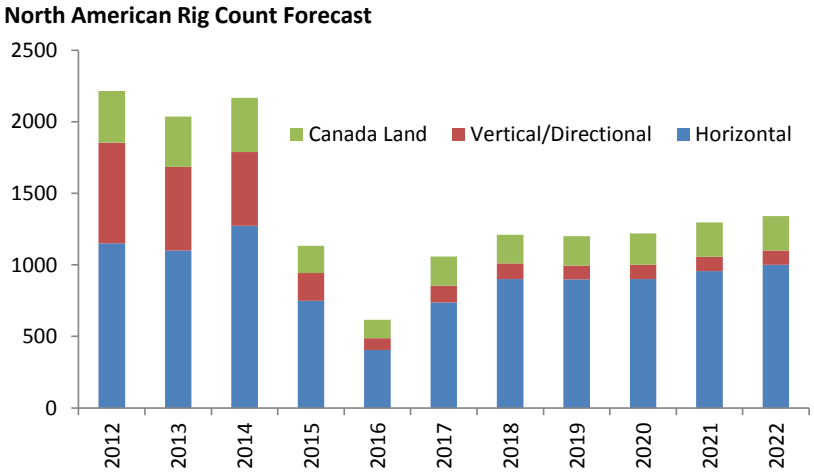
Source: Company Data/Documents, Morgan Stanley Research; includes estimates – only stocks under coverage with >5% estimated sales exposure.

Where Are We in the Oil & Gas Cycle?

Both WTI and Brent crude oil prices have accelerated over the last 12 months and appear to have settled in the mid-60s.



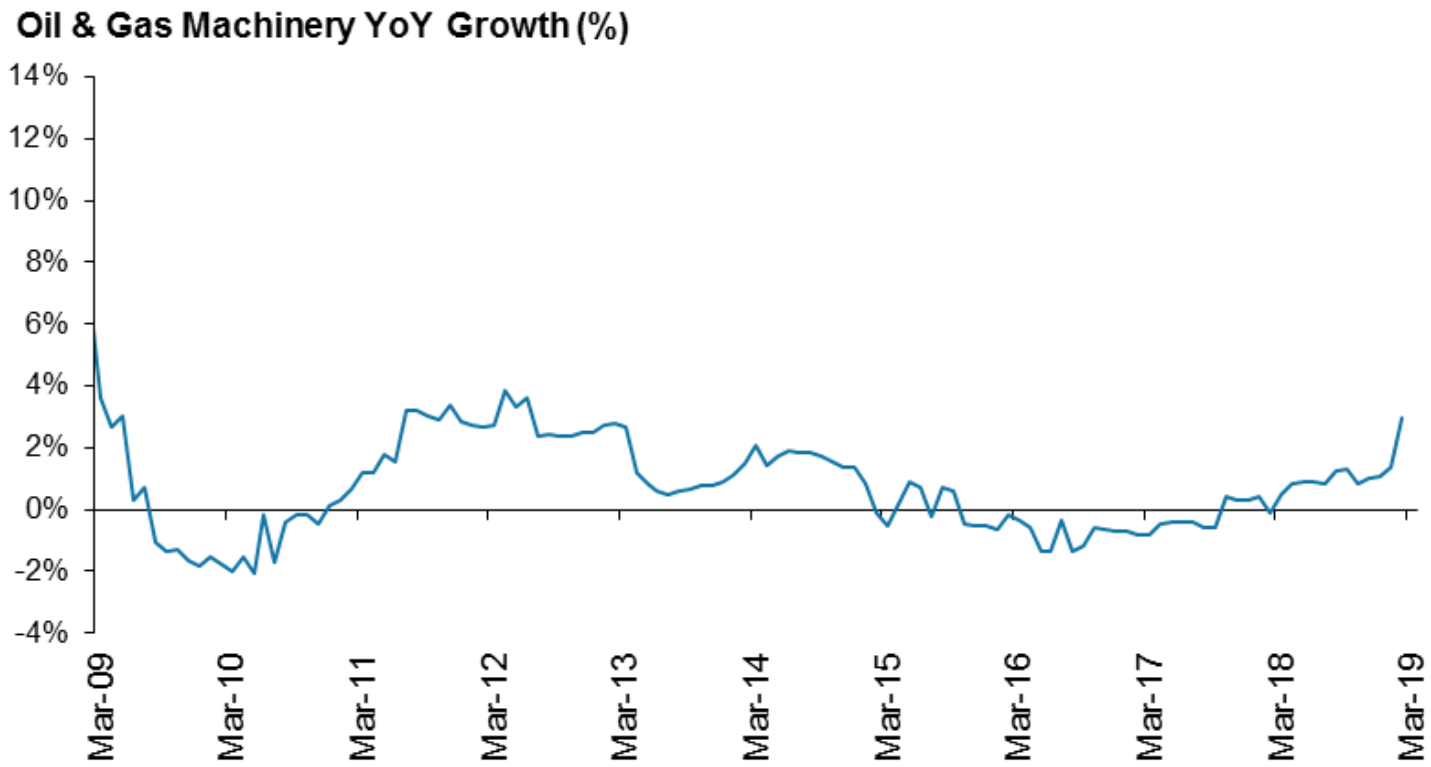
NAm rig count fell ~80% peak-to-trough from 2014 to 2016. However, rigs were up ~14% in 2018 and are expected to be relatively flat this year.



Source: Thomson Reuters, Rystad Energy, Company Documents, Morgan Stanley Research. * Including both Opex and CapEx.

Where Are We in the Oil & Gas Cycle? (Cont.)

O&G equipment pricing fell into negative territory, but has tracked upwards after stabilizing around zero. We have been surprised by the resilience of equipment pricing.

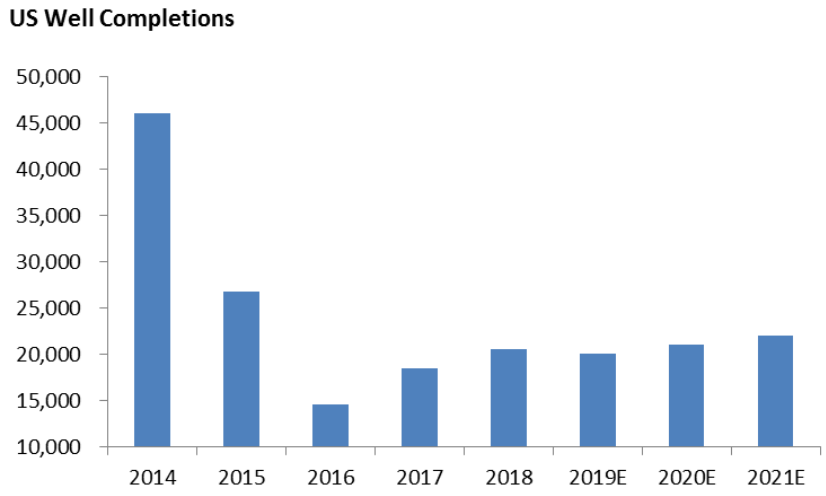


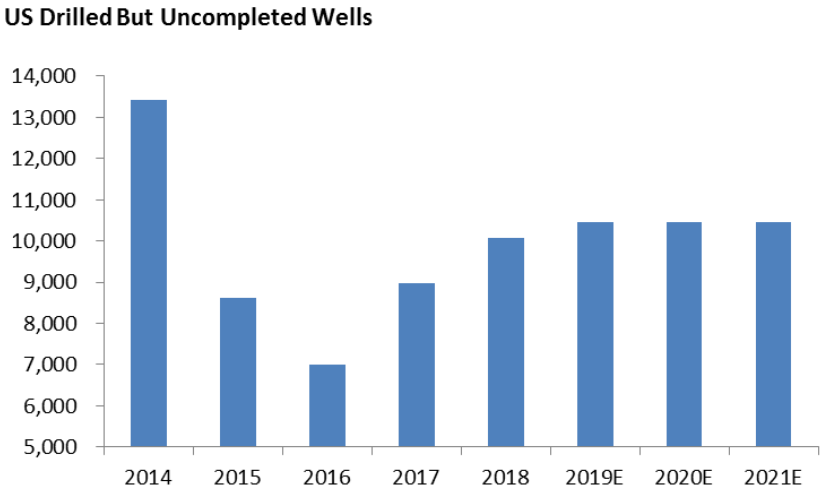
Source: Company Documents, Morgan Stanley Research.

Where Are We in the Oil & Gas Cycle? (Cont.)

US Well Completions troughed at ~14.6k in 2017 before recovering ~27% in 2017 and another 11% in 2018. Well completions are expected to be down slightly this year.

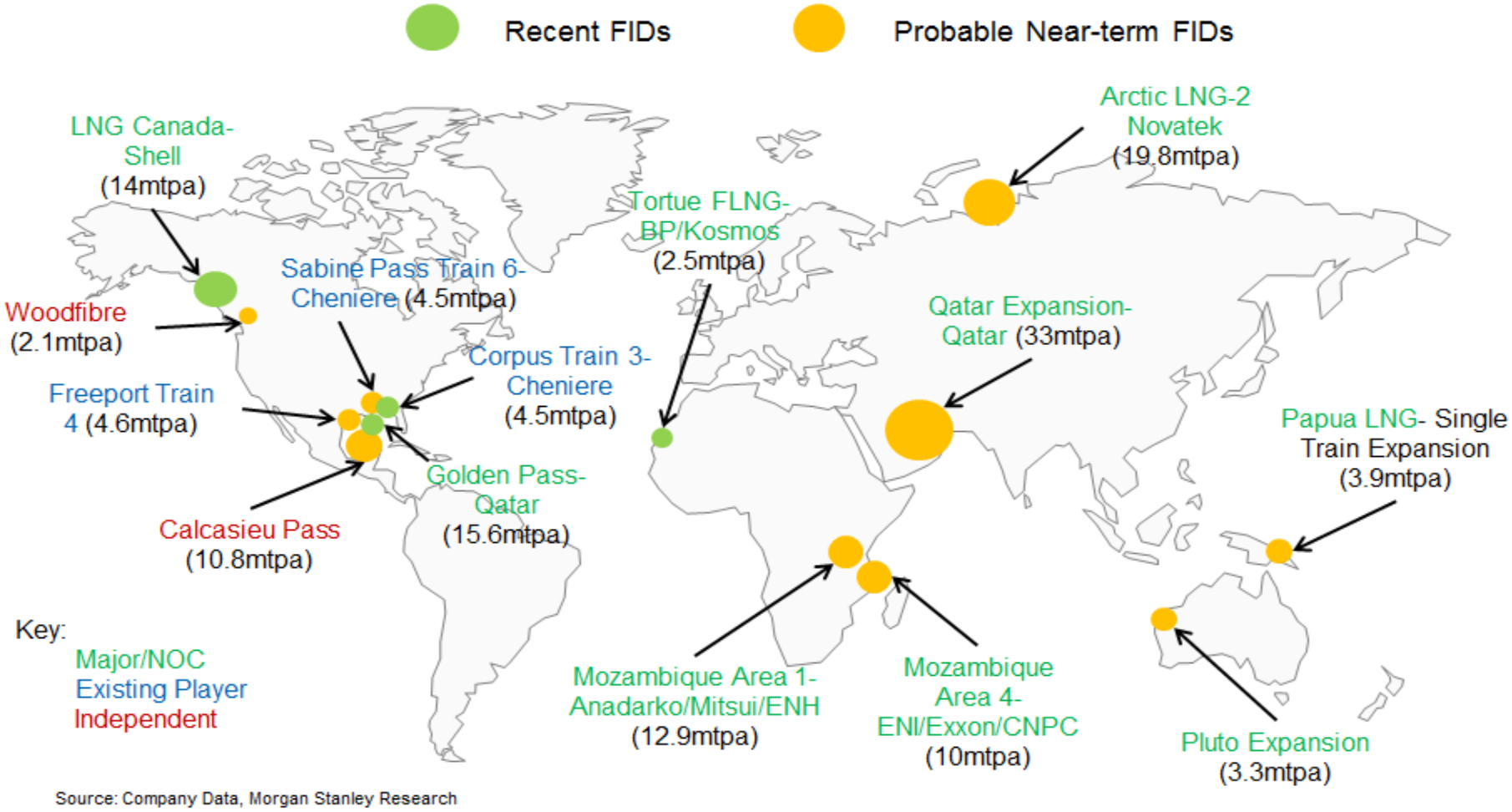
On the other hand, our OFS team expected DUCs to increase a further ~4% this year after a 28% increase in 2017 and 12% increase in 2018.





Source: Rystad Energy, Baker Hughes, IHS, PropTester, Land Rig Newsletter, Company Data, Morgan Stanley Research estimates

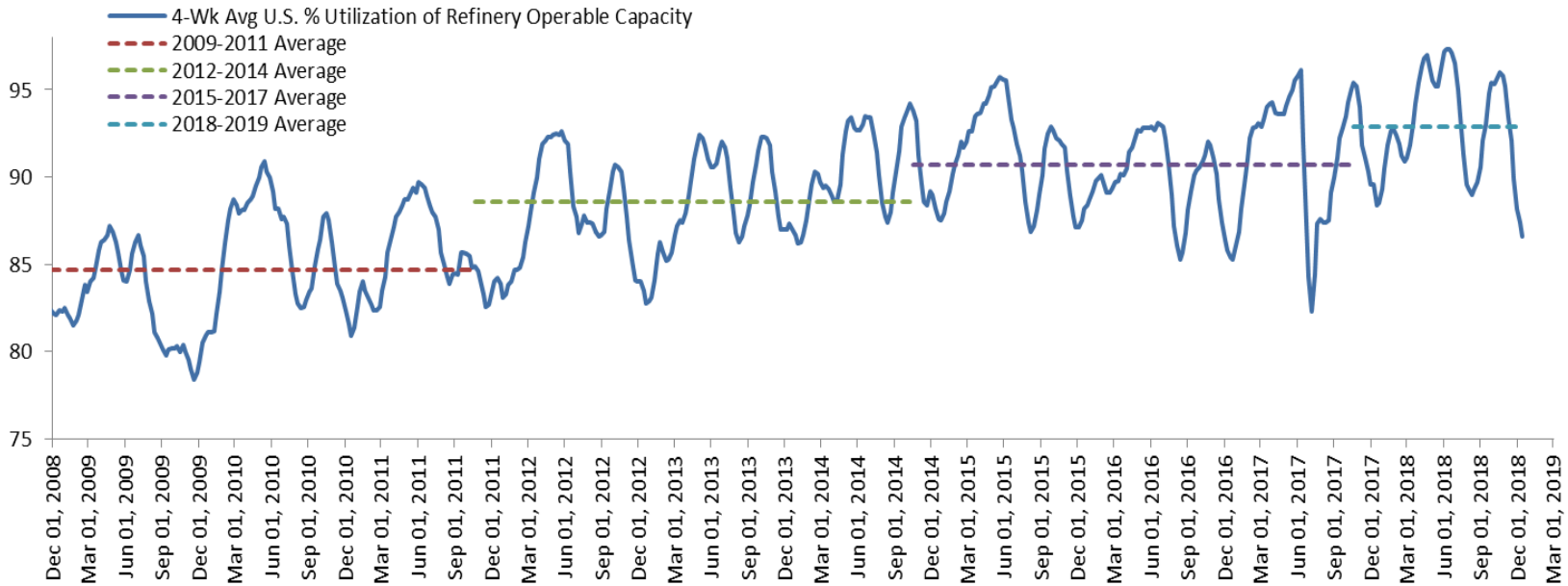
The Next Wave of FIDs Will Be From Existing Players and Majors



Source: Company Data, Morgan Stanley Research

Oil & Gas Productivity Can Benefit Industrials

US Refining Capacity Utilization: Steadily Higher, No New Entrants, Customers Willing to Pay for Uptime

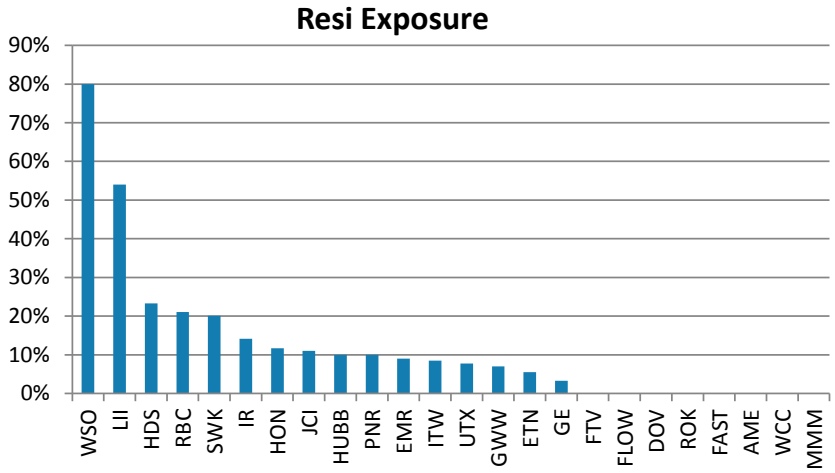


Source: Morgan Stanley Research, EIA

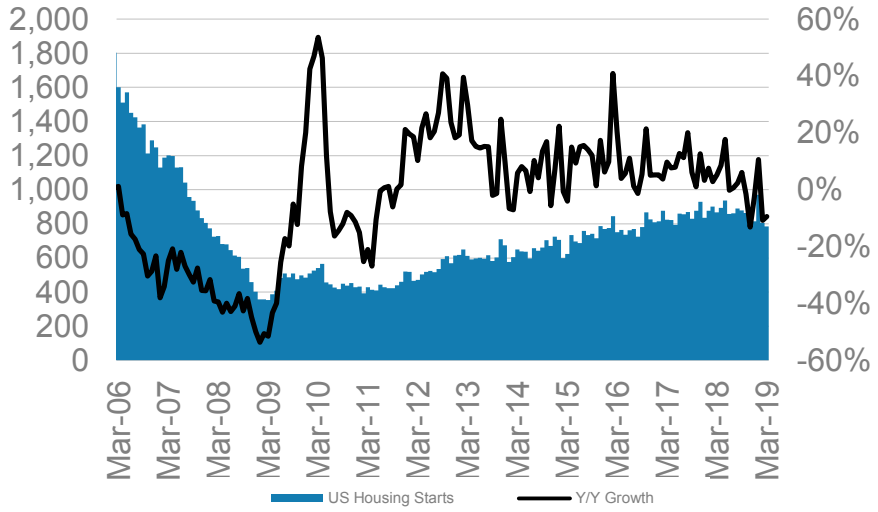
Where Are We in the Consumer Cycle?

Consumer - Residential Construction

EEMI Resi Construction Exposure by Stock (~8% of sales on average).



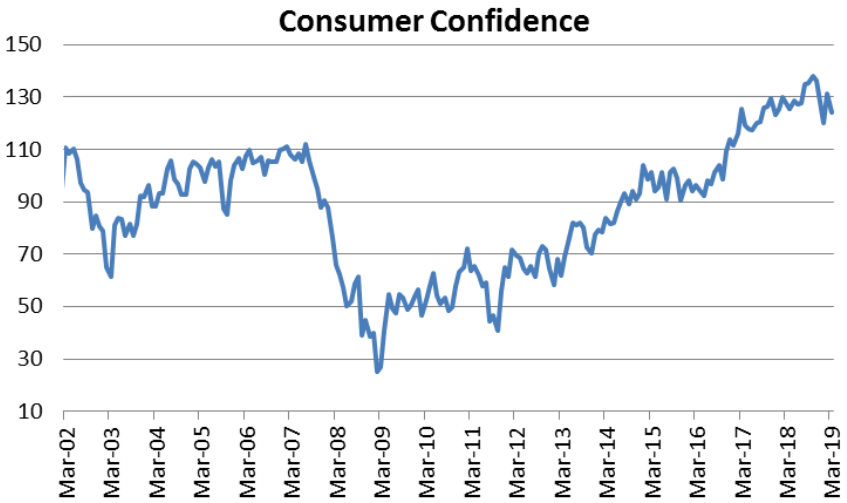
US Single-Family Housing starts continue to rebound from the trough in 2010-2011. Housing starts were down 9% in March.



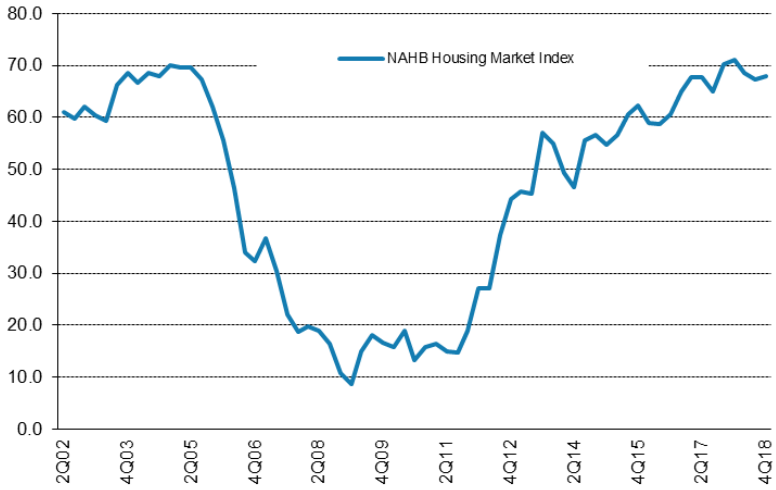
Source: Company Data, Census Bureau, Morgan Stanley Research.

Consumer - Residential Construction (Cont.)

Consumer sentiment is a key indicator of residential demand. To that end, Consumer Confidence has begun to roll off recent peaks.



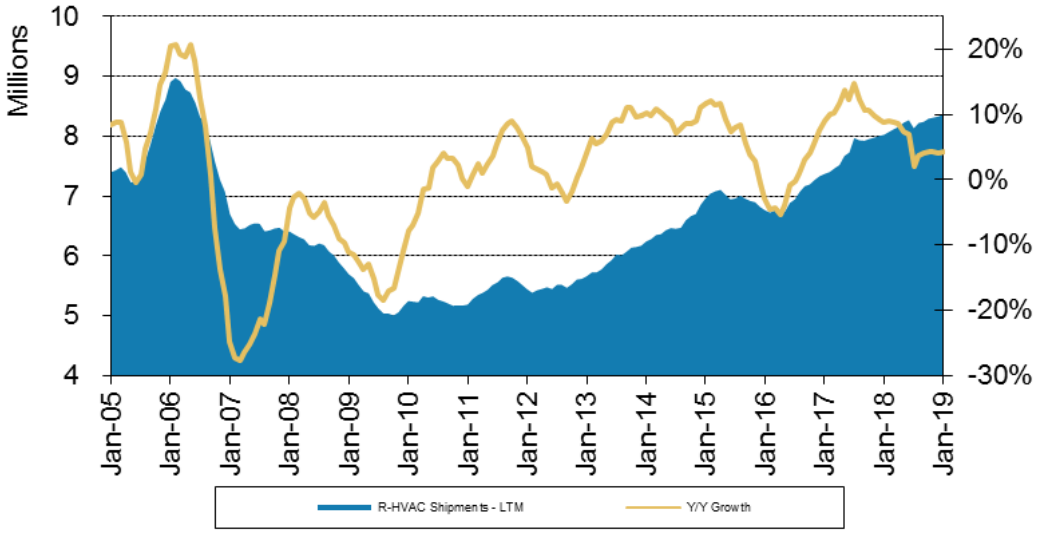
The NAHB Housing Market continues to strengthen, nearing pre-recessionary levels.

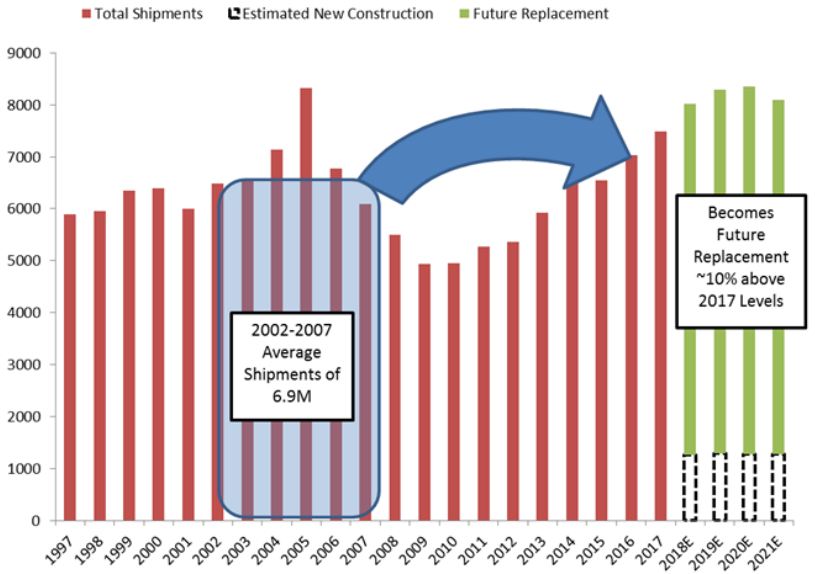


Source: NAHB, Standard Poor's, Morgan Stanley Research.

Consumer – R/HVAC

R-HVAC shipments have broadly rebounded to prior peak levels (excluding 13SEER pre-buy) as new housing has been complemented by replacement demand





Source: Company Data, Census Bureau, Thomson Reuters, Morgan Stanley Research.

Where Are We in the Aerospace & Defense Cycle?

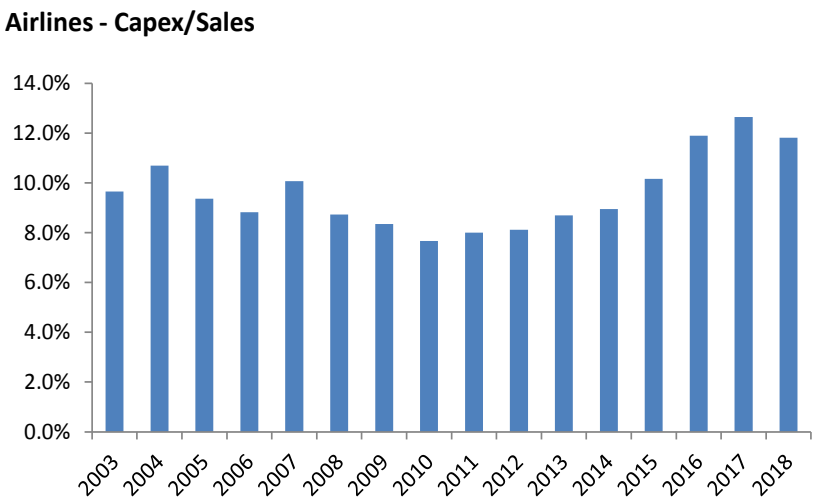
Aerospace Exposure by Stock

	% of Total Sales		Exposure Details
	Commercial Aero	Defense	
PH	12%	8%	Control actuation systems & components, Engine systems & components, Fluid conveyance systems & components, Fluid metering, delivery & atomization devices, Fuel systems & components, Fuel tank inerting systems, Hydraulic systems & components, Lubrication components, Pneumatic control components, Power conditioining & management systems, Thermal management, Wheels & brakes
HON	18%	12%	- Supplies aircraft engines, integrated avionics and service solutions, and related services for aircraft manufacturers, airlines, aircraft operators, military services and defense and space contractors. Key products includ auxiliary power units, propulsion engines, environmental control, connectivity, electric power, engine controls, flight safety, communications, navigation, radar and surveillance systems, aircraft lighting. - Provides technical services, logistics services, advanced systems and instruments, aircraft wheels and brakes, MRO services, turbochargers and thermal systems.
AME	16%	10%	- **EIG:** Supplier of airframe & engine monitoring systems, engine sensors, avionics (for small aircraft), fluid gauging systems, pressure transducers and acceleratmeters for large commercial, biz & regional and military aircrafts. - **EMG**: Manufactures highly engineered electrical connectors and electronics packaging, motor-blower systems and heat exchangers used in thermal management for the aerospace and defense, as well as 3rd-party MRO services.
ETN	5%	3%	Manufacturers of pumps, motors, hydraulic power units, hose and fittings, electro-hydraulic pumps and power and load management systems for use in aerospace applications, controls and sensing products, fluid conveyance products, and fuel systems including fuel pumps, sensors, valves, adapters and regulators.
Averrage	13%	8%	

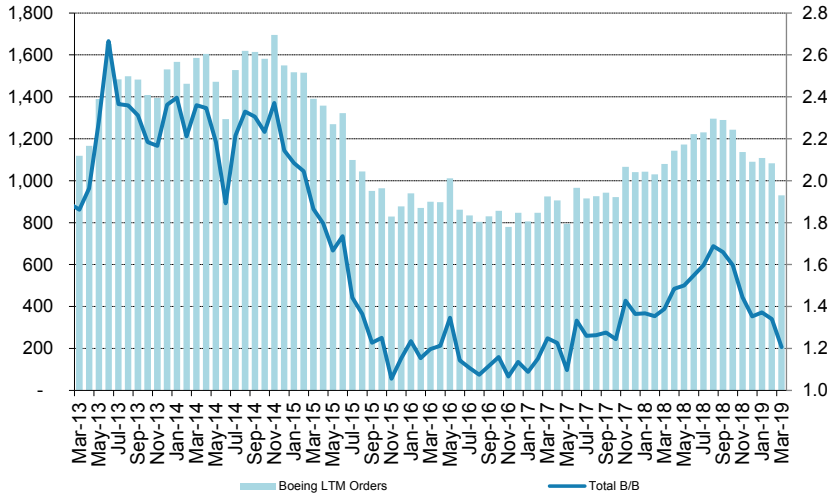
Source: Company Data/Documents, Morgan Stanley Research; includes estimates – only stocks under coverage with >5% estimated sales exposure.

Where Are We in the Commercial Aerospace Cycle?

Airline Capex as % of total sales has settled near its long-term average after peaking above 10% in the last two years.



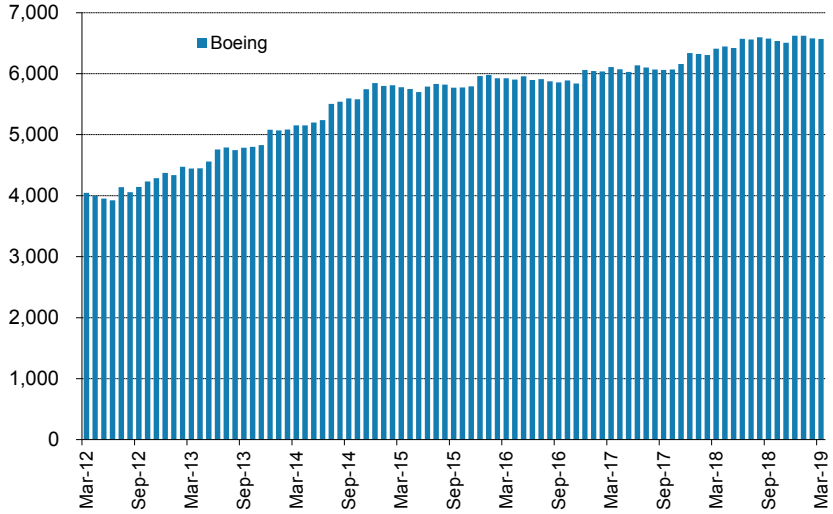
Boeing orders and book-to-bill appear to have peaked in mid-2018.



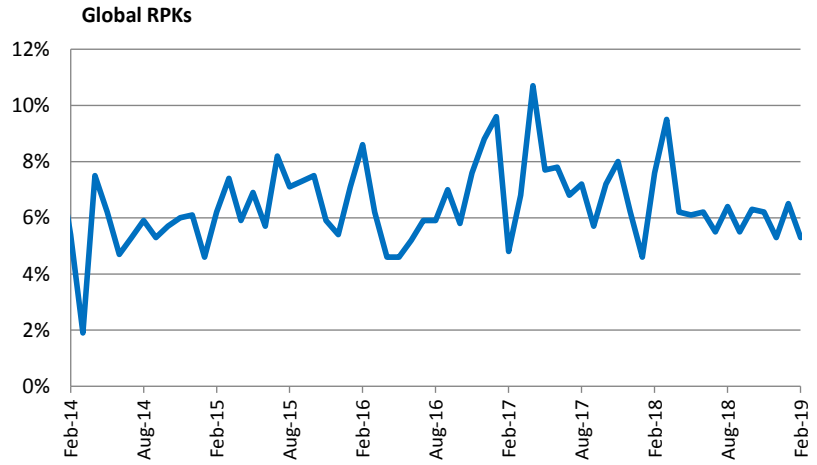
Source: IATA, Company Data, Airbus GMF 2015, Ascend, Morgan Stanley Research

Where Are We in the Commercial Aerospace Cycle? (Cont.)

Backlogs at Boeing have stabilized at near record levels



The outlook for spares demand remains promising as flight hours continue to churn higher

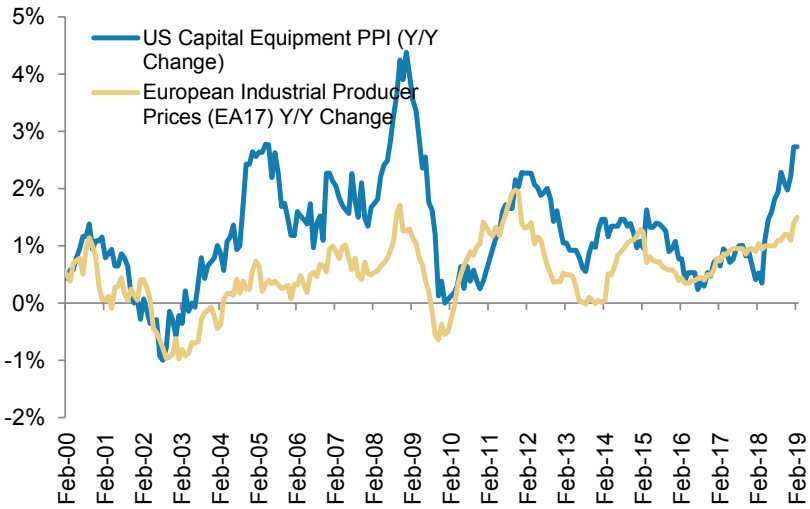


Source: IATA, Company Data, Airbus GMF 2015, Ascend, Morgan Stanley Research

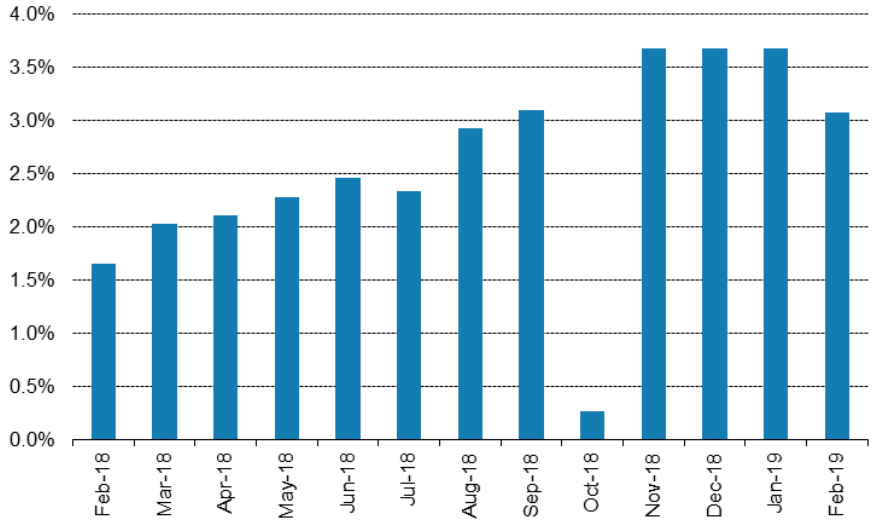
What Is the Outlook for Margins?

Pricing Power Remains Robust, Helping Offset Inflation

Capital Equipment pricing in the US remained robust in 1Q19, nearing ~2.5ppt in the quarter after being only modestly positive for the later half of this decade.



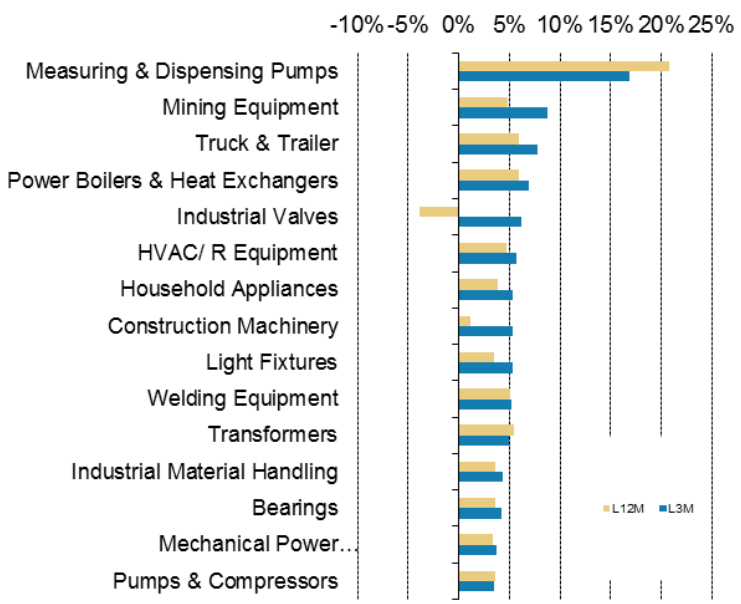
When we refine our view by looking at average US pricing for key EE/MI end markets, pricing moderated slightly to +3.1% Y/Y in February vs. 2.3% on average in 2018.



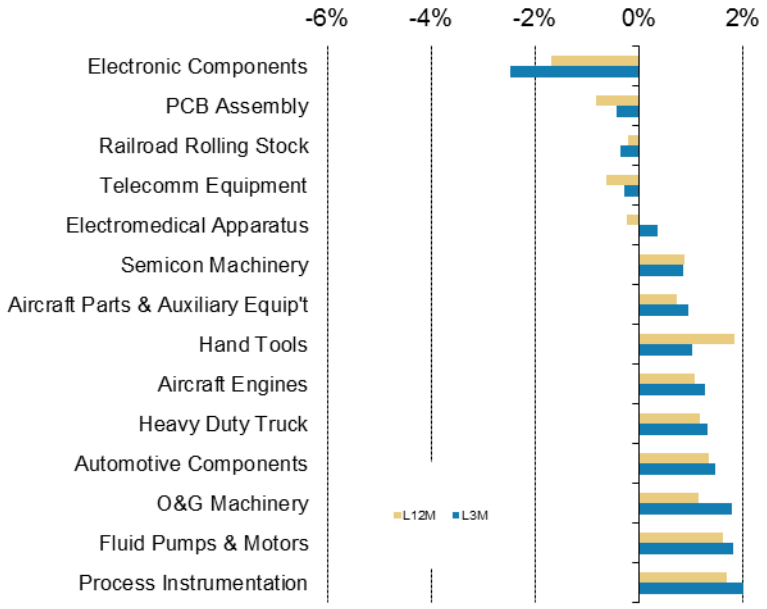
Source: BLS, Company Data, Morgan Stanley Research.

Pumps, Transformers, and Welding Strong, Electronics and Telecom Weakest

Top Industries for Pricing (L3M and L12M)



Bottom Industries for Pricing (L3M and L12M)

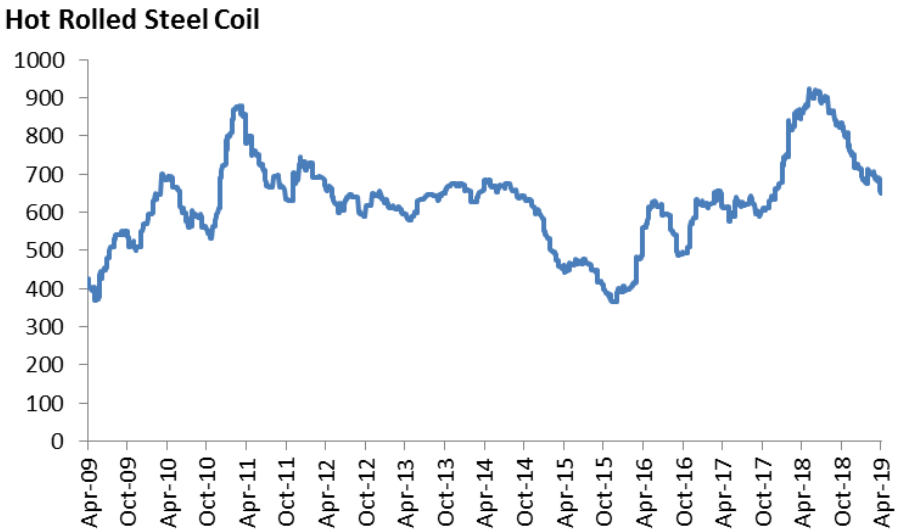


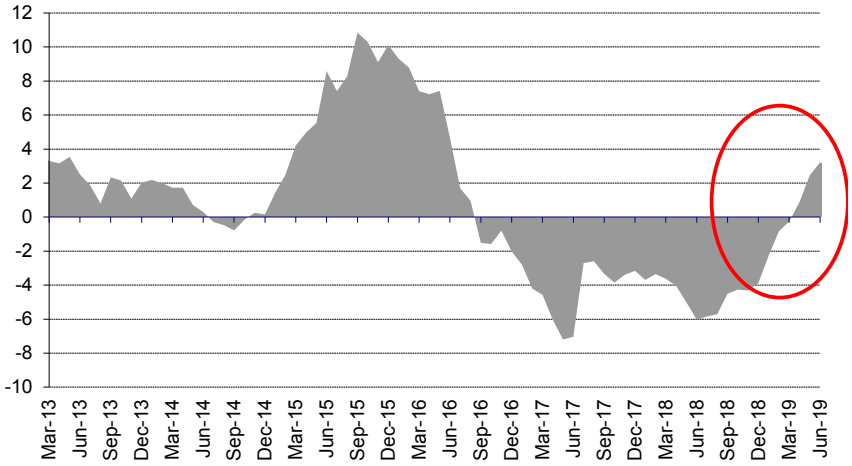
Source: BLS, Company Data, Morgan Stanley Research.

Raw Material Inflation Headwind Moderating

US HRC steel (Mid West $/ton) price has moderated from peaks within the past year (down ~32% from May 2018). The increase was predominately driven by expectations of stronger demand, and recent discussions around tariffs and trade wars.

If we extrapolate the current trend, our gross margin barometer suggests that the US Cap Goods price/cost gap could flip positive by 2Q/3Q.



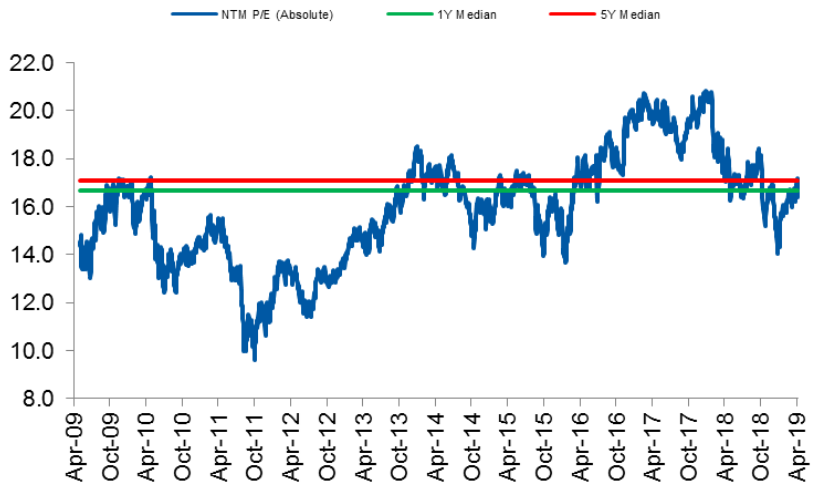


Source: BLS, Company Data, Morgan Stanley Research.

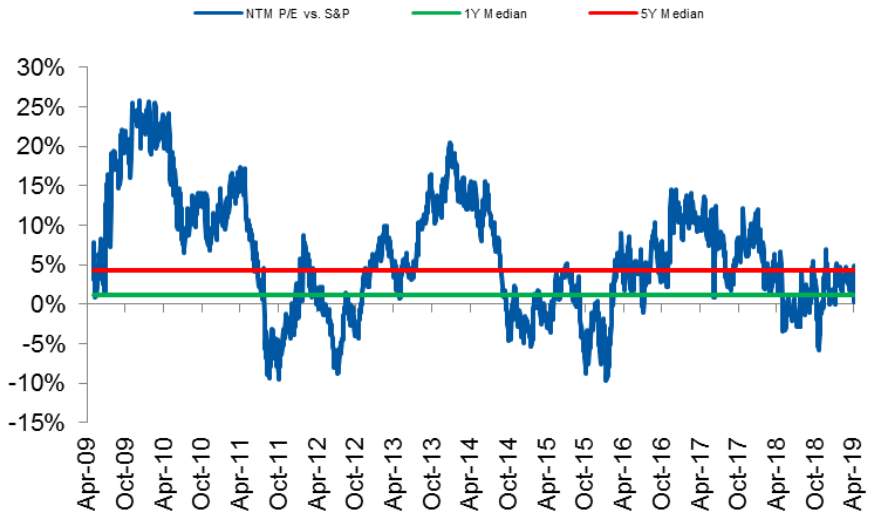
How Does the Multi-Industry Group Trade?

The Group Trades at ~16.4x Consensus Estimates, Roughly In-Line with the S&P 500 (In Line With LT Trend)

We've seen substantial multiple compression following increased volatility around global trade and fears of peak-cycle end markets, with a slight rebound in recent months.

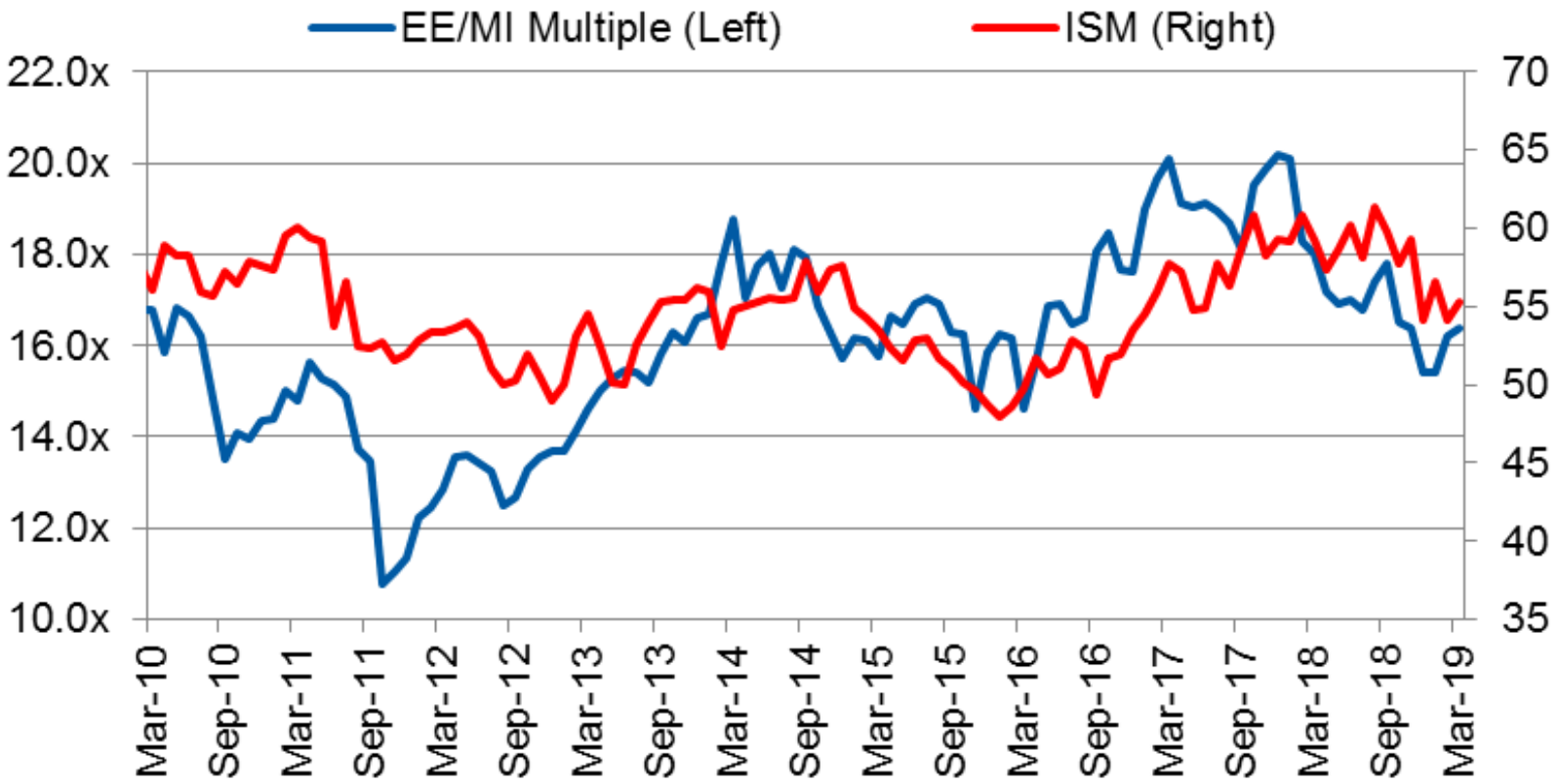


The group's multiple now sits at roughly in-line with the S&P 500, in-line with its historical 1Y and 5Y Medians.



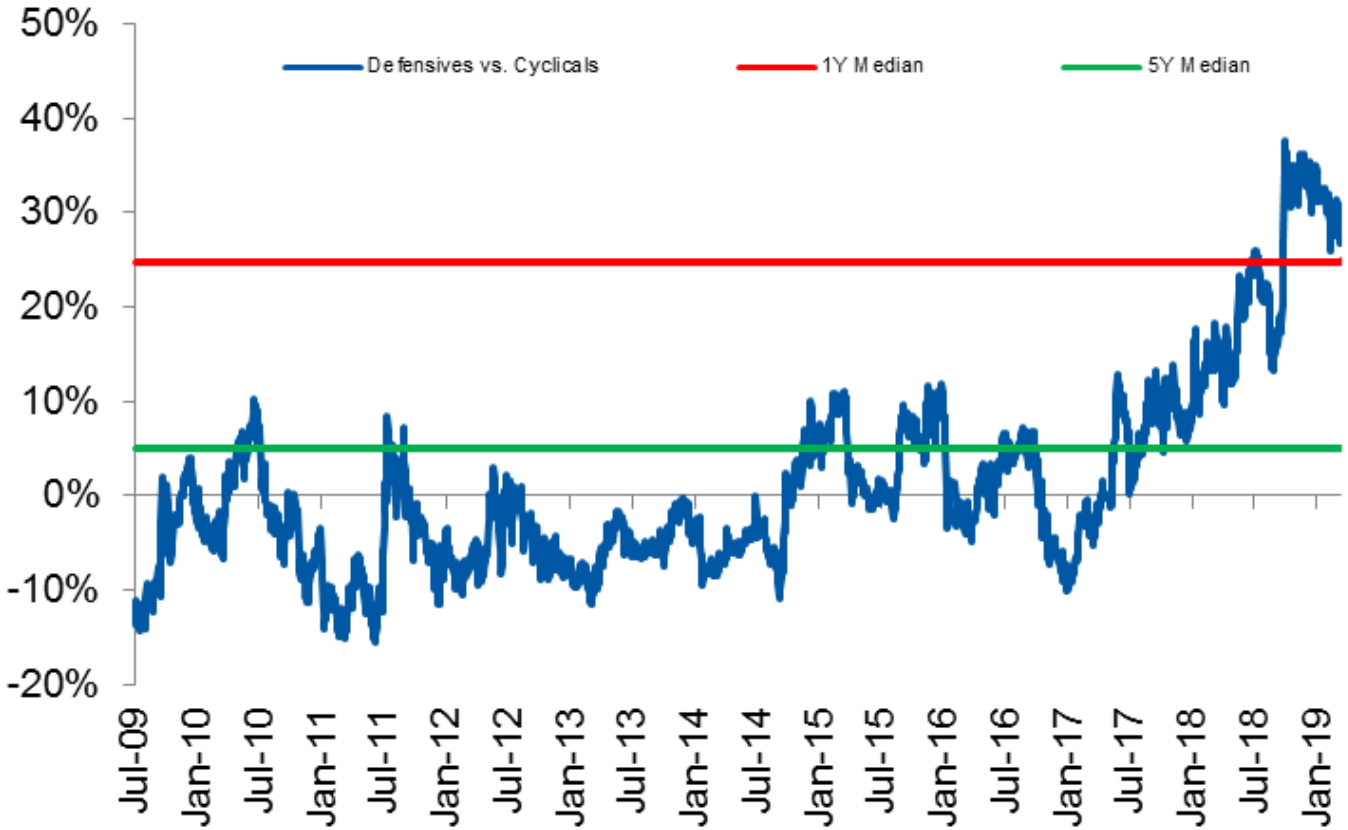
Source: Priced as of April 21 2017; Morgan Stanley Research, Thomson Reuters.

The Group's Premium to the S&P Generally Tracks the ISM Trend



Source: Morgan Stanley Research, Thomson Reuters, ISM

Defensives are again preferred to cyclicals, but we are seeing moderation off recent peaks



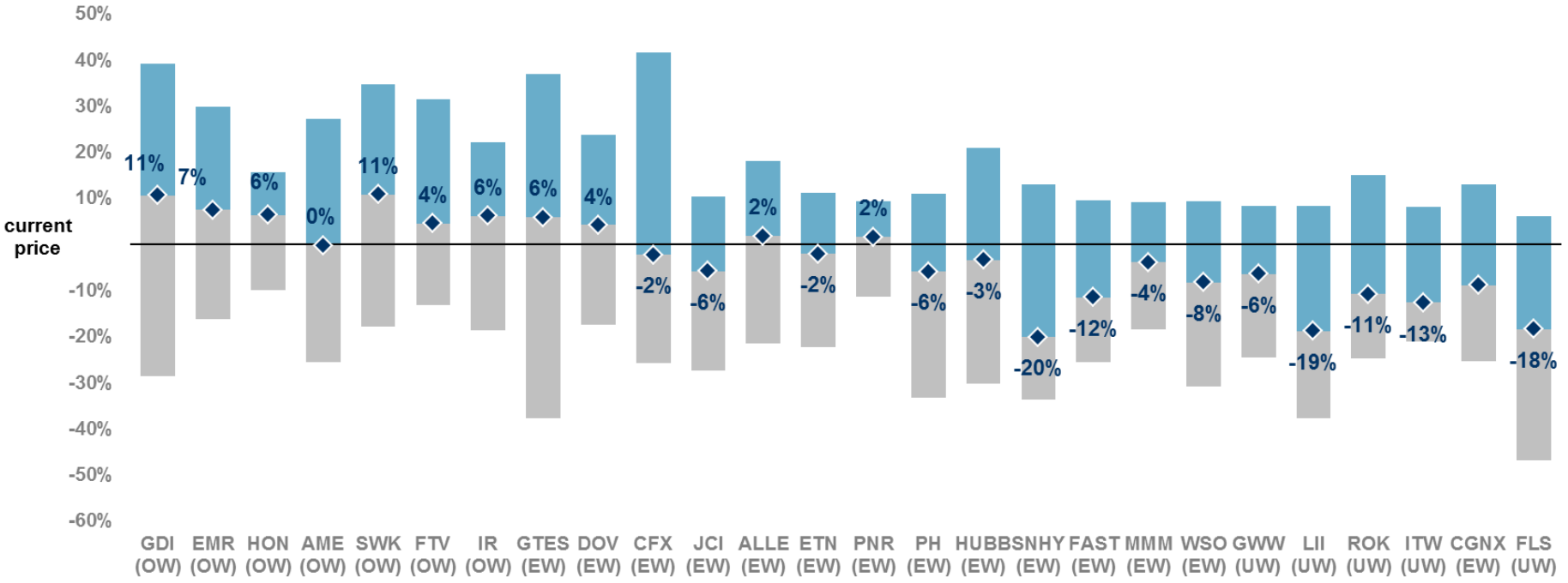
Source: Morgan Stanley Research, Thomson Reuters.

Investment Summary

Investment Summary

- **Top Ideas Favor Long-Cycle Markets, Process Industries**
  - **Top pick is Emerson, followed by Gardner Denver**
- **Avoid Discrete Capex Exposure and Growth Risk**
  - **We are exiting a multi-year supercycle for automotive and electronics capex**
  - **Growth valuation premium to value has become historically stretched**
- **Special situations are highly attractive given macro uncertainty, high valuation in broader industrials**
  - **Gardner Denver (OW) and Ingersoll-Rand (OW) have deal catalysts, Lennox (UW) valuation now looks unsustainable with the creation of IR as a separate HVAC pure play.**

EE/MI Risk Rewards



Source: Thomson Reuters, Morgan Stanley Research, Priced as of 4/20/2018

Valuation Methodology & Risks – UPDATE THESE

EMR

Our $77 Price Target is based on 18x Base Case NTM EPS of $4.30. Our Base Case assumes EMR grows ~6-7% in 2019 based on 8% growth in Automation Solutions and 4% growth in CRS. We expect growth to fall off to ~5% in 2020 and ~4% in 2021. Our 18x multiple is based on EMR trading at a ~17% premium to peers on NTM P/E, above its last 3 year average premium. We expect EMR to continue holding its premium as automation spending, specifically in process-heavy industries, continues to grow.

Potential Upside Catalysts

- IMO 2020 investment and LNG infrastructure could drive order acceleration or momentum at high levels
- Indications of margin progress
- Accretion and synergy updates on V&C, Aventics, and Tools and Test

Potential Downside Risks

- Decline in crude prices could slow orders
- Process capex plateauing or not increasing at the expected rate
- Increasing capacity utilization in process facilities can limit the need for new automation
- Continued inflation an escalating tariff environment with a lack of offsetting price increases represents a potential headwind to margin

GDI

Implied 49.3% ownership in IR NewCo assuing $250m of synergies. The announced RMT between GDI and IR's Industrial business creates a ~$19bn EV pure-play industrial compressor business. Assuming the combined company trades at ~11.8x - in line with peers - GDI's assumed ~49.3% ownership in the combined company (following an employee stock grant) implies ~$40/share value for the stock.

Potential Upside Catalysts

- Well completions within the Permian region are a large driver of quarter-to-quarter EBITDA for GDI. Upside within weekly data could provide a positive catalyst heading into 2Q.
- We would expect shares to continue to re-rate as we approach the "early 2020" expected RMT transaction close date.

Potential Downside Risks

- Deceleration in the global industrial and energy cycles would have an impact on GDI given exposure to Energy versus the group.
- Negative news regarding the GDI/IR Industrial RMT transaction could jeopardize upside or cause a combination not to occur.

Valuation Methodology & Risks

IR

18.3x our Base Case EPS of $7.49. Our base case is based on total organic growth of 6.6% in 2019, above the current guide and decelerating to 4% in 2020. We expect incremental margins to return to the 25-30% range as productivity benefits continue to roll through on top of price increases. Our 18.3x multiple is based on IR's standalone Climate business trading in-line with HVAC peers and a ~50% ownership interest in GDI NewCo stock.

Potential Catalysts

- We believe IR is ultimately a quarter-to-quarter thesis in that non-residential construction is "stronger for longer" and does not exhibit the same volatility as it did last cycle.
- Order rates in both commercial HVAC and Industrial serve as markers for the sustainability of the non-residential construction cycle.
- Price increases to cover further commodity headwinds, freight costs, and tariffs would be viewed positively.

Risks to Achieving Price Target

- Lack of pricing to offset commodity inflation, tariffs and freight costs.
- Recession-level slowdown in the broader Industrial and Construction markets.
- Industrial margin improvement slower than expected.

LII

17.5x our NTM EPS of $12.59. For 2019, we assume ~7% organic growth driven by share gain after the tornado impact and price increases, decelerating to ~4% growth in 2020 as the tornado noise normalizes. Our 17.5x multiple is based on LII trading in-line with peers, given LII's strategic value is narrowing and it's heavier on residential, which appears later in the cycle.

Potential Catalysts

- The mid-year closing of a window in which to transact with Carrier should narrow the valuation premium LII has enjoyed since the discussion of consolidation increased in 2018.
- In 2Q19, LII will be fully up and running following the tornado disruption and should be reclaiming share. If growth underpaces peers, investors could be more skeptical about LII's ability to reclaim share in a timely matter before the cycle matures.

Risks to Achieving Price Target

- An acquisition announcement, particularly in Residential, would likely be a positive catalyst given management's turnaround record and the scale potential.
- Further pricing power in 2019 would be a positive for earnings revisions, particularly if inflation subsides.

Morgan Stanley

FOUNDATION

May 2019

Industrials Spring Training Teach-in

US Machinery



Source: Shutterstock

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For analyst certification and other important disclosures, refer to the Disclosure Section, located at the end of this report.

Stock recommendations and disclosures in this report are as of May 3, 2019; stock prices as of April 30, 2019, unless otherwise noted.

Agenda

1. When to Own Machinery Stocks?

2. How to Analyze Machinery Stocks
    1. Revenue
    2. Orders
    3. Replacement Cycles
    4. Cost Structure
    5. Capital Allocation
    6. Valuation

3. Deep Dive on Construction Equipment

4. Deep Dive on Ag Equipment

5. Deep Dive on Truck OEMs & Suppliers

6. Key Debates & Top Picks

US Machinery Ratings and EPS Estimates

Morgan Stanley Valuation Comps | Machinery												
4/30/2019	MS	Current	Price	Upside	Mkt Cap	3 Yr.	MS EPS Est. (CY)				MS EPS Est.vs. Cons.	
Ticker	Rating	Price	Target	%	($mil.)	Beta	2017	2018	2019E	2020E	2019E	2020E
Construction Equipment												
CAT	OW	$139.42	165.00	18%	$77,300	1.49	$6.88	$11.22	$12.34	$13.14	0%	2%
URI	OW	$140.92	176.00	25%	$10,772	1.73	$10.60	$16.26	$20.35	$23.10	6%	8%
WSC.O	OW	$13.47	19.00	41%	$1,604	-	-$2.52	-$0.19	$0.15	$0.54	-	-
TEX	EW	$33.33	37.00	11%	$2,263	1.37	$1.35	$2.71	$3.78	$3.89	-3%	0%
OSK	EW	$82.59	91.00	10%	$5,530	1.32	$4.83	$7.16	$7.90	$8.39	3%	7%
Avg/Sum[e]				**21%**		**1.48**					**2%**	**4%**
Agriculture Equipment												
DE	OW	$165.63	192.00	16%	$52,271	1.21	$6.91	$9.58	$11.52	$12.95	1%	3%
AGCO.K	UW	$70.78	60.00	-15%	$5,748	1.04	$3.02	$3.89	$4.64	$5.17	0%	-4%
CNHI.K	EW	$10.90	12.00	10%	$14,723	1.25	$0.46	$0.80	$0.87	$0.94	-1%	-3%
Avg/Sum[e]				**4%**		**1.17**					**0%**	**-1%**
Trucks and Suppliers												
PCAR.O	UW	$71.67	63.00	-12%	$24,341	1.20	$4.26	$6.24	$6.64	$5.55	2%	-4%
CMI	EW	$166.29	167.00	0%	$26,170	1.21	$10.62	$13.26	$16.53	$15.45	5%	4%
WBC	EW	$132.44	137.00	3%	$6,814	0.87	$6.86	$7.87	$7.34	$7.35	-6%	-8%
REVG.K	EW	$12.69	11.00	-13%	$782	1.26	$1.21	$0.85	$1.29	$1.25	8%	-12%
Avg/Sum[e]				**-5%**		**1.06**					**3%**	**0%**
Machinery Average												
Avg/Sum[e]				**5%**		**1.27**					**1%**	**-1%**

Source: Thomson Reuters, Morgan Stanley Research. Note that all data is on a calendar year basis. *CAT, DE, NAV, and PCAR EBITDA are for Equipment Operations only. Estimates as of 5/3/19.

US Machinery Trading Comps

Morgan Stanley Valuation Comps | Machinery Valuation Metrics (Consensus & Morgan Stanley Estimates)												
4/30/2019	Cons. P / E Ratio*			MS P / E Ratio*			MS EV / EBITDA Ratio*			MS Net Debt (Cash) / EBITDA		
Ticker	2019	NTM	2020	2019	NTM	2020	2019	NTM	2020	2018	2019	2020
Construction Equipment												
CAT	11.3	11.1	10.8	11.3	11.0	10.6	7.7	7.6	7.6	0.1	0.0	-0.1
URI	7.4	7.0	6.6	6.9	6.6	6.1	4.8	4.5	4.1	3.0	2.4	1.9
WSC.O	-	32.3	16.5	-	-	25.0	4.5	3.9	2.9	8.1	4.7	3.1
TEX	8.6	8.6	8.5	8.8	8.7	8.6	5.5	5.3	5.1	2.1	0.9	0.5
OSK	10.7	10.7	10.6	10.5	10.2	9.8	6.7	6.4	6.2	0.4	0.3	-0.1
Avg	**9.5**	**9.3**	**9.1**	**9.4**	**9.1**	**8.8**	**6.2**	**6.0**	**5.7**	**1.4**	**0.9**	**0.6**
Agriculture Equipment												
DE	14.5	13.9	13.2	14.4	13.7	12.8	10.3	10.0	9.5	2.8	1.8	0.6
AGCO.K	15.2	14.3	13.2	15.3	14.6	13.7	7.8	7.5	7.1	1.4	1.2	0.8
CNHI.K	12.4	11.9	11.3	12.5	12.1	11.6	5.7	5.4	5.1	0.6	0.5	0.1
Avg	**14.1**	**13.4**	**12.5**	**14.0**	**13.5**	**12.7**	**7.9**	**7.6**	**7.2**	**1.6**	**1.1**	**0.5**
Trucks and Suppliers												
PCAR.O	11.0	11.6	12.4	10.8	11.7	12.9	6.9	7.3	7.9	-1.5	-1.5	-2.2
CMI	10.5	10.8	11.2	10.1	10.4	10.8	6.7	6.8	7.0	0.2	0.2	-0.1
WBC	16.9	16.8	16.6	18.0	18.0	18.0	10.8	10.4	9.8	1.4	0.9	0.2
REVG.K	10.6	9.8	8.9	9.8	10.0	10.1	6.7	6.3	5.7	2.9	2.2	1.2
Avg	**10.8**	**11.2**	**11.8**	**10.4**	**11.0**	**11.8**	**6.8**	**7.1**	**7.5**	**-0.7**	**-0.7**	**-1.1**
Machinery Average												
Avg	**11.8**	**11.5**	**11.2**	**11.7**	**11.5**	**11.4**	**7.2**	**7.1**	**6.8**	**1.2**	**0.8**	**0.3**

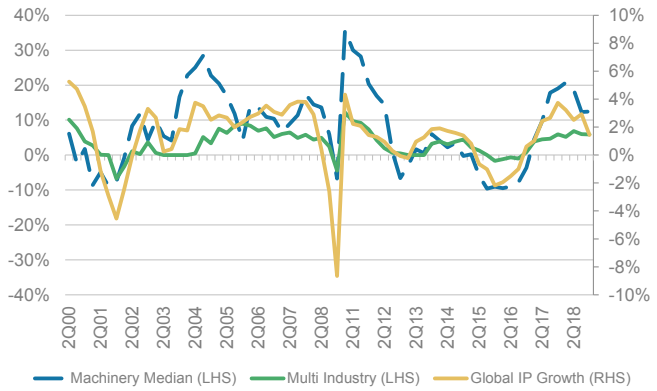
Source: Thomson Reuters, Morgan Stanley Research. Note that all data is on a calendar year basis. *CAT, DE, and PCAR EV/EBITDA are for Equipment Operations only. Estimates as of 5/3/19.

When to Own Machinery Stocks?

Machinery stocks are considered early cycle within the broader Industrial complex

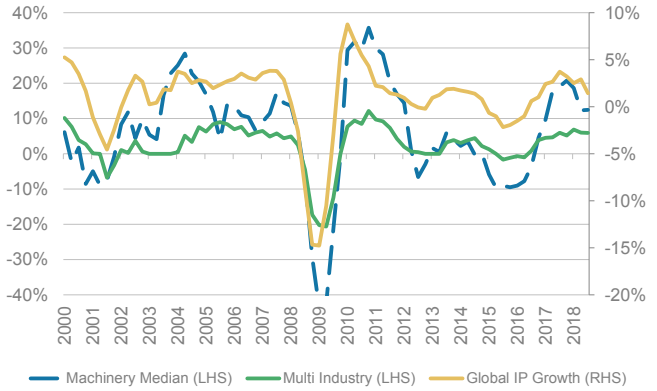
Machinery organic growth has historically shown its highest correlation with Industrial Production on a coincident and 1Q lagged basis. As such, Machinery is typically considered early cycle within the broader Industrial complex as it would theoretically see organic growth expansion/contraction at an earlier point vs. other Industrial sub sectors. Since 2000, Machinery organic growth has shown a 0.79/0.82 correlation with Global IP on a coincident/1Q lag – however, excluding 2009 & 2010, this correlation falls to 0.62/0.30 – suggesting a somewhat weaker correlation with the broader Industrial complex vs. other Industrial sections (e.g. EE/MI).

Organic Growth vs. Global IP Growth (ex-2009/2010)



	No Lag	1Q Lag	2Q Lag	3Q Lag	4Q Lag
AGCO	0.12	(0.03)	(0.04)	(0.02)	0.06
ALSN	0.82	0.76	0.59	0.33	0.00
CAT*	0.45	0.25	0.19	0.14	0.08
CMI	0.56	0.21	(0.00)	(0.13)	(0.08)
DE*	0.42	0.23	0.06	(0.10)	(0.12)
PCAR	0.33	0.06	(0.16)	(0.34)	(0.39)
TEX	0.58	0.47	0.39	0.27	0.24
WBC	0.64	0.05	(0.22)	(0.33)	(0.22)
OSK (Acce	0.69	0.24	0.14	(0.08)	(0.16)
CNHI	0.17	0.04	(0.02)	(0.09)	(0.11)
Median	**0.61**	**0.30**	**0.08**	**(0.07)**	**(0.10)**
Average	**0.55**	**0.21**	**0.02**	**(0.14)**	**(0.18)**

Organic Growth vs. Global IP Growth (2000-2017)

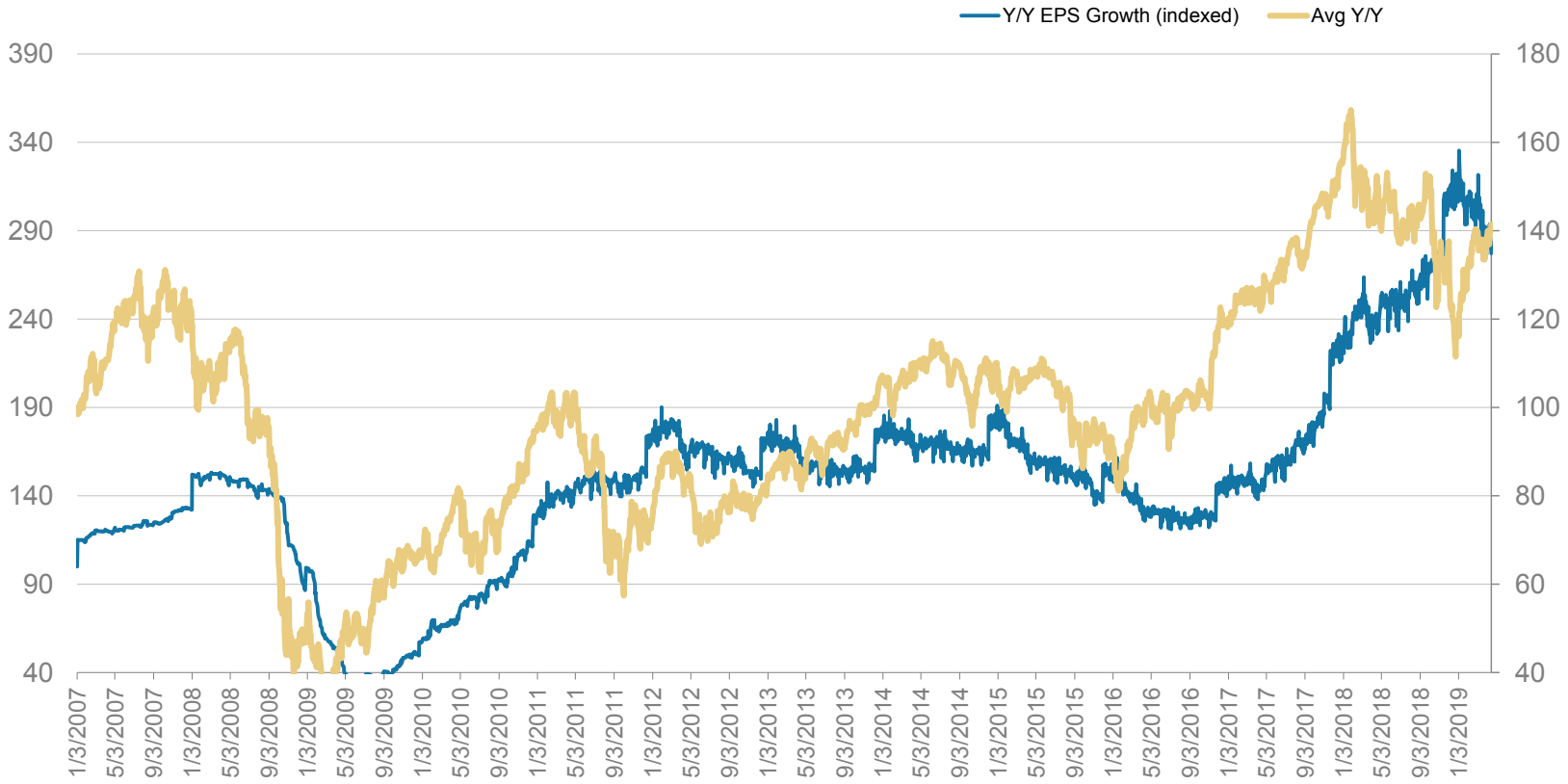


	No Lag	1Q Lag	2Q Lag	3Q Lag	4Q Lag
AGCO	0.32	0.53	0.62	0.56	0.36
ALSN	0.82	0.76	0.59	0.33	0.00
CAT*	0.63	0.77	0.70	0.46	0.11
CMI	0.68	0.65	0.48	0.27	0.07
DE*	0.59	0.63	0.50	0.24	(0.04)
PCAR	0.59	0.57	0.43	0.23	0.03
TEX	0.68	0.83	0.80	0.64	0.38
WBC	0.90	0.83	0.52	0.11	(0.28)
OSK (Acce	0.80	0.73	0.51	0.27	0.06
CNHI	0.43	0.47	0.43	0.32	0.17
Median	**0.79**	**0.82**	**0.65**	**0.37**	**0.07**
Average	**0.76**	**0.78**	**0.62**	**0.37**	**0.08**

Source: Company Data, Morgan Stanley Research

Own Machinery Stocks during periods of positive EPS revisions; Sell during negative revisions

Price Performance vs. EPS Growth Revisions (indexed to 2007)



Source: Thomson Reuters, Company Data, Morgan Stanley Research

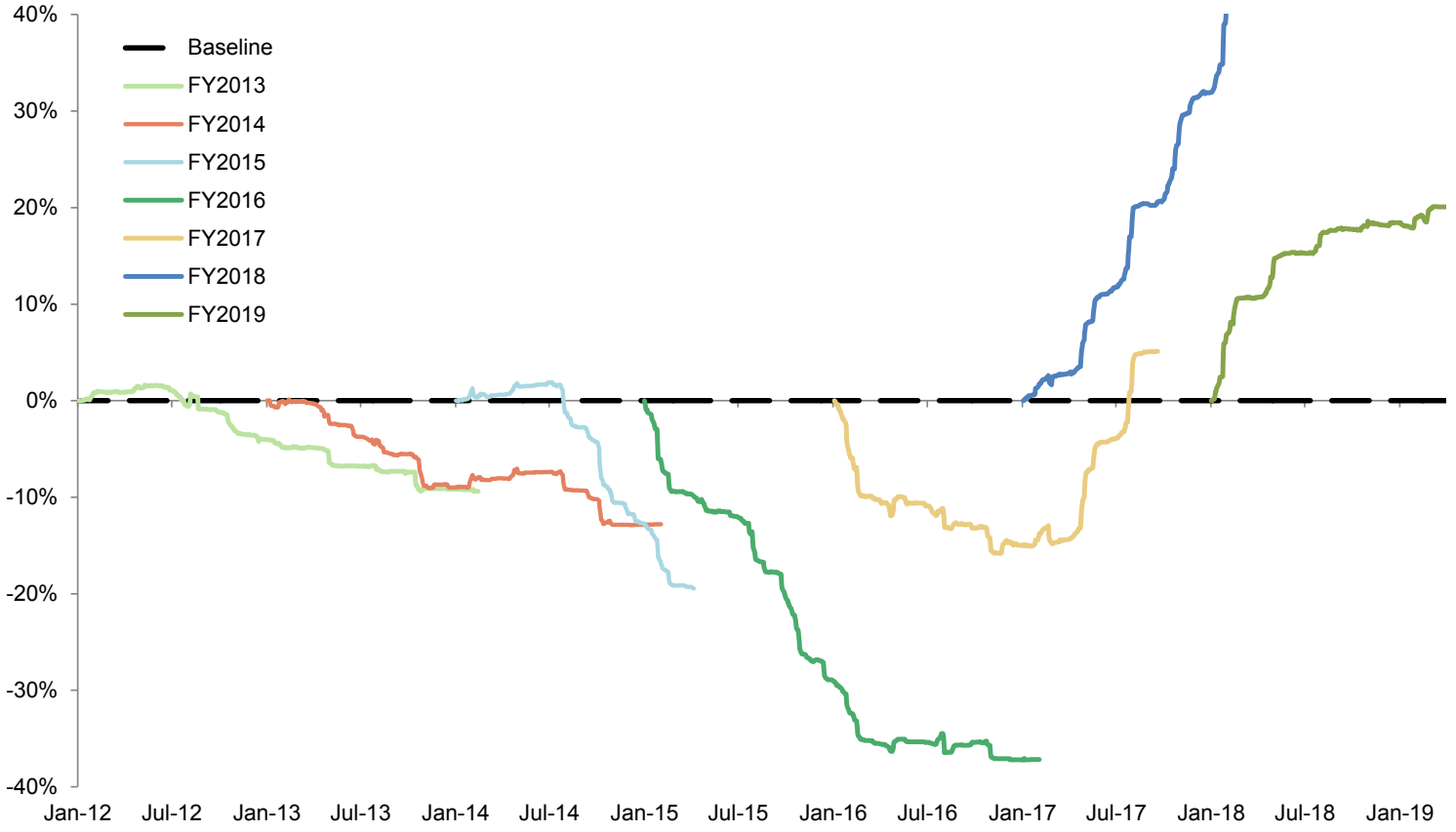
EPS revisions have historically been the most reliable predictor of outperformance

T1 - T3 Spread	2017	2016	2015	2014	2013	2012	2011	2010	2009	2008	2007	2006	2005	2004	Median	Average	# of O/P years
EPS Revisions	16%	-23%	2%	44%	21%	3%	46%	50%	22%	11%	75%	18%	21%	29%	21%	24%	13
FCF Yield	20%	-14%	-12%	-4%	14%	-33%	20%	-19%	103%	21%	8%	60%	-11%	-6%	2%	10%	7
Price / Book	-17%	18%	-1%	14%	-11%	28%	-18%	0%	2%	-5%	114%	34%	-20%	1%	0%	10%	7
P/E	-27%	12%	-17%	1%	-45%	-1%	15%	10%	-36%	1%	0%	19%	-29%	41%	0%	-4%	7
Dividend Yield	-14%	17%	3%	-14%	-42%	-60%	4%	-23%	104%	15%	16%	-42%	-4%	19%	0%	-2%	7
Organic Growth	-4%	-10%	-22%	-1%	-9%	-21%	-20%	-49%	-6%	19%	-22%	2%	4%	-9%	-9%	-11%	3
Share Repurchases*	-4%	-8%	14%	-14%	-7%	-26%	-20%	73%	-106%	4%	37%	-16%	-36%	-30%	-11%	-10%	4

Factor	Type	Definition	Ranking
EPS Revisions	Sentiment	% change in current CY median EPS estimates	T1 = Stocks with the most positive EPS revisions
P/E	Valuation	Discount or premium vs. 10Y average NTM P/E as of the prior YE	T1 = Stocks with the highest discount entering the year
FCF Yield	Valuation	Trailing 12m Free Cash Flow / Market Cap as of the prior YE	T1 = Stocks with the highest FCF Yield entering the year
Price / Book	Valuation	Market Cap at prior YE / (Total assets less intangibles and liabilities)	T1 = Stocks with the lowest Price / Book entering the year
Dividend Yield	Capital Allocation	Trailing 12m dividend yield	T1 = Stocks with the highest dividend yield
Organic Growth	Growth	Organic growth during the prior calendar year	T1 = Stocks with the highest organic growth
Share Repurchases	Capital Allocation	Change in shares outstanding between current YE and prior YE	T1 = Stocks with the most shares repurchased during the current year

Source: Company Data, Morgan Stanley Research

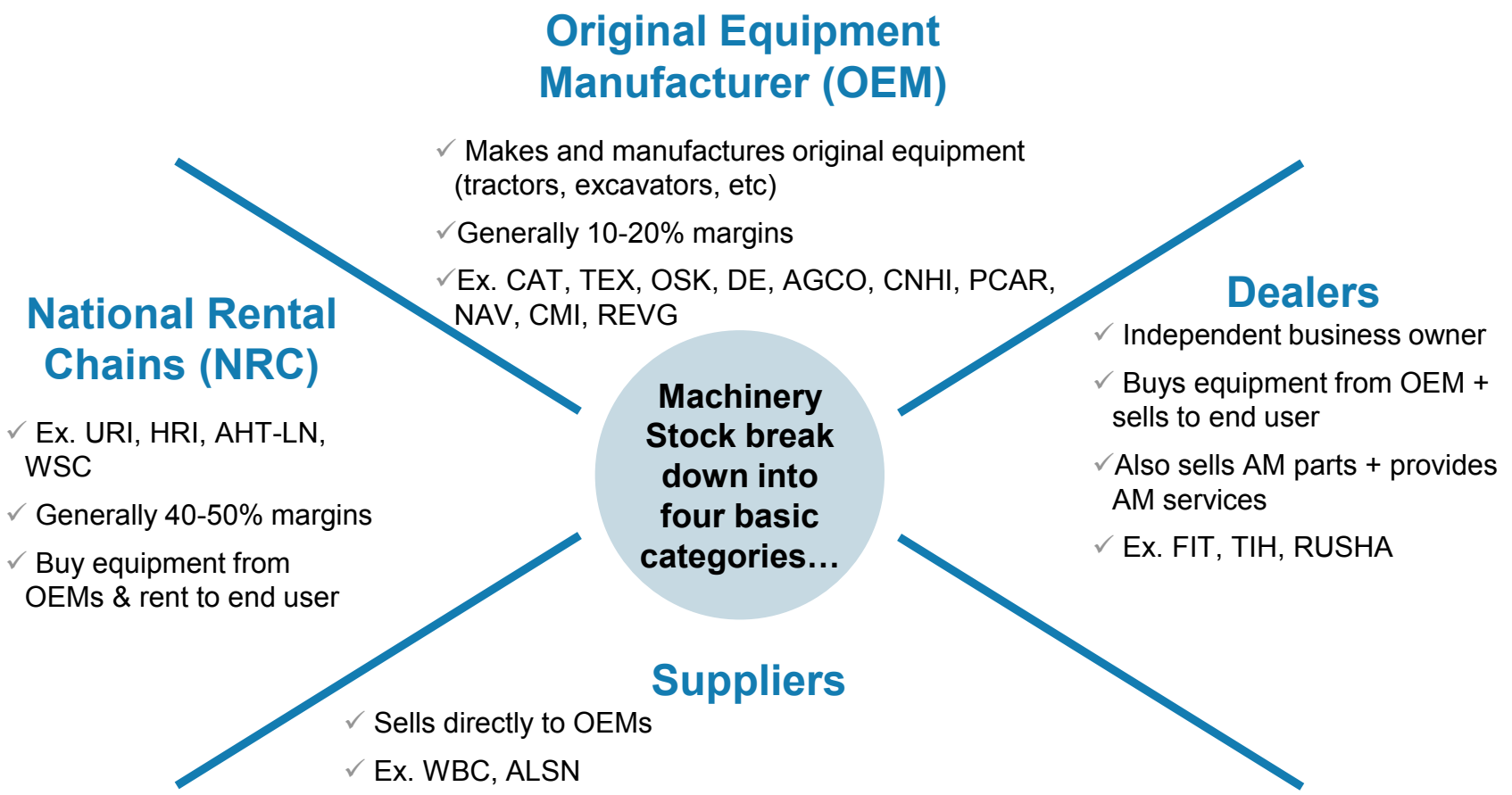
Analysts had been too optimistic on the scope of the downturn, and conversely more conservative on the degree of the 2017/2018 recovery



Source: Thomson Reuters, Company Data, Morgan Stanley Research

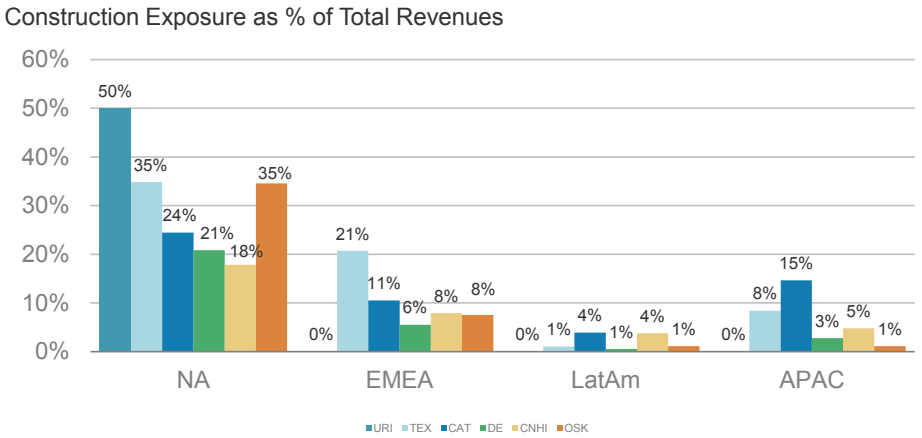
How to Analyze Machinery Stocks

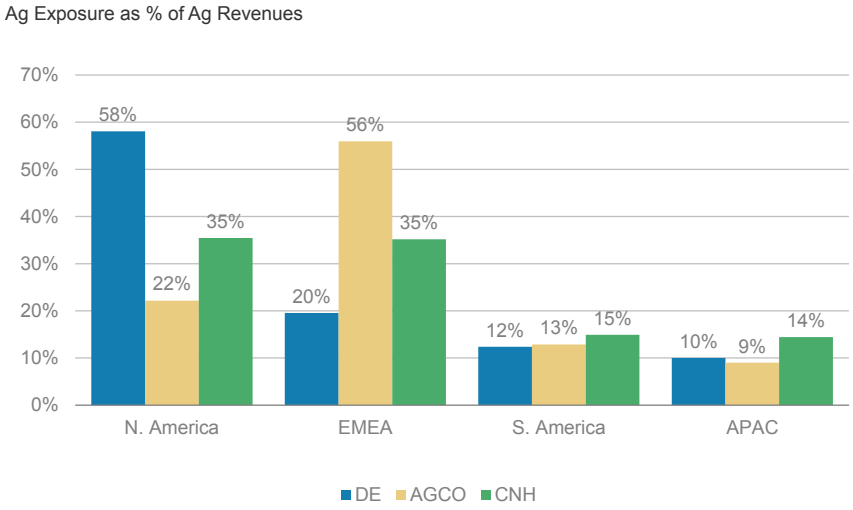
What type of Machinery Stock?

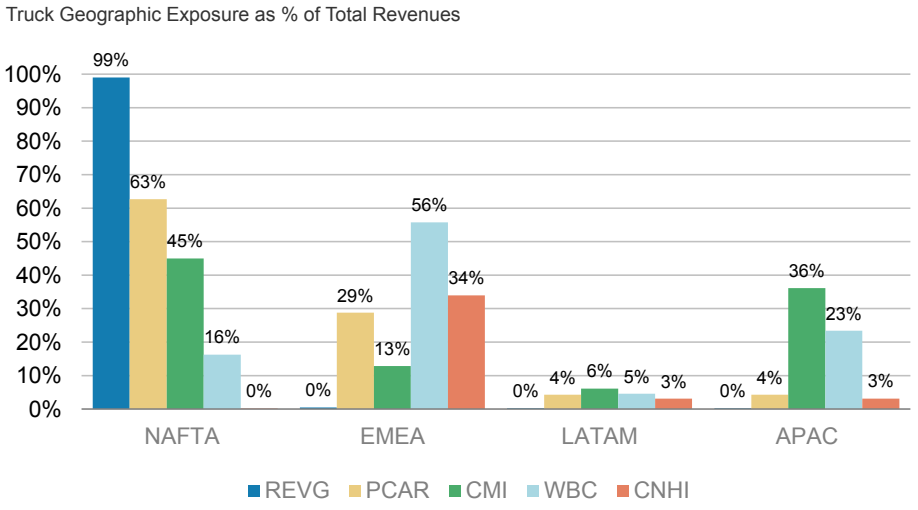


Source: Company Data, Morgan Stanley Research.

US Machinery Geographic Exposure

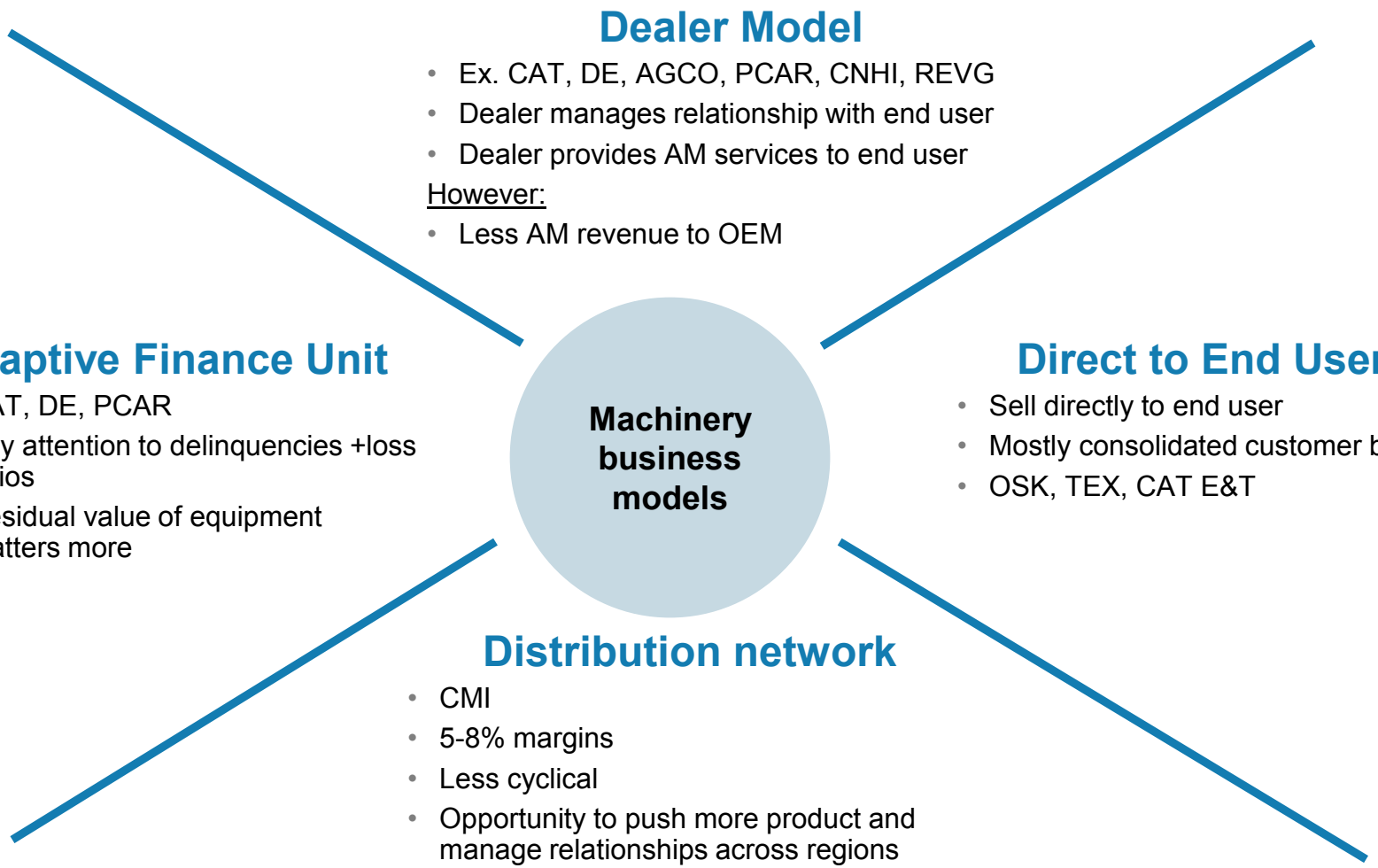






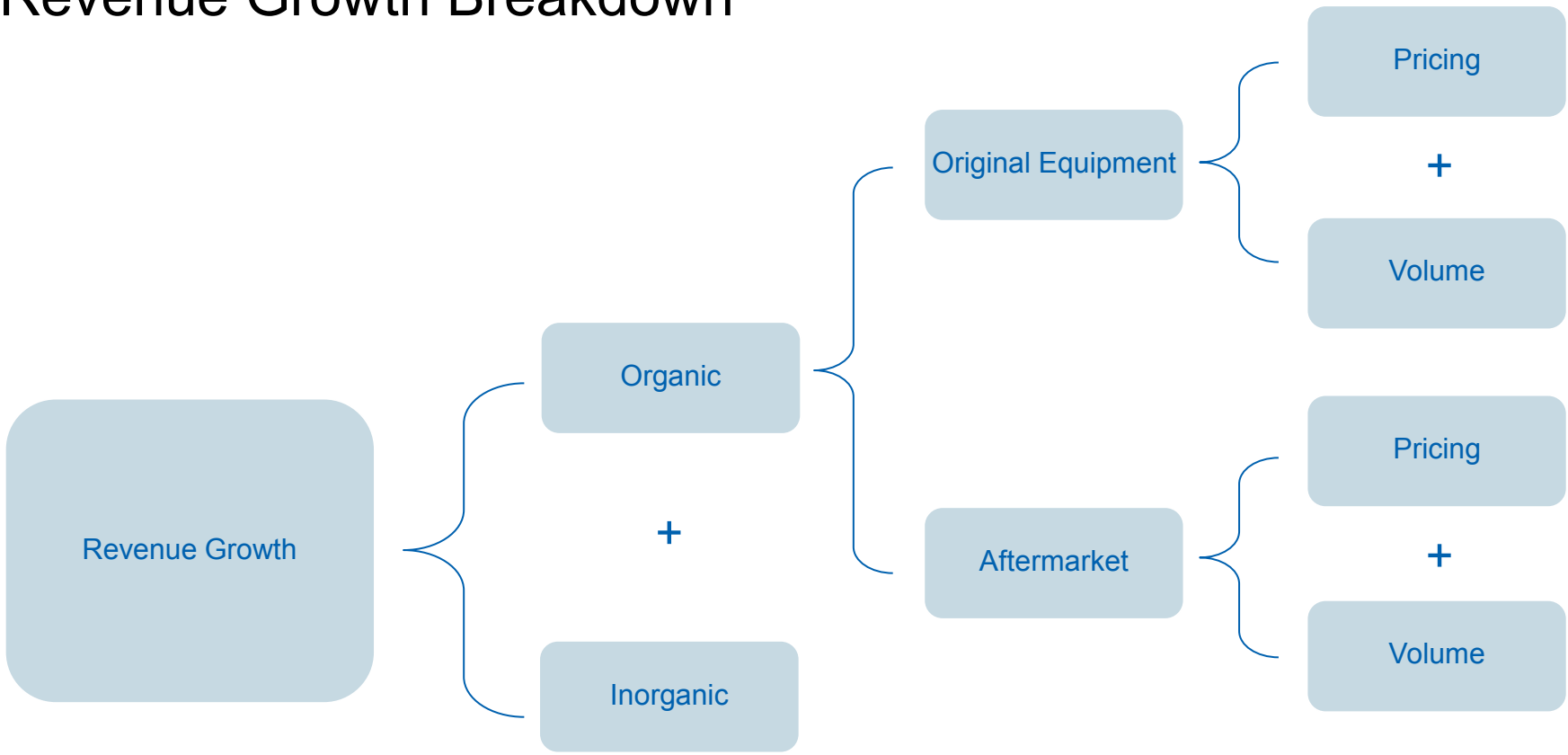
Source: Company Data, Morgan Stanley Research

What type of business model?



Source: Company Data, Morgan Stanley Research

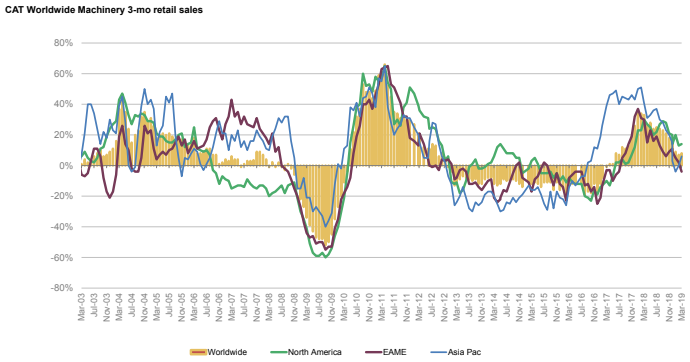
Revenue Growth Breakdown



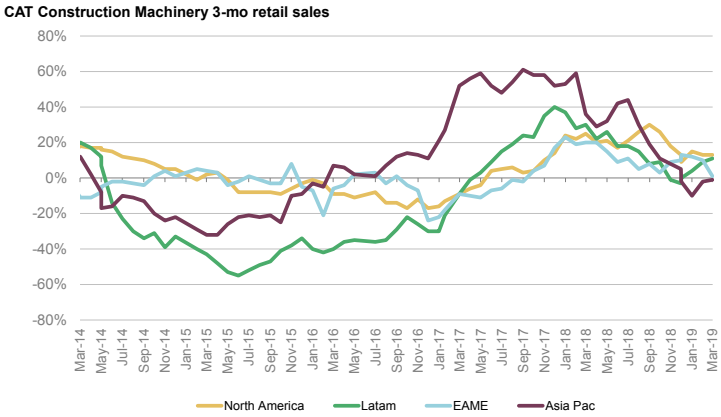
Source: Company data, Morgan Stanley Research

Retail Statistics are backwards looking, but helpful for identifying where we are in cycle

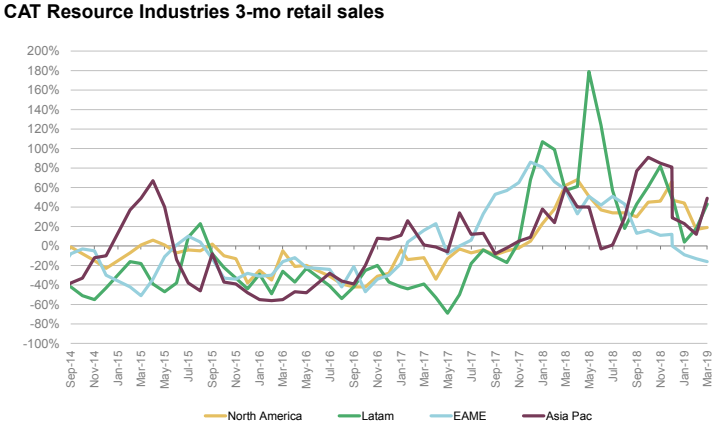
Worldwide Machines



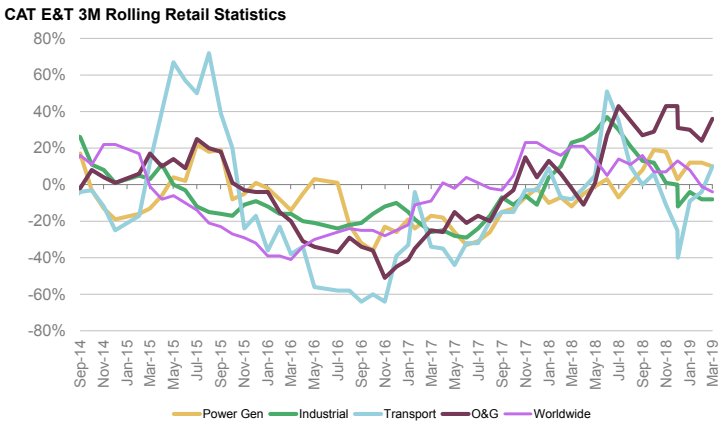
Construction Industries



Resource Industries



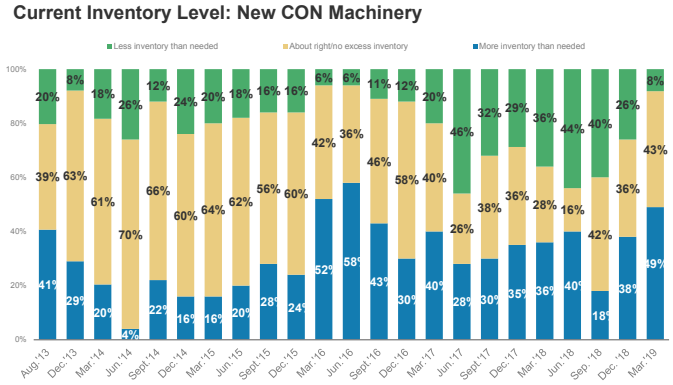
E&T



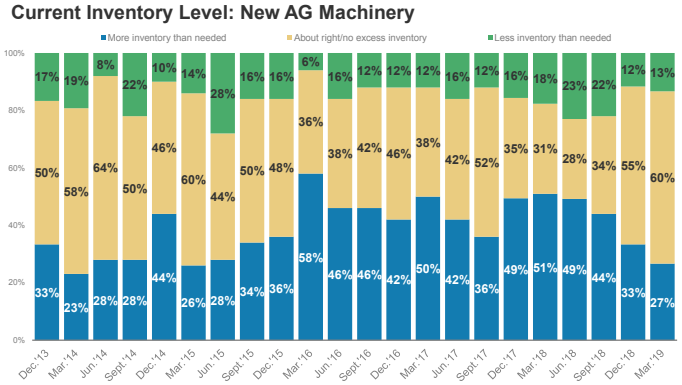
Source: Company data, Morgan Stanley Research

Retail Sales don't include aftermarket sales or swings in dealer inventories

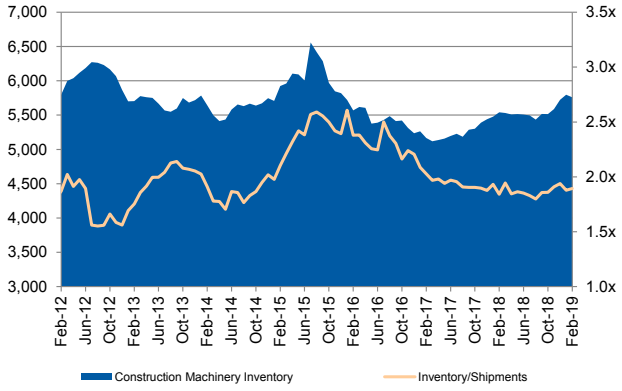
Current Inventory Level: New Construction Inventory



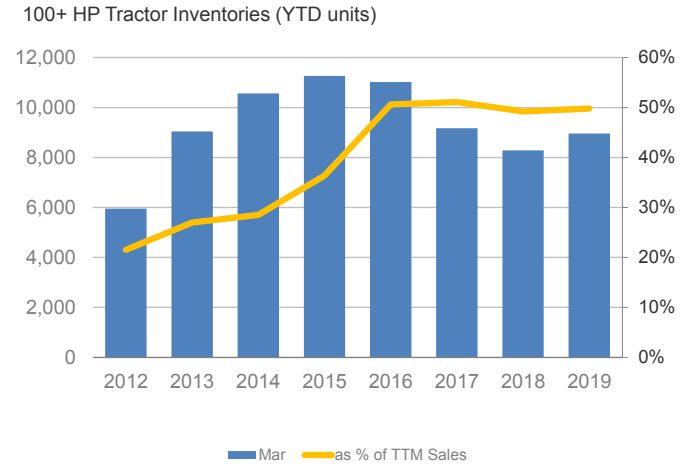
Current Inventory Level: New Ag Inventory



Inventory/shipment ratios (~1.89x in 2/2019 vs ~1.84x in 2/2018) are still well below levels seen in 2015/2016.



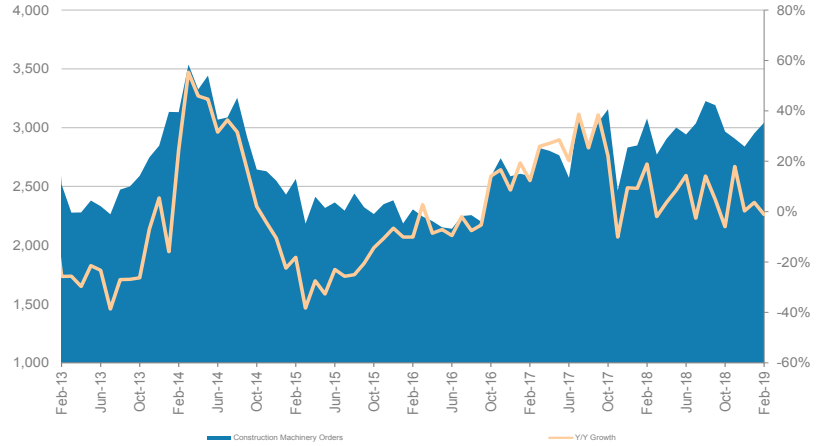
100+ HP tractor inventories have fallen ~15% since '14 but remain ~50% of TTM sales



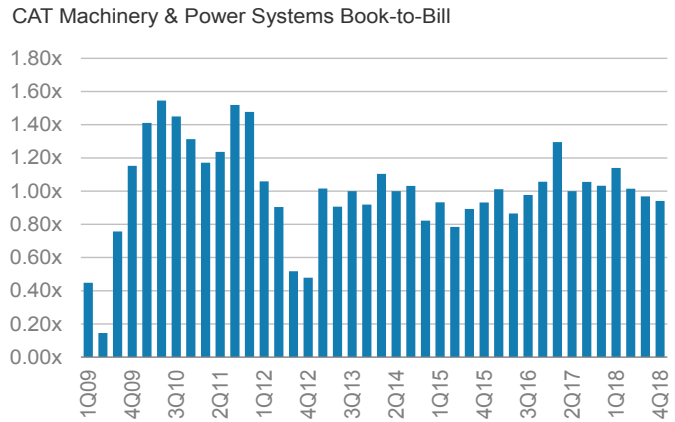
Source: Company Data, Morgan Stanley Research

Orders are better leading indicator

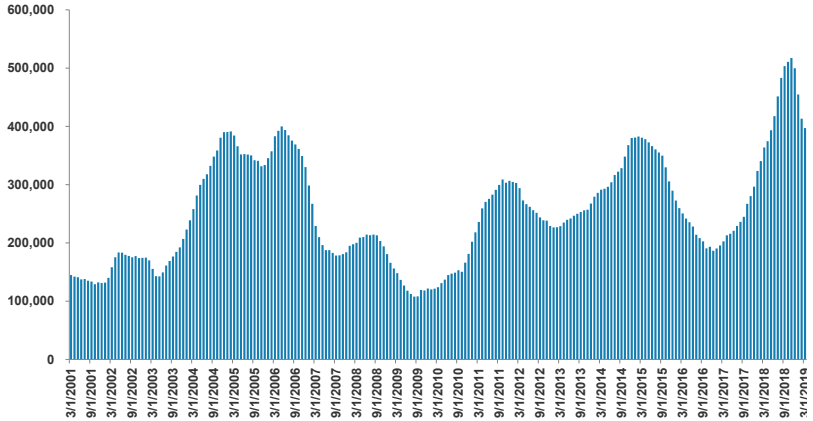
Construction Machinery Orders



CAT Machinery & Power Systems Book-to-Bill



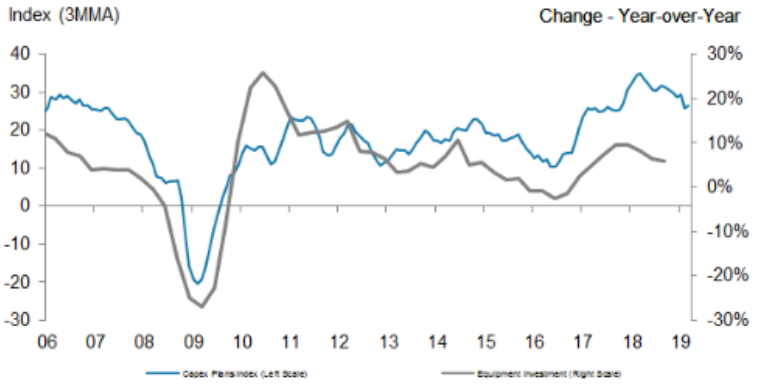
TTM Class 8 Orders



Source: Company Data, BEA, ACT Research, Morgan Stanley Research

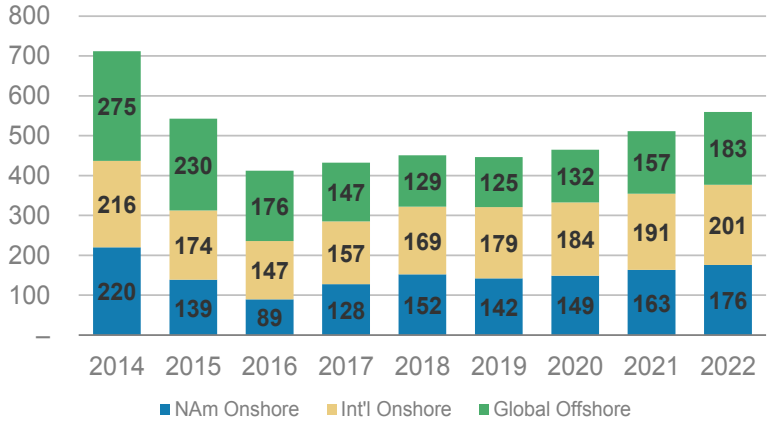
O+G, Mining + Rental Co. Capex correlate with OEM topline

Composite Capex Plans Index

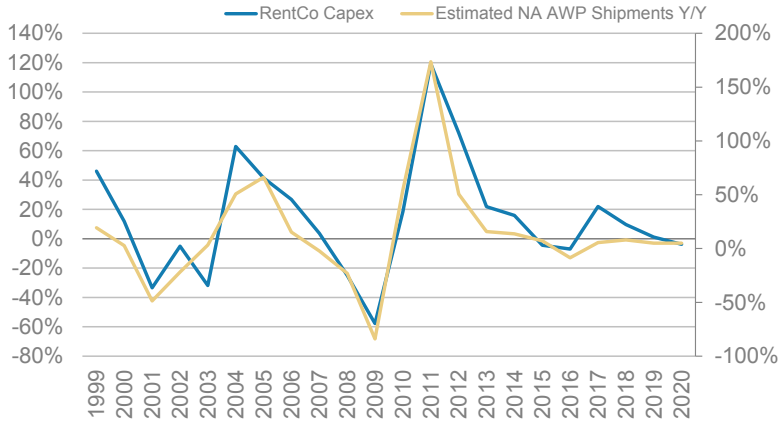


Source: Federal Reserve Banks of Richmond, Philadelphia, New York, Kansas City, Texas, Bureau of Economic Analysis, Morgan Stanley Research

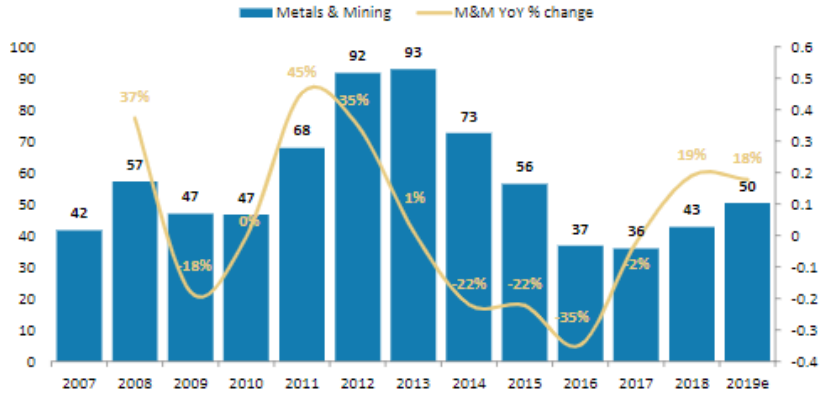
Global Upstream O+G Capex *($ billions)*



RentCo Capex vs. NA AWP Shipments



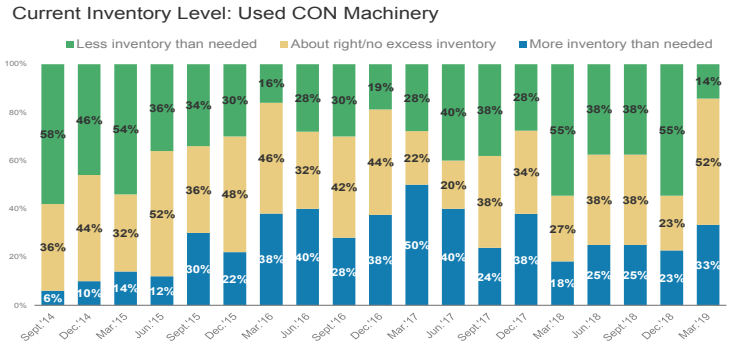
Mining Capex



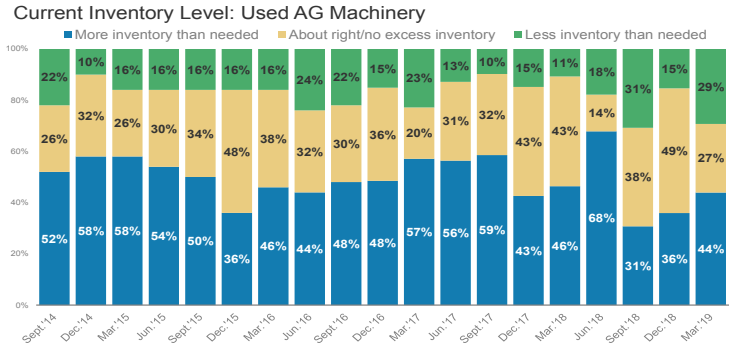
Source: Thomson Reuters, Company Data, Morgan Stanley Research

Used Equipment Pricing/Inventory impacts New Equipment

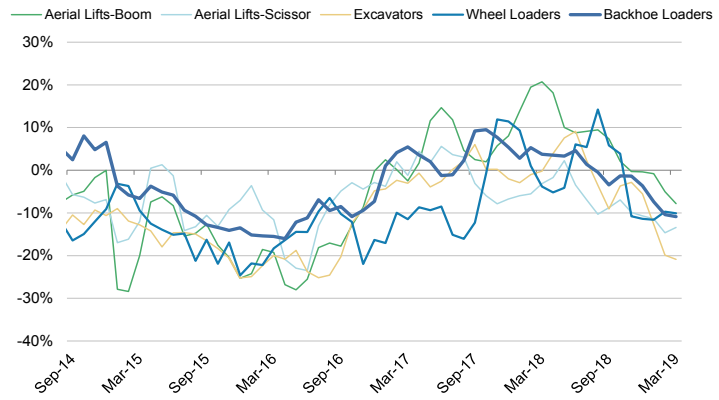
Construction used equipment inventory



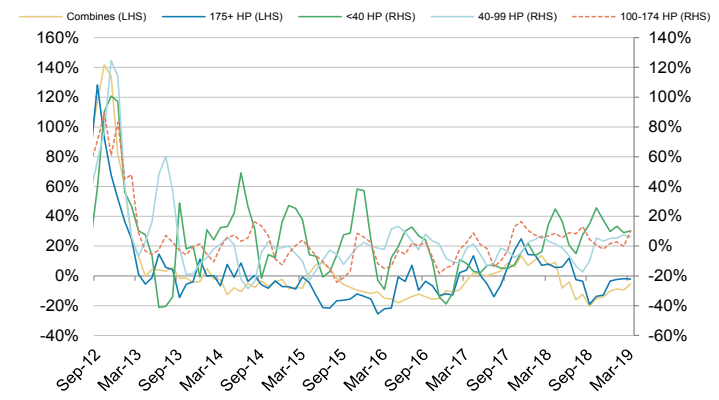
Ag used equipment inventory



Construction used equipment pricing



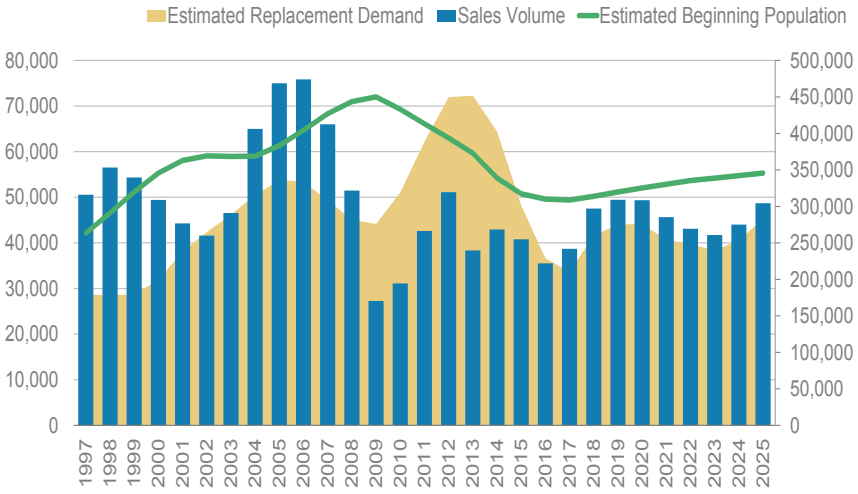
Ag used equipment pricing



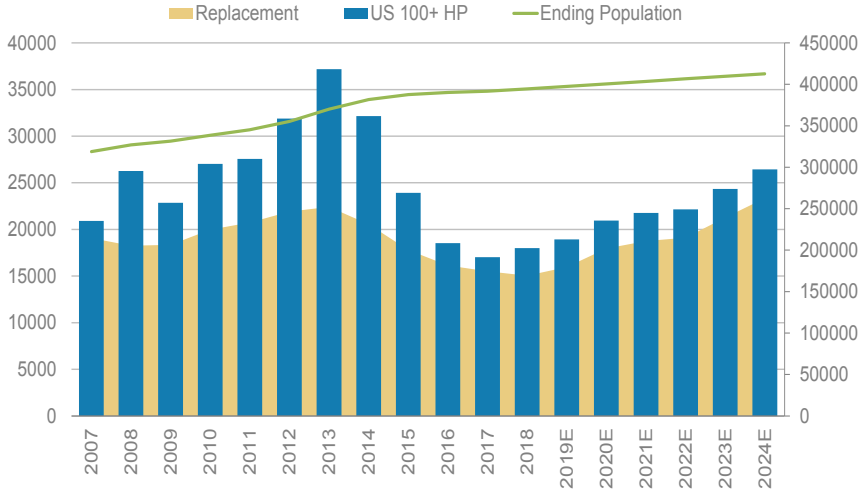
Source: AlphaWise, Morgan Stanley Research

Understanding replacement cycle dynamics

North America Heavy Construction Equipment Sales (Units) vs Population



US 100+ HP Tractor Sales



Source: Company data, Off-Highway Research, Morgan Stanley Research

Higher Aftermarket sales reduces cyclicality of OEMs

Original Equipment (OE)

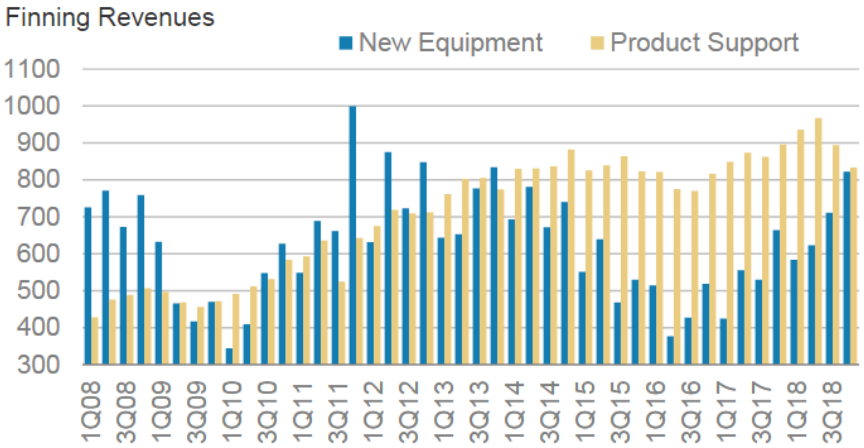
- ✓ Makes and manufactures original equipment (tractors, excavators, etc.)
- ✓ Generally 5-20% margins
- ✓ Ex. CAT, TEX, OSK, DE, AGCO, CNHI, PCAR, CMI, REVG

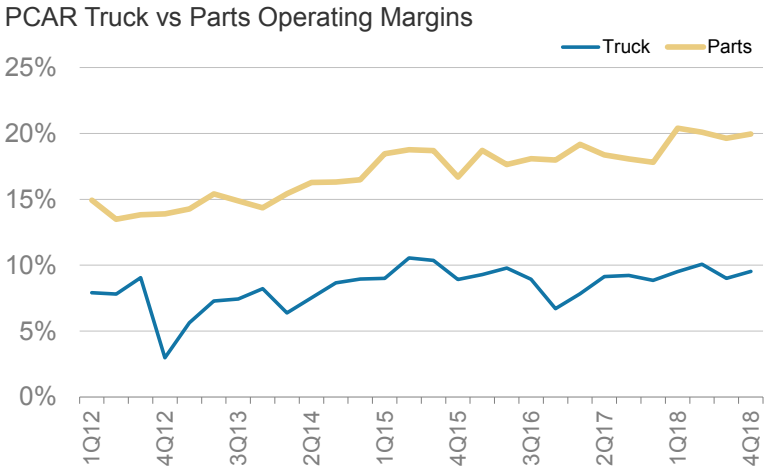
Aftermarket Services

- ✓ Generally offered by the dealer
- ✓ Generally 20+% margins

Aftermarket Parts (AM)

- ✓ Most OEMs also sell parts
- ✓ Some manufacture their own, others merely distribute
- ✓ Generally 15-35% margins

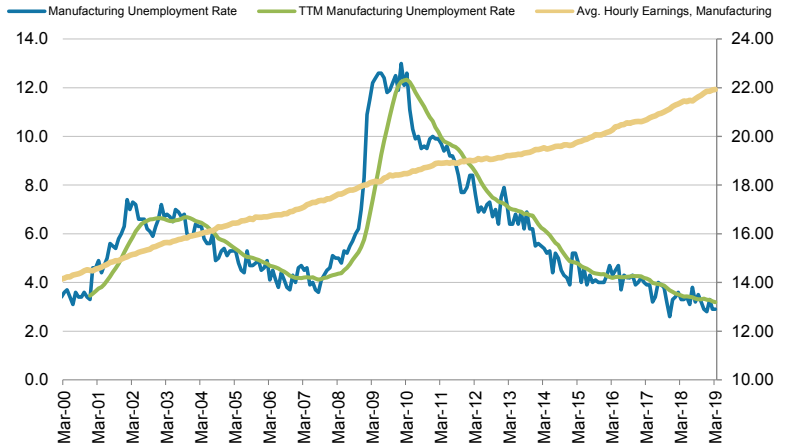


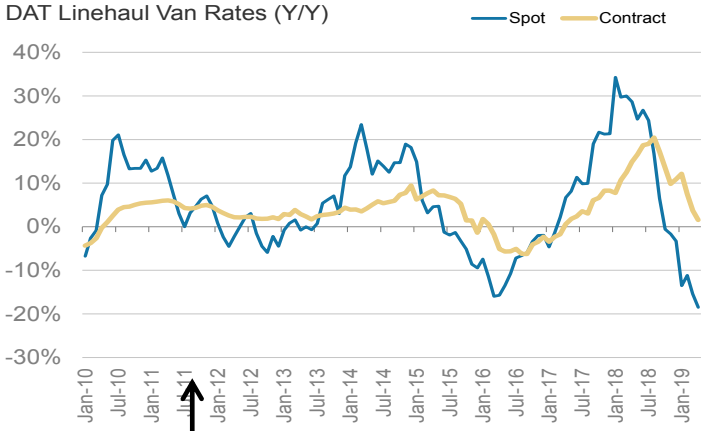


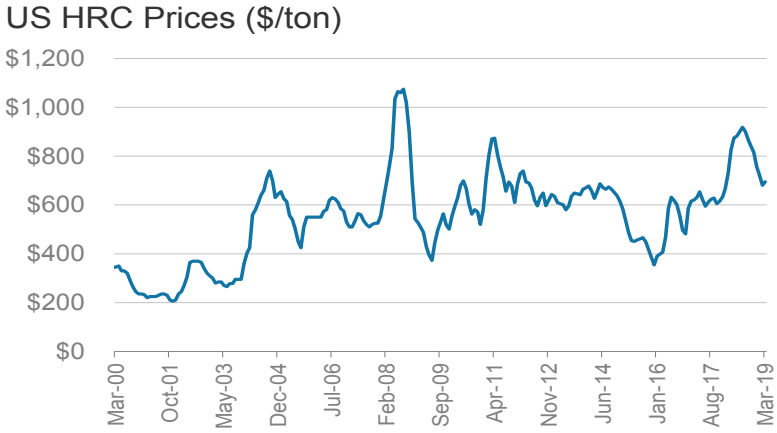
Source: Company Data, Morgan Stanley Research

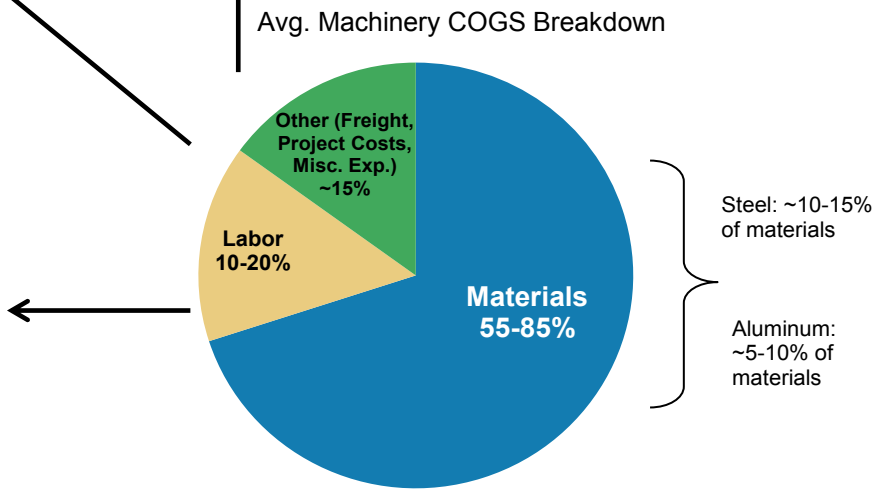
Price/Cost Trends – input costs have been rising, but end market strength has supported incremental pricing power to offset input inflation

Labor Cost Trends





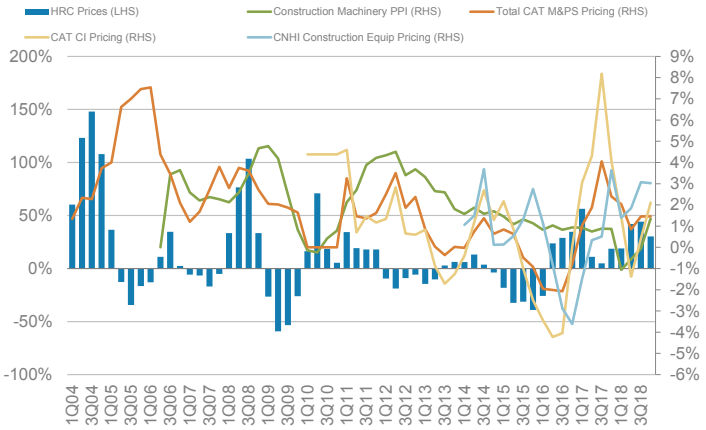




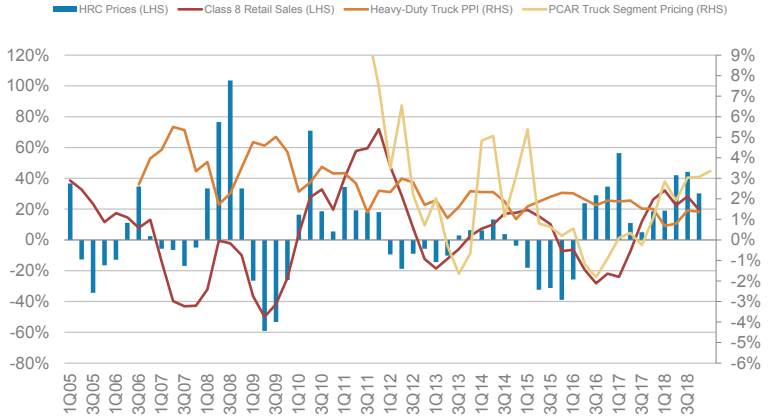
Source: BLS, Company Data, Morgan Stanley Research

Pricing: Construction + Ag OEMs can generally pass cost inflation through pricing

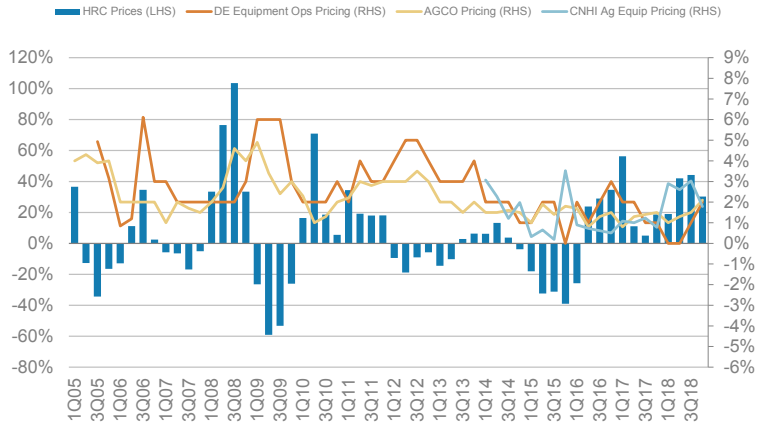
Construction companies appear to have been successful at passing through spikes in steel inflation



Heavy truck pricing appears to be more dependent on the health of the Class 8 cycle rather than commodity inflation...



Ag pricing has been stable over time



Source: ACT, BLS, Company Data, Morgan Stanley Research

Focus on Incremental/Decremental Margins

$$\text{Incremental Margin} = \frac{\text{Change in Adj. Op Income}}{\text{Change in Sales}}$$

- Generally 20-25% incrementals are considered good for mid cycle
- Focus on accelerations/decelerations
- Volatility can be caused by:
  - Stage of recovery
  - FX Revenue Tailwinds/Headwinds can dampen/expand
  - Labor + Material inflation
  - Cost cutting programs (SG&A, R&D, Procurement Initiatives, Restructuring)
  - Best practice → make adjustments

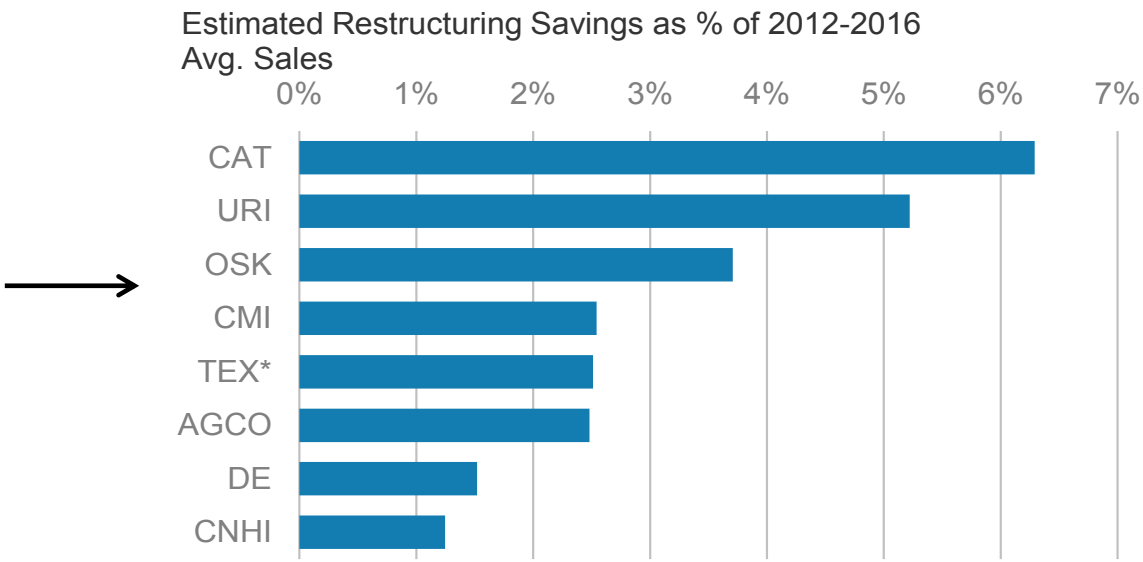
Core Operating Income Incremental Margin	2017	1Q18	2Q18	3Q18	4Q18	2018	1Q19E	2Q19E	3Q19E	4Q19E	2019E	1Q20E	2Q20E	3Q20E	4Q20E	2020E
AGCO	13%	8%	6%	6%	23%	8%	38%	37%	25%	23%	28%	27%	15%	15%	15%	17%
CAT	42%	35%	35%	28%	25%	32%	23%	38%	27%	34%	31%	27%	27%	27%	26%	27%
CMI	16%	17%	23%	17%	24%	20%	11%	-9%	13%	-59%	-1%	29%	29%	29%	31%	29%
CNHI	-5%	15%	19%	3650%	-700%	24%	61%	19%	9%	13%	11%	26%	27%	26%	28%	27%
DE	14%	32%	22%	18%	6%	19%	4%	15%	32%	33%	19%	33%	34%	25%	25%	29%
OSK	21%	15%	24%	5%	32%	18%	31%	2%	6%	4%	14%	-35%	20%	20%	20%	5%
PCAR	8%	15%	15%	11%	14%	14%	6%	8%	3%	22%	-1%	9%	10%	11%	11%	11%
REVG	8%	-5%	-11%	94%	83%	-25%	-270%	9%	12%	25%	12%	17%	17%	9%	10%	16%
TEX	-20%	23%	15%	9%	9%	15%	-2%	-42%	-48%	-14%	-21%	-5%	-32%	-10%	18%	-18%
URI	26%	16%	19%	16%	22%	24%	9%	23%	39%	69%	24%	41%	45%	54%	53%	25%
WSC	-5%	17%	33%	16%	15%	17%	11%	11%	36%	99%	21%	71%	74%	77%	79%	75%
WBC	16%	16%	17%	-3%	82%	10%	38%	50%	25%	15%	156%	18%	18%	18%	18%	18%

Source: Company Data. CAT, CNHI, PCAR & DE reflect underlying Equipment Operations

Restructuring over ’15-17 time period has boosted incremental margins as revenues come back

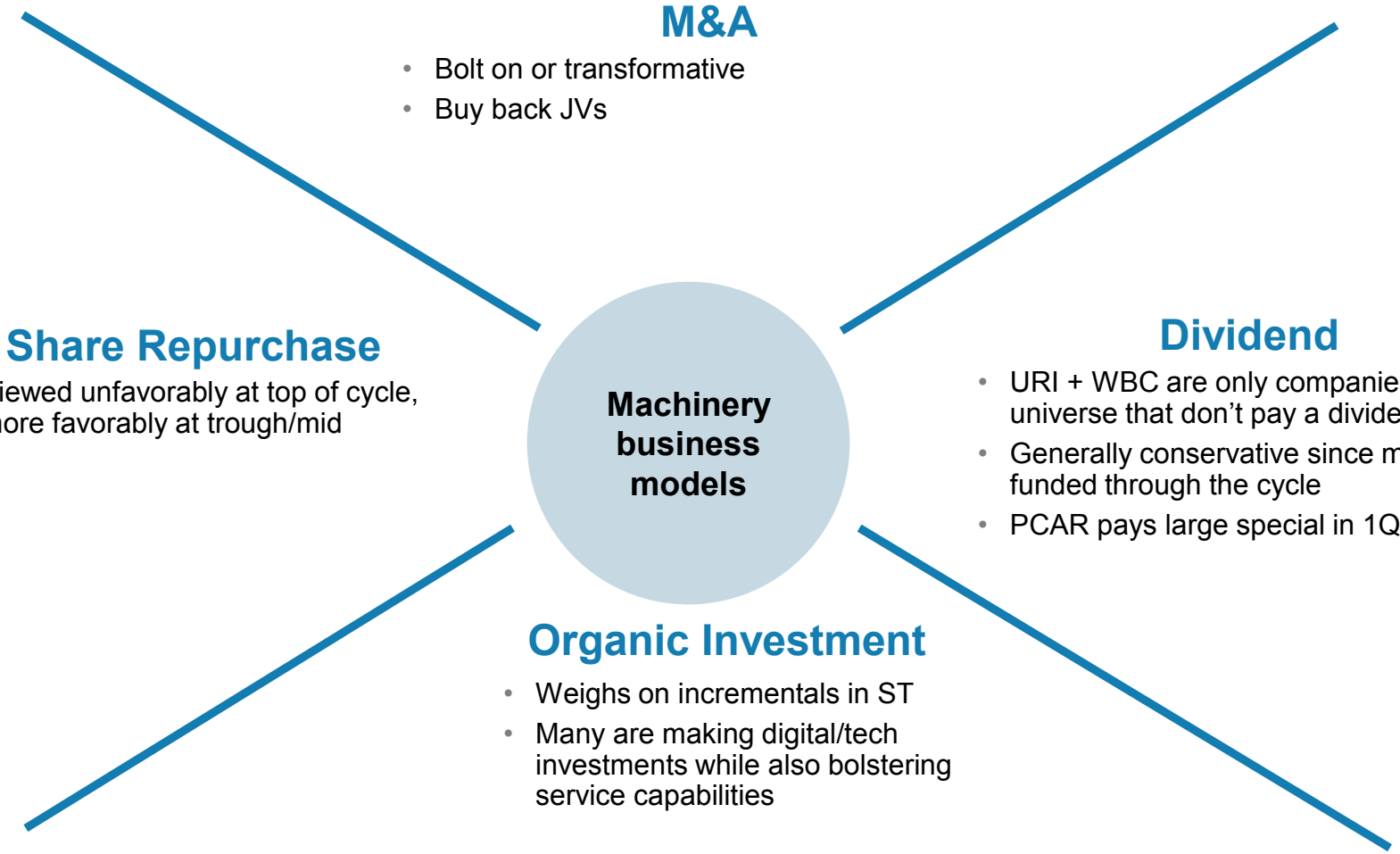
Notable Machinery Cost Savings Programs

Company	Market Cap	Targeted & Achieved Run Rate Savings (in dollars or bps of margin improvement) since 2014
CAT	$88,502	Achieved: $3.3bn in asset reduction off ~$2.4bn in targeted restructuring costs
CMI	$26,729	Achieved: ~$460m in annualized cost savings
AGCO	$5,203	Achieved: ~$150m in savings in 2014-2016 Targeted: ~$75m in savings from 2017-2019
DE	$47,924	Targeted: $500m
OSK	$5,782	Achieved: $255m
TEX*	$2,875	Targeted: ~$125m Achieved: $41m in 2016 restructuring savings
URI	$15,026	Targeted: ~$200m from Project XL ~$35m in cost synergies from NEFF acquisition, to be realized by end of year 2 ~$40m in potential synergies from NES
CNHI	$16,455	Achieved: ~$266m** Targeted: ~$100m in expenses to generate ~$80m in run rate savings



Source: Company Data, Morgan Stanley Research

How to spend cash?

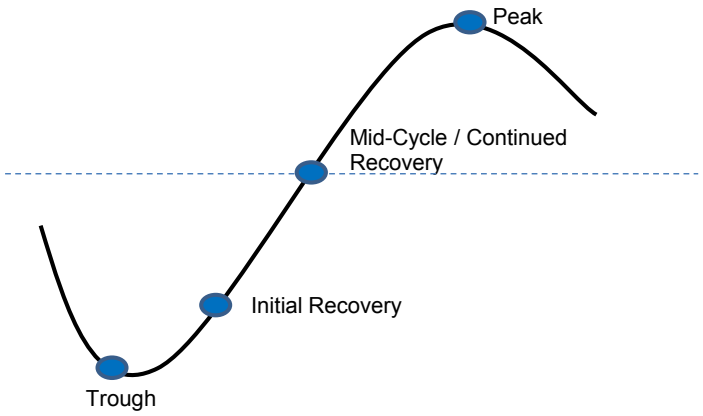


Source: Company Data, Morgan Stanley Research

Valuation

How do we value Machinery stocks?

When valuing Machinery stocks, we ascribe to a cyclical valuation framework based on where we are in the cycle (Exhibit 266). As we approach mid-cycle levels, we believe investors should focus on a NTM P/E or NTM EV/EBITDA given the additional clarity on revenue growth, price cost pressures, and the impact of restructuring when looking at a shorter term horizon. We use Peak EPS as secondary, "gut-check" methodology, acknowledging that our peak estimates generally require many assumptions and we tend not to know when peak occurs until it has passed. That said, as names in the sector begin to approach peak levels, we believe investors will should consider 'normalized' earnings numbers (i.e. 10-15 year average revenues on an updated cost-structure). We think using "normalized" valuation levels for construction stocks is still 1-2 years away as upwards EPS revisions continue to challenge peak earnings estimates. At peak and trough, we also consider P/Sales or EV/Sales as a secondary methodology.



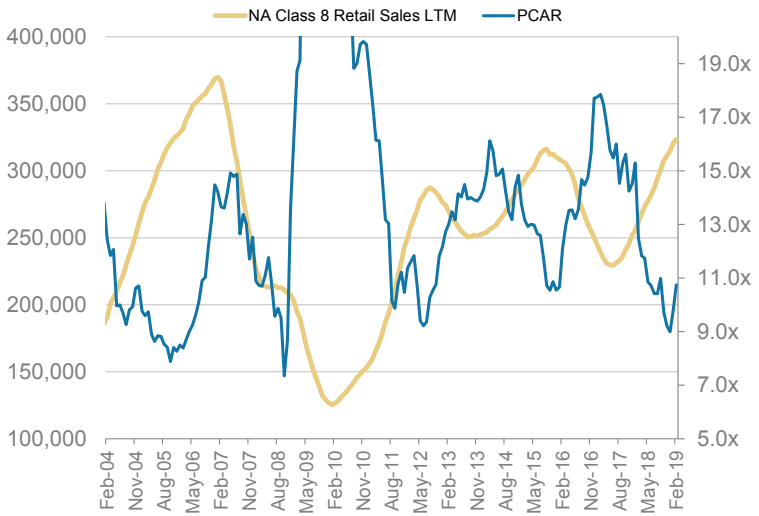
Point in Cycle	Valuation Methodology	Qualitative Commentary
Peak	Normalized EPS / EBITDA Price/LTM Sales	- What's the downside risk? - Macro-Economic Health - Potential Restructuring
Mid-Cycle / Continued Recovery	NTM EPS / EBITDA	- Strength of Upcycle - Degree of Volume Leverage & Price/Cost Impacts - Testing "Peak Earnings" hypothesis
Initial Recovery	NTM EPS/EBITDA Peak EPS / EBITDA	- Potential Strength of Upcycle - Impact from Restructuring - What Can This Be Worth in a Best Case Scenario?
Trough	Normalized EPS / EBITDA Price/LTM Sales Sum of the Parts	- Impact from Restructuring - Strategic Alternatives - How to Assess Value under Depressed Conditions

Source: Company Data, Morgan Stanley Research

Valuation “Peaks” when Sales/EPS trough

PCAR's NTM P/E multiple typically peaks near the trough of LTM Class 8 Retail Sales - as we continue to enter a period of accelerating sales, risk is clearly to the downside.

PCAR NTM P/E vs. LTM Class 8 Retail Sales



Similarly, CMI shares priced in a simultaneous recovery in NA truck and off-highway markets - as such, we expect some degree of multiple compression to continue as both retail sales and off-highway markets continue to accelerate.

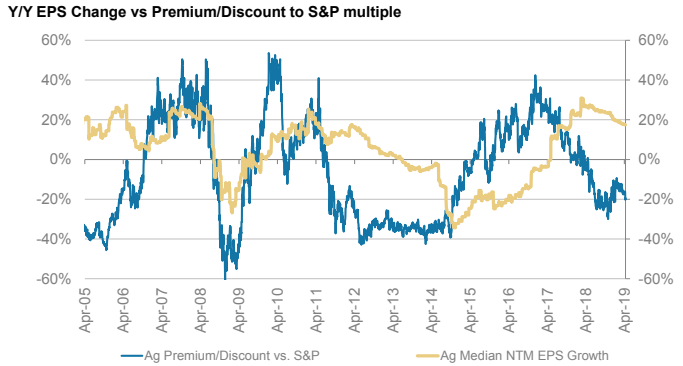
CMI NTM P/E vs. LTM Class 8 Retail Sales



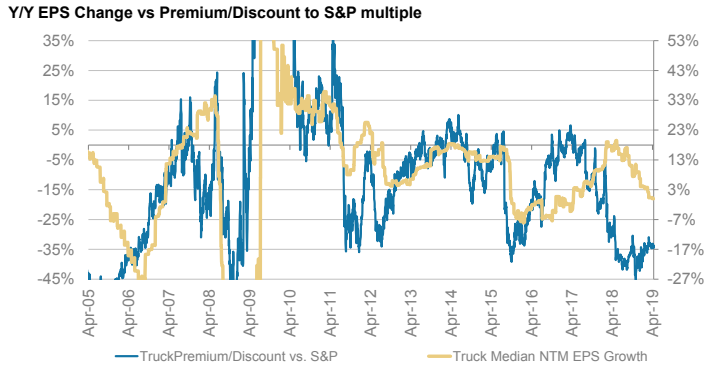
Source: Thomson Reuters, ACT, Company data, Morgan Stanley Research

In periods of multiple compression, identifying upside to EPS revisions is key

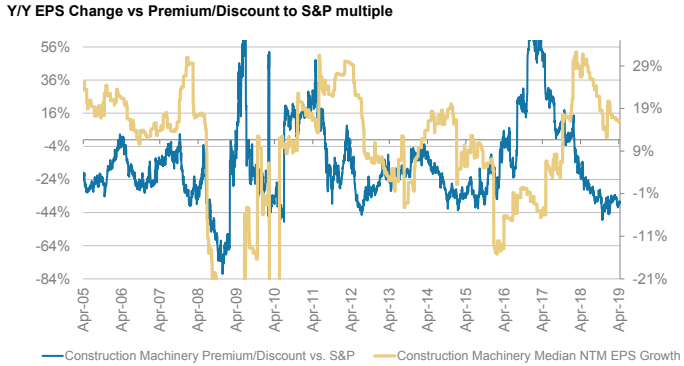
Ag multiples are currently trading at a 19% discount to the market multiple vs the 5 year median of a 1% premium. Ag machinery multiples generally trade at a median -13% discount to the market multiple during periods of positive EPS revisions.



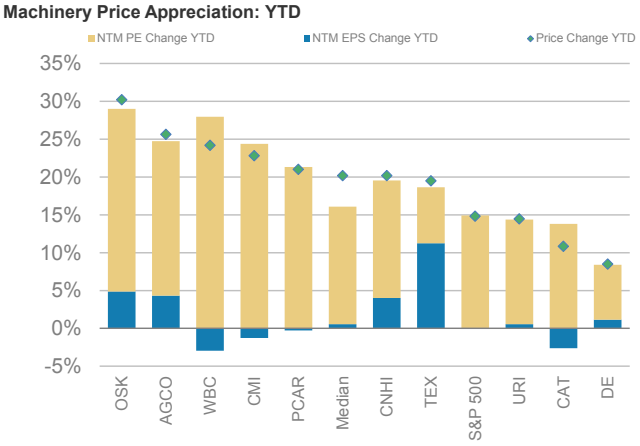
Truck multiples are trading at 11.0x (34% discount to S&P) – consistent with historical peak valuations.



Construction multiples (ex URI which we value on EBITDA) are currently trading at a -38% discount to the market multiple vs. the 5-year median of -20%.



In a broad reversal from 18's trends, machinery multiples have seen meaningful expansion YTD – despite little changes to earnings estimates.



Source: Company data, Thomson Reuters, Morgan Stanley Research

Construction Equipment (incl. O&G and Mining)

Agriculture Equipment

Truck OE Equipment & Suppliers

Construction Equipment

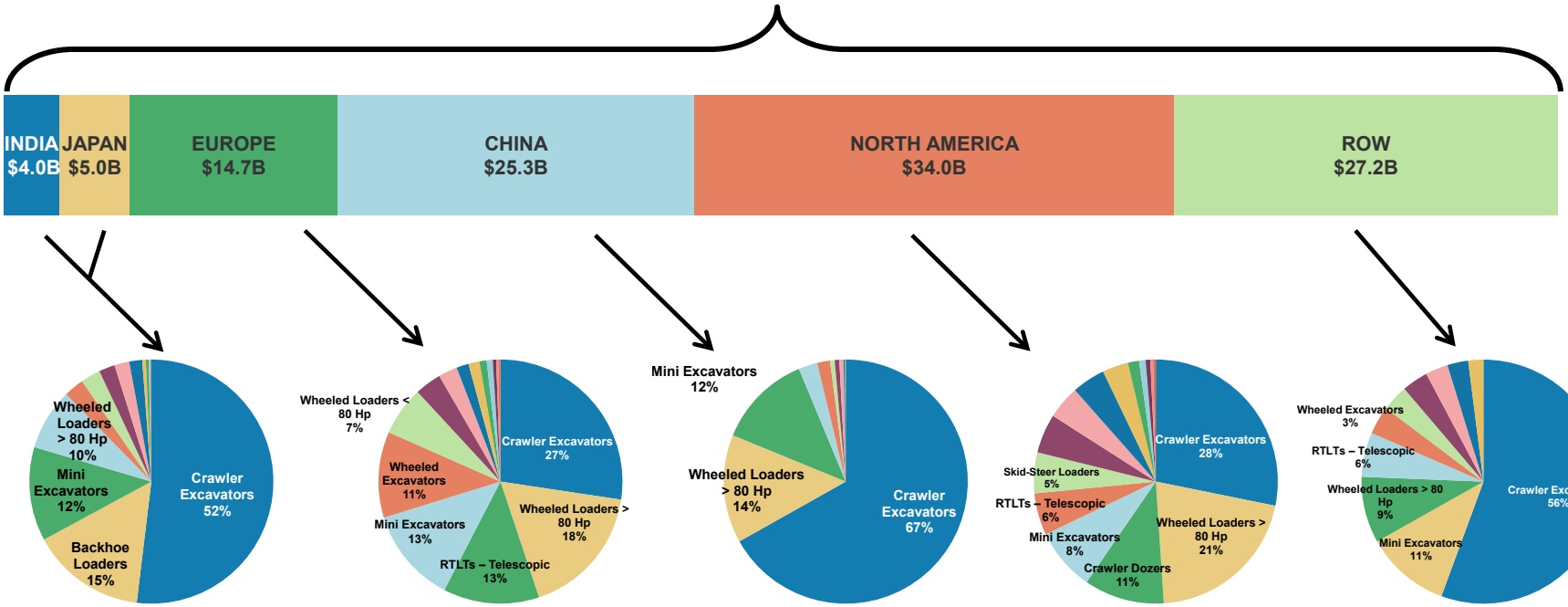
Construction Equipment & Market Primer: Who sells what?

			CAT	DE	CNH	TEX	OSK	MTW	Komatsu	Hitachi	Kubota	Sumitomo	Volvo	Liebherr	Altec
	Light Construction Equipment	Mini Excavators	✓	✓	✓				✓	✓	✓		✓		
		Wheel Loaders	✓	✓	✓				✓		✓		✓		
		Skid Steers	✓	✓	✓				✓		✓		✓		
		Backhoe Loaders	✓	✓	✓				✓		✓		✓		
		Aerial Lifts				✓	✓								✓
	Heavy Construction Equipment	Excavators	✓	✓	✓				✓	✓			✓	✓	
		Wheel Loaders	✓	✓	✓				✓	✓			✓	✓	
		Backhoe Loaders	✓	✓	✓				✓				✓		
		Motor Graders	✓	✓	✓				✓				✓		
		Off-Highway Trucks	✓	✓	✓				✓				✓	✓	
	Cranes	Boom Trucks						✓				✓		✓	✓
		Mobile Telescopic				✓		✓				✓		✓	✓
		Lattice Boom				✓		✓				✓		✓	
		Tower				✓		✓						✓	

Source: Company data, BEA, Morgan Stanley Research

Crawler Excavators drive sales in every regional construction equipment market

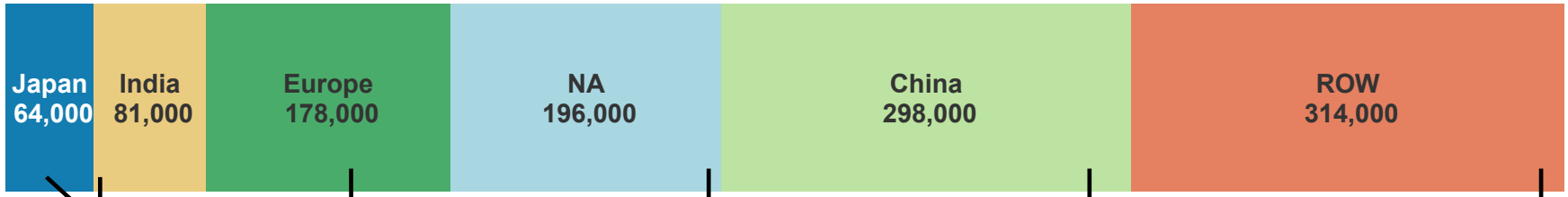
$110B market in 2018
(excludes ~$35B cranes + $10B aerials)

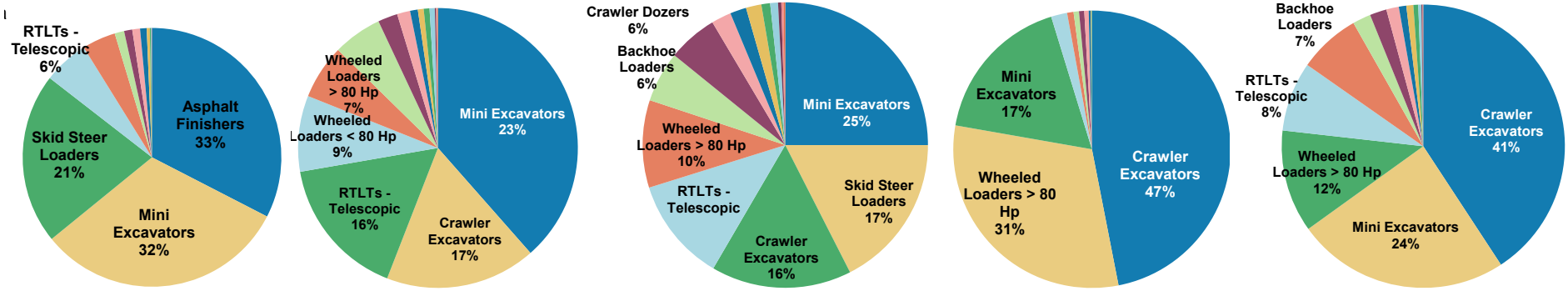


Source: Off-Highway, Morgan Stanley Research

China is largest market by units

1.1m unit market in 2018 (excludes cranes + aerials)

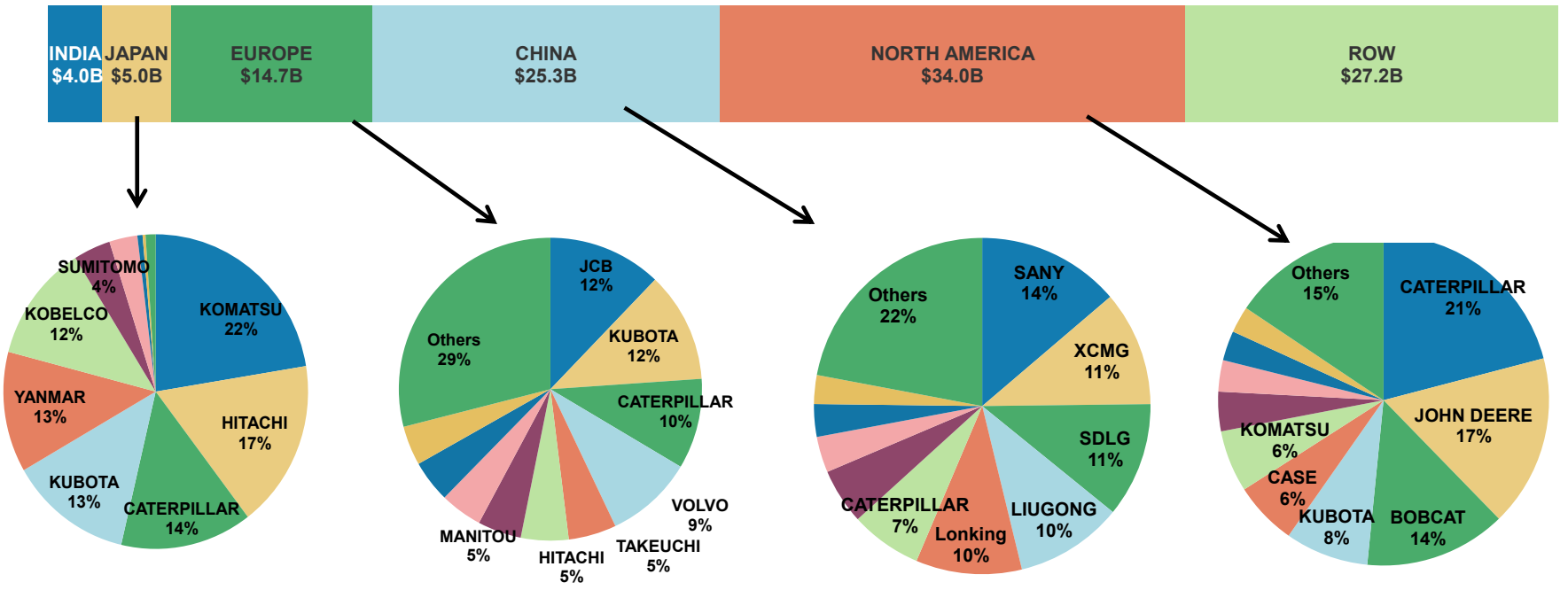




Source: Off-Highway, Morgan Stanley Research

North America is the most consolidated market while China is most fragmented

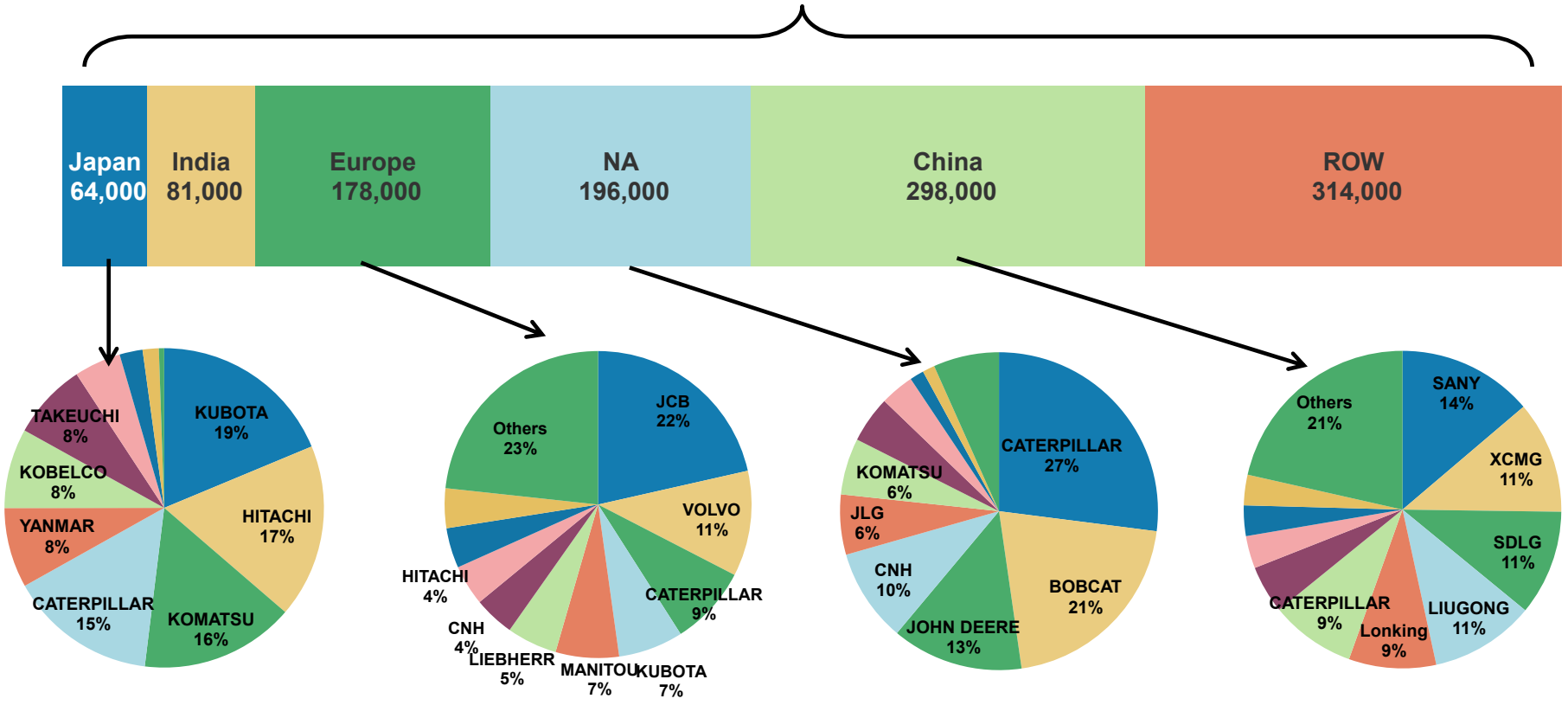
$110B market in 2018
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Source: Off-Highway, Morgan Stanley Research

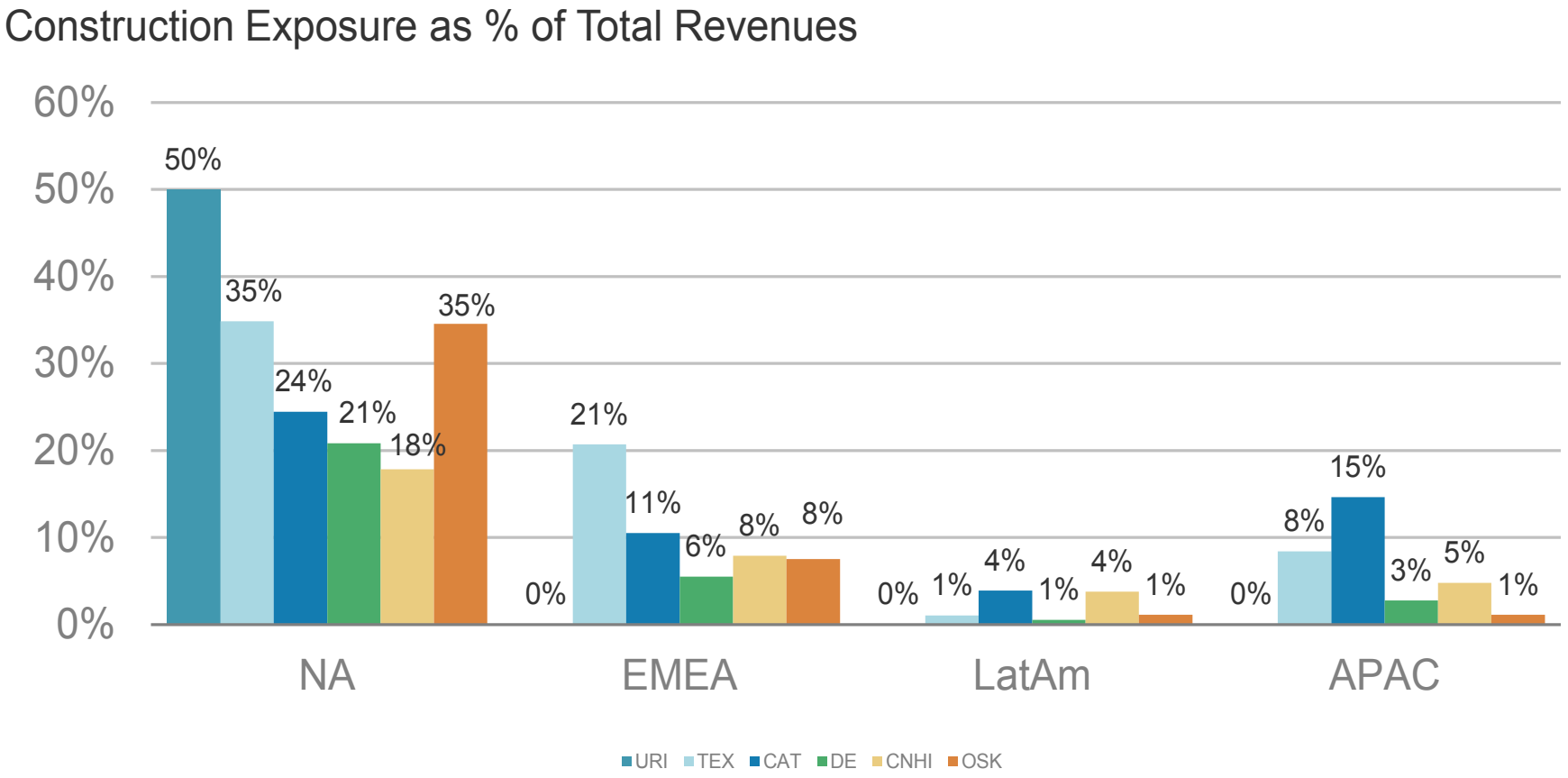
Looking at unit share can be misleading

1.1m unit market in 2018 (excludes cranes + aerials)



Source: Off-Highway, Morgan Stanley Research

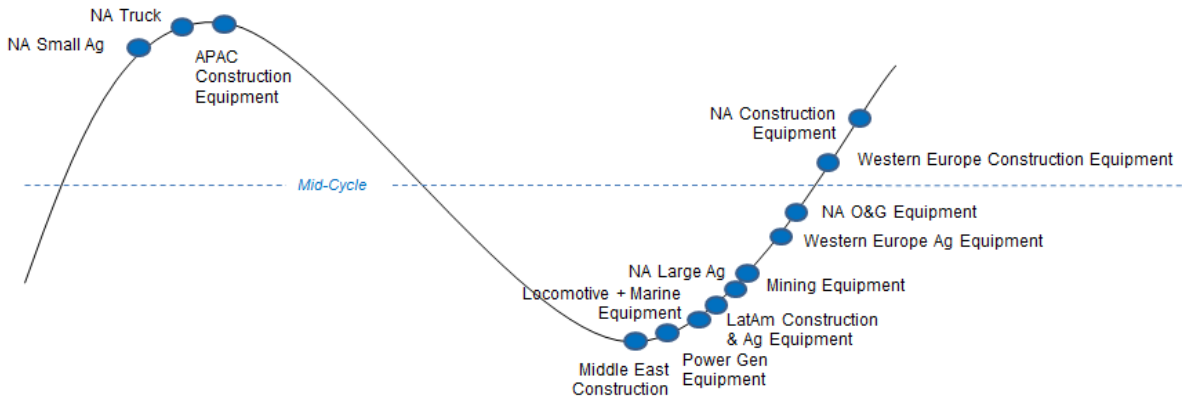
Construction stocks are most levered to the NA Construction Equipment market



Source: Company data, BEA, Morgan Stanley Research

Where are we in the Construction Equipment Cycle?

The global construction equipment market is emerging from a downturn that lasted ~8 quarters ('15 - '16). We are ~8-9 quarters into a recovery that began in 1Q17, though our replacement work suggests limited scope for OE demand beyond 2019.



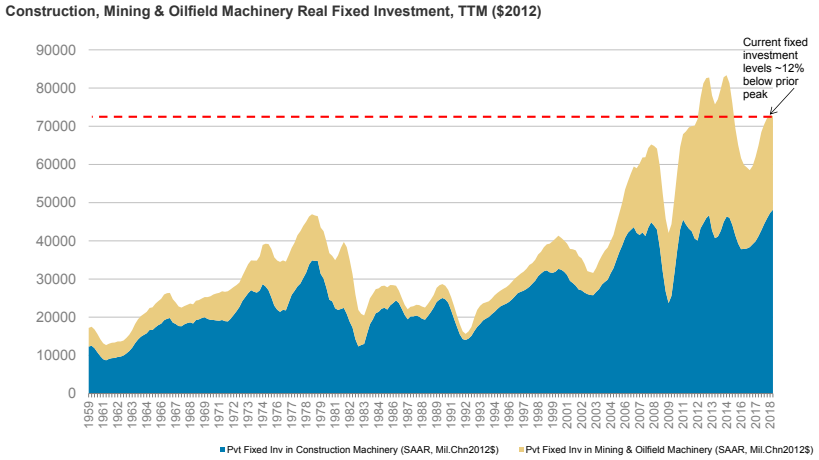
Construction Equipment Sales Growth	2015	2016	2017	2018E	2019E	2020E
North America	-1%	-7%	11%	18%	2%	-1%
Light	3%	0%	12%	13%	0%	-2%
Heavy	-5%	-13%	9%	23%	4%	0%
EAME	-2%	-2%	12%	9%	2%	-5%
Light	-1%	5%	12%	9%	-2%	-7%
Heavy	-2%	-9%	11%	9%	6%	-4%
LatAm	-33%	-27%	13%	13%	19%	13%
APAC/ROW	-19%	6%	41%	27%	-7%	-9%
Weighted Average	**-8%**	**-5%**	**17%**	**17%**	**2%**	**-2%**

Source: Company data, EDA, Off-Highway Research, Morgan Stanley Research

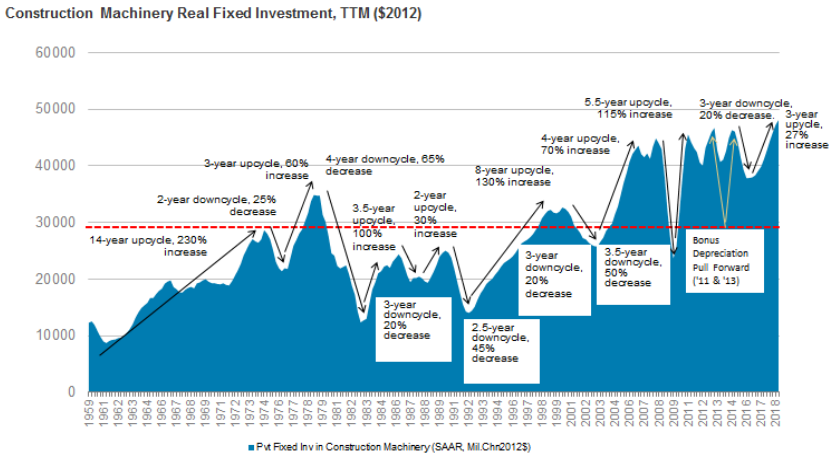
A typical NA construction equipment up cycle rises 70-80% and down cycle falls 35-40%

A "typical" construction equipment revenue up-cycle lasts ~4 years (50 months) and features an increase in revenue of 70-80%, excluding inflation, from trough to peak. A typical revenue downturn on average lasts 10 quarters and features a 35-40% decline in revenue from peak (ex inflation) to trough. Construction Machinery stocks generally inflect ~2-3 quarters before revenues do, largely because investors value Construction Equipment stocks on next-12-month's (NTM) earnings. On average, it pays to own Construction Equipment stocks for the final 3 quarters of the down-cycle, through the trough and recovery until 2-3 quarters before peak (~75% of the up-cycle).

Construction, Mining & Oilfield Machinery Real Fixed Investment, TTM



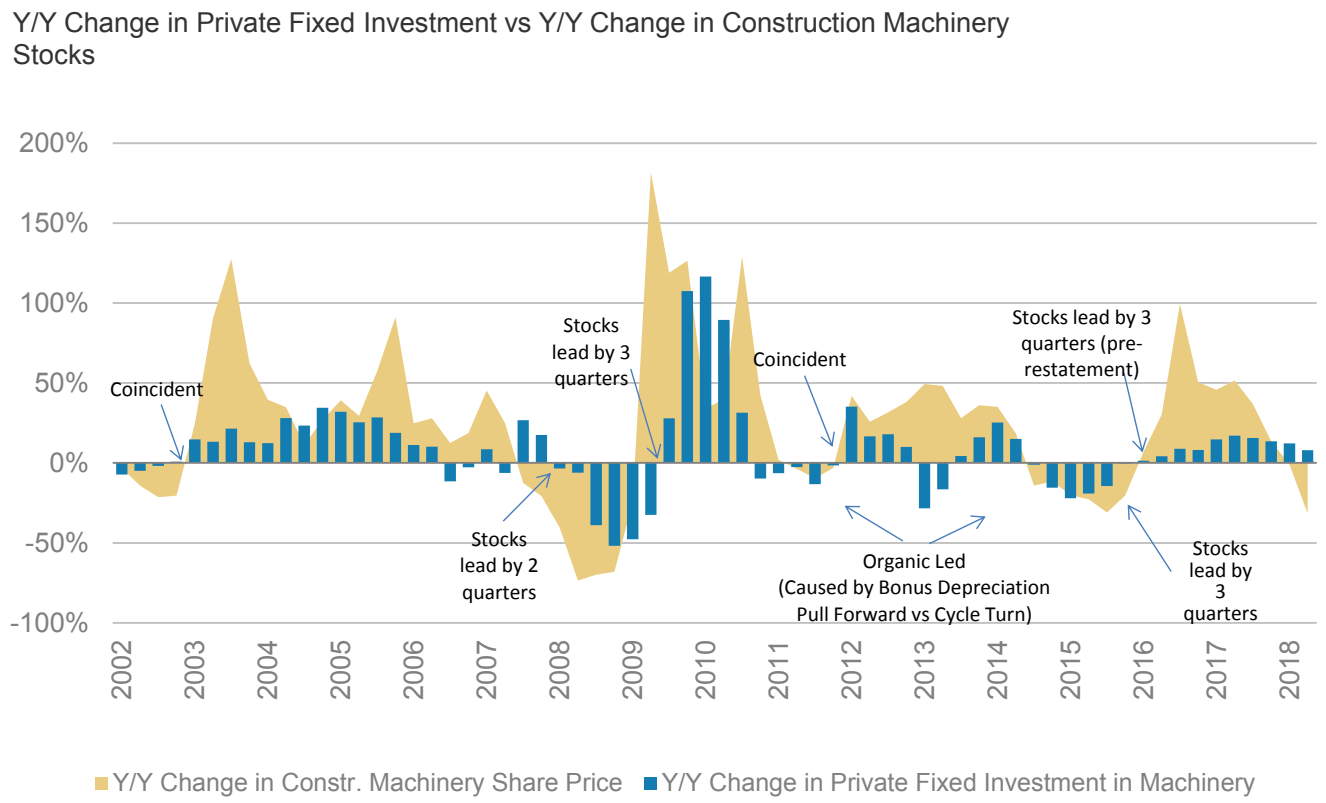
Construction Machinery Real Fixed Investment, TTM



Source: Company data, BEA, Morgan Stanley Research

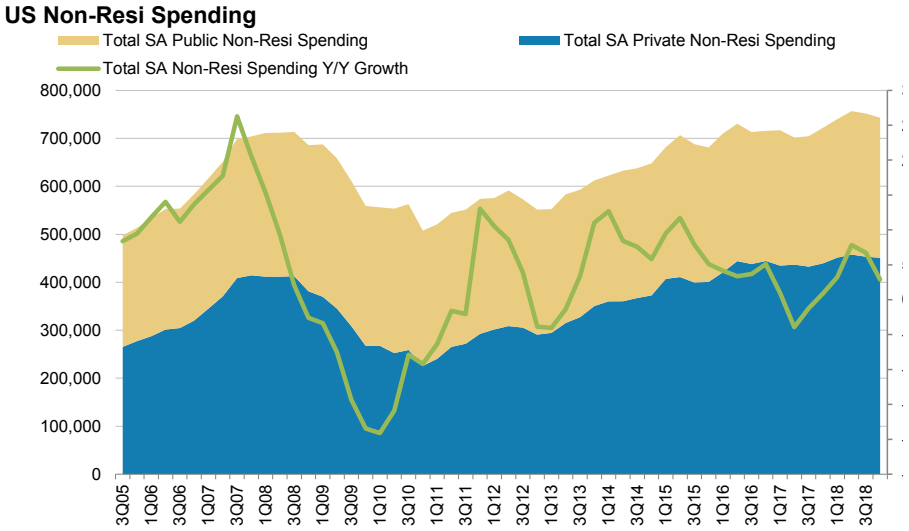
Stocks generally turn ~3 quarters before organic growth does

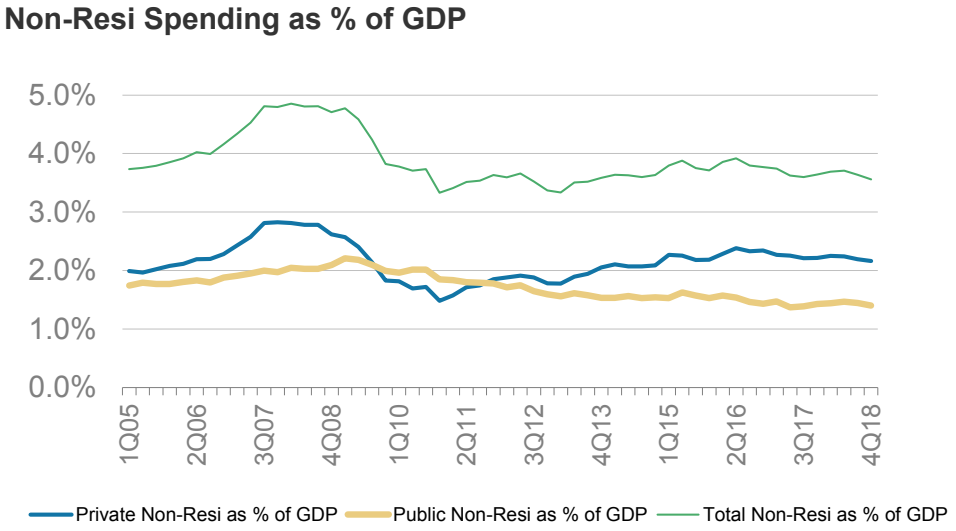
Y/Y Change in Private Fixed Investment vs. Y/Y Change in Construction Machinery Stocks



Source: Company data, Thomson Reuters, BEA, Morgan Stanley Research

Non-Resi construction spending is in 8th year of expansion

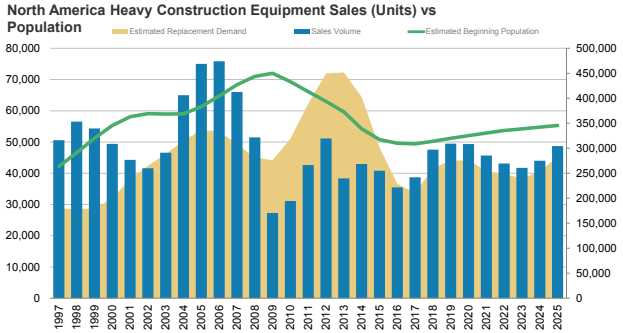




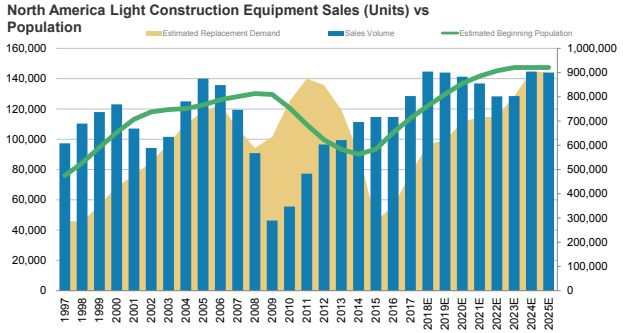
Source: Company data, US Census, BLS, Morgan Stanley Research

Fundamentals drive population/fleet growth, but Y/Y sales are driven by replacement

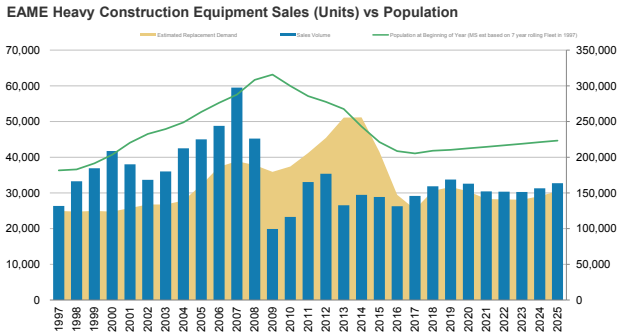
Replacement Analysis implies ~4% growth in heavy equipment demand in 2019 assuming fleet growth of 1.7% (fleet remains ~30% below pre-recession levels in '19).



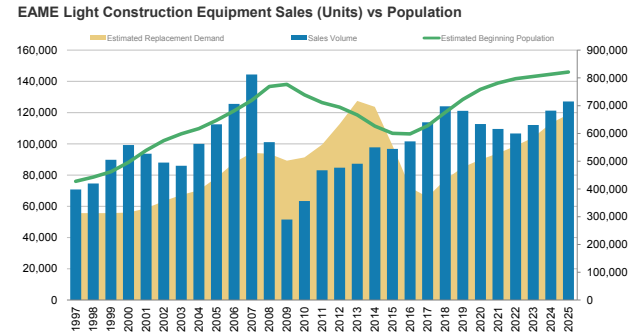
Replacement Analysis implies flat NA Light construction unit growth in '19 assuming LSD fleet growth (implying the fleet returns to pre-recession peak levels by 2019).



Replacement Analysis implies ~6% growth in EAME Heavy unit construction growth in '19 followed by declines of 4%/7% in '20/'21 assuming fleet growth of 1%.



Replacement Analysis implies declines of 2%/7% in '19/'20 assuming LSD fleet growth (fleet remains ~6% below pre-recession levels in '19).



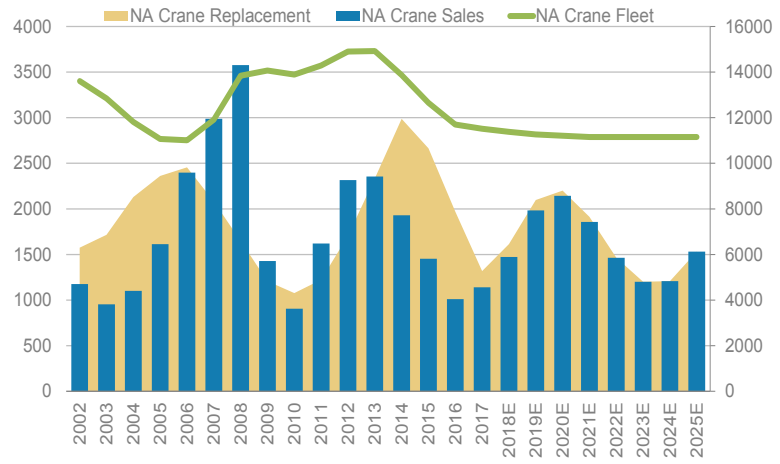
Source: Company data, Off-Highway Research, Morgan Stanley Research

Cranes & Aerials – ’18 Inflection for Cranes, Aerials Carry Risk of Pull Forward

The outlook for NA AWPs likely remains one of the largest question marks heading into 2019. To this point, 2017 & 2018 AWP demand was primarily driven by fleet growth rather than replacement - with new use applications (e.g. petchem facilities and data centers) driving growth in the population above initial expectations. Although international aerial adoption is expected to continue in 2019 and beyond, we expect 2019 unit volumes to recouple towards the outlook for NRC capex - and although NRC disclosure for 2019 has been limited, we have heard some conversations from the OE channel suggesting that rental fleets could grow another 5-10% in 2019. AWP OEMs have repeatedly expressed confidence in the 2021-2023 replacement cycle - and so incremental rental fleet growth in 2019 (and possibly 2020) could help to bridge the gap to a more sustained replacement cycle over that time frame. NA cranes demand is expected to recover more meaningfully in 2019 and 2020 - a theme supported by TEX's steady BtB trends and its upbeat commentary around NA utilization/improving O+G exposures.

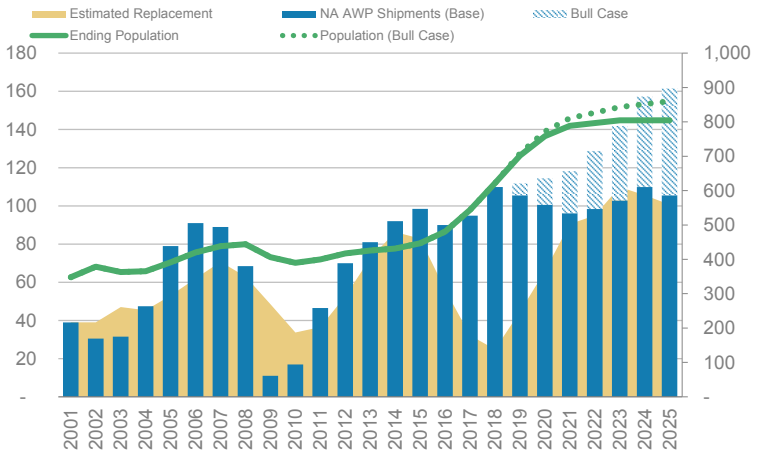
Our replacement work suggests NA crane demand is likely to be up ~35% in '19 with an incremental 8% growth in 2020, following low 30% growth in 2018.

North American Mobile Crane Sales vs. Expected Replacement



Our replacement work suggests aerials volumes will likely be down ~4% in 2019 and ~5% in 2020. Our bull case (which embeds 1ppts of higher fleet growth) suggests volumes could be up ~2% in 2019 and 2020.

North American AWP Industry Units vs. Expected Replacement

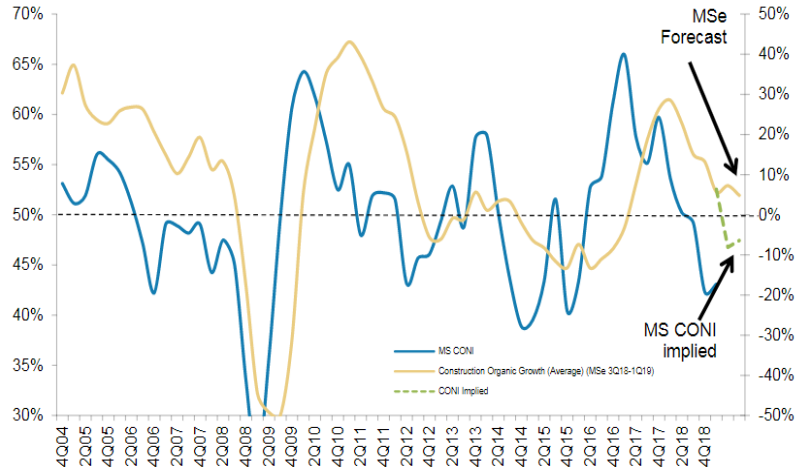


Source: Company data, Morgan Stanley Research

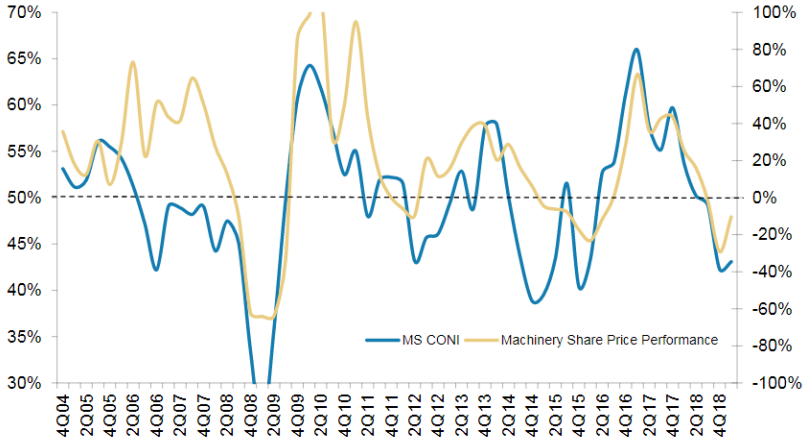
MS CONI – Historically Strong Correlation with Share Price and Organic Growth

MS CONI is our preferred leading indicator of sector growth. It has an 80% correlation with share price (co-incident) and a 90% correlation with organic growth (6 month lag).

Our Indicator Index, MS CONI, implies 2Q19-3Q19 organic growth of ~-6%/-4% vs. MSe of ~7%/5%, suggesting some degree of risk to near-term estimates.



MS CONI has accurately tracked Machinery share performance over the past 10 years, with a correlation of 0.78.



Source: Company data, Morgan Stanley Research

Key Construction End Markets

Oil and Gas

Mining

Infrastructure

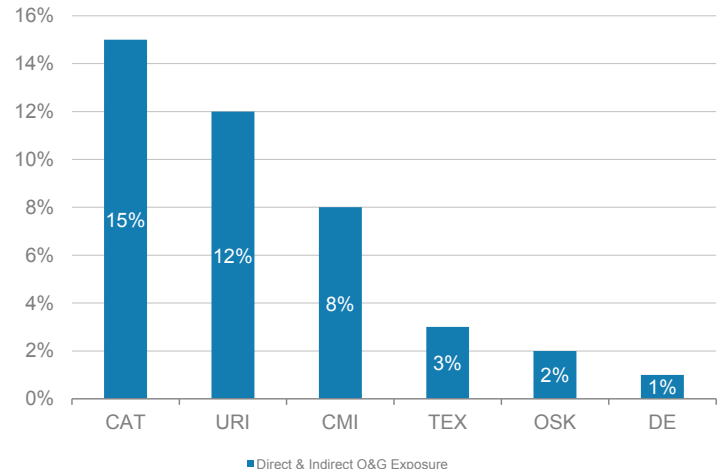
Rental

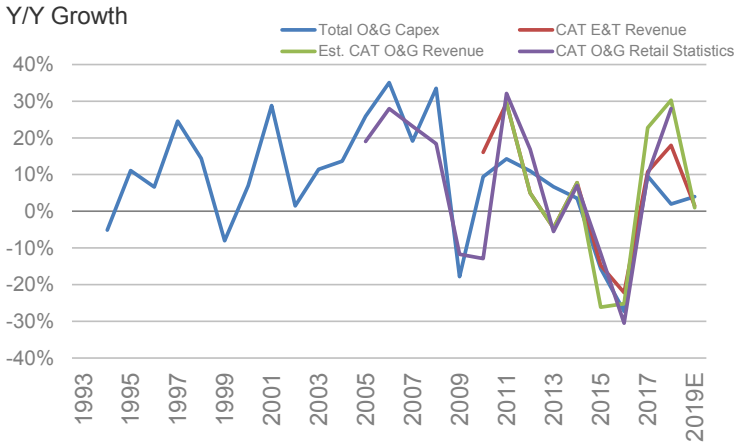
US Machinery End Market Exposures

	CAT	TEX	URI	DE	OSK	CNHI	WSC	CMI	WBC	PCAR	REVG	Median
Resi Construction	3%	17%	4%	4%	13%	1%	6%	0%	0%	0%	0%	**4%**
Non-Resi Construction	31%	46%	44%	27%	25%	9%	29%	8%	0%	0%	0%	**29%**
US Non-Resi Construction	22%	24%	44%	20%	20%	5%	29%	5%	0%	0%	0%	**21%**
US Non-Resi Construction (General)	14%	12%	30%	9%	11%	3%	10%	2%	0%	0%	0%	**12%**
US Infrastructure (Incl in Non-Resi)	8%	9%	13%	8%	1%	1%	9%	3%	0%	0%	0%	**8%**
US Oil & Gas Related Construction	3%	3%	5%	1%	2%	1%	10%	3%	0%	0%	0%	**3%**
Europe Non-Resi Construction	8%	15%	0%	11%	8%	2%	0%	0%	0%	0%	0%	**8%**
Mining & Quarry	20%	6%	0%	0%	0%	0%	0%	4%	0%	0%	0%	**0%**
Agriculture	5%	0%	0%	68%	0%	43%	1%	0%	0%	0%	0%	**3%**
Industrial	11%	15%	36%	0%	0%	0%	36%	9%	0%	0%	0%	**6%**
Oil & Gas (Direct + Indirect)	15%	3%	12%	1%	2%	1%	10%	8%	0%	0%	0%	**3%**
Electric Power	8%	7%	5%	0%	0%	0%	0%	9%	0%	0%	0%	**3%**
Aerospace & Defense	0%	0%	0%	0%	20%	0%	0%	0%	0%	0%	0%	**0%**
Transportation/Truck	13%	0%	0%	0%	21%	47%	0%	63%	100%	100%	100%	**7%**
Other	15%	12%	0%	0%	18%	0%	28%	0%	0%	0%	0%	**6%**
Total Exposure to NA Infrastructure, Europe Non-Resi, O&G & Mining	**54%**	**36%**	**30%**	**21%**	**13%**	**5%**	**19%**	**18%**	**0%**	**0%**	**0%**	
Total Auto Exposure	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**0%**	**9%**	**5%**	**0%**	**0%**	
Total Industrial Exposure	**11%**	**15%**	**36%**	**0%**	**0%**	**0%**	**36%**	**9%**	**0%**	**0%**	**0%**	
Total Consumer Exposure	**0%**	**0%**	**0%**	**7%**	**0%**	**0%**	**0%**	**9%**	**5%**	**0%**	**29%**	

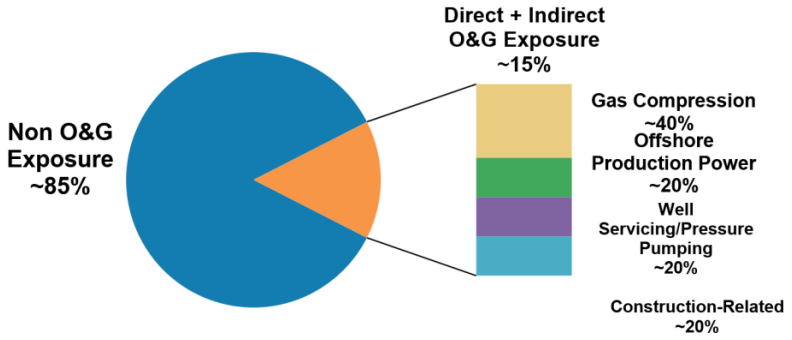
Source: Company data, Morgan Stanley Research

O&G: CAT, URI and CMI are most exposed to O+G capex –

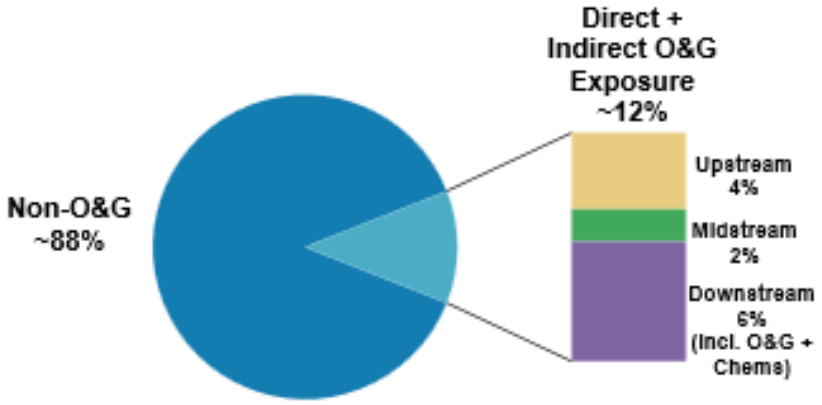




Est. CAT O&G Exposure

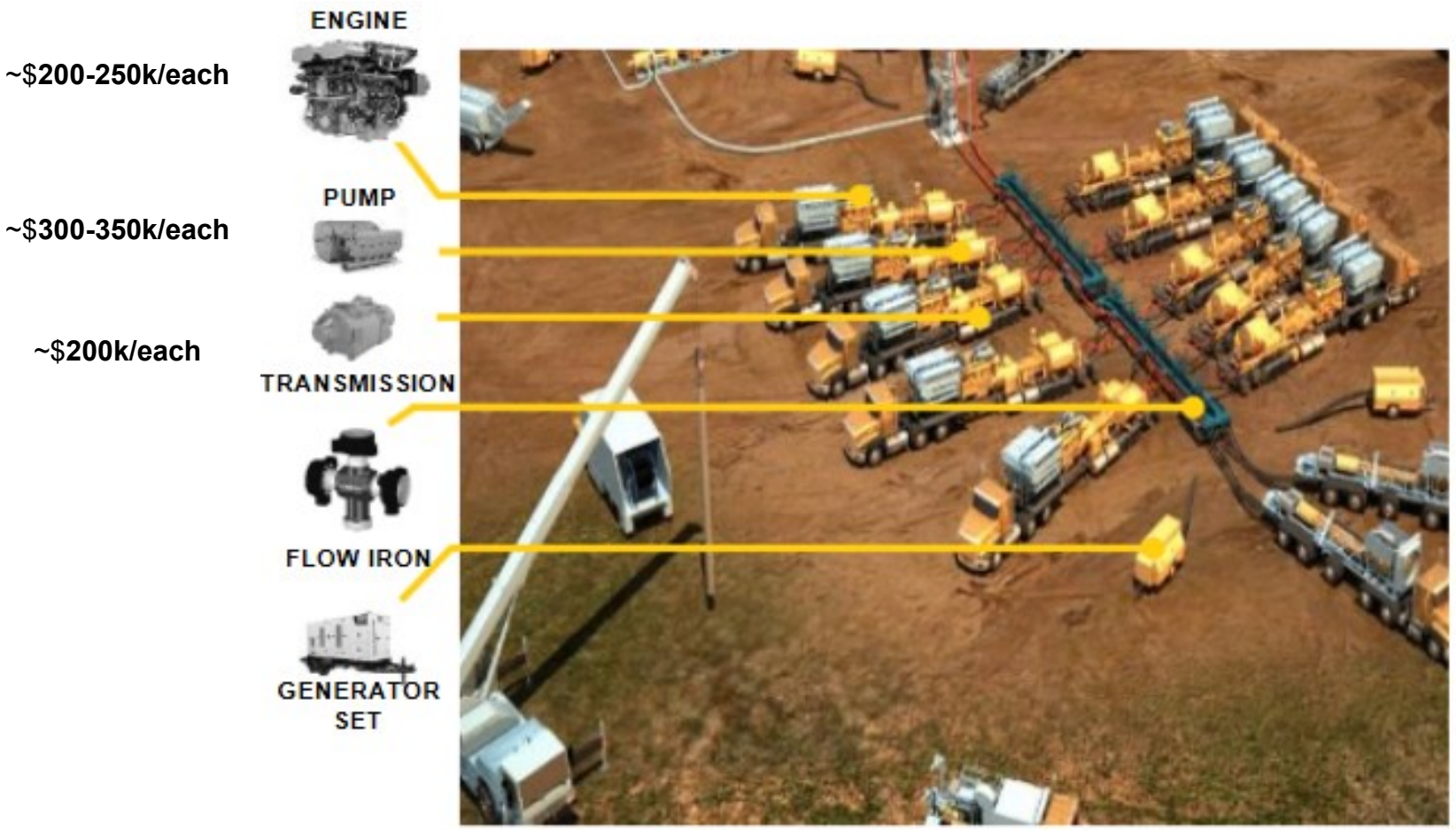


Est. URI O&G Exposure



Source: Company data, Thomson Reuters, Morgan Stanley Research

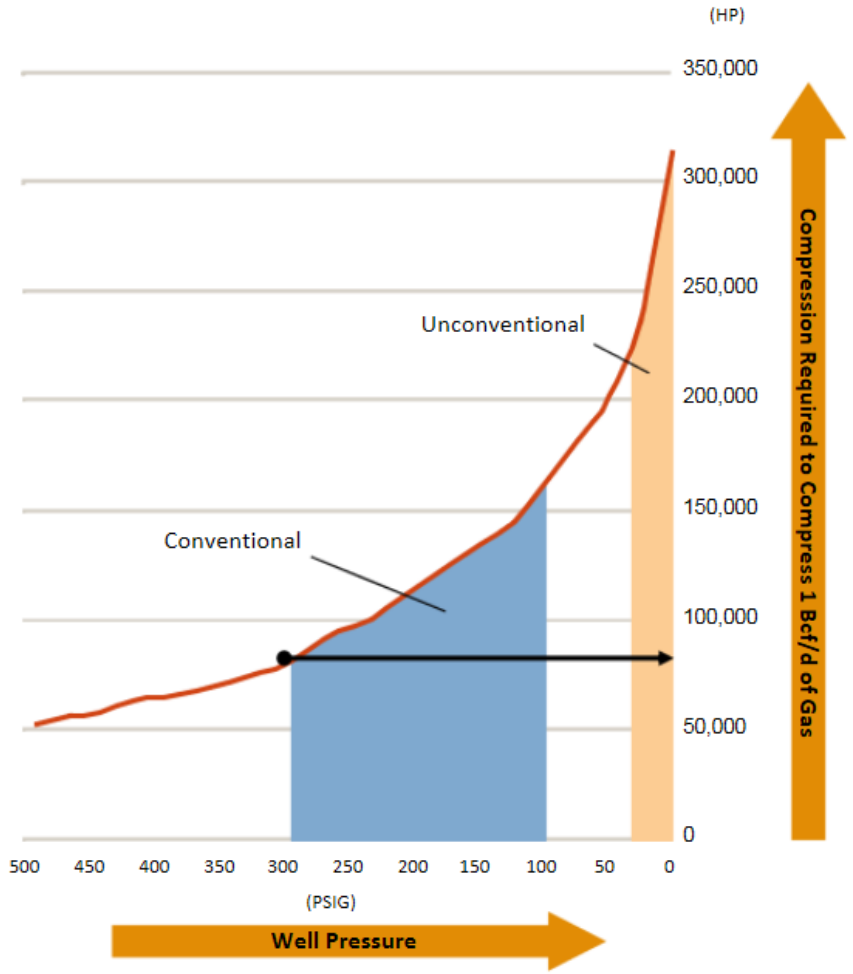
Typical Frac Pumping Unit has 40k HP provided by 16-20 2250-2500 HP engines



Source: Company data, Morgan Stanley Research

Shale Production Drives Increasing Compression Requirements

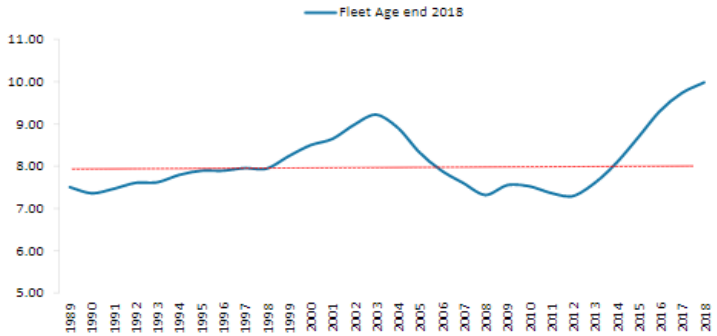
- Much of CAT's sales into gas compression in NA is adding additional horsepower to existing pipelines vs pieline buildout capex.
- Shale gas is typically produced at lower wellhead pressures (0-50 PSIG) in contrast to conventional gas wells (100-300 PSIG)
- Pipeline specifications remain constant – requiring gas pressure to be increased significantly to move gas into and through pipelines
- As a result, to move the same amount of gas requires significantly more compression



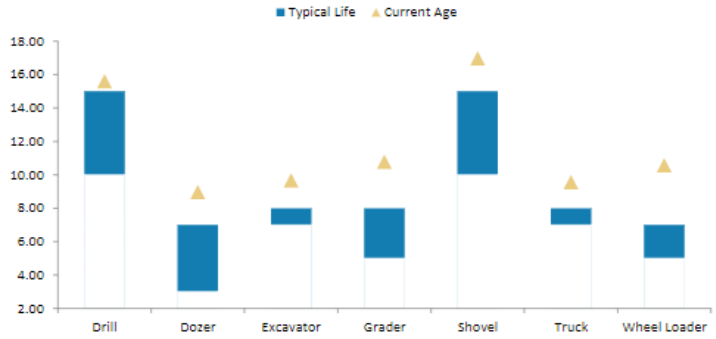
Source: Company data, Thomson Reuters, Morgan Stanley Research

Mining: Our global mining truck replacement analysis implies 10-20% growth through '20

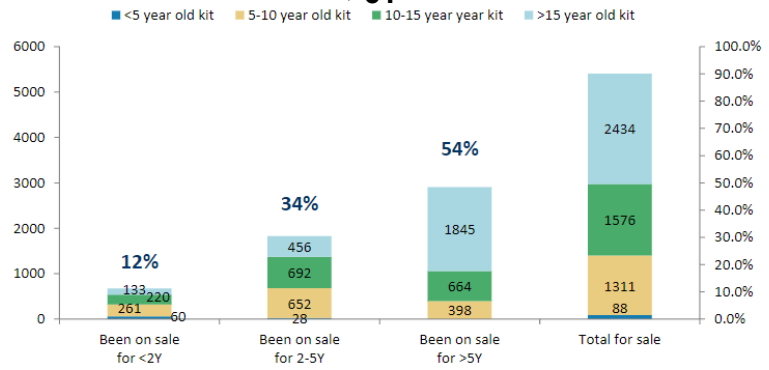
The Mining Machinery fleet has reached an average age of 10Y old, the highest in 30 years



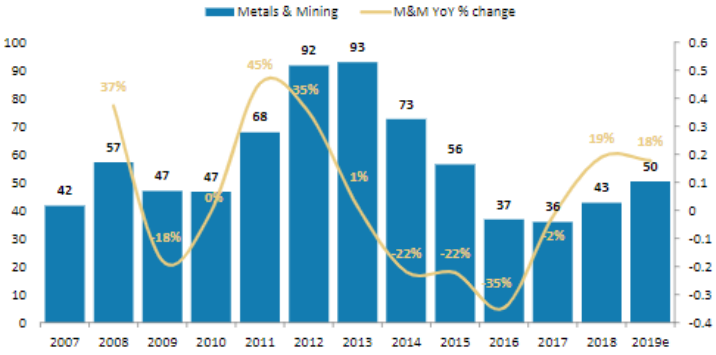
Age profile varies by equipment type but all categories now have average ages above the top end of a normal range – this provides a 'need' for miners to replace / upgrade



Idled equipment looks too old to be worth bringing back with >50% of idle kit >15Y old & having been on sale for >5Y



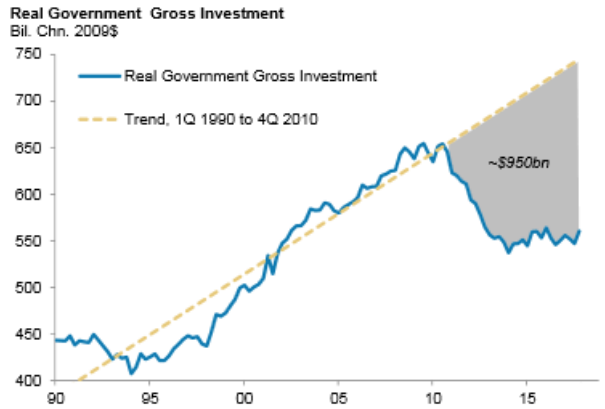
Our Mining capex tracker indicates another good year of growth in 2019, though absolute levels still 54% below peak



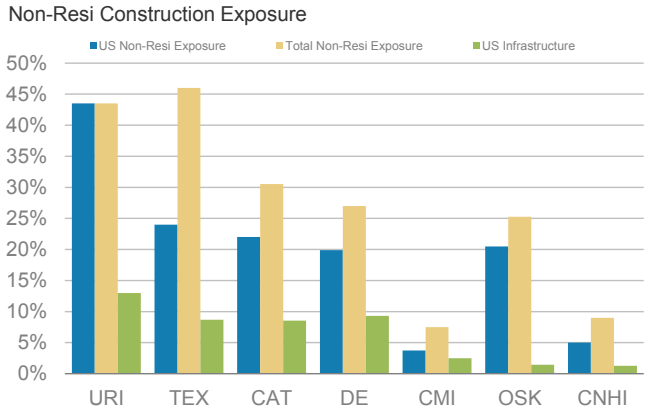
Source: Company data, Parker Bay, Morgan Stanley Research

Infrastructure spend is rebounding even without an infrastructure bill

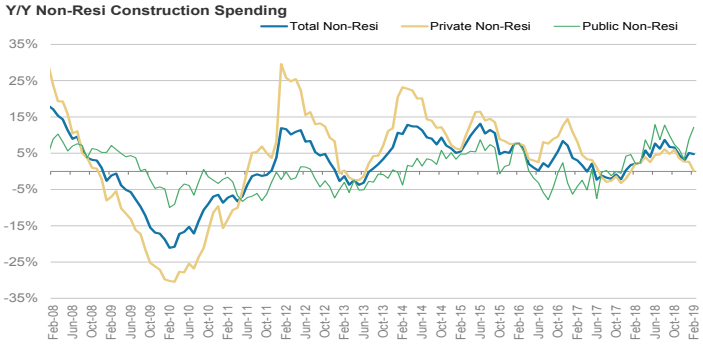
Government Investment Has Been Running Below Trend Since 2010



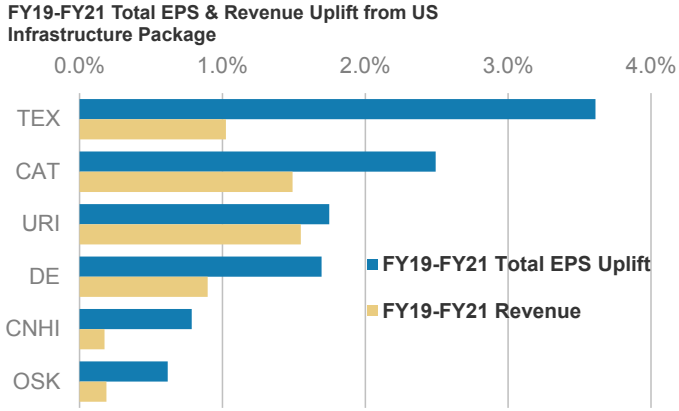
By our estimates, DE and URI have the highest level of exposure to US Infrastructure



Non-Resi construction spending has continued to recover after a modest slowdown in mid-2017, with public spending leading the recovery at +8.8%/+12.1% in January and February's readings.

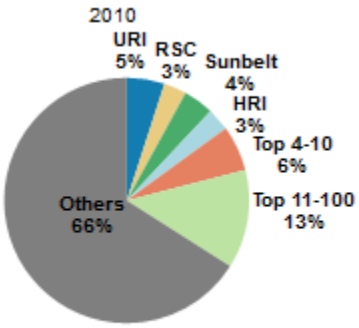


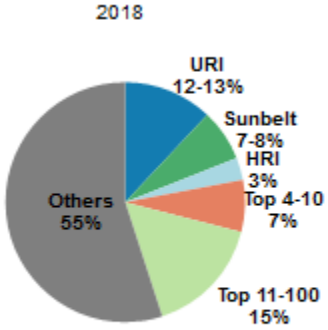
Per our analysis, CAT, URI, and TEX would be the primary beneficiaries of an infrastructure spending package on top line basis, but TEX would see the greatest lift to EPS.

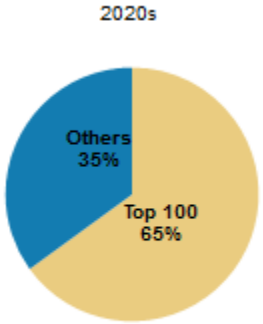


Source: Company data, US Census, AlphaWise, Morgan Stanley Research

Rental Equipment Market is consolidating



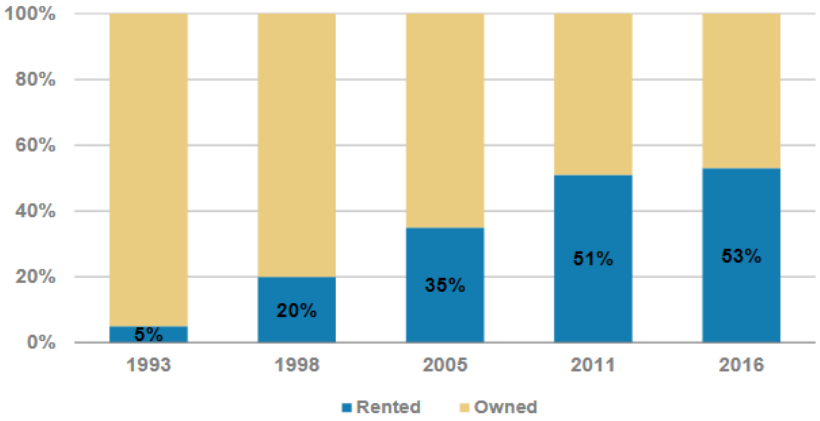




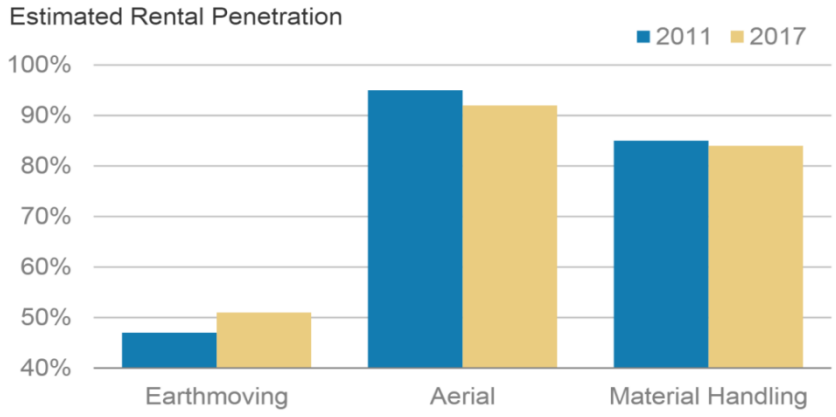
+25%

+40-50%

Rental share has increased for the past 25 years, even through 2011 (the last time 100% capital expensing was in place) – we expect capital expensing to have little effect on the secular trend towards renting vs. buying.

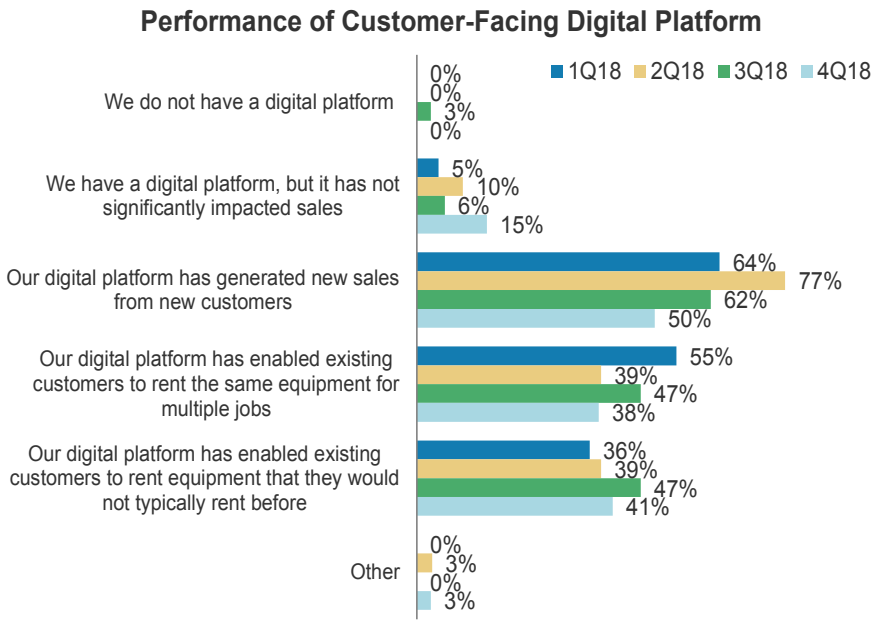


URI has bolstered areas of its fleet (e.g. Earthmoving) which are still relatively underpenetrated from a Rent vs. Buy perspective vs aerial and material handling equipment.

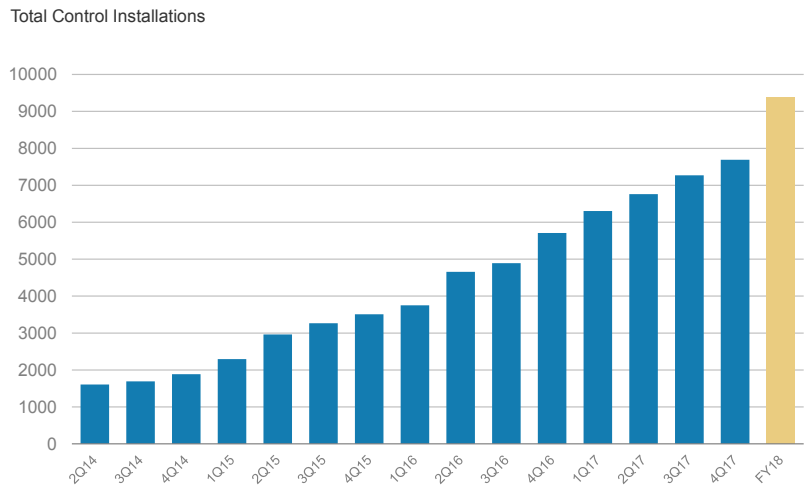


Source: Company data, Daniel Kaplan Associates, Morgan Stanley Research

Recently launched digital platforms encourage further share gains for rental chains



We also expect TC installations (and TC-attributable revenue) to steadily increase through 2019e as URI continues to increase penetration at the customer level.



Source: Company data, Morgan Stanley Research

Agriculture Equipment

Ag Equipment & Market Primer: Equipment Types

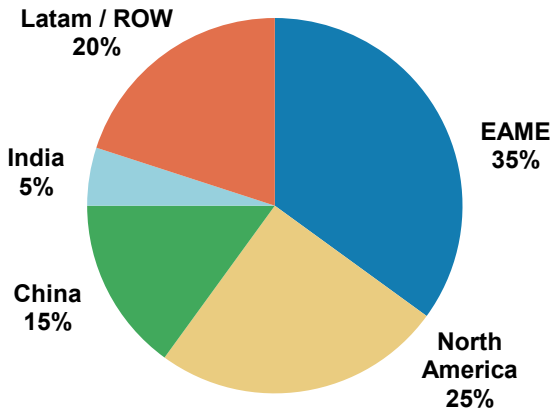
Category	Product	Description	Key Players	Approx. Price
Tractors	Compact Utility Tractor 	- Small tractor designed for landscaping and estate management - generally <40 HP	AGCO, CNH, Kubota, Claas, Mahindra, Deutz-Fahr	<$20k
Tractors	Utility Tractor 	- Common on livestock farms, not commonly used to grow crops - 45-140 HP	AGCO, CNH, Kubota, Claas, Mahindra, Deutz-Fahr	$15-50k
Tractors	Row-Crop Tractor 	- Designed for growing / cultivating row crops - 140-360 HP	AGCO, CNH, Kubota, Claas, Deutz-Fahr	$100-300k
Tractors	Four-Wheel-Drive Tractor 	- Large, high horsepower tractors for the most demanding tasks on large farms - 360-560 HP	AGCO, CNH, Claas	$225-400k
Harvesting	Combine 	- Machine that cuts and threshes grain crops	AGCO, CNH, Claas, Deutz-Fahr	$275-475k
Harvesting	Cotton Stripper 	- Strips the entire plant of both open and unopened bolls - 190 HP	AGCO, CNH	$175-200k
Harvesting	Cotton Picker 	- Removes the seed cotton from the plant and builds bales - 373 HP or 530 HP	AGCO, CNH	$400-700k
Harvesting	Sugarcane Harvester 	- Cuts cane at the base of the stalk, strips the leaves, and chops it into consistent lengths	AGCO, CNH	$350-450k

Category	Product	Description	Key Players	Approx. Price
Hay & Forage	Forage Harvester 	- Harvests plants to make silage for livestock feed	AGCO, CNH, Claas	$200-400k
Hay & Forage	Windrower 	- Cuts hay and small grain crops, forms rows with the cut crop	AGCO, CNH, Claas	$100-125k
Hay & Forage	Baler 	- Compresses cut crop into compact bales for easy transport and storage	AGCO, CNH, Claas, Deutz-Fahr	$15-40k
Hay & Forage	Mower 	- Cuts and also allows for crimping and crushing of newly cut hay for faster drying	AGCO, CNH, Claas, Deutz-Fahr	up to $40k
Crop Care	Planters and Seeders 	- Includes planters, drills, air seeders	AGCO, CNH, Claas	up to $200k
Crop Care	Tillage 	- Includes plows, disks, rippers	AGCO, CNH, Claas, Deutz-Fahr	up to $100k
Crop Care	Self-Propelled Sprayer 	- Sprays pesticides, herbicides, fungicides for quality control	AGCO, CNH	$150k-350k
Crop Care	Ag Management 	- Electronics for nutrient and land management	AGCO, CNH, Claas	up to $100k

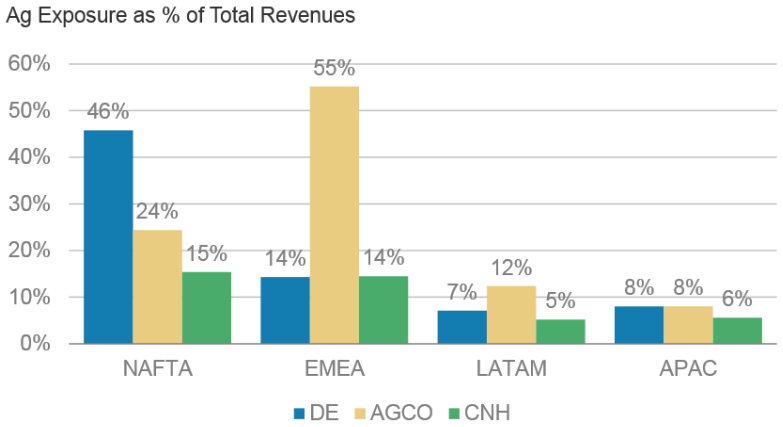
Source: Company data, Morgan Stanley Research

Regional Sales & OEM Exposures

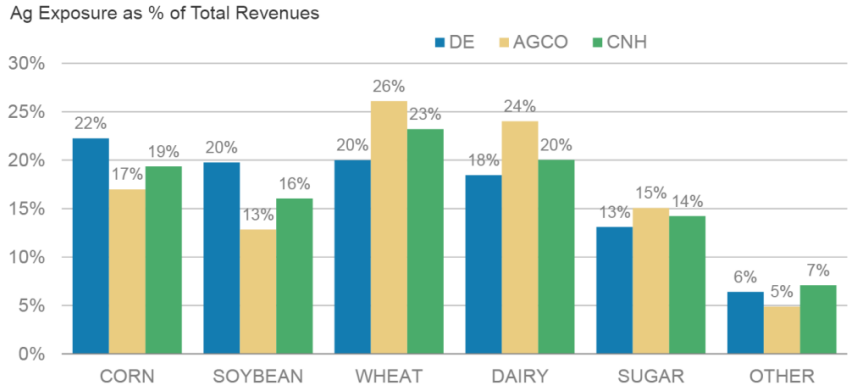
Global Ag Equipment Sales by Region



On a total revenue basis, AGCO over-indexes to Europe + South America, while DE is a purer play on North America.



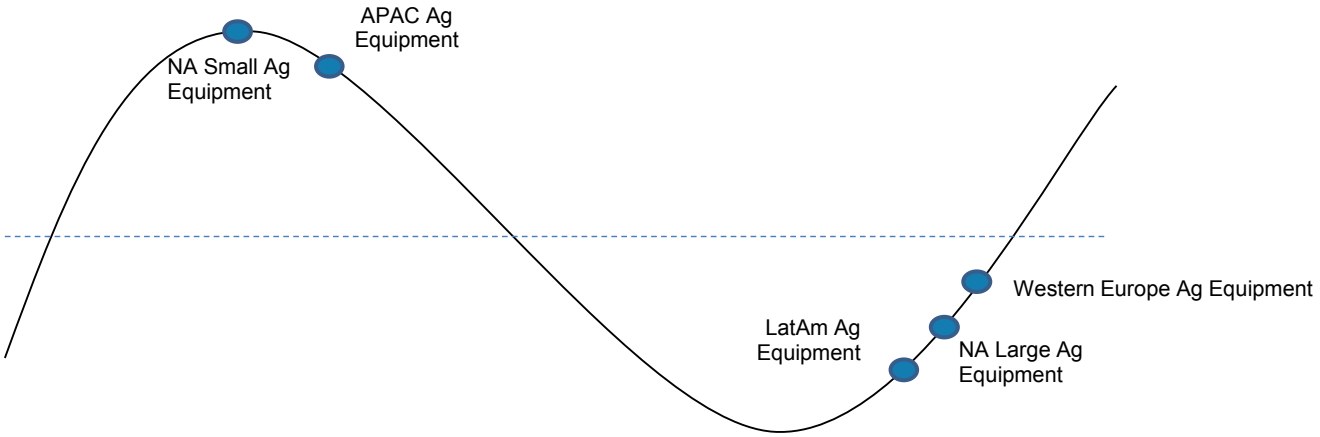
DE has the highest exposure to Corn and Soybeans, while AGCO has highest exposure to wheat, dairy and sugar.



Source: VDMA, Company data, Morgan Stanley Research

Where are we in the Ag Equipment Cycle? Below Mid-Cycle

With the exception of N. America Small Ag and general APAC Ag, most Ag Equipment Markets remain below mid-cycle. On average, Ag OEMs forecasted expect low single digit positive sales in NA, Europe + S. America, with modest declines in APAC.



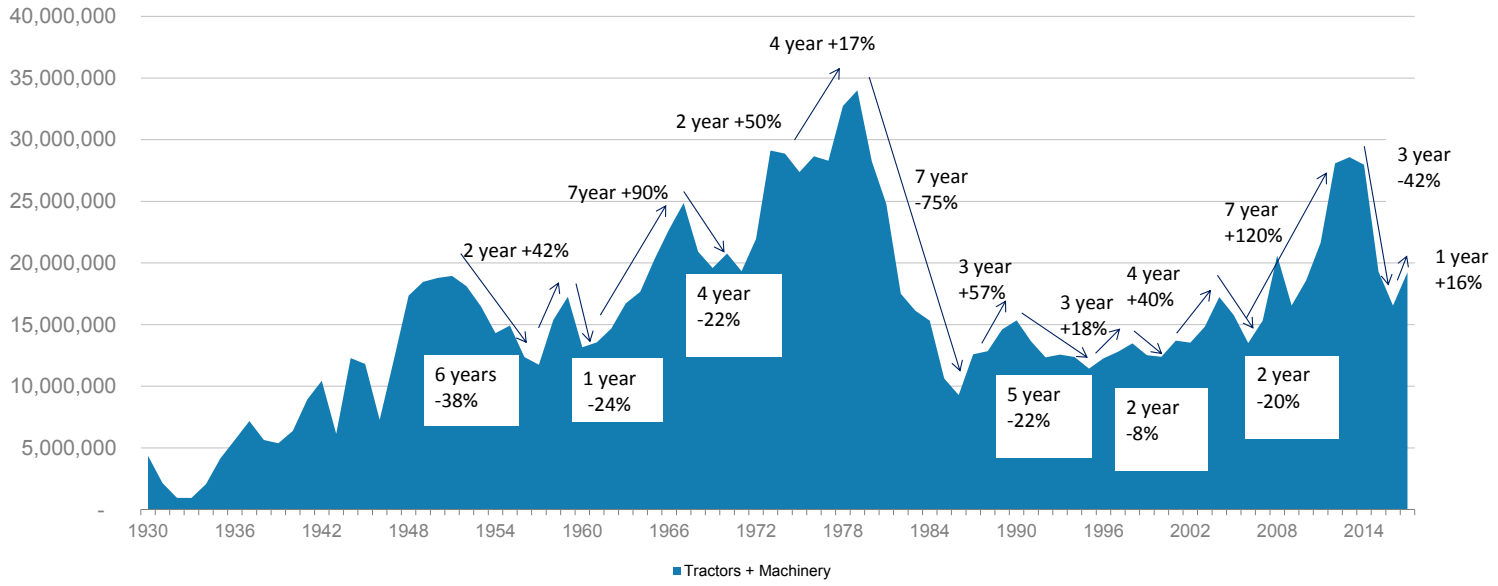
2019	North America	EAME	South America	Asia Pac / ROW*
AGCO	Flat to +5%	Flat	Flat to +5%	ND
DE	Flat to +5%	Flat	Flat to +5%	Flat to 'slightly down'
CNH Tractors	<140 HP: Flat 140+ HP: Flat to +5%	Flat to +5%	Flat to +5%	Flat*
CNH Combines	Flat	-5% to Flat	Flat	-10% to -5%
Average	**~2%**	**0%**	**~2%**	**~ (3%)**

Source: Company data, EDA, Off-Highway Research, Morgan Stanley Research. Company guidance as of 4Q18.

The large ag equipment cycle is ~4 years up and 3-4 years down with average increases of 50% and declines of ~30%.

Real Farm Capex Spent on Tractors+ Machinery - which we view as a proxy for N.A large ag equipment spend - suggests that the most recent '14 peak was 15% below the '79 peak in real terms. On average, the large ag equipment cycle is ~4 years up and 3-4 years down (~7 years peak to peak) with average increases of 50% and declines of ~30%.

Farm Capex Spent on Tractors + Machinery (2019 dollars, 000s)

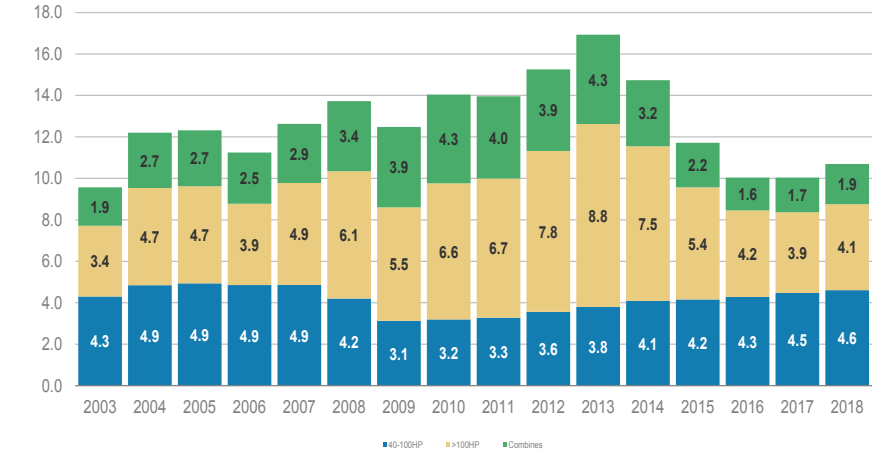


Source: Company data, AEM, BEA, Morgan Stanley Research

A decline in Large Ag Equipment drove declines in NA demand

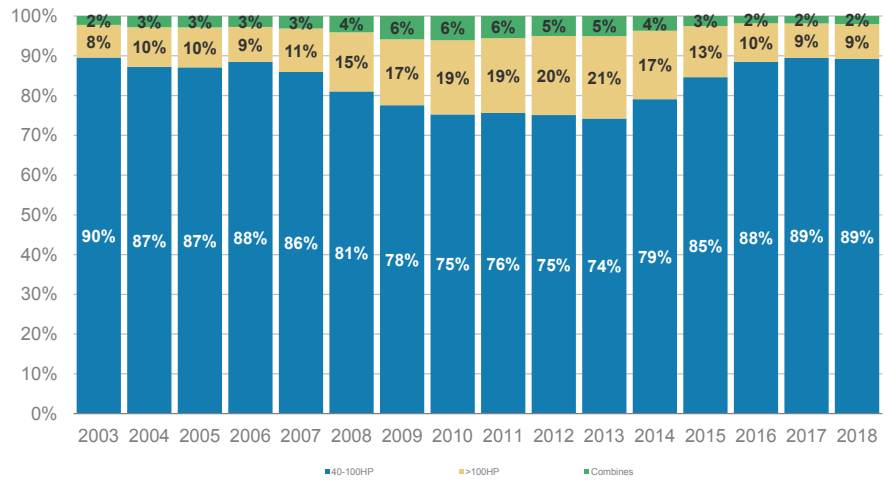
The slowdown in Aq Equipment spend has been driven by declines large ag (combines and tractors >100 HP).

US Tractor + Combine Sales Value (MS est)



"Large" Ag makes up only 10-25% of units but 60-80% of sales

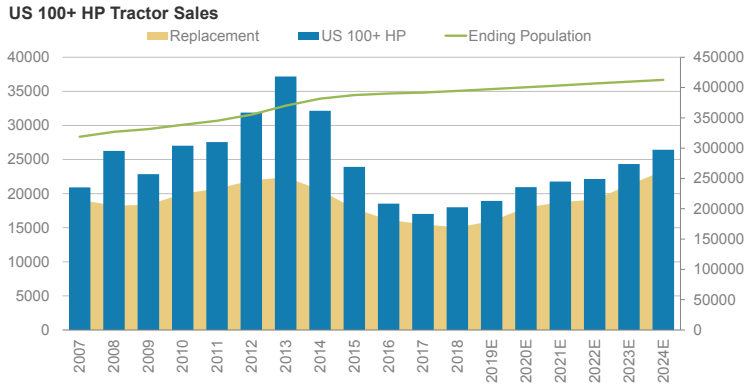
US Ag Equipment Market Share by Units (MS est)



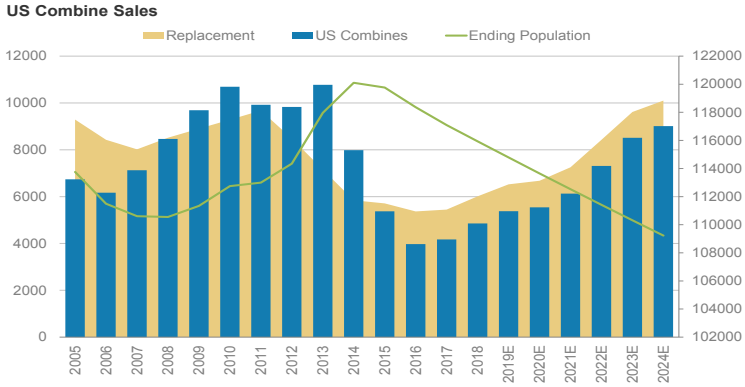
Source: USDA, AEM, Anfavea, Morgan Stanley Research

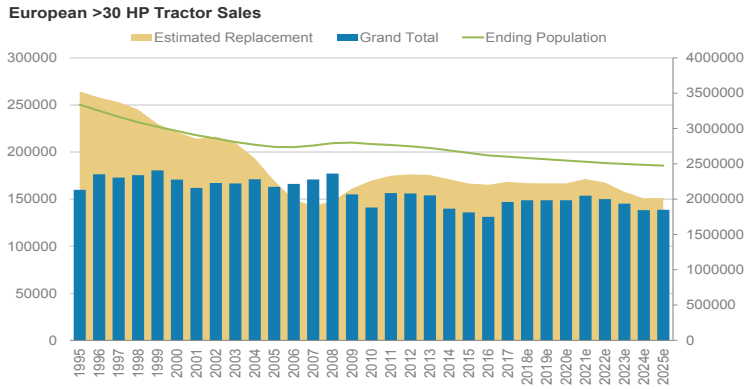
NA and European Replacement Cycles Underway – North America

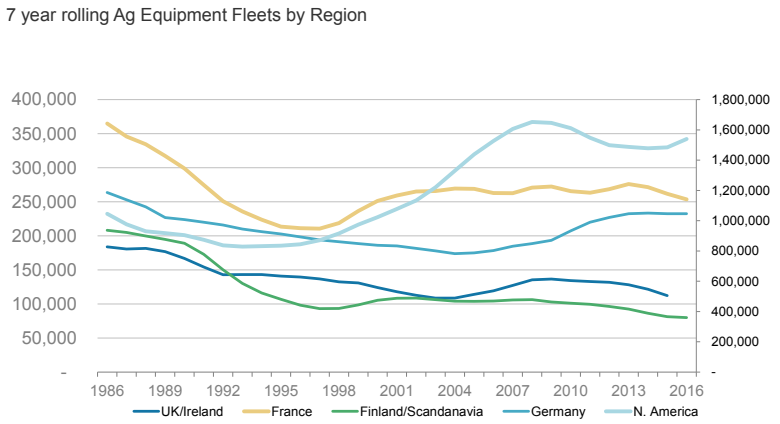
We see ~5% avg. p.a. growth in mid-to-large sized tractors (100+ HP) through 2022…



…which compares to ~10% average p.a. growth in Combines over the next four years...

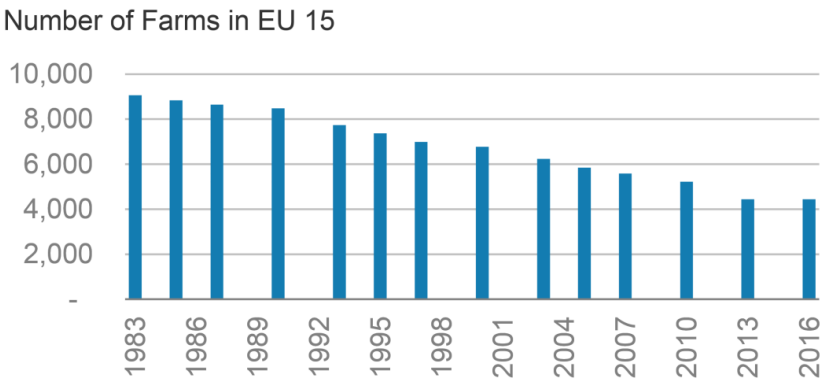




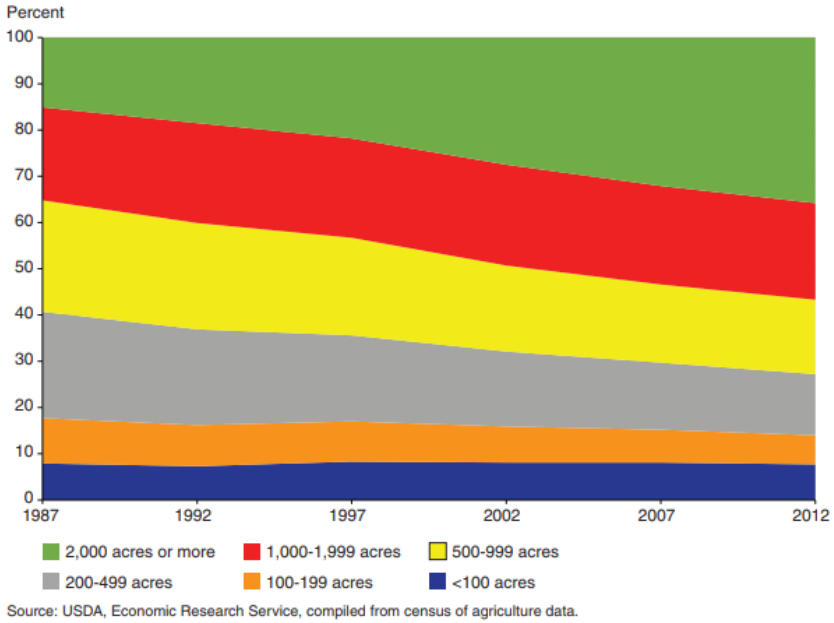


Source: Company data, AEM, BEA, Morgan Stanley Research

Farms are consolidating in NA and Europe and growing in size



NA farms are consolidating and getting larger – over 30% of farms have >2k acres vs 15% 30 years ago.



Source: USDA, Economic Research Service, compiled from census of agriculture data.

Source: Company data, AEM, BEA, Morgan Stanley Research

Government Programs and Actions can significantly impact Ag Equipment markets

US: Section 179 / Bonus Depreciation Tax Incentives

A deduction which allows farmers to realize income tax benefits from accelerated depreciation on capital purchases. The Tax Cuts and Jobs Act (passed YE 17) increased first-year bonus depreciation from 50% to 100% (in effected through 2023). The incentive falls in a declining step pattern following 2023 – i.e. to 80% in 2024 to 20% by 2027. Used equipment is now included.

US: Renewable Fuels Standard (RFS) Mandate

A national policy that requires a certain volume of renewable fuel to replace or reduce the quantity of petroleum-based transportation/jet fuel and heating oil. The EPA implements the program in consultation with the USDA and Department of Energy, and most tangibly impacts ethanol blending and soybean biodiesel requirements.

Brazil: FINAME / Moderfrota

A government program that provides support for the Agricultural sector via lower interest rate borrowing. The current Moderfrota rate is 7.5% for small/mid-sized farmers and 9.5% for large farmers (as of Nov' 18).

Source: Cummins, Company data, Morgan Stanley Research. *Note that the Moderfrota rate depends upon farm size .

Government Programs and Actions can significantly impact Ag Equipment markets

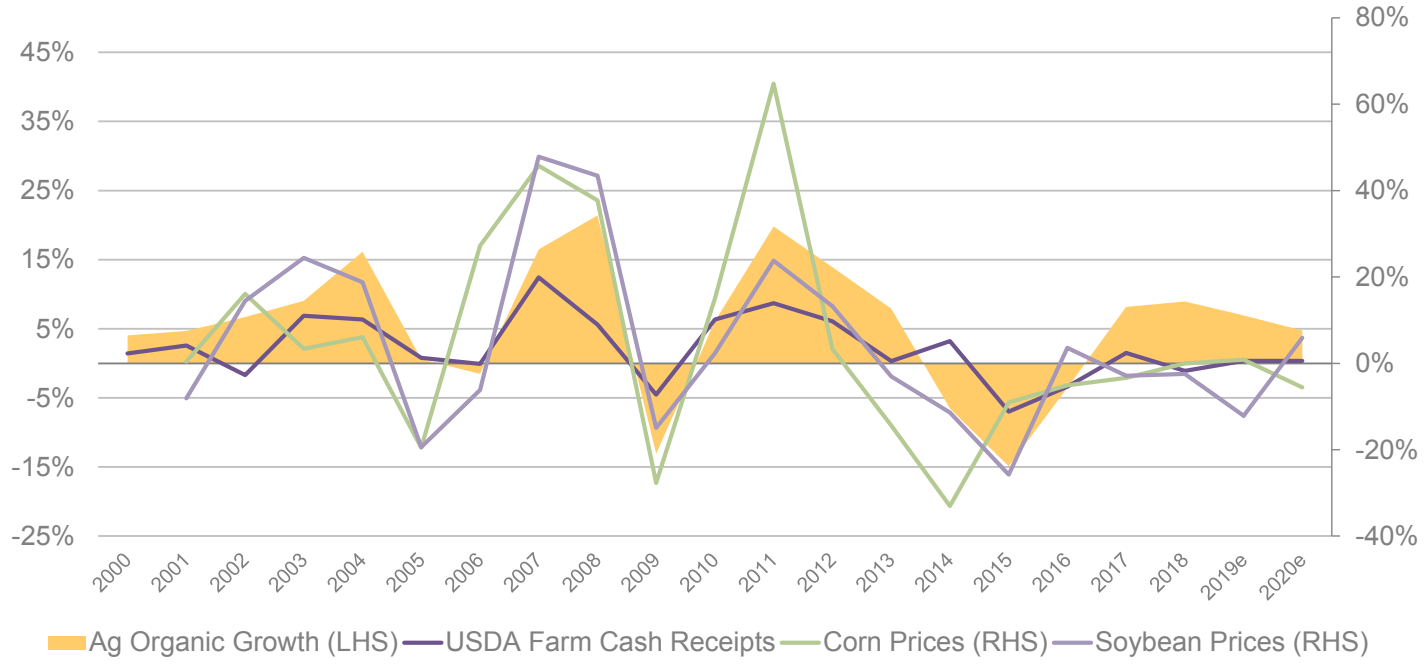
US Farm Bill	The 2018 Farm Bill ("Agriculture Improvement Act") was passed by Congress in Dec '18. Farm Bills are passed about every five years, creating and reauthorizing federal programs in a number of different interests.
China Ethanol Mandate	Chinese government plans to achieve nationwide use of 10 percent ethanol (E10) by 2020. Currently, there is no ethanol blending mandate on the national scale in China, but some provincial governments have adopted ethanol blend requirements at varying degrees.
EU: Common Agriculture Policy	The 2014-2020 CAP budget is frozen at 2007-2013 nominal levels (-14% in real terms). In general, Pillar 1 payments (which include direct payments and market expenditures) will be held steady, but Pillar II (rural development) will face cuts.
Global Emissions Standards	In the US, transition to tier 4 final is largely complete, however emissions standards in Europe (Stage IV) and Brazil (Stage IIIA) continue.

Source: Cummins, Company data, Morgan Stanley Research. *Note that the Moderfrota rate depends upon farm size .

Ag Equipment demand is highly correlated with grain prices & US Farm Cash Receipts

Ag Equipment Organic growth is highly correlated with corn prices (70%), soybeans prices (80%), and US Cash Farm Receipts (85%). All three are also highly correlated with Ag stock performance on a 1 year lag (65% with corn, 74% soybean, 67% Farm Cash Income). Correlations to sugar, milk, and wheat are less significant, but milk prices are highly correlated with European organic growth (60%).

Ag Equipment Organic Growth vs Y/Y Change in Grain Prices and Y/Y Cash Farm Receipts

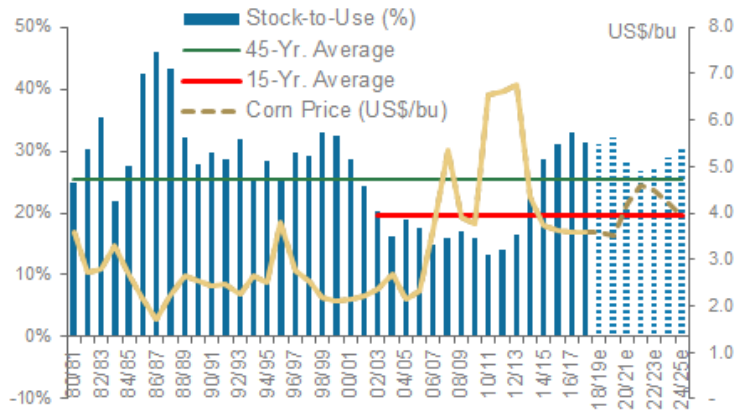


Source: Company data, BEA, USDA, Morgan Stanley Research

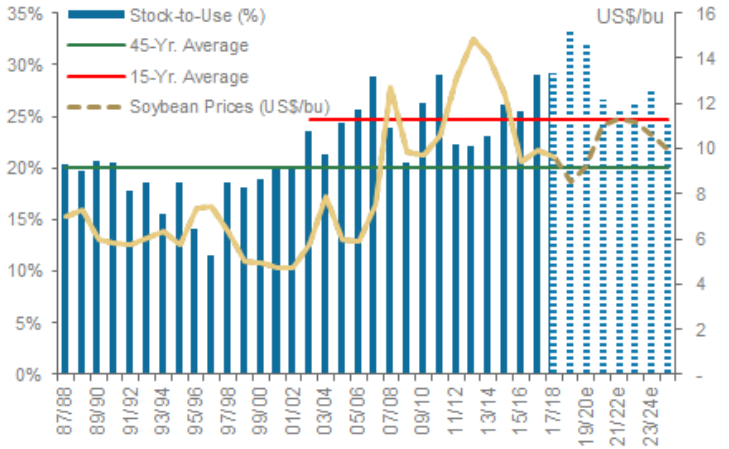
We expect ASF to exert near term pressure on grain prices

Our agribusiness analyst Javier Martinez de Olcoz Cerdan expects weaker grain prices driven by lower demand from China as ASF disrupts the nation's pork industry. After embedding the team's updated price forecasts, the latest cut of our DE sales regression implies ~1-2ppts of downside to Ag & Turf organic growth in '19/20 - with growth subsequently re-accelerating in '21 on the back of a recovery in both corn and soybean prices. In that context, we acknowledge that any sustained weakness in global soybean prices & demand is likely to result in further purchase deferrals in 2020 - although our work suggests both replacement demand and potential gov't support should help to limit the downside risk to legacy 2020 ests. As such, we view any 2020 weakness as more of an air pocket in replacement demand (as opposed to a negative inflection) - and so we remain positive on the long-term outlook for DE (OW) as both trade and commodity prices normalize beyond 2020

Javier sees a more muted impact to corn, as almost all of Chinese corn demand is sourced locally.



In contrast, the team expects the reduction in Chinese imports to drive inventories higher in key exporting countries (USA/Brazil/Argentina).

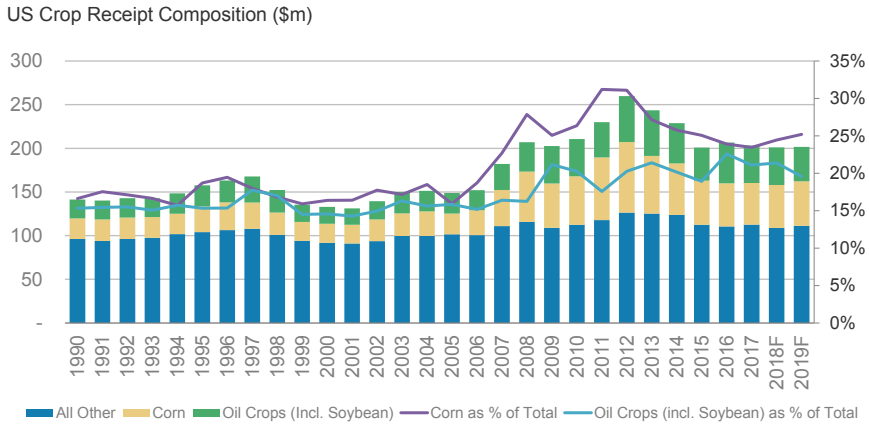


Sour

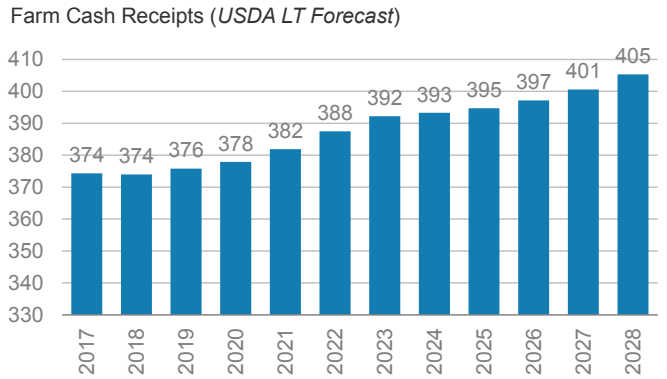
What is the Outlook for US Farm Cash Receipts?

Continued trade tensions and recent developments surrounding China's protein industry (and underlying demand for feed) suggest continued pressure on US Farm Cash receipts. The USDA currently forecasts Crop Cash receipts to be roughly flat Y/Y in 2019, following a ~1.0% expected decline in 2018. Long-term, the Department forecasts ~1% of growth p.a. through 2028 with the assumption that U.S./China trade tensions continue throughout the end of the decade. As such, we are turning incrementally more cautious on a potential air pocket in Ag demand in 2020 - although we remain bullish on the long-term growth from replacement demand that should benefit the Ag players beyond '21. As highlighted by both our replacement work and DE mgmt, the resiliency of replacement demand has continued to drive growth in underlying unit volumes despite an unsupportive commodity and trade backdrop - which speaks to both the elevated age of the fleet and underlying need for equipment replacement. Corn and soybeans make up ~50% of cash crop receipts in the US. DE would be the biggest beneficiary of a US farm cash crop receipts recovery. US farmers have ~50% exposure to both corn and soybean crops, and stand to benefit from an recovery in both corn and soybean prices.

Corn and Oil Crops (incl soybeans) account for ~20-25% of Cash Receipts



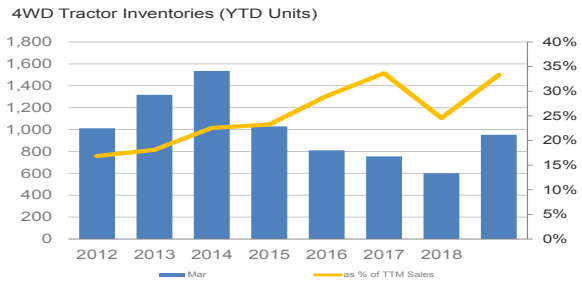
The USDA calls for modest ~1% growth in cash receipts between '19 and '28.



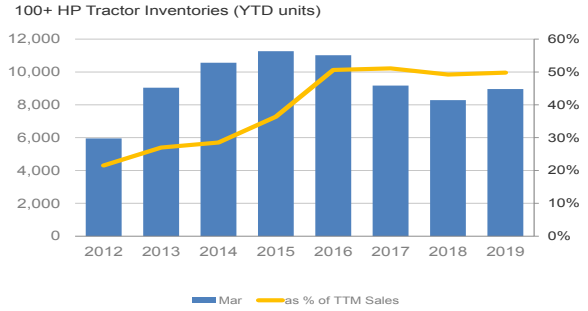
Source: Company data, USDA, Morgan Stanley Research

NA Inventory Normalized, but Still Elevated as % of TTM Sales

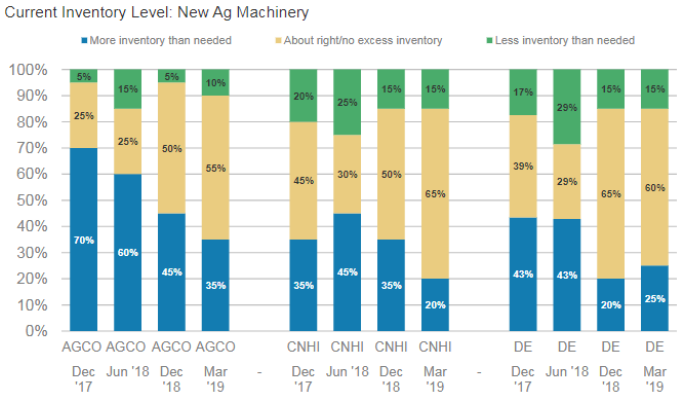
4WD Tractor Inventories have fallen ~40% since '14, but represent ~30% of TTM sales



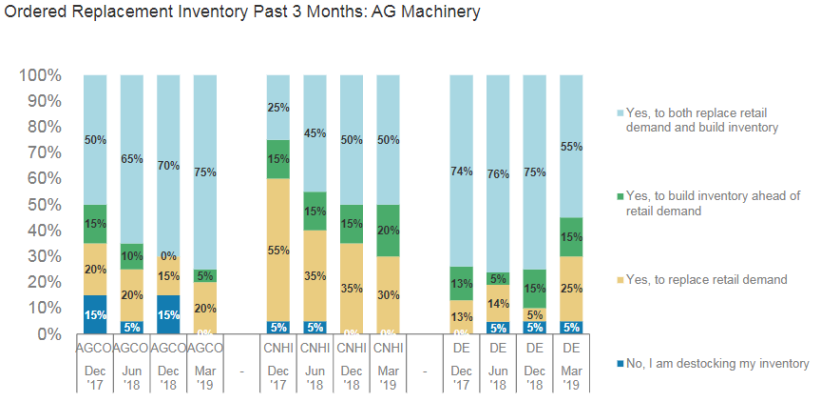
100+ HP tractor inventories have fallen ~15% since '14 but remain ~50% of TTM sales



At the brand level, inventory levels for new equipment appear healthy, with notable improvement seen amongst AGCO dealers.



To this point, more AGCO dealers are ordering replacement inventory, suggesting '18's underproduction initiatives at the OEM have been successful.

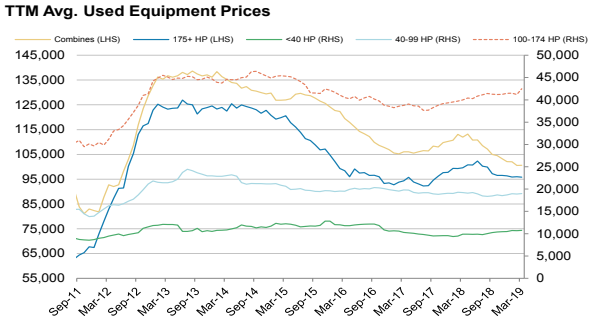


Source: AEM, AlphaWise, Morgan Stanley Research

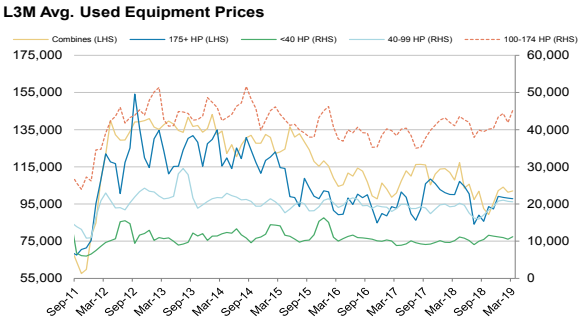
Used Equipment prices are improving even though used equipment is getting older

Used pricing and inventory levels are critical to the health of new pricing and inventory levels – both have been steadily improving. We also note that with older pieces of equipment beginning to hit the used markets, there are emerging signs of a replacement cycle underway.

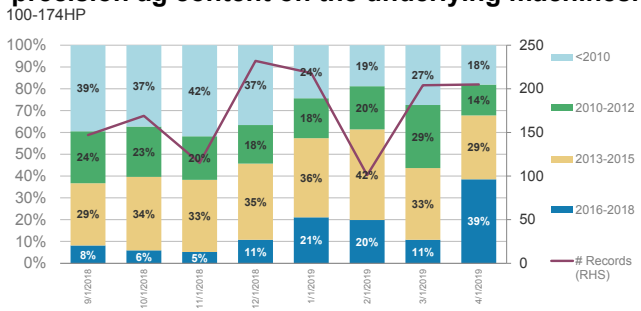
HHP pricing has weakened Y/Y (TTM), down ~2.6% in March (vs. +4.8% Mar '18)...



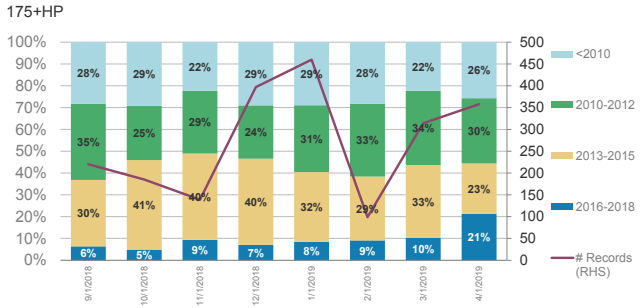
Though could be showing signs of stabilization. L3M HHP prices were up +80bps in March, following 8 negative readings.



March's HHP reading likely benefitted from an increase of newer model year units in the market, complemented by increased precision ag content on the underlying machines.



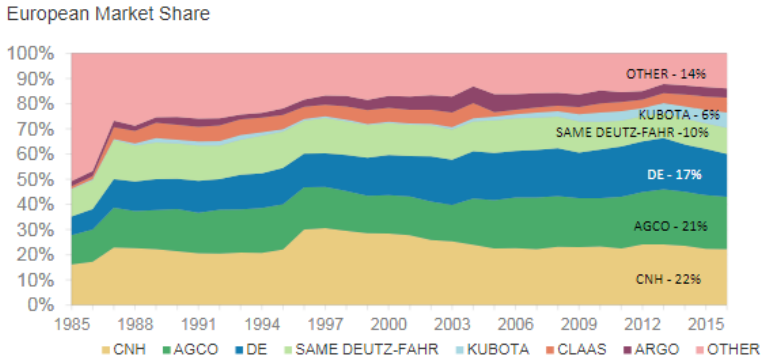
That said, results differed within the 175+HP vertical which saw a similar increase in newer units, without the accompanying used price improvement (-2.5% Y/Y).



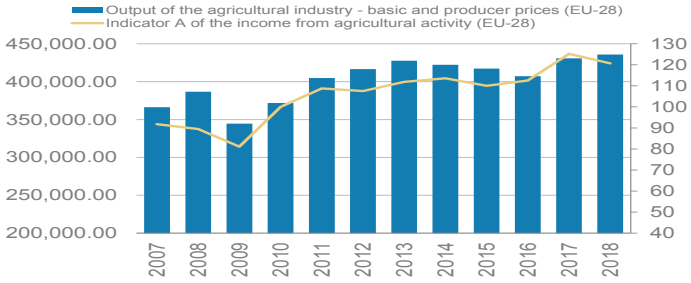
Source: TopBid, Auction House, Morgan Stanley Research

European Market Data

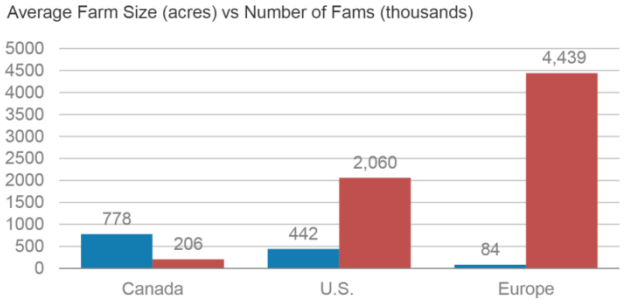
The European ag markets are slightly more nuanced than North American markets, as EU farms are generally larger in number and smaller in size. To this point, there are nearly twice as many farms in Europe than in the US, but they are ~1/5 the size on average and generally require smaller equipment. Similar to NA, Western Europe farms have consolidated since the 1980s. Farms have grown modestly as a result (though still small relative to US farms), which has driven demand for higher capacity equipment. Technology and other precision farming solutions (including autonomous equipment) aimed at enhancing productivity and profitability are important factors within the buyers purchasing decision.



Although farm income did decline from 2013-2016, we note that the extent of the decline was not nearly as severe as NA - farm output and income levels accelerated meaningfully in 2017 and were likely pressured by the widely reported drought conditions in 2018.



There are 2x as many farms in Europe than in the US, but they are 1/5 the size on average and generally require smaller equipment.

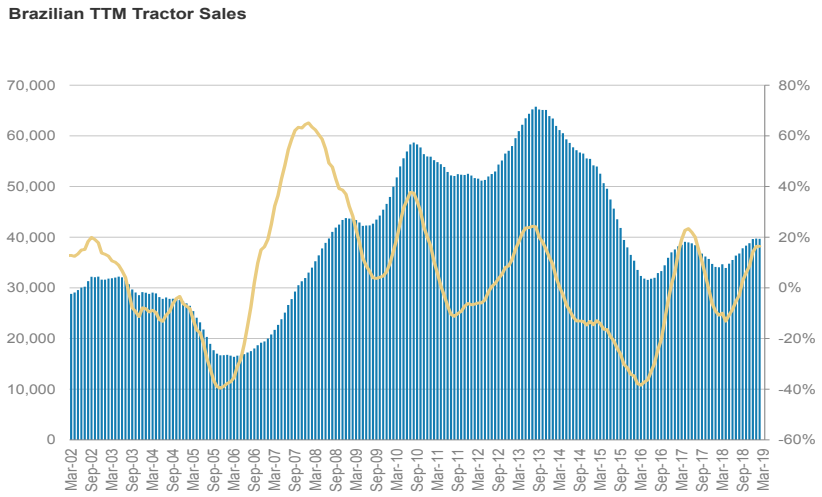


Source: Off-Highway Research, Company data, Eurostat, Morgan Stanley Research

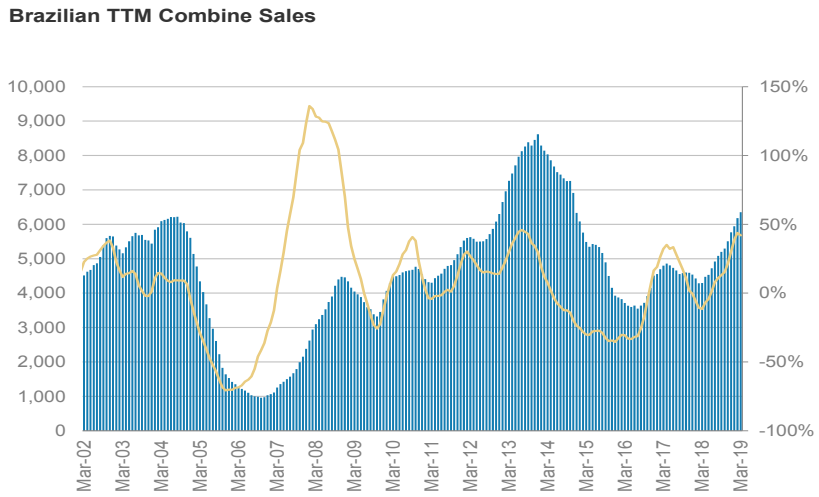
Latin America Market Data

Per OEM commentary, Brazil is estimated to account for ~80-90% of the LatAm market, and is largely expected to see continued improvement throughout the course of 2019. Supportive outcomes from both the presidential election (generally viewed as a 'pro-ag' administration) and government financing program (FINAME) drove strong sales throughout 2H as farmer confidence improved. Looking ahead, OEM's expect to see continued improvement in the region as sentiment continues to normalize, harvest conditions improve, and as farmer profitability sees a modest improvement (largely due to the U.S./China trade dispute).

Brazil tractor sales rebounded in 2H18 as farmers gained additional visibility on the gov't financing program and policy landscape.



Combine sales Combine sales have followed a similar trajectory, and are continuing to improve with TTM sales up ~44% in February.

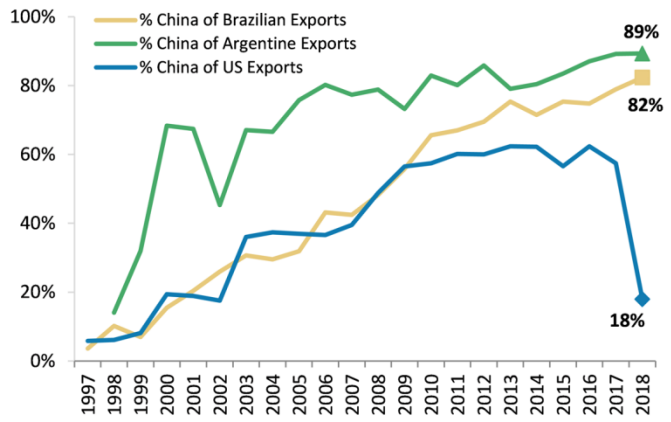


Source: AEM, Anfavea, Morgan Stanley Research

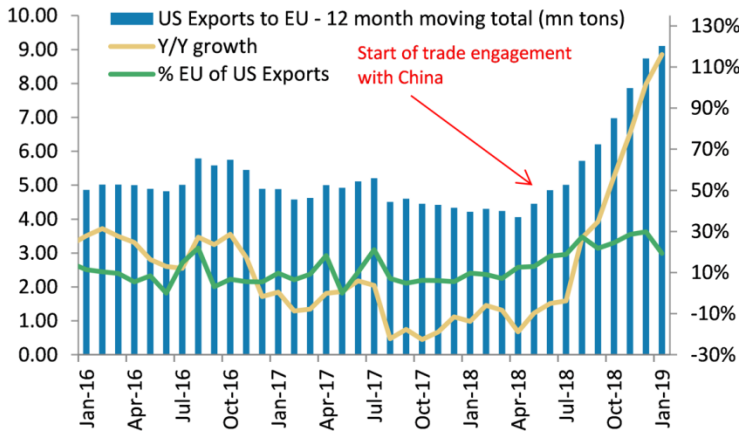
Soybean Tariff Implications

South American production could benefit in near-term, but skeptical on long-term ability to compensate for lost US exports

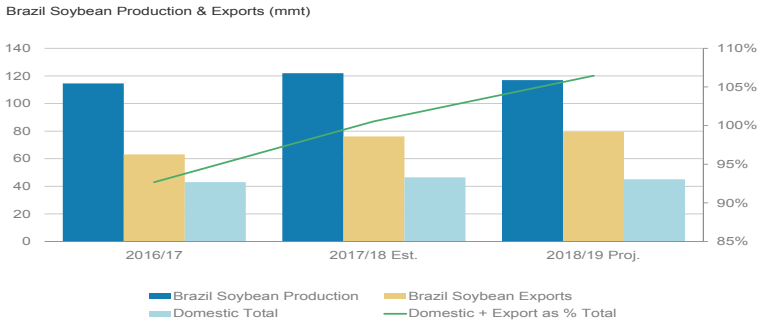
Given the trade disputes with US, China has to diversify soybean imports...



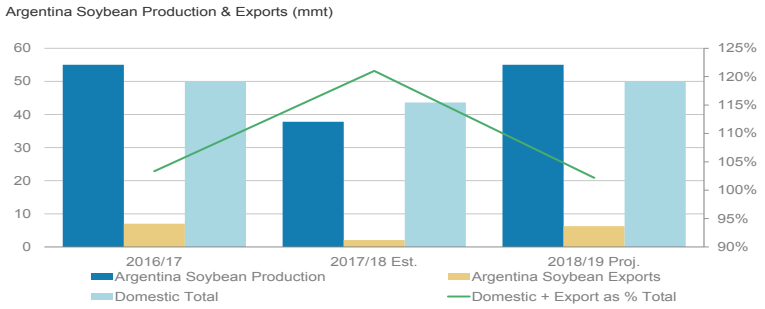
...with lower soybean imports from China, US shifted exports to other regions such as EU



Exports + Domestic Demand are forecasted to be ~106% of Brazil's production.



Following a challenging harvest in '18, Exports + Domestic demand is expected to see a degree of normalization.



Source: Secex, Indec Argentina, Company data, USDA, Morgan Stanley Research

Global Soybean Market Data

The US, Brazil and Argentina account for ~90% of global soybean exports.
China remains by far the most important importer of soybeans, accounting for ~5.6x the next closest importer (EU).

Largest Soybean Producing Countries - 2018 est.
(Marketing year - thousands of hectares, tons per hectare, and thousands of metric tons)

Rank	Country	Area Harvested	Yield	Production	Exports	Domestic Consumption
1	United States	35,657	3.5	123,664	51,029	60,611
2	Brazil	36,100	3.2	116,500	79,500	45,050
3	Argentina	17,500	3.1	55,000	6,300	49,200
4	China	8,400	1.9	15,900	100	105,100
5	India	11,000	1.0	11,000	250	10,320
6	Paraguay	3,300	2.7	9,000	5,600	3,975
7	Canada	2,550	2.9	7,300	5,300	2,695
8	Ukraine	1,700	2.6	4,400	2,950	1,280
9	Russia	2,739	1.5	4,027	850	5,537
10	Bolivia	1,400	1.9	2,700	10	2,605
11	European Union	930	2.9	2,700	125	18,300
12	Uruguay	990	2.0	1,980	1,900	81
13	South Africa	730	1.8	1,275	5	1,497
14	Nigeria	1,000	1.0	1,000	30	1,080
15	Serbia	220	2.8	625	80	580
	World	126,080	2.9	360,076	154,200	348,488
	Top 15 as % of World	99%	NM	99%	100%	88%

Source: USDA, as of March 2019

Largest Soybean Importing Countries - 2018 est.
(Marketing year - thousands of metric tons)

Rank	Country	Imports
1	China	88,000
2	European Union	15,800
3	Argentina	5,350
4	Mexico	5,230
5	Egypt	3,350
6	Japan	3,300
7	Thailand	3,150
8	Taiwan	2,730
9	Indonesia	2,725
10	Turkey	2,600
11	Iran	2,450
12	Pakistan	2,450
13	Russia	2,450
14	Vietnam	2,200
15	South Korea	1,365
	World	151,215
	Top 15 as % of World	95%

Source: USDA, as of March 2019

Source: USDA, AEM, Anfavea, Morgan Stanley Research

Truck

Truck Equipment & Market Primer: Equipment Types

	Medium-Duty (Class 5)	Medium-Duty (Class 6-7)			Heavy-Duty (Class 8)
Type	**On-Road**	**Transit**	**Medium-Duty On-road**	**Vocational**	**Traditional Day Cab / Sleeper & Vocational**
Uses	Small service trucks, City Delivery 		Beverage Truck, Single-Axle, Rack Truck, Large Walk-in, City Delivery 	Dump truck, Fire & Emergency, Refuse, Service, Sweeper, Towing 	
Brands	Ford, Freightliner (Daimler), International (Navistar), Kenworth (PCAR), Peterbilt (PCAR	Local: Freightliner (Daimler), Thomas Built (Daimler), International (Navistar), Bluebird, Collins (REVG) Mass: Van Hool, North American Bus Industries	Ford (Class 6), Freightliner (Daimler), International (NAV), Peterbilt (PCAR), Kenworth (PCAR), Hino (Toyota)	Kenworth (PCAR), Peterbilt (PCAR), Mack (Volvo), Volvo, Freightliner (Daimler), Autocar (Refuse)	Freightliner (Daimler), Kenworth (PCAR), International (NAV), Peterbilt (PCAR), Volvo, Mack (Volvo), Western Star (Daimler)
ASP	$50-$70k	$75k	$70-$100k	$120-$250k	$100-$160, $200-$400k Vocational
Daimler:					
Freightliner	✓	✓	✓	✓	✓
Western Star					✓
Volvo (Mack & Volvo)					✓
PCAR (Peterbilt & Kenworth)	✓		✓	✓	✓
Navistar (International)	✓	✓	✓	✓	✓
Ford	✓		✓	✓	
Oshkosh				✓	
REV Group		✓		✓	
Toyota (Hino)			✓		

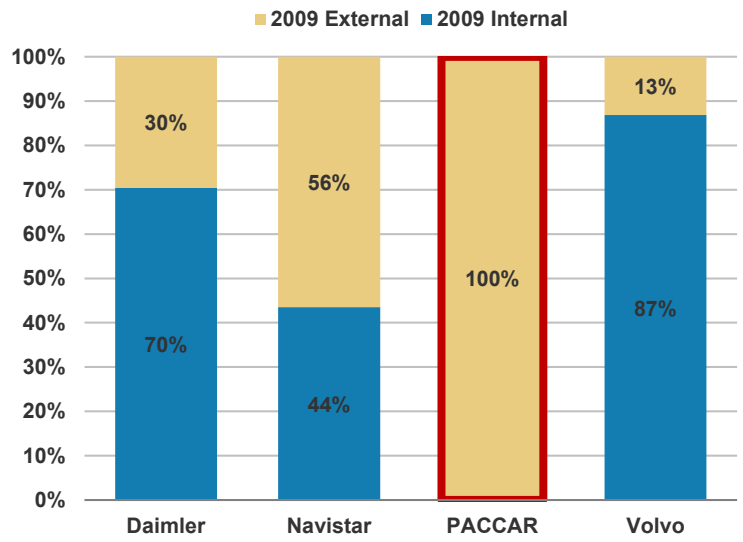
Source: ACT, DAT, Company Data, Morgan Stanley Research

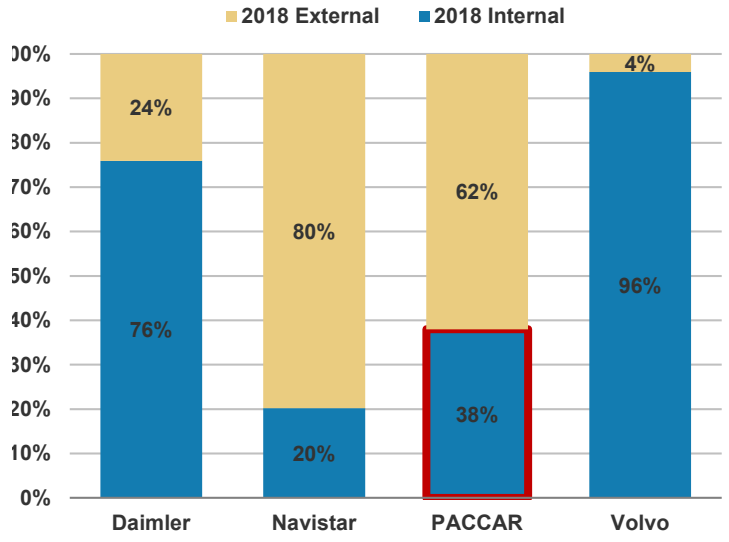
Truck Equipment & Market Primer: Equipment Types

	On-Highway				
Type	Light-Duty	Medium-Duty	Heavy-Duty	Natural Gas	Power / Industrial
HP	350 hp (light-duty), 300 - 600 hp (RV)	150 - 400 hp	300 - 600 hp	Natural gas engines are available for every class of truck	350 hp +
Uses	Heavy-duty pick-up trucks and motor homes	City delivery, buses, medium vocational	Long haul and short haul trailers, heavy vocational		Industrial gnerators, marine, oil & gas, mining, rail
					
Component-Only					
Cummins	✓	✓	✓	✓	✓
Westport	✓	✓	✓	✓	
OEMs					
PACCAR		✓	✓		
Detroit Diesel (Daimler)		✓	✓		
Navistar		✓	✓		
Volvo		✓	✓	✓	✓
Ford	✓	✓			
Hino (Toyota)		✓			
Caterpillar				✓	✓

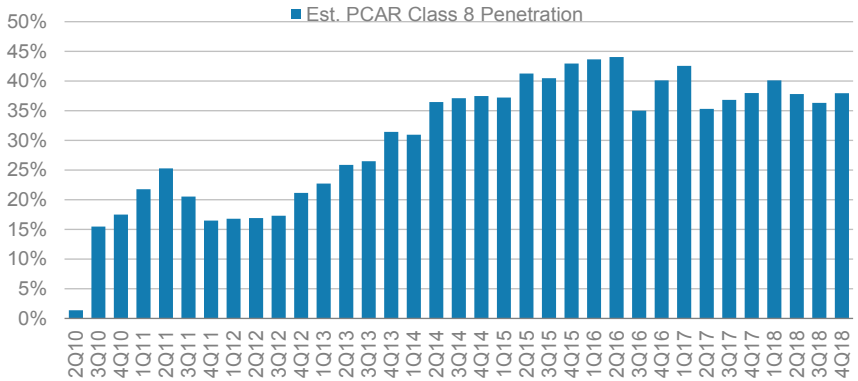
Source: ACT, DAT, Company Data, Morgan Stanley Research

Vertical Integration at PCAR has plateaued; NAV recently launched A26





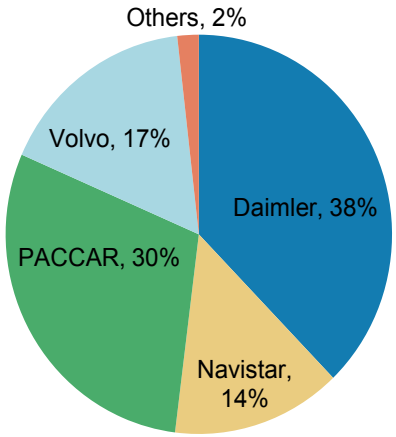
PCAR Estimated MX Penetration

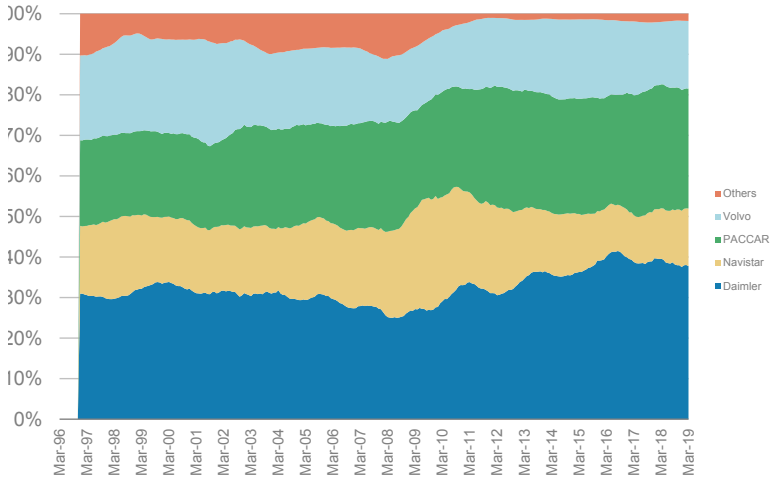


Source: ACT, DAT, Wards, Company Data, Morgan Stanley Research

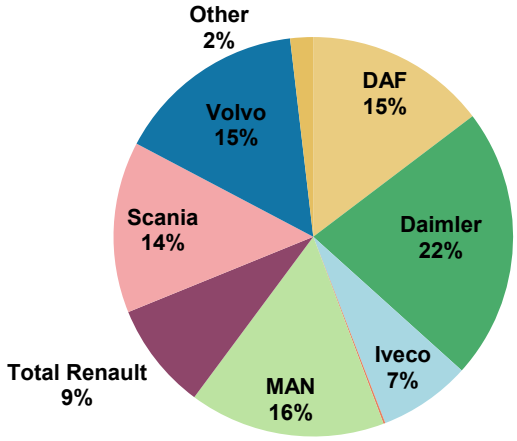
NAFTA is most consolidated; Daimler is market leader

LTM NAFTA Class 8 Sales Share

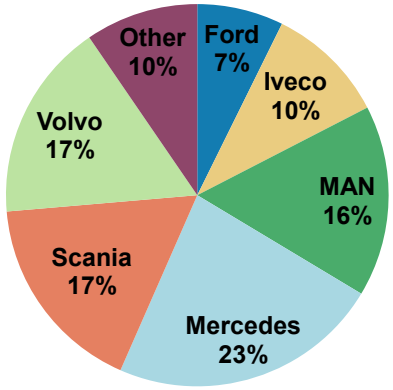




Est. W Europe Heavy Truck Market Share



Brazil Heavy Truck Market Share

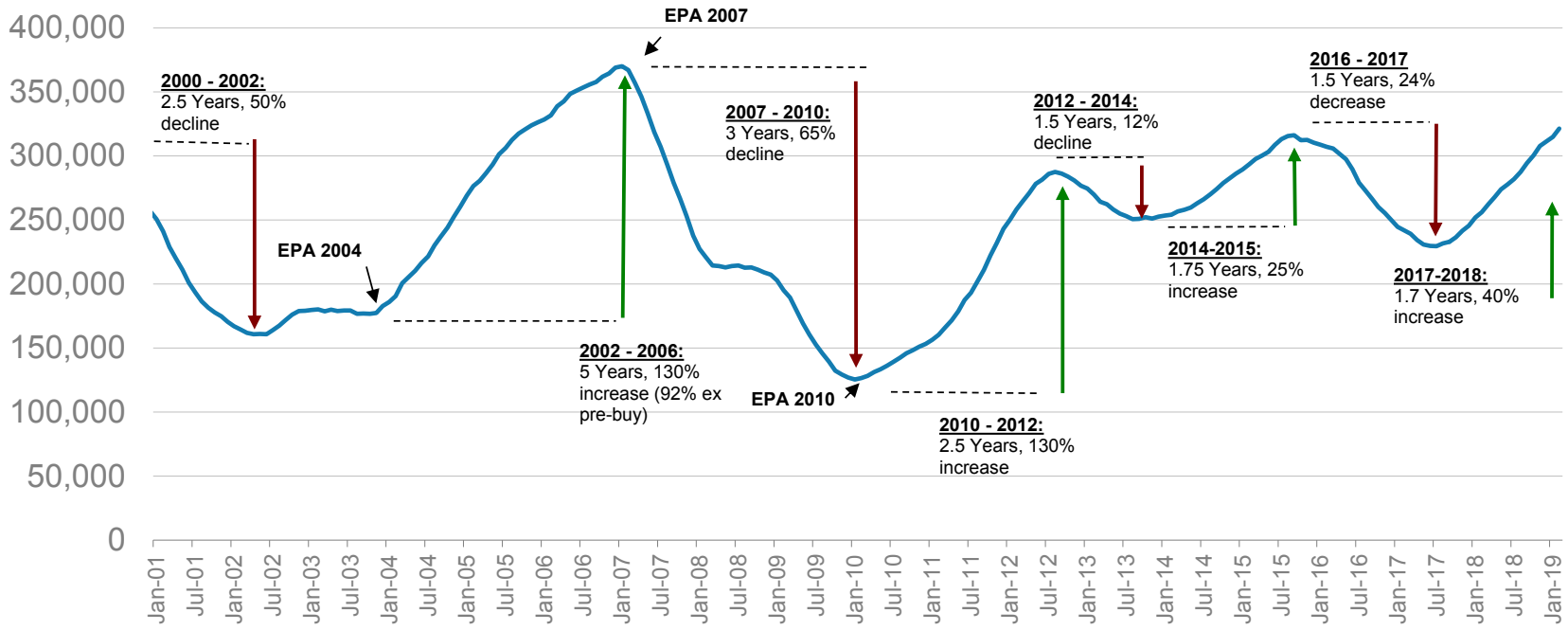


Source: ACT, ACEA, DAT, Company Data, Morgan Stanley Research

Truck cycles are generally 2-4 years up, 1-2 years down

Ex-EPA regulation incentives, Truck cycles are generally 2-4 years up, 1-2 years down, driven by large fleets who replace their trucks every 2 years to remain within warranty and reduce maintenance. The EPA 2007-driven pre-buy was the most notable anomaly over our data set, given the confluence of strong freight demand, robust trucker profitability and a more compelling payback argument vs. other emissions regulations.

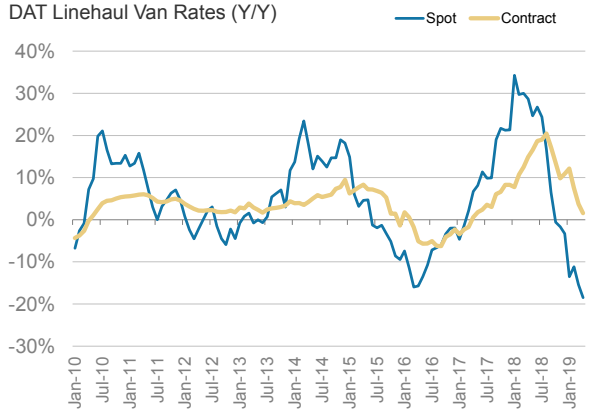
NAFTA Class 8 Truck Sales (T12M)



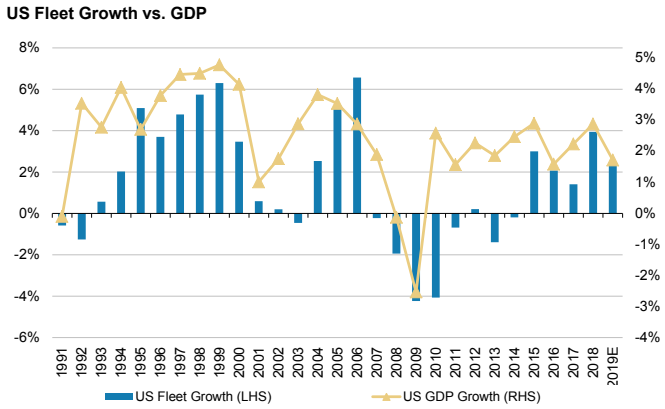
Source: AEM, Anfavea, Morgan Stanley Research

NAFTA Class 8 Truck Orders & Sales correlate with DAT freight rates, Trucker EBITDA & Capex and MS TLFI; Fleet growth correlates with GDP

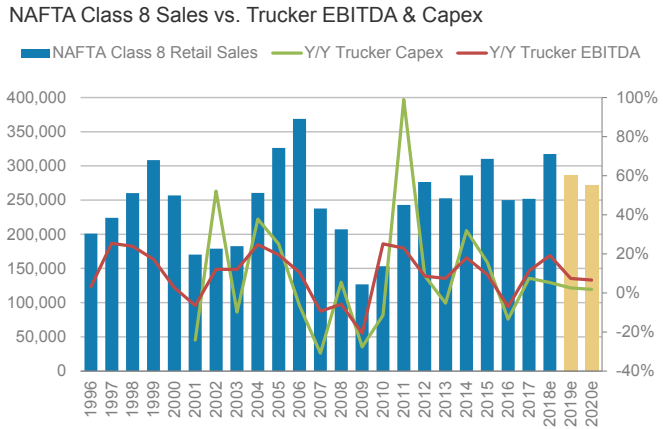
Historically, DAT Freight rates have correlated well with orders, suggesting some degree of supply indiscipline on the part of TLs- similarly, a sharp spike in rates in 4Q17/1Q18 coincided with robust Class 8 order intake.



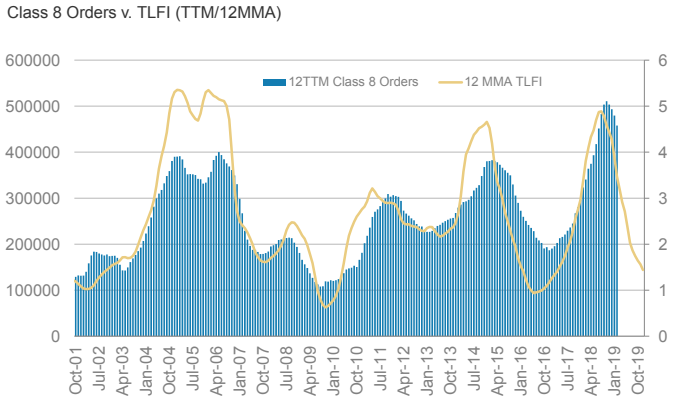
US Class 8 Fleet Growth correlates with GDP.



Class 8 Retail Sales have shown a meaningful correlation with Trucker EBITDA and Capex.



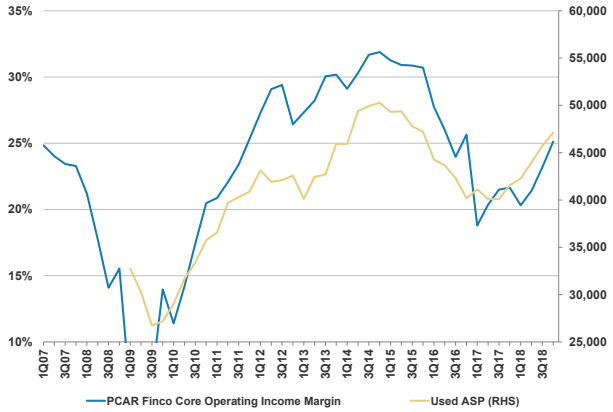
Historically we have witnessed a very strong relationship between our Freight team's TTM TLFI and TTM Class 8 orders - as such, we continue to view the team's indicator as a valuable predictor of retail sales.



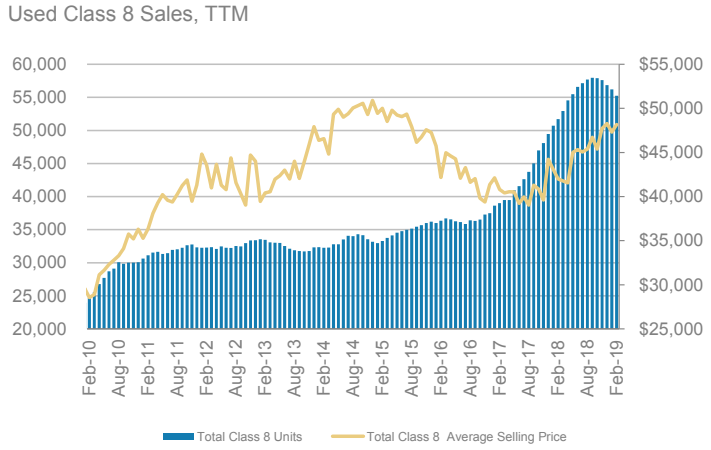
Source: ACT, DAT, Company Data, Morgan Stanley Research

NAFTA Class 8 Used pricing has improved as used sales have accelerated

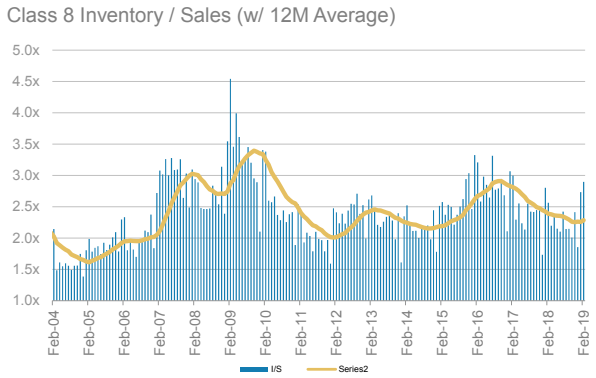
PCAR's FinCo margins have historically shown a meaningful correlation with used truck pricing.



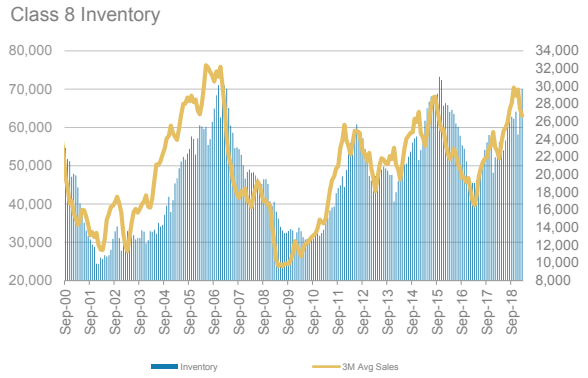
Following record levels of activity in 2018, used truck sales appear to have peaked



Inventories appear healthy on a % of sales basis, following elevated levels in 2016.



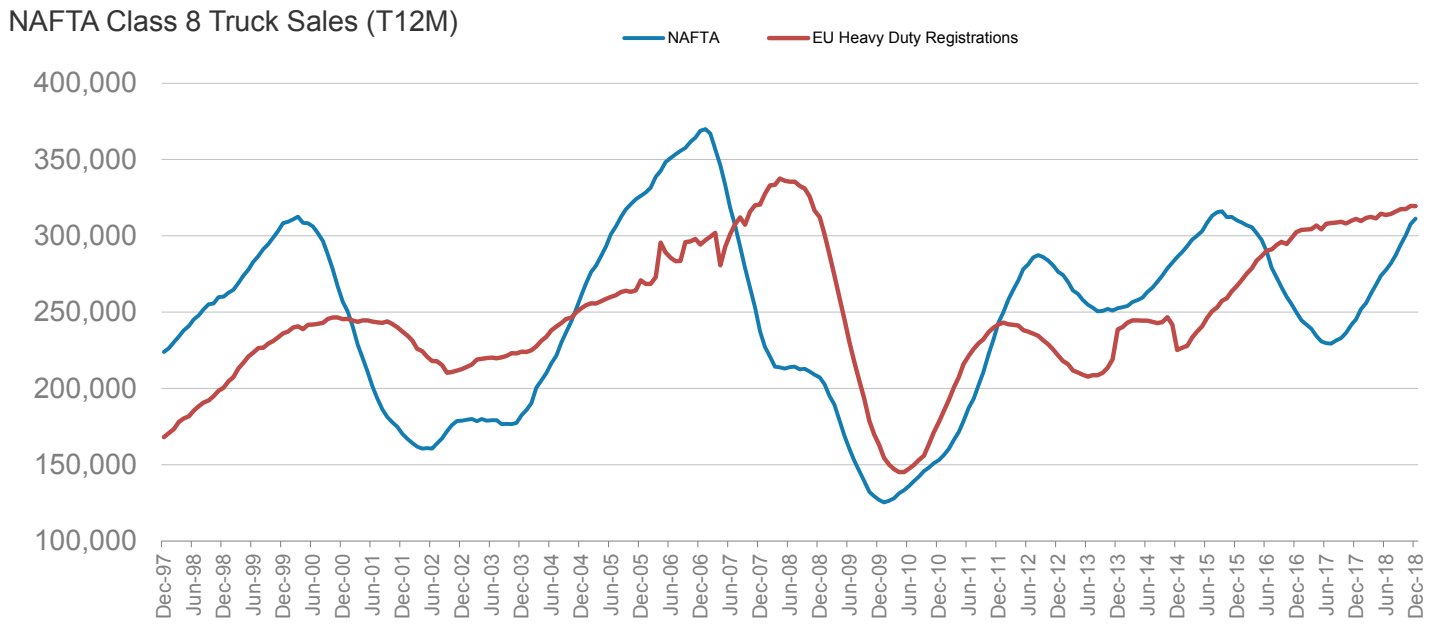
That said, inventories have retraced to prior peak levels on an absolute basis.



Source: ACT, Company Data, Morgan Stanley Research

European Truck Market – Likely approaching peak, but no obvious drop off

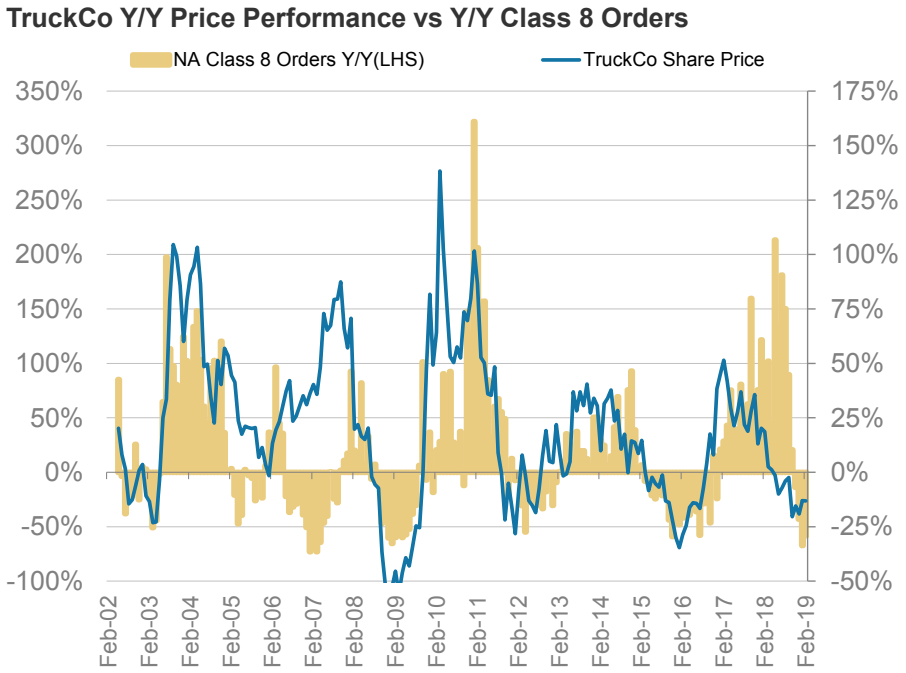
European registrations were somewhat more inconsistent vs. NA retail sales following the last recession, with the pace of registrations coming in well below prior peak levels (while NA retail sales achieved a level similar to pre-buy adj. prior peak in 2015). Our European Autos team broadly attributes this to somewhat poorer credit quality and lagging effects of European QE, which began to benefit owner operators to a more noticeable degree in 2016 and early 2017 (given the lack of larger, publically traded fleets in the EU). After several years of steady results, our European team forecasts Western European Heavy Duty Truck registrations to contract -8%/-10% in '19/'20.



Source: Global Insight, ACEA, ANFAVEA, CAAM, SIAM, JADA, AEB, Company Data, Morgan Stanley Research

Truck share price performance tends to track orders

Historically, shares have tracked orders, but outperformance generally wanes as order growth peaks. We have seen this effect across the entirety of the NA truck complex, as both PCAR and CMI price performance generally begins to soften as signs emerge of peak NA order growth. To this point, recent Y/Y price performance has shown signs of slowing, especially following growth rates in 1Q18 and early 2Q18 which could imply that we are at or near peak order growth rates in the current cycle. With the recent softening in order data, we see increasing evidence that growth rates have peaked in this cycle - which we feel implies underperformance at the TruckCo level until further clarity on the cycle trough can be reached.



Source: Global Insight, ACEA, ANFAVEA, CAAM, SIAM, JADA, AEB, Company Data, Morgan Stanley Research

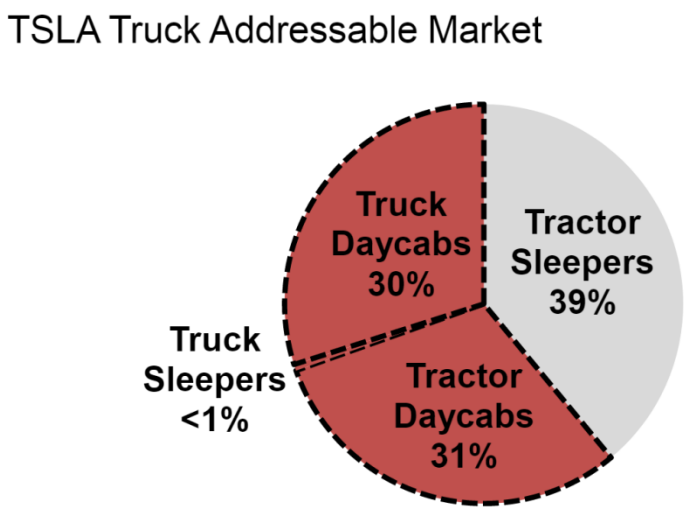
Electric Trucks Threat impacts valuation more than EPS estimates

Truck OEMs and suppliers have acknowledged that EV technology is continuing to improve, with increasing degrees of market penetration as battery and fuel cell producers continue to perfect their technology. Most legacy long-haul truck OEMs and suppliers still anticipate that commercialized EV technology is still well in the distance, with management teams suggesting 5-10 years as a reasonable time horizon for implementation within the tractor sleeper Class 8 market. We broadly do not disagree - the lack of a comprehensive charging infrastructure and maintenance presence across the US is likely to slow widespread adoption on long-haul routes, as drivers tend to heavily rely on these necessities over the course of a route. Further, our payback analysis shows that the payback on a EV truck still remains marginally above the typical payback period for a larger carrier (~2 years). Combined with the previously mentioned headwinds for long-haul adoption, we expect TLs and larger operators to lag initial adoption of such zero-emission products.

Of the publically announced TSLA truck orders to date, we note a healthy mix of publically traded carriers (JBHT & SNDR), along with notable private fleets (PepsiCo, Sysco, Anheuser-Busch)

Date	Company	Order #	Date	Company	Order #
11/17/2017	J.B. Hunt	40	11/30/2017	Continental Express	1
11/17/2017	Walmart	15	12/10/2017	Elemental Landscape	3
11/17/2017	Meijer	4	12/7/2017	Anheuser-Busch	40
11/17/2017	SEI Logistics	1	12/7/2017	Mecca & Son Trucking	1
11/17/2017	Loblaw	25	12/8/2017	Sysco	50
11/17/2017	Girteka	1	12/11/2017	Schneider	TBD
11/17/2017	Flexport	1	12/12/2017	PepsiCo	100
11/19/2017	Ryder	TBD	N/A	Hub Group	10-20
11/20/2017	NFI	TBD	12/1/2017	Sitra	1
11/22/2017	JK Moving Services	4	12/19/2017	UPS	125
11/21/2017	Fercam	1	12/23/2017	ASKO	10
11/25/2017	Breytner Transport	1	1/7/2018	Norway Posten	1
11/28/2017	DHL	10	1/14/2018	Bee'ah	50
11/29/2017	Best Transportation	1	3/26/2018	FDX	20
11/29/2017	Fortigo	1	4/6/2018	TCI Transportation	50
11/29/2017	Speedy Transport	5	4/24/2018	City Furniture	5
11/29/2017	Fuel Transport	4	9/6/2018	Walmart	30
11/30/2017	Titanium	5	11/20/2018	Alberston	10
			Total		**585**

~60% of the Class 8 market meets the daycab configuration requirements, and are typically used in LTL, Private Fleet and Vocational applications - we would expect these verticals to see the earliest degree of penetration.



Source: Thomson Reuters, ACT, Company data, Morgan Stanley Research

Electric Trucks payback is still likely outside a typical TL's payback period

Our payback analysis shows an EV falling marginally outside of the typical TL's payback period (i.e. 2 years) - although we note this likely falls within private fleet payback ranges, with upside to the payback period in the form of battery technology advancements and incremental miles traveled.

	Diesel (PCAR, NAV)		Battery Powered Electric (TSLA)		Fuel Cell ex-Fuel (Nikola)		Fuel Cell (Nikola)
Tractor Cost (Daycab)	$125,000		$180,000		$350,000		$350,000
Tractor Cost (Sleeper)	$150,000		$180,000		$375,000		$375,000
Add: Incremental Tax	$0		$2,550		$13,500		$13,500
Add: Incremental Dep. Exp.	$0		$8,500		$45,000		$45,000
Cost in Excess of Diesel	**$0**		**-$53,550**		**-$283,500**		**-$283,500**
Range	500-750 miles		300-500 miles		~1,200 miles		~1,200 miles
Fuel Type	Diesel		Kwh		Hydrogen		Hydrogen
Fuel Price per Type	$3.05/gallon		$0.15/kwh		0 (subsidy)		$1.07(est)/Fuel
Miles per Fuel Unit Average	7		19		13-15		13-15
Kwh/mile	NM		1.8		NM		NM
Total Kwh per Year	NM		225,000		NM		NM
Total Miles Driven per Year	125,000		125,000		125,000		125,000
Total Cost of Fuel	$54,464		$33,750		$0		$9,554
Total Cost of Maintenance	$12,000		$12,000		$12,000		$12,000
Total Cost of Insurance	$8,000		$8,000		$8,000		$8,000
Total Cost of Tires	$3,500		$4,000		$4,000		$4,000
Total Annual Cost	$77,964		$57,750		$24,000		$33,554
Total Annual Savings vs. Diesel	**$0**		**$20,214**		**$53,964**		**$44,411**
Payback Period (Years)	**NA**		**2.65**		**5.25**		**6.38**

Source: Thomson Reuters, ACT, Company data, Morgan Stanley Research

Key Debates and Top Picks

Current Investor Debates

How much will price/cost weigh on FY19 margins?

Consensus view: Price/cost pressure will continue through 2019

Our view: We expect cost headwinds to moderate significantly in FY19 - especially in 2H - led by steel and aluminum deflation. Pricing actions at construction and ag equipment companies should offset the majority of the headwinds in 1H (barring a sharp cyclical decline in demand) and price/cost to potentially turn positive in 2H. Truck OEMs/suppliers (PCAR, WBC) likely have the most difficult time passing through price increases given our expectation for a cyclical decline in sales in 2H.

Where are we in the Non-Resi Cycle?

Consensus view: Investors question whether broader Non-Resi demand can continue to grow in the context of prior rate hikes & choppier Resi

Our view: Even with Non-Resi construction now exceeding its prior peak in absolute dollars, we forecast 5.0-5.5% growth in Non-Resi construction spending in FY19 based on our bottom up build. Our analysis suggests rising interest rates tends to coincide with an increase in Non-Resi spending, (not a decrease), the 2s 10s spread is negatively correlated with Non-Resi spending, and while Resi spending has led changes in Non-Resi spending over several periods, timing within each period is difficult to predict and is most highly correlated with commercial construction spending.

What is the outlook for O+G capex?

Consensus view: 4Q18 Oil price volatility will drive sustained capex cuts at the energy Majors & Upstream/Service cos – with offshore and int'l capex activity unlikely drive a recovery in capex beyond '19/'20

Our view: On ests from our global O+G analysts, our updated capex buildup currently implies modest declines of ~1% in 2019 offset by growth of 4%/10% in 2020 and 2021. 2017 & 2018 O+G growth had largely been driven by US onshore activity – however we increasingly expect int'l and offshore activity to pick up the baton as 4Q18 volatility results in a brief '20 air pocket in servicing activity. Well compression and midstream activity is expected to remain supportive in light of continued takeaway headwinds.

How will deteriorating farmer sentiment impact the replacement cycle?

Consensus view: Weaker farmer sentiment on the back of prolonged US/China trade disputes and declining profitability will drive a more muted replacement cycle

Our view: Trade tensions in 2018 have pressured farmer sentiment in North America throughout the year, with recent weather and ASF developments representing incremental headwinds. That said, both our replacement work and commentary from DE mgmt continue to highlight the resiliency of replacement demand, driving growth in underlying unit volumes despite an unsupportive commodity and trade backdrop. In our view, this speaks to both the elevated age of the fleet and underlying need for equipment replacement – which should resume more meaningfully in '21 on the back of trade/commodity normalization.

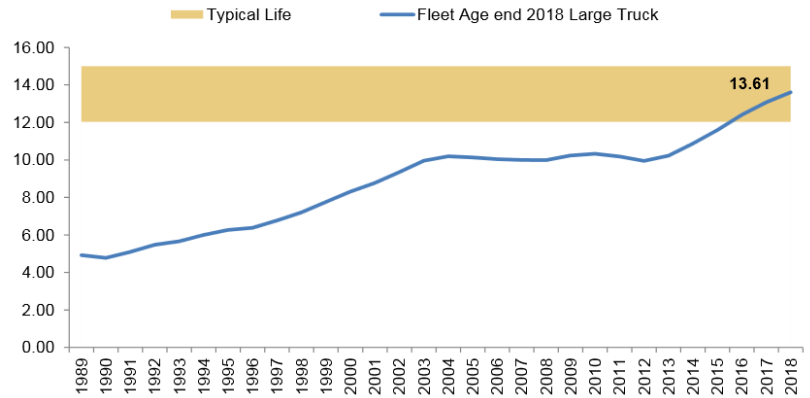
How far will Class 8 Truck fall in 2019?

Consensus view: Investors view recent order weakness as transient, with still-elevated backlog levels likely to drive further production growth in the near-to-medium term.

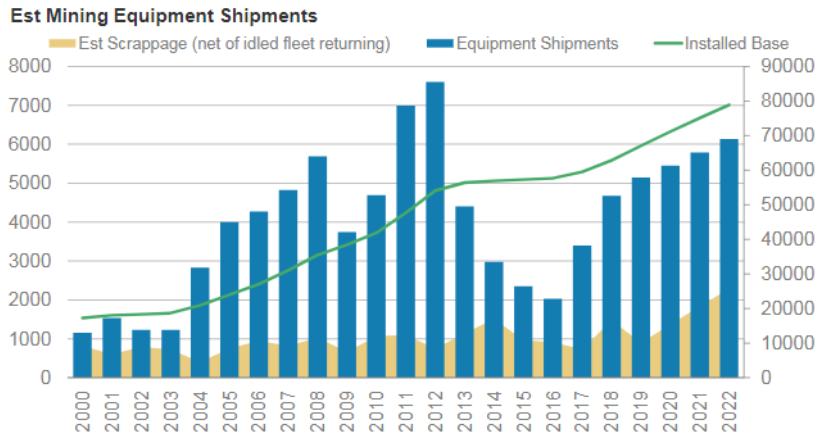
Our view: Our regression-implied 2019 NAFTA retail sales forecast stands ~8% below ACT, with MSe of 297k (-6% Y/Y) standing below ACT at 323k (+2% Y/Y). Our forecast utilizes inputs from our Freight team's TLFI and is forecasted based on the team's straight-line forecast for 2019. Despite the October backlog standing at 302k units, we expect production discipline to result in some production to be shifted towards the outyears as OEMs look to manage what is likely to be another multi-year downcycle in NA truck markets following Y/Y order declines of ~60% YTD.

Top Picks: Caterpillar (CAT) - OW

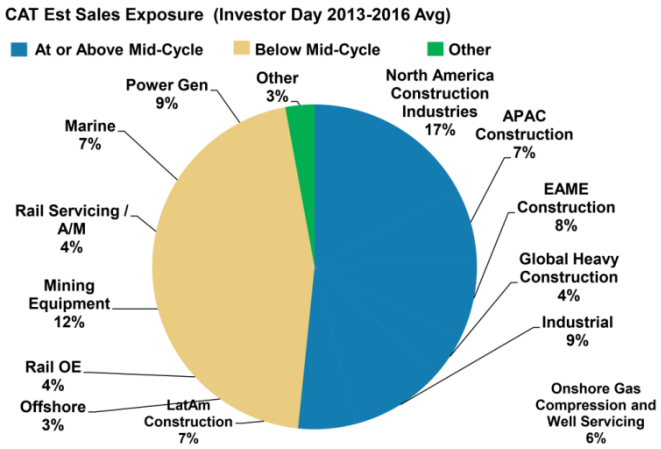
Our analysis of the global large mining truck fleet suggests a fleet age of ~13.6 years – which on a ~12-15 year useful life implies a limited ability to further extend fleet ages.



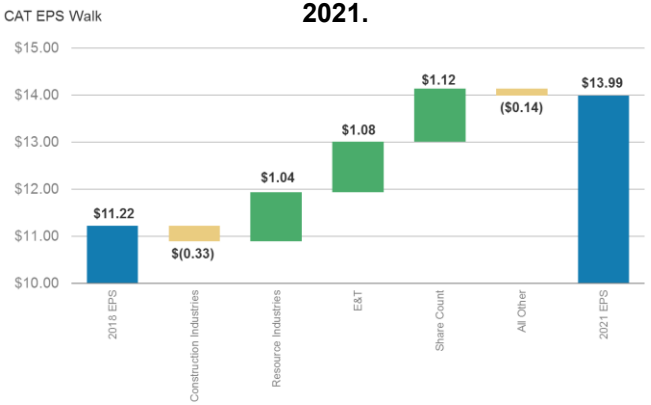
We expect accelerating scrappage/equipment replacement to complement a modest return to active fleet growth in '19/'20 and beyond.



We estimate ~45% of CAT's portfolio remains below mid-cycle, i.e. inconsistent with current valuation trends.



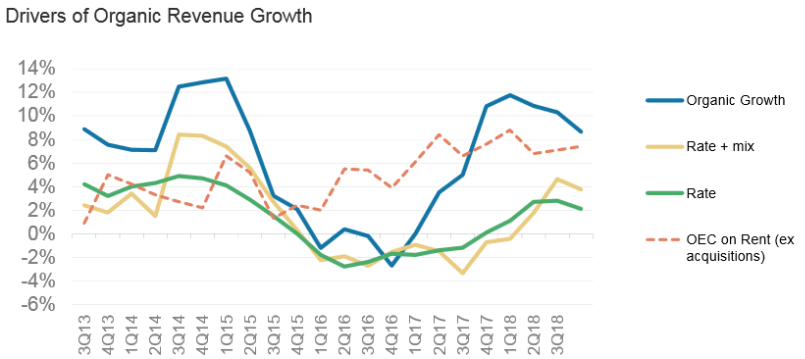
We see ~$1.04 of positive EPS contribution from Resource offsetting ~33c of net negative EPS contribution from Construction through 2021.



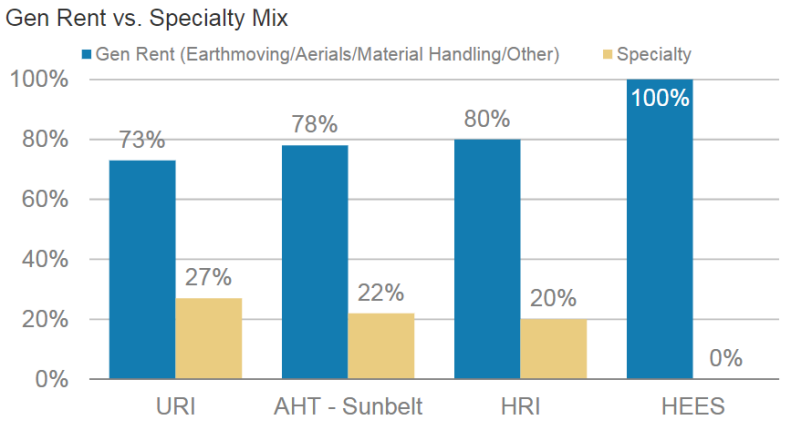
Source: Company data, Off-Highway Research, Parker Bay, Morgan Stanley Research

Top Picks: United Rentals (URI) - OW

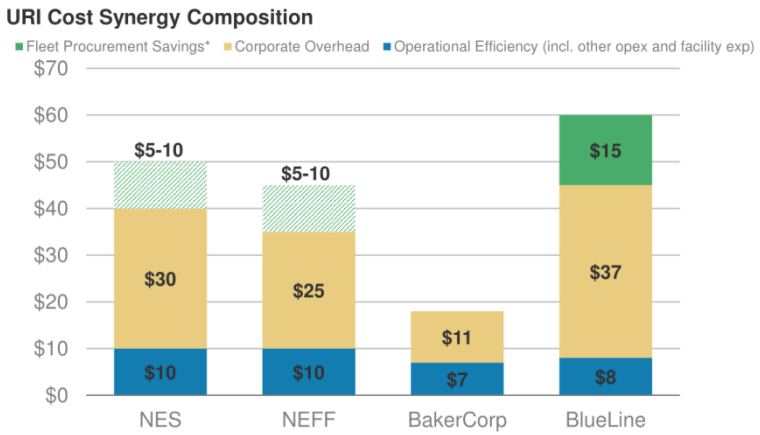
Investors generally focus on two metrics for URI - rate & time utilization – but these dismiss more capital intensive means of revenue growth and ignore cross-selling.



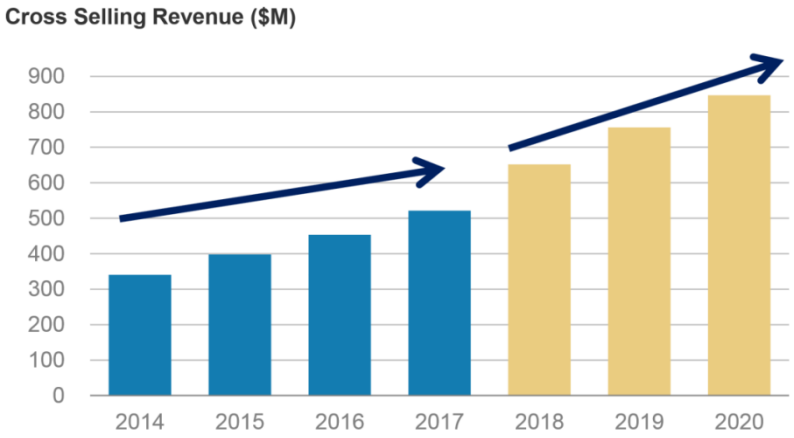
URI carries the highest mix of Specialty vs. its RentCo peers



Most of URI's cost synergy targets are focused on corporate overhead and operational efficiency - we see no reason why this cannot be repeated at future acquisitions.



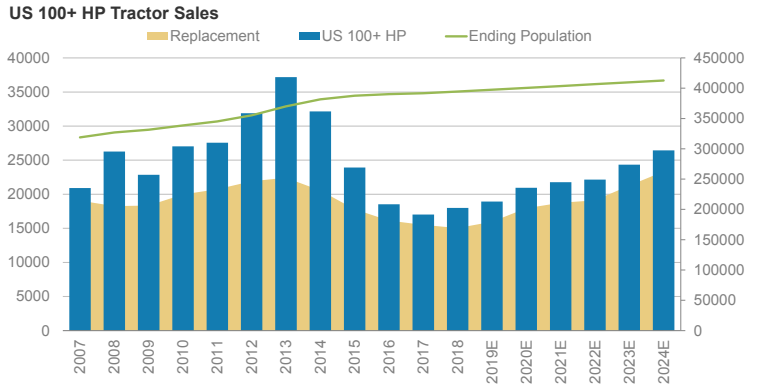
URI has executed on its Specialty (and Gen Rent) cross-sell strategy at its acquired companies – we expect this to continue through 2020



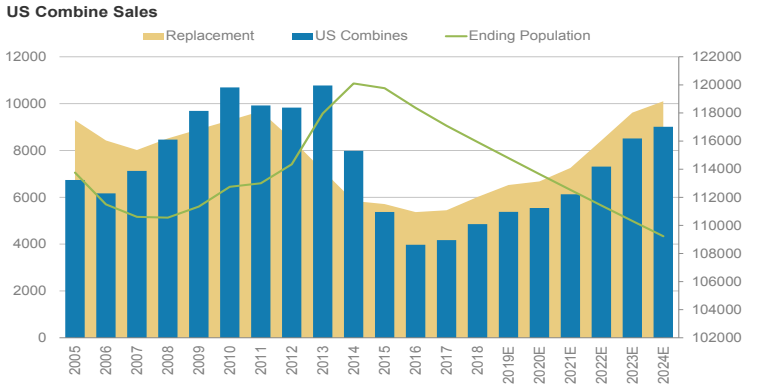
Source: Company data, Daniel Kaplan Associates, Morgan Stanley Research

Top Picks: Deere & Company (DE) – OW

We see ~5% avg. p.a. growth in mid-to-large sized tractors (100+ HP) through 2022…

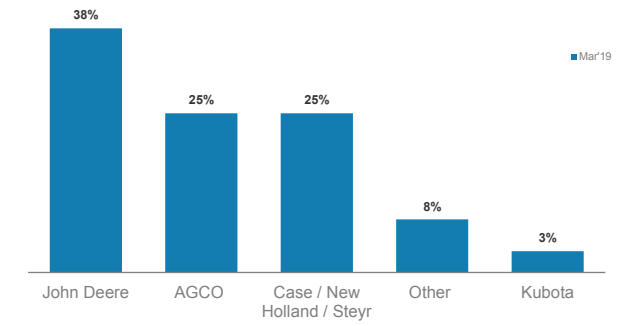


…which compares to ~10% average p.a. growth in Combines over the next four years...



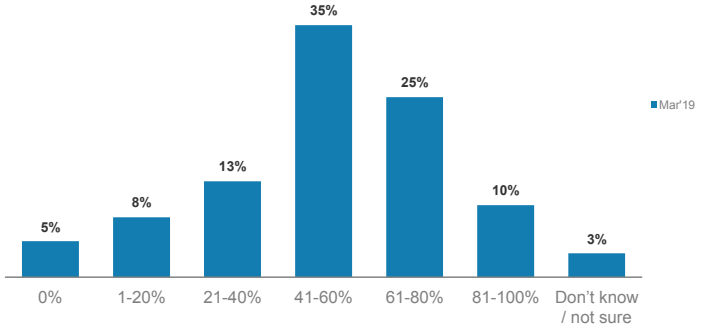
Our survey suggests DE currently has the most robust precision ag product portfolio. While most dealers voted for their respective OEM partner, the results show a degree of defection – as there were an equal number of dealers surveyed across AGCO/CNHI/DE.

Most Comprehensive Suite of Precision Ag Technology



Further, our 53% (on average) of new equipment sales are carrying at least one precision ag product.

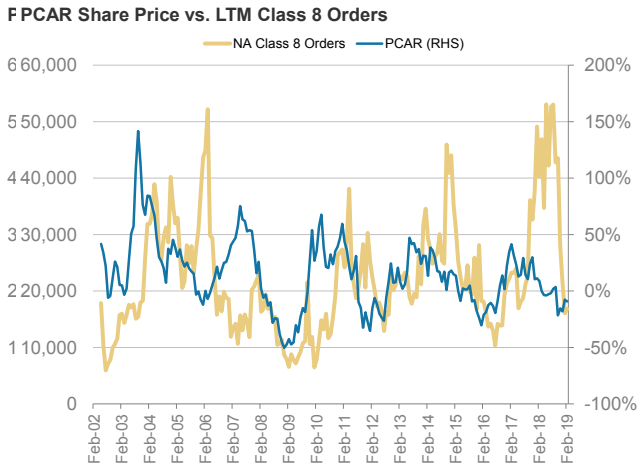
Proportion of Equipment Sales Carrying One or More Products of Precision Ag Technology



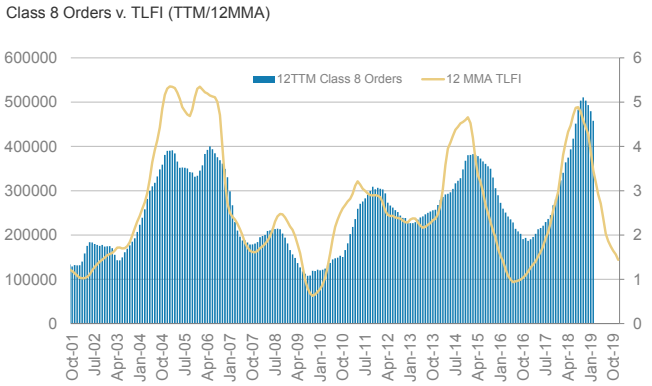
Source: Eurostat, NBS, Thomson Reuters, Morgan Stanley Research

Top Picks: PACCAR (PCAR) - UW

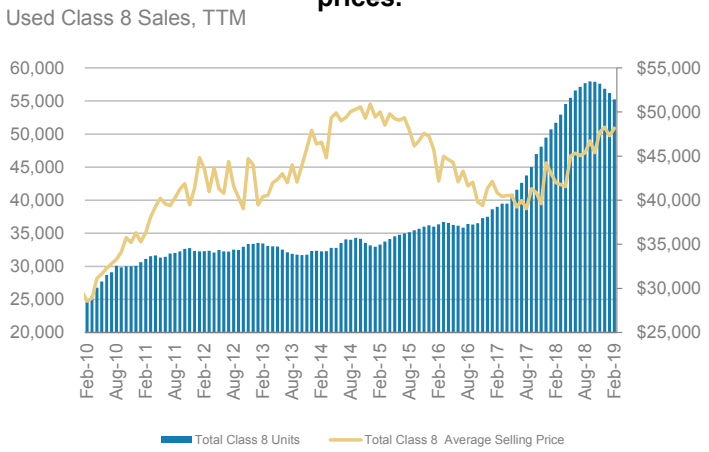
PCAR shares tend to trade on Cl8 orders.



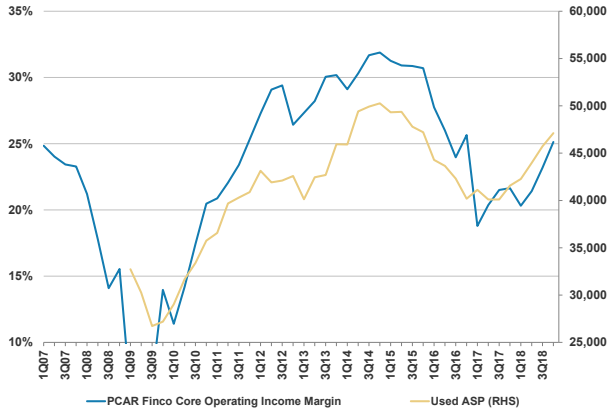
The 12MMA TLFI and Class 8 12MMA orders have historically shown an extremely close correlation (0.87) – suggesting order growth will decline further into 2019.



Following record levels of activity in 2018, used truck sales appear to have peaked, with lower activity likely pressuring prices.



PCAR's FinCo margins have historically shown a meaningful correlation with used truck pricing.



Source: ACT, Company Data, Morgan Stanley Research

VMR

CAT

- **Our Price Target is In-Line with our Base Case Scenario.** 12.6x Base Case FY20e EPS of $13.14. Revenues up 4% in '19 (to $57B), with 2% growth in '20 (to $58B). We forecast ~3%/-33% growth in CI in '19/'20 on moderating growth in NA complemented by declines in APAC (and EAME in FY20), 15%/7% growth in RI as the OE replacement cycle ramps up, and 3%/6% growth in E&T supported by continued growth in O&G capex following a 1H19 well servicing air pocket. On ~35% consolidated incremental margins, we forecast adj operating margins of ~16.6% in '19 and ~17.0% in '20 as CAT sees benefits from both FY19 pricing actions and moderating cost inflation in 2H19, offset by a higher tax rate of 26%. We apply a 12.6x multiple to FY20 EPS based on CAT's average ~0.8x Rel P/E multiple at peak and a NTM market multiple of 16.0x. We model ~$3.3B of repurchases in FY19 followed by ~$3.0B in FY20.
    - **Potential Catalysts:** An Infrastructure spending package materializes. Continued recovery in oil prices and O&G capex. More robust than expected cost savings targets. Mining OE recovery. A share buyback/accelerated repurchase announcements. Incrementally more positive Non-Resi macro data.
    - **Risks:** Political resistance to increased infrastructure spending / tax reform. Oil prices volatility or O&G CapEx cuts. Mining fleet age extends beyond 13 years and replacement cycle fails to materialize. A more competitive pricing environment. Adverse legal developments as a result of ongoing investigations.

URI

- **Our price target methodology is in line with our base case scenario.** ~5.2x Base Case FY20 EBITDA of ~$4.9B. In our Base Case, we forecast 4-6% organic topline growth, driven by URI's cold starts, cross-selling and digital initiatives. We assume URI executes on stated NEFF/NES/BakerCorp/BlueLine deal synergies and that rates trends between ~1-2%. We embed ~$400-500m in acquisition-related EBITDA accretion in FY19. Our 5.2x multiple represents a slight discount to the average of our regression-implied multiples (measuring margin expansion, ROIC, organic growth and rates, which implies ~5.6x), and a ~1.0x premium to URI's historical valuation/~1.0x discount to other high margin rental peers (AHT-LN).
    - **Potential Catalysts:** Infrastructure spending package materializes. Continued recovery in oil prices and O&G capex. Improvement in rental rates and industry supply / demand. Incrementally more positive Non-Resi macro data. Additional M&A, especially within the higher margin Specialty Rental segment. Better than anticipated accretion from the acquisition of NES/NEFF.
    - **Risks:** Infrastructure spending fails to materialize. Changes to oil price (both to the upside and downside) given URI's leverage to this end market. Material strength or weakness in used equipment pricing. Further deceleration in rental rates if IRCs become more aggressive.

DE

- **Our price target is consistent with our base case valuation methodology.** ~15.1x Base Case FY20 EPS of $12.70. A&T organic growth remains solid at ~9% in FY19, followed by solid LSD-MSD growth through 2021. Construction revenues grow ~10-15% through 2019 as strength in underlying construction spending carries into 2019. We model mixed incrementals in A+T through FY19 as 1Q's cost pressures linger through 2Q, and ~30-40% incrementals in C+F as Wirtgen-related amortization rolls off. We apply DE's relative 0.98x multiple at mid-cycle on a market multiple of 15.5x, which implies a 15.1x multiple.
    - **Potential Catalysts:** A recovery in commodity prices and US cash receipts. Better than expected top-line synergies from the Wirtgen acquisition. Better than expected incrementals as price/cost pressures fade, and restructuring actions take hold. US infrastructure bills passes, driving outsized C&F top-line growth.
    - **Risks:** Commodity price pressure truncates ongoing replacement cycle. Used inventories deteriorate, limiting pricing power and demand pull-through. Management mis-execution around Wirtgen synergies and $500b cost cutting plan. Supply chain woes and price/material headwinds persist.

PCAR

- **Our Price Target Valuation Methodology Is Consistent With Our Base Case.** ~13.5x "normalized" EPS of $4.80. We assume 2H18/1H19 represent peak build rates in the current cycle, suggesting US and Canadian markets progressively decelerate through 1H19 and turn negative by 4Q. NA volumes decline in 2H, while European volumes remain strong in 1H19 but turn negative by YE and decelerate further in '20. We give the company credit for ~5-8% growth within Parts in '19, moderating to LSD growth in '20. We also assume modest 1ppt p.a. growth in pricing. Given our expectation for peak EPS in FY19 and declines thereafter, we value PCAR using a 13.5x multiple (0.85x rel to market multiple of 15.5x) on 'normalized' EPS of $4.80. Our multiple represents a ~10% discount to PCAR's historical normalized mid-cycle rel multiple of 0.95x given the EV threat.
    - **Potential Catalysts:** NAFTA Class 8 cycle lasts longer than expected. European truck demand remains more robust than expected. New entry into emerging markets. Brazilian market recovers faster than expected. Acceleration of vertical integration initiatives. A/M growth is better than expected due to captive service opportunity. Transformative M&A.
    - **Risks:** Pricing environment (for both new and used trucks) turns challenging. Further deterioration in freight industry fundamentals. Entrance of industry disruptors (e.g. Tesla, Nikola) as EV/AV technology progresses faster than anticipated. Order strength deceleration through 2019.

Source: Company Data, Morgan Stanley Research

Morgan Stanley

FOUNDATION

May 2019

MORGAN STANLEY RESEARCH
North America

Morgan Stanley & Co. LLC

Industrials Spring Training Teach-In

Metals & Mining








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For analyst certification and other important disclosures, refer to the Disclosure Section, located at the end of this report.

Stock recommendations and disclosures in this report are as of May 3, 2019; stock prices as of April 30, 2019, unless otherwise noted.

Metals and Bulks We Cover Globally

	commodity	bearish		neutral			bullish	
*	Copper							
*	Gold/silver							
	Nickel							
*	Aluminium							
	Palladium							
	Platinum							
	Diamonds							
	Cobalt							
*	Iron ore							
*	Steel							
*	Zinc/lead							
*	Alumina - spot							
	Thermal coal							
	Manganese ore							
	Lithium							
*	Hard coking coal							

Source: Morgan Stanley Research Commodities Team estimates. * Note: Commodities to which covered US equities are exposed.

Types of Metals & Mining Companies

Diversified Miners

Teck
Rio Tinto
bhpbilliton
GLENCORE

Converters

USS
AK Steel
NUCOR
SDI
KAISER ALUMINUM
Constellium

Pure-plays Metals & Mining

ALCOA
FREEPORT-McMoRan
BARRICK
WARRIOR MET COAL
CLIFFS
NEWMONT

Counter Cyclicals

?

Source: Company data, Morgan Stanley Research estimates.

Mapping Metals/Bulks Exposures for Companies

Ticker	Name	2016 Reveue Exposure															
		Copper	Moly	Silver	Zinc	Lead	Nickel	Bauxite	Alumina	Aly	Gold	Oil	Met Coal	Energy Coal	PGM	Iron Ore	Others
AA-US	Alcoa Corp							3%	25%	70%							2%
ABX-US	Barrick Gold Corp	5%									92%						2%
AEM-US	Agnico Eagle Mines Ltd	0%		4%	0%						96%						
ARCH-US	Arch Coal Inc												35%	65%			
AUY-US	Yamana Gold Inc	11%		6%							82%						
BTU-US	Peabody Energy Corp												23%	77%			
CENX-US	Century Aluminum Co									100%							
CLF-US	Cleveland-Cliffs Inc															100%	
CSTM-US	Constellium NV																100%
FCX-US	Freeport-McMoRan Inc	70%	4%								10%	9%					7%
FM-T	First Quantum Minerals Ltd	80%			1%		7%				10%						2%
FNV-T	Franco-Nevada Corp			18%							70%	5%			6%		1%
HBM-T	Hudbay Minerals Inc	67%		4%	19%						10%						0%
HCC-US	Warrior Met Coal Inc												100%				
HL-US	Hecla Mining Co			39%	13%	9%					39%						
IAG-US	IAMGOLD Corp										100%						
KALU-US	Kaiser Aluminum Corp																100%
KGC-US	Kinross Gold Corp			3%							97%						
LUN-T	Lundin Mining Corp	66%		2%	13%	3%	8%				6%						1%
NEM-US	Newmont Mining Corp	4%									96%						
RGLD-US	Royal Gold Inc	1%		8%	1%	0%					68%						21%
SCCO-US	Southern Copper Corp	78%	5%	5%	4%												7%
TECK-US	Teck Resources Ltd	22%			34%								45%				0%
WPM-T	Wheaton Precious Metals Corp			54%							46%						

Source: Company data, Morgan Stanley Research estimates.

Forecasting Metals Prices: Copper Case Study

1 **Supply** – Bottom's up analysis of mine by mine production

	2017	2018	2019e	2020e	2021e	2022e	2023e	2024e	2025e
Batu Hijau	165	90	108	115	115	112	112	112	112
Grasberg	468	577	291	357	658	800	800	800	800
Wetar SxEw	25	28	28	25	20	15	6	0	0
Indonesia	**658**	**695**	**427**	**497**	**793**	**927**	**918**	**912**	**912**
ASIA	**2,976**	**3,094**	**2,920**	**3,173**	**3,535**	**3,716**	**3,749**	**3,751**	**3,896**
Global Mine Production	**20,138**	**20,819**	**20,336**	**20,987**	**21,529**	**22,003**	**22,056**	**21,848**	**21,714**

2 **Demand** – GDP growth, PPI, etc.

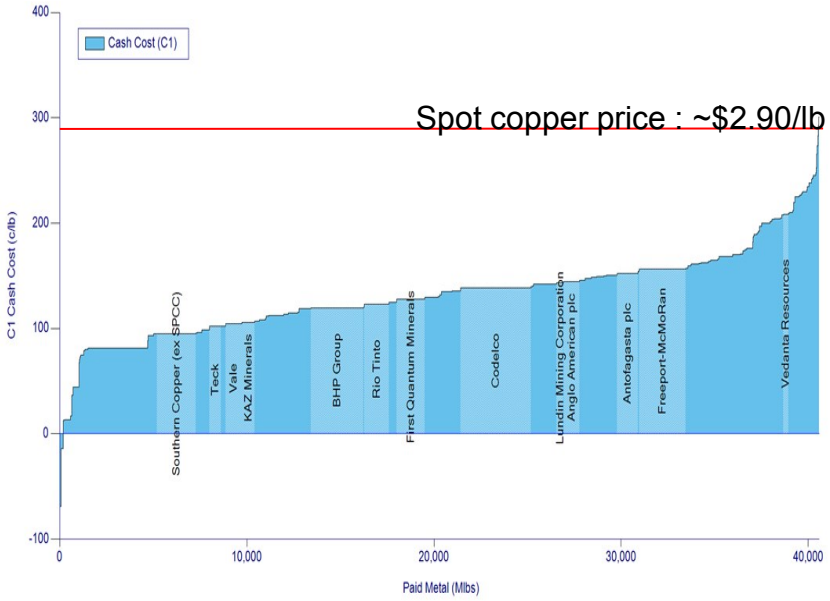
	2017	2018	2019e	2020e	2021e	2022e	2023e	2024e	2025e
China	10,910	11,510	11,683	11,916	12,155	12,386	12,609	12,760	12,913
Growth rate, %	*1.8%*	*5.5%*	***1.5%***	***2.0%***	***2.0%***	***1.9%***	***1.8%***	***1.2%***	***1.2%***
Asia	**14,781**	**15,425**	**15,689**	**16,025**	**16,347**	**16,665**	**16,977**	**17,221**	**17,466**
Growth rate, %	*2.1%*	*4.4%*	*1.7%*	*2.1%*	*2.0%*	*1.9%*	*1.9%*	*1.4%*	*1.4%*
World	**22,839**	**23,489**	**23,868**	**24,339**	**24,776**	**25,198**	**25,597**	**25,902**	**26,203**
Growth rate, %	*1.0%*	*2.8%*	*1.6%*	*2.0%*	*1.8%*	*1.7%*	*1.6%*	*1.2%*	*1.2%*

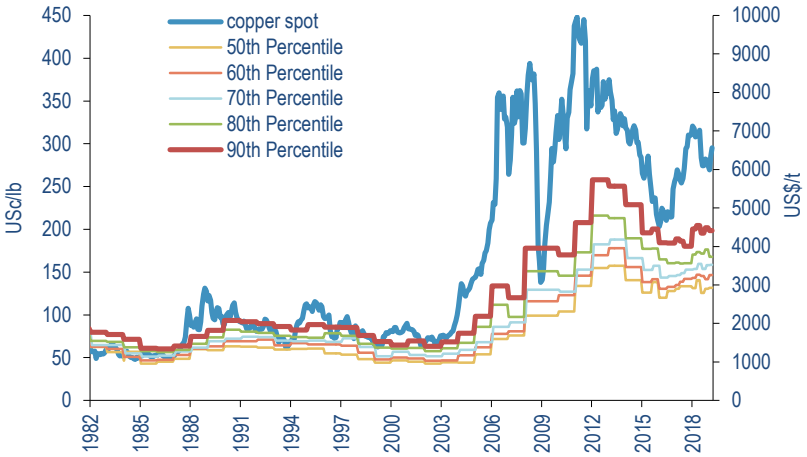
Source: Morgan Stanley Research Commodities Team estimates.

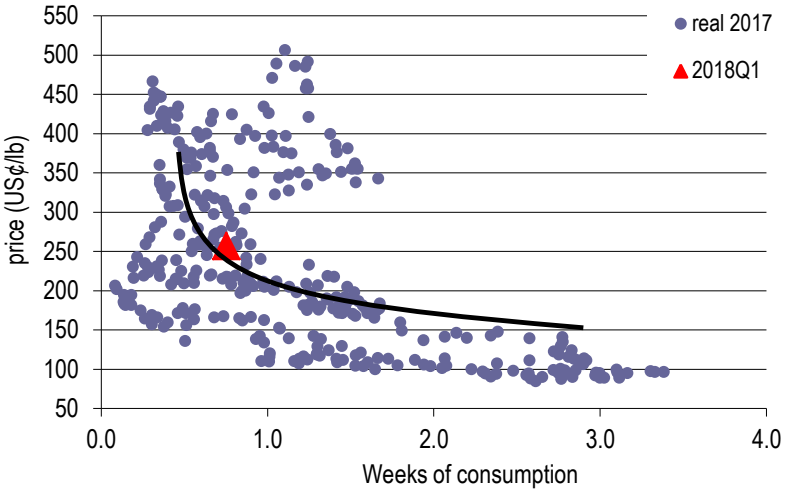
Forecasting Metals Prices: Copper Case Study

3 **Cost Curve & Inventories:** Costs help set a floor, Ceiling is more difficult to estimate

2019 Copper C1 Cash Cost Curve



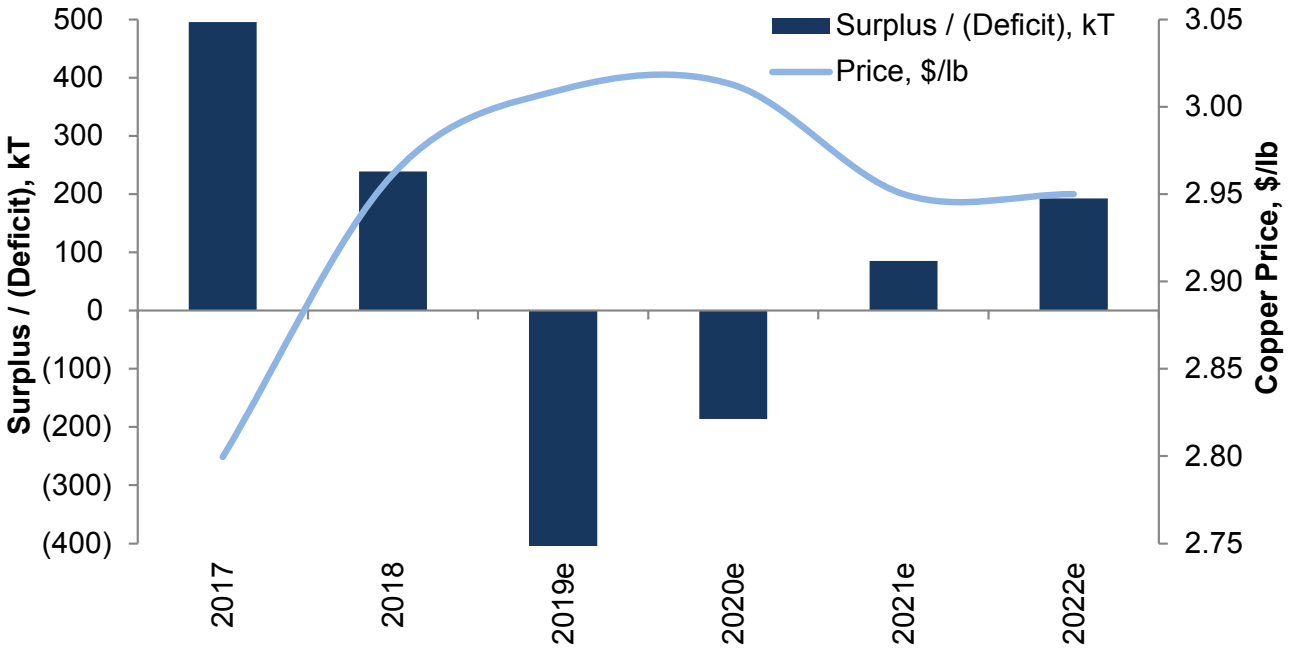




Source: Wood Mackenzie, MS Commodity Team's Forecasts: The Price Deck – 2Q 2019: Head Start

Forecasting Metals Prices: Copper Case Study

4 The supply-demand model determines if the market is heading towards a (bigger/smaller) surplus or (bigger/smaller) deficit, which determines directional pricing



Copper is a ~24 mnt (or 24,000 kT) market

Source: Bloomberg, Morgan Stanley Research Commodities Team estimates.

Investing in/Trading Metals & Mining Equities- Part 1

Two basic ways to model Metals & Mining companies:

- Metals & Miners: Volume * (Commodity Price – Cost)
- Converters: Sequential modeling assuming sensitivities to inputs

Hedging? Largely no for the key revenue driver.

Need a strong view on:

- Global economy (esp US and China)
- Price forecast, else link models to forward curves and MTM every day
- S/D models: Keep close eye on global supply
- Relevant political, country, and asset level risks

Not to forget:

- Beta to commodity (operating and/or financial leverage)
- Beta to market (NEM vs. ABX)
- Alpha

Investing in/Trading Metals & Mining Equities- Part 2

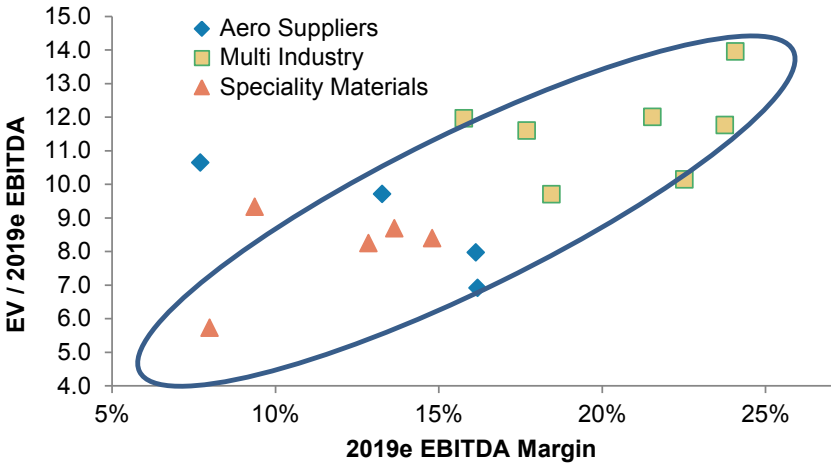
Miners trade cheaper than Industrials on EV/EBITDA

- Sustainable ROE, esp. if earnings stream are volatile
- Cash conversion can be lower
- M&A offsetting declining assets
- Mean reversion- capacity restarts/addition at higher prices
- Boom to bust cycles

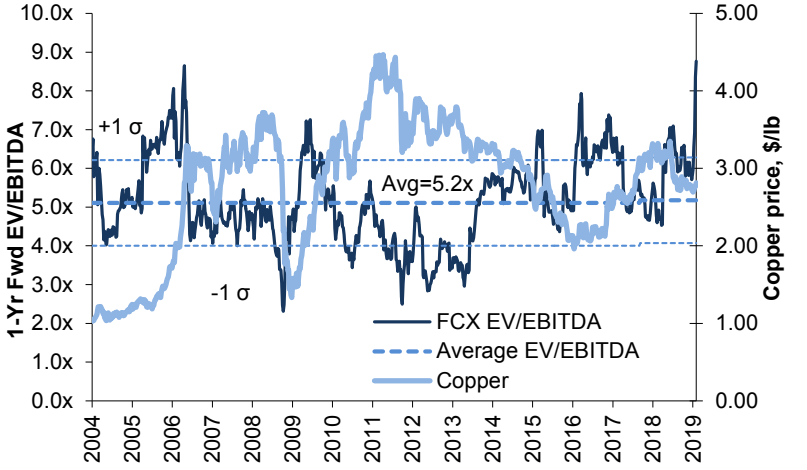
Valuation tools for metals/mining companies

- Multiples: Sustainable FCF yield is very relevant. EV/EBITDA expands with lower prices, contracts with higher prices.
- DCF/NAV: May or may not be the primary tool, typically gives upside to current market price
- Gold stocks: Valued using NAV, trade at a premium to other metals stocks because they have low/negative market beta and therefore a low WACC (~5%)

Correlations Between Margins and Multiples



When Copper Prices Rise, FCX's Multiple Contracts



Source: Thomson One, Morgan Stanley Research estimates.

Steel

Global Steel Market: Key Industry Themes

1. Global steel consumption is driven by urbanization. China is the largest producer and consumer of steel. Chinese steel consumption likely peaked in 2018, but ongoing stimulus will support a soft landing.

2. China's recent supply side reforms have raised utilization rates and lowered Chinese steel exports, helping global prices recover. Stricter environmental controls are keeping a lid on supply growth.

3. Prices of the two key raw materials– iron ore and metallurgical coal – have been higher than expected, which has helped prices. Mid to longer term, we expect raw material and finished steel pricing to decline.

Global Steel Market: Driven by Chinese Demand

- China is the largest producer and consumer of steel globally and urbanization is the biggest driver for demand.
- Chinese demand may have peaked, but we don't think it will fall off sharply.

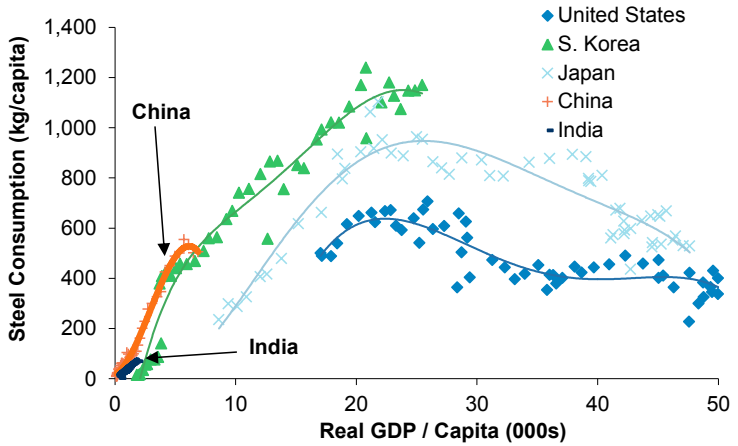
Top Suppliers

Country	2018 Supply
China	52%
EU-28	9%
N. America	7%
Japan	6%
Russia/CIS	6%
ROW	21%
Total (Mnt)	**1,796**

Top Consumers

Country	2018 Demand
China	50%
EU-28	10%
N. America	9%
Other APAC	5%
India	6%
ROW	21%
Total (Mnt)	**1,676**

Per capita demand in China seems to be leveling out



China Steel Consumption Index

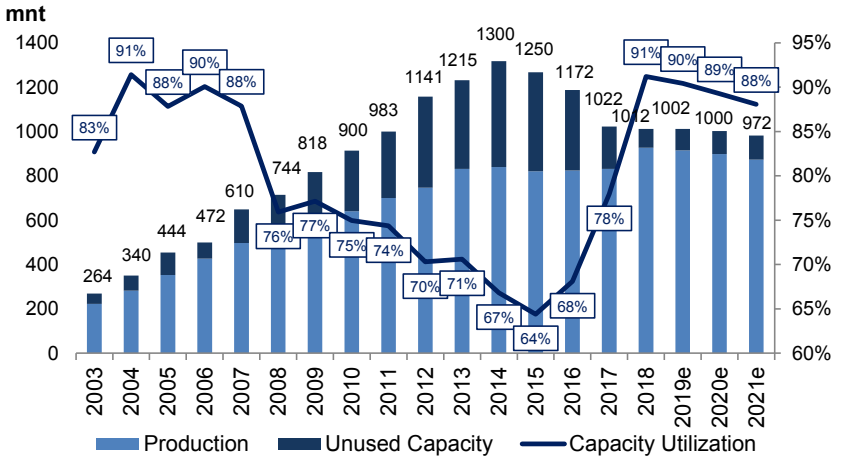
Key Drivers & Weightings	Jul-18	Aug-18	Sep-18	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	2017	1H18	2H18	2018	2019e
(YoY chg)													
Res Property - 24%	11%	3%	-1%	-1%	-4%	2%	-3%	-3%	**7%**	12%	22%	**17%**	**-7%**
Other Property - 15%	3%	0%	-18%	-13%	-13%	-6%	-6%	-6%	**24%**	4%	-9%	**-4%**	**-7%**
Infrastructure - 24%	6%	0%	3%	14%	1%	0%	10%	10%	**10%**	5%	5%	**5%**	**7%**
Machinery Sales -20%	30%	23%	12%	21%	7%	7%	1%	37%	**46%**	35%	16%	**26%**	**6%**
Auto sales - 6%	-4%	-4%	-12%	-12%	-14%	-13%	-16%	-14%	**4%**	5%	-10%	**-3%**	**2%**
Ship building - 2%	-9%	62%	-16%	33%	1%	-41%	-4%	-4%	**21%**	-29%	-3%	**-19%**	**-11%**
White goods sales - 2%	8%	-1%	-8%	-3%	-4%	7%	8%	4%	**16%**	8%	0%	**3%**	**-5%**
Other Industrial (PMI) - 7%	1%	1%	1%	0%	0%	-1%	-1%	-1%	**2%**	1%	0%	**1%**	**0%**
Steel Consumption Index	**10%**	**8%**	**5%**	**3%**	**1%**	**1%**	**-1%**	**2%**	**17%**	**9.9%**	**6.7%**	**7.9%**	**-0.7%**
Steel Appt. Consumption	**13%**	**10%**	**11%**	**15%**	**16%**	**16%**	**6%**	**2%**					

Source: World Steel Association, World Bank, CEIC, NBS, IISI, CRU, Bloomberg, Morgan Stanley Research. Note: Per capita demand data refers to crude steel equivalent

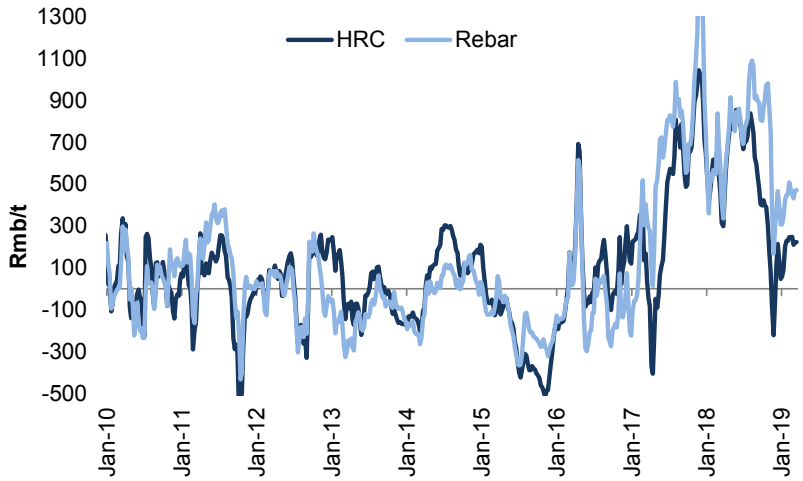
Global Steel Market: China Environmental Controls

- Steel industry reform was a top priority in China in 2017 and helped significantly improve utilization rates and gross profits, in addition to lowering China's net exports
- Lower Chinese steel exports, and healthier margins, have boosted global steel pricing
- Now China's focus has turned from capacity reform to environmental controls. Net new capacity additions are modest.

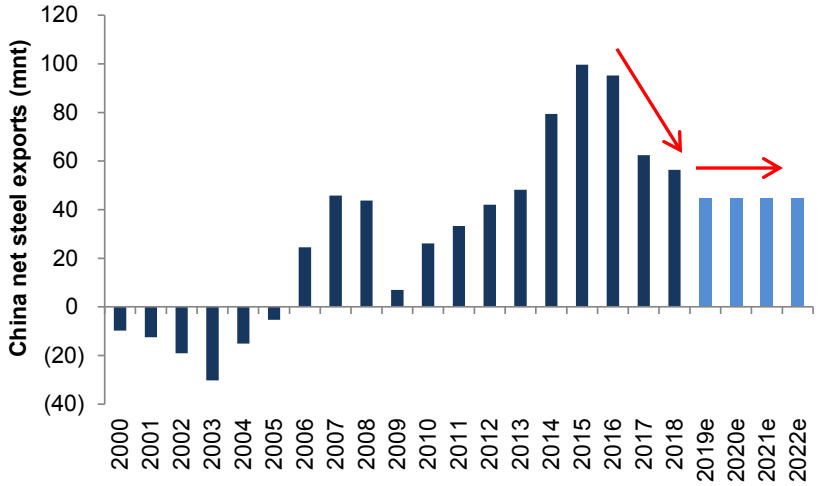
Crude Steel Capacity, Production and Utilization



MS estimated GP/t for Mills (Spot)



China Steel Product Net Exports



Source: Mysteel, NDRC, MIIT, Morgan Stanley Research.

US Steel Market: Key Industry Themes

1. Section 232 duties (25%) have raised US steel prices but appear temporary. However, it has encouraged permanent capacity additions, raising concerns of oversupply. New, lower cost capacity will likely take share from both older assets and imports.

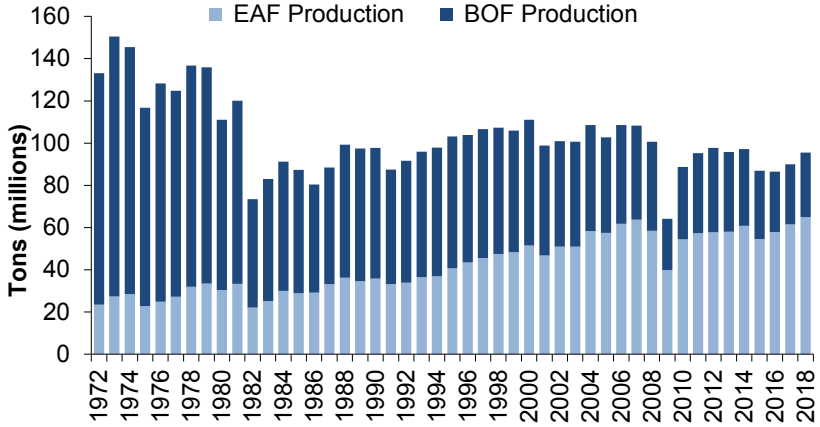
2. US domestic steel prices are set by local supply/demand and also dependent on price of imported product. Import arbitrage price acts as an important price ceiling.

3. For US demand side, construction is the largest end market, and could benefit from higher Infrastructure spending in the future

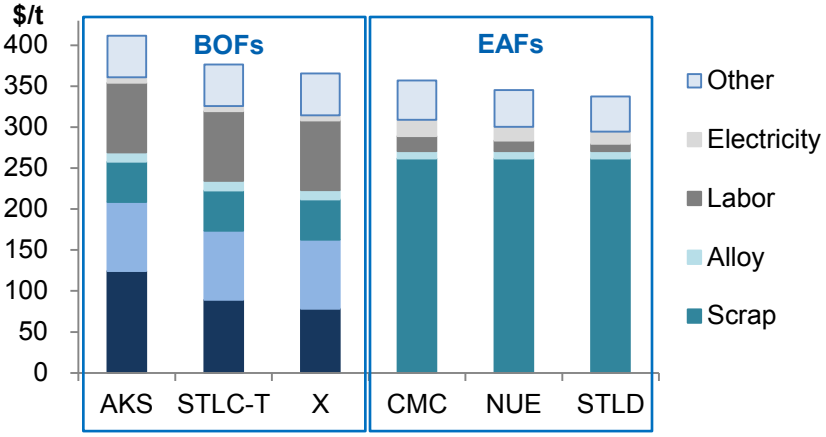
EAFs Continue to Take Market Share from BOFs

- Production from Electric Arc Furnaces (EAF, ferrous scrap + electricity) has been gaining market share from Blast Furnaces (BOF, iron ore + coking coal) in the US
- Older, higher cost assets are less competitive and likely to lose market share to the new, low cost capacity coming in
- But even uncompetitive assets can change hands several times before permanently closing

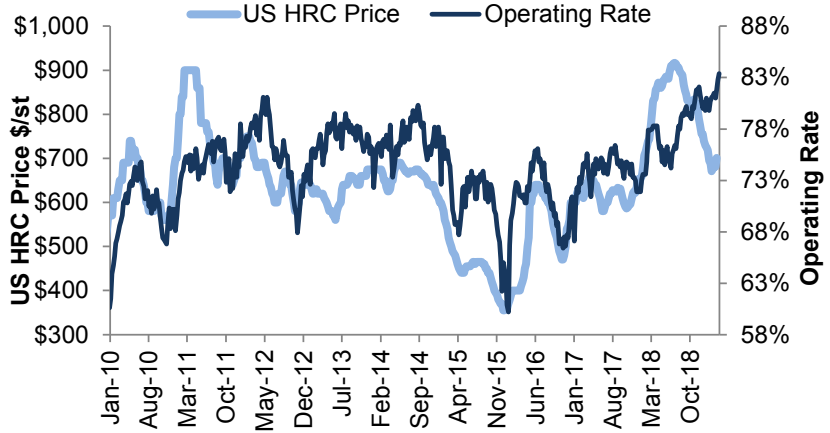
EAF-Based Production Has Been Taking Share in the US



Theoretical Mill Level Cash Costs Per Ton Across Our Steel Coverage

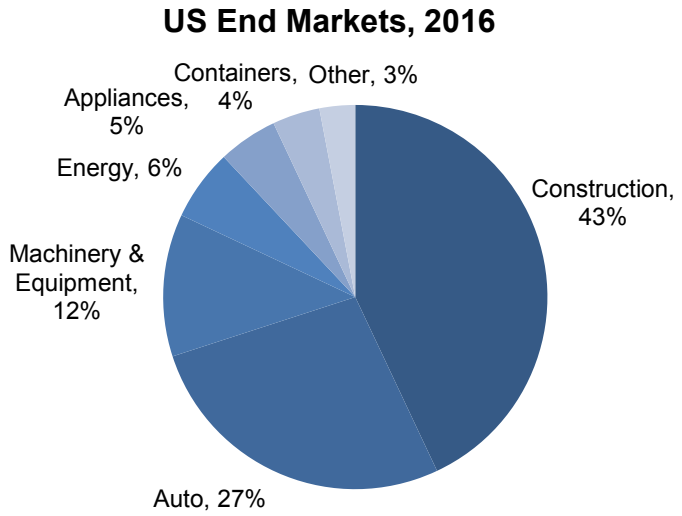


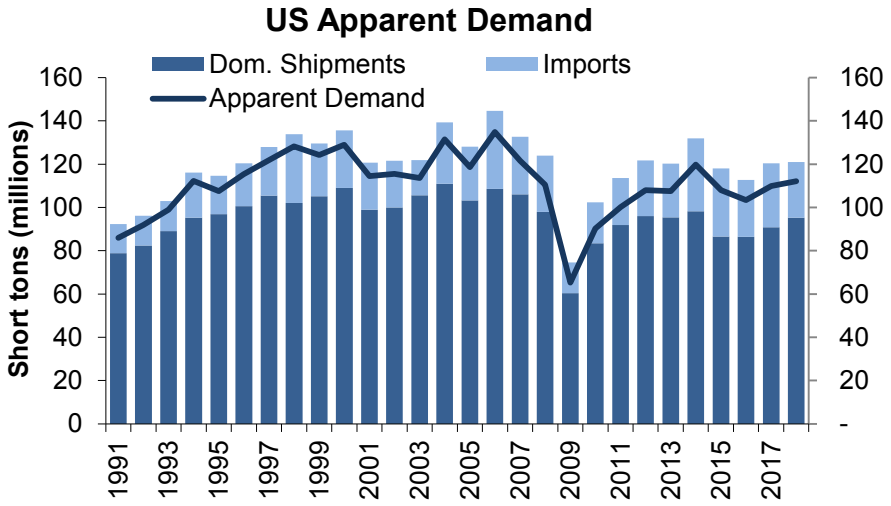
US Capacity Utilization vs HRC Price



Source: AISI, Bloomberg, Company data, Morgan Stanley Research estimates.

US Steel Market: Demand



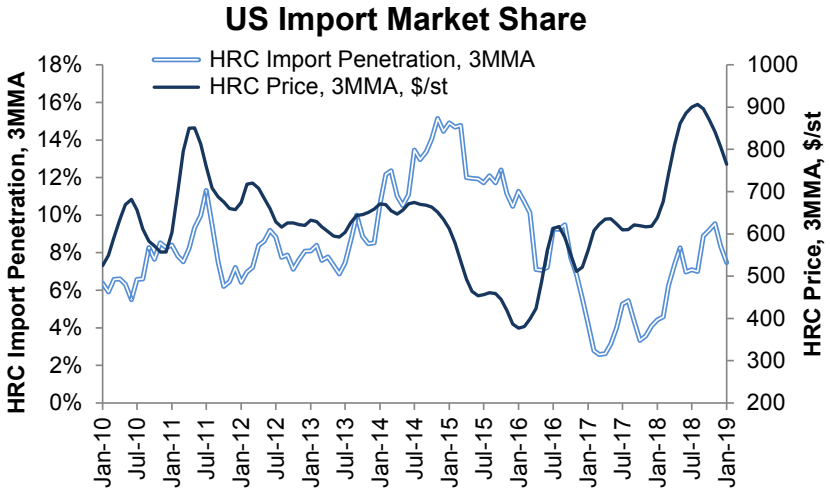


End-Market Exposure by Company	AKS	STLC-T	X	CMC	NUE	STLD
Service Center	15%	52%	15%	-	-	-
Automotive	63%	1%	12%	-	12%	14%
Industrial / Energy	22%	37%	-	7%	35%	46%
Construction	-	-	15%	57%	45%	40%
Containers	-	-	7%	-	-	-
Other	-	11%	51%	36%	8%	-

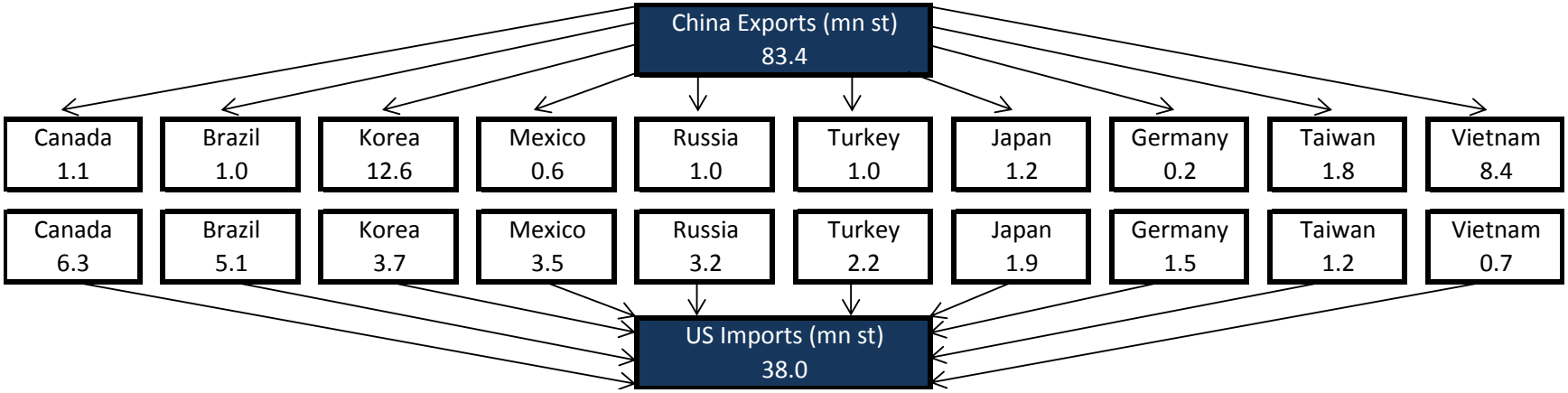
Source: AISI, Company data, Morgan Stanley Research estimates.

Section 232 Tariffs Sent US Prices to Record Highs

- Tariffs of 25% on worldwide imports of steel products, on the basis of a threat to the US national security
- Investigation was concluded in February 2018, and tariffs announced March 2018; some countries were under temporary exemptions through June 2018
- Chinese steel exports effectively end up displacing a lot of steel production in large markets, which may then push their local production towards the US

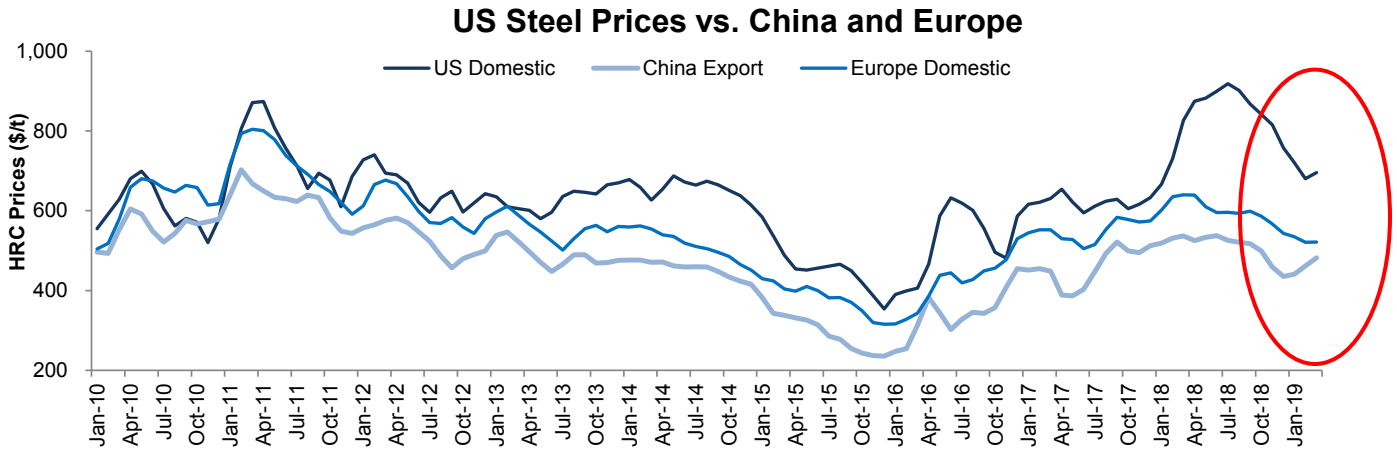


China is the Largest Steel Exporter, US is the Largest Steel Importer



Source: SBB, Department of Commerce, U.S. Census Bureau, Morgan Stanley Research. *HRC = Hot Rolled Coil. Bottom chart shows 2017 import/export data.

Higher Prices Have Encouraged Capacity Additions in the US



Steelmaking Capacity Additions Announced in the US

Company	Location	2018e	2019e	2020e	2021e	2022e	Total
Flat Products Capacity Expansions, kt							
US Steel	Granite City, IL	2,800					
JSW / Acero Junction*	Mingo Junction, OH		1,600				
Big River*	Osceola, AK			1,650			
JSW	Baytown, TX			1,000			
Nucor	Gallatin / Ghent, KY				1,400		
Steel Dynamics	Southwest US				3,000		
Nucor	Midwest US					1,200	
BlueScope North Star*	Delta, OH					1,000	
JSW / Acero Junction*	Mingo Junction, OH					1,000	
Total		**2,800**	**1,600**	**2,650**	**4,400**	**3,200**	**14,650**
Long Products Capacity Expansions, kt							
Comercial Metals	Durant, OK	350					
Liberty House*	Georgetown, SC	551					
Nucor	Sedalia, MO			350			
Nucor	Frostproof, FL			350			
US Steel	Fairfield, AL			1,600			
Total		**901**	**0**	**2,300**	**0**	**0**	**3,201**
Total Capacity Expansion, kt		**3,701**	**1,600**	**4,950**	**4,400**	**3,200**	**17,851**

US Steel Industry – Pre Section 232

2017 Key Statistics	mnt
Domestic shipments	90.9
Imports (ex semi-finished)	29.6
Exports	10.2
Apparent Demand	109.9
Capacity	121.8
Capacity utilization	73.9%

Current capacity utilization: >80%

Source: SBB, AISI, AMM, Company data, Morgan Stanley Research, *For non-covered companies, data is based on publically available information.

US Steel Market Has Trade Barriers Beyond Section 232

- Total duty= Anti-dumping + Countervailing + Section 232.
- While Section 232 has dominated headlines in 2018, the US has other import duties on several steel products
- The top steel exporters to the US include Canada, Brazil, South Korea, Mexico, and Russia
- Many of these countries have been subject to antidumping and countervailing duties on steel imports to the US

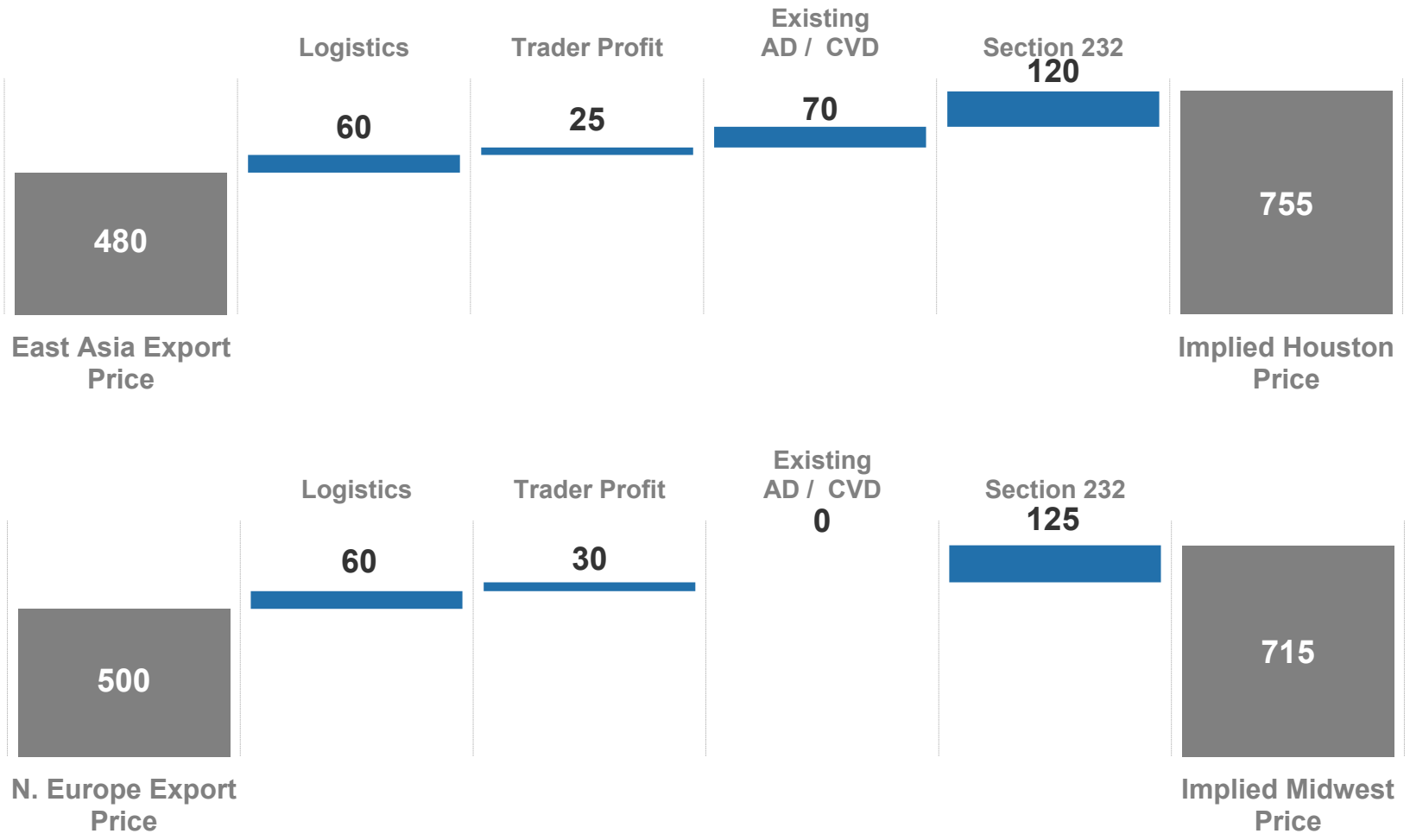
Steel Product	Anti-Dumping Duties		Countervailing Duties	
	min	max	min	max
Hot Rolled	4%	34%	4%	59%
Cold Rolled	5%	266%	4%	256%
Corrosion resistant	3%	210%	0%	241%
Plate	4%	148%	4%	251%
OCTG	0%	118%	4%	20%
Rebar	0%	209%	1%	16%
GOES	4%	242%	128%	128%

Top Hot Rolled Coil Exporters to the US

Country	Average HRC* Antidumping Duty	Average HRC* Countervailing Duty
Russia	129%	-
China	91%	-
Indonesia	48%	10%
India	40%	552%
Brazil	34%	11%
Taiwan	25%	-
Thailand	12%	2%
Korea	7%	-
Turkey	6%	6%
Japan	6%	-
Netherlands	4%	-

Source: Department of Commerce, U.S. Census Bureau, Morgan Stanley Research. *HRC = Hot Rolled Coil

Imports Help Set a Ceiling for US Steel Pricing

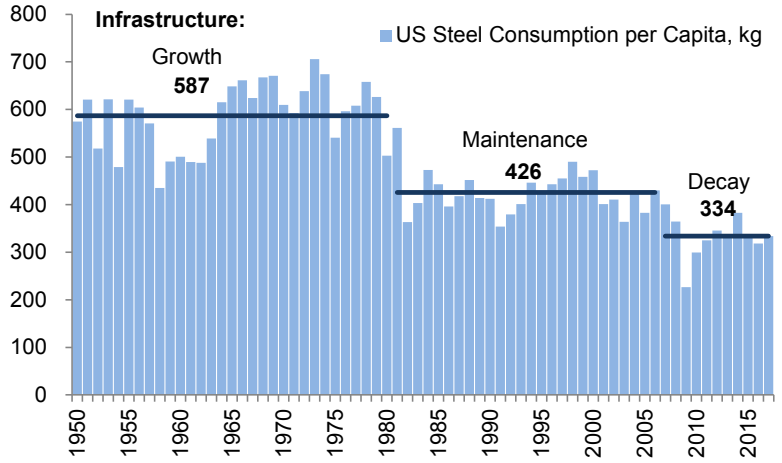


Source: Morgan Stanley Research estimates. Note: Prices are in $/short ton as of April 10, 2018. Calculated for commodity grade Hot Rolled Coil (HRC) .

US Steel Market: US Infrastructure is Due for a Refresh

- Higher infrastructure spending would drive direct steel shipments to construction and second order benefits from higher demand from autos, machinery, general engineering etc.
- We estimate that every $100 bn of construction put in place will consume ~4 mnt of steel
- That is a ~4% increase in demand vs. 2017
- Higher demand could lead to greater pricing power and improved EBTIDA margins

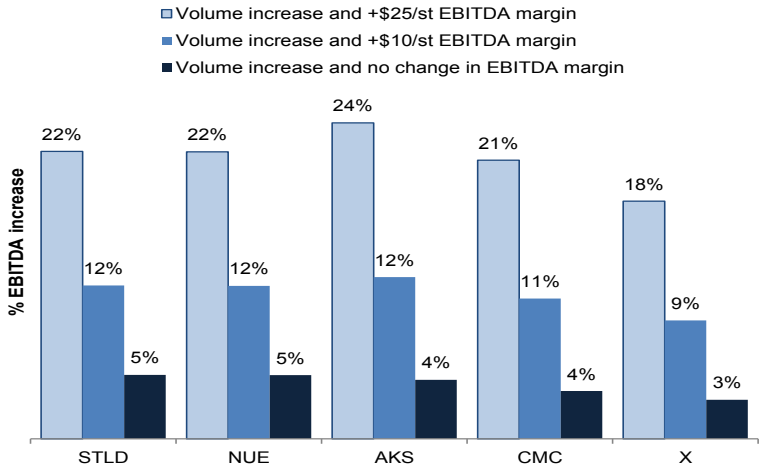
Steel Demand in the US is Below Historical Levels



An Infrastructure Package Could Lift Annual Steel Demand by 4%

Case	Amount over 10-Year Period	Total Steel Demand, mn st	Period, Years	Demand/ Year, mn st	% Increase in Demand vs. 2017
Bull Case	$2.4 trillion	84.0	10	8.4	8%
Base Case	$1.1 trillion	38.5	10	3.9	4%
Bear Case	$0	0.0	10	0.0	0%

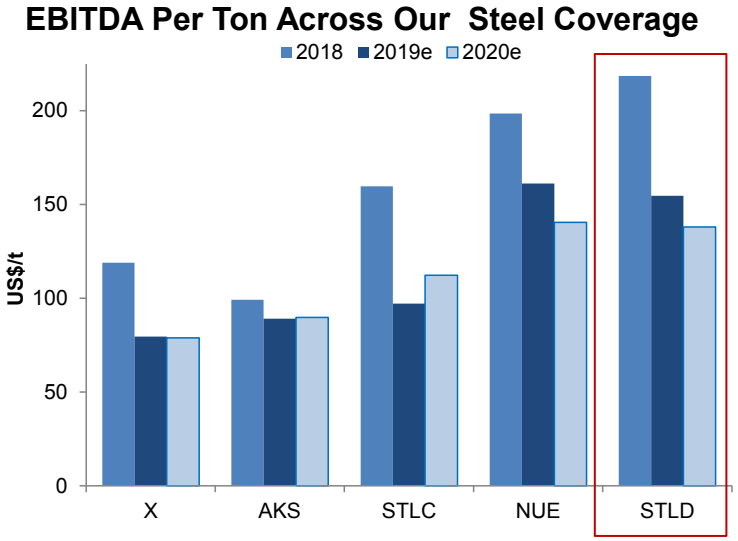
With $1.1 tn of Infrastructure Spending, Steelmakers Could Benefit From EBITDA Margin Improvement Relative to Our 2020e

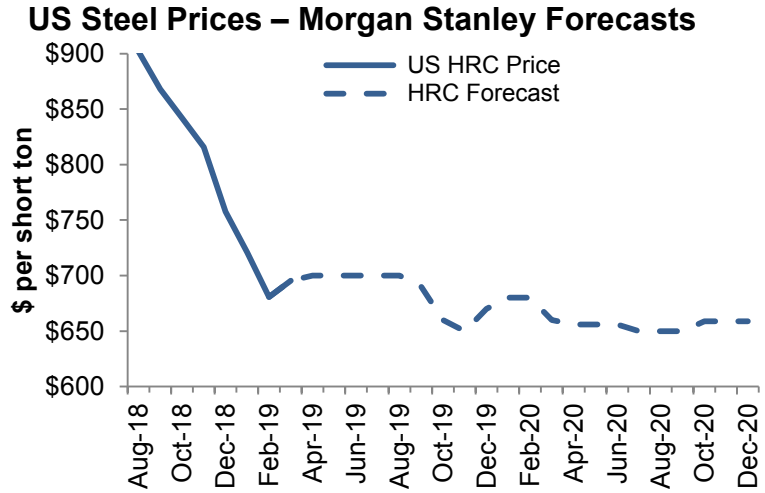


Source: AISI, U.S. Census Bureau, Company Data, World Steel Association, Morgan Stanley Research estimates

Steel Dynamics Is Our Top Pick in the Steel Space

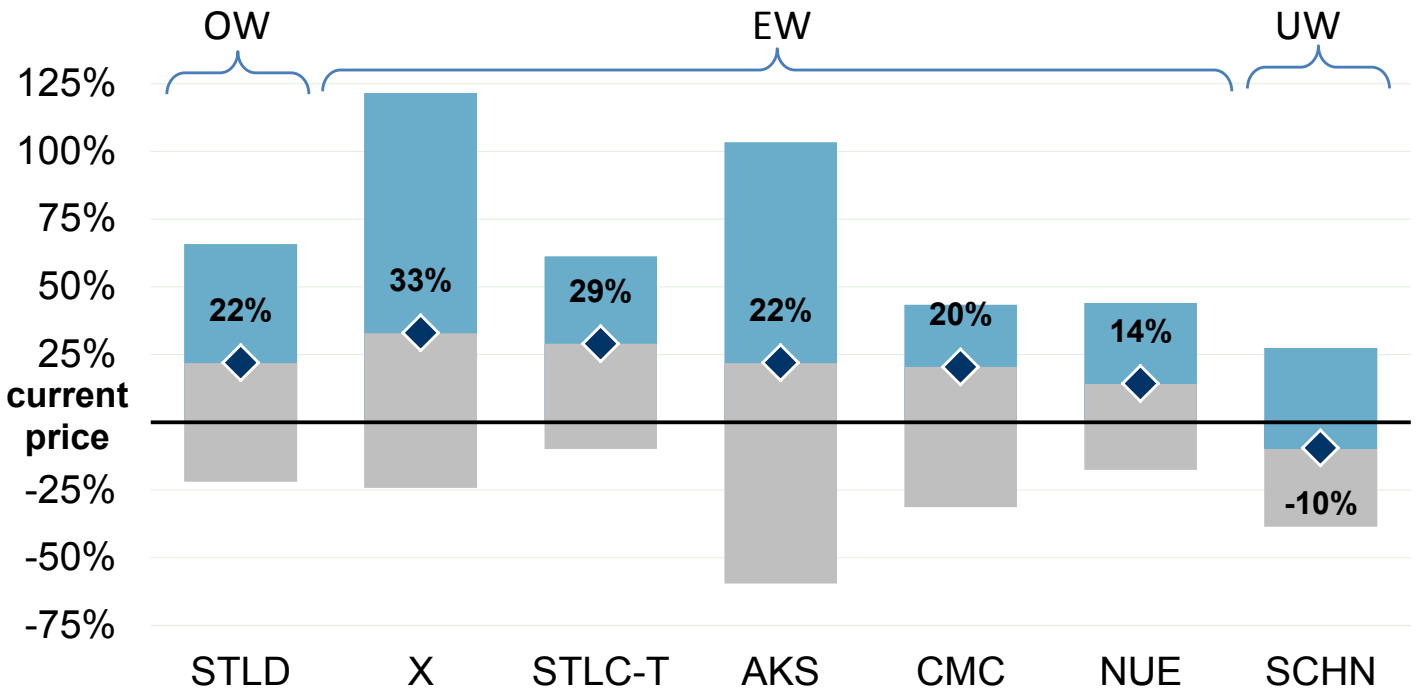
- PT of $39 for ~20% upside
- Levered to short term pricing cycles
- Stable and predictable earnings stream
- Moving further and further downstream to improve through-cycle EBITDA/ton
- Offers good downside protection





Source: SBB, Thomson Reuters, Company data, Morgan Stanley Research.

Risk Reward Across US Steelmaking Coverage



Source: Thomson One, Morgan Stanley Research estimates. Note: As of 4/29/2019 close

Investment Thesis – Steel Coverage

Steel Dynamics (STLD): Low cost producer earns above cost of capital through the cycle. OW

- Ability to weather all points in the cycle with a variable cost structure. Conservative balance sheet and strong liquidity

Nucor (NUE): Defensive mini-mill play. EW

- Earnings levered to construction, manufacturing and auto end markets. Defensive balance sheet and strong liquidity

Commercial Metals (CMC): Construction levered rebar maker. EW

- Strongly levered to nonresidential construction activity. Gaining synergies and improving through cycle profitability at some recently acquired long product assets. Would be a key beneficiary of any US infrastructure plan

US Steel (X): Highly levered play on steel prices. EW

- Facing production/costs challenges from ongoing asset revitalization programs. High beta play on the steel market. Challenged by rising steel supply domestically.

AK Steel (AKS): Levered value-added steel play. EW

- Weaker demand from autos and electrical steel could be a drag. Challenged by rising steel supply domestically.

Stelco (STLC-T): Canada-based Low Cost Operator. EW

- Working to regain share in the North American automotive market.

Schnitzer Steel (SCHN): Pure-play scrap and auto parts recycler with an export focus. UW

- Downside pressure to margins from weaker international scrap fundamentals.

Metals & Bulks

Metals & Bulks: Key Industry Themes

1. Prefer copper among all base metals. Mine production declines this year and demand growth above 0% is sufficient to tighten the market. Chinese demand fundamentals are improving since the stimulus over last 6-9 months.

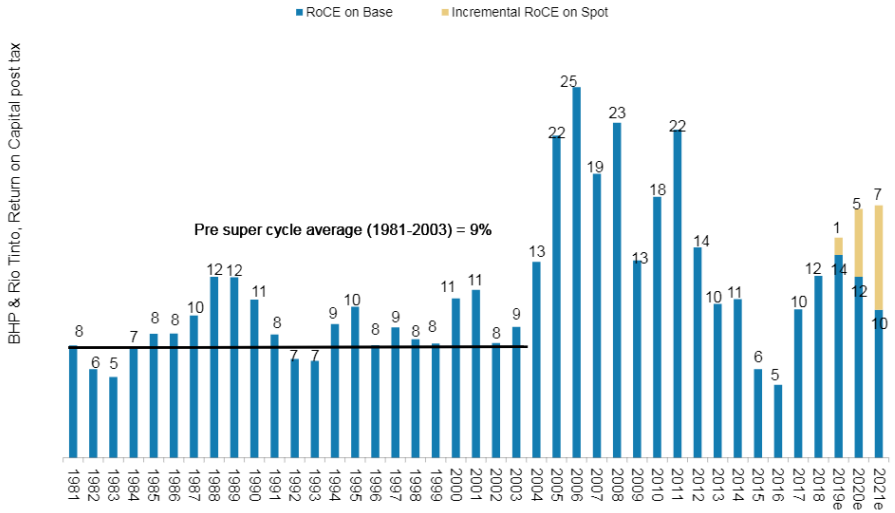
2. Longer term, Electric Vehicles become a bigger driver of demand growth for copper & aluminum, but near term benefit is limited

3. Gold- flight to safety in growth slowdown as real rates start decline

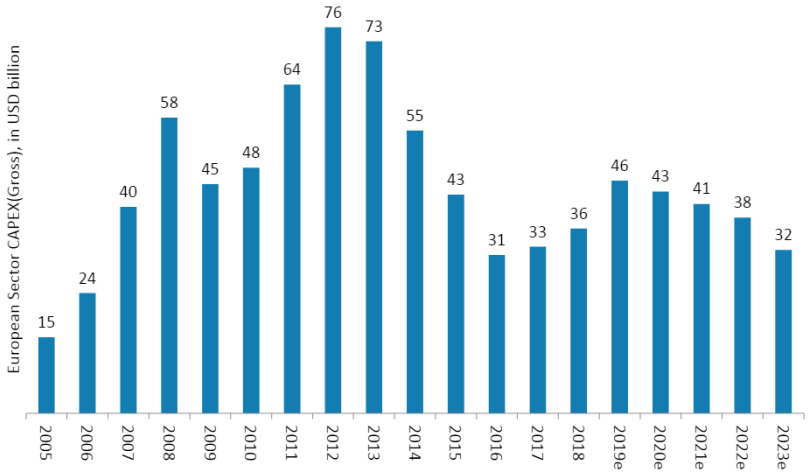
4. Bulks (iron ore, met coal, thermal coal) are least preferred since Chinese demand peak is likely behind us

Mining Cycle Continues Its Recovery

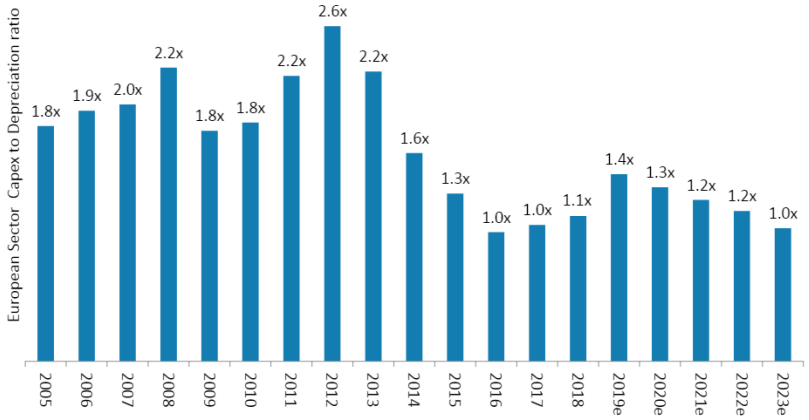
- Mining cycle continues to recover from 2015-16 lows
- The global team forecasts rising capex through 2019 followed by a slow decline
- Upside potential to capex forecasts if commodity prices stay high/accelerate
- Falling net debt-to-EBITDA over the next five year period



Mining Capex



Mining Companies Net Debt to EBITDA

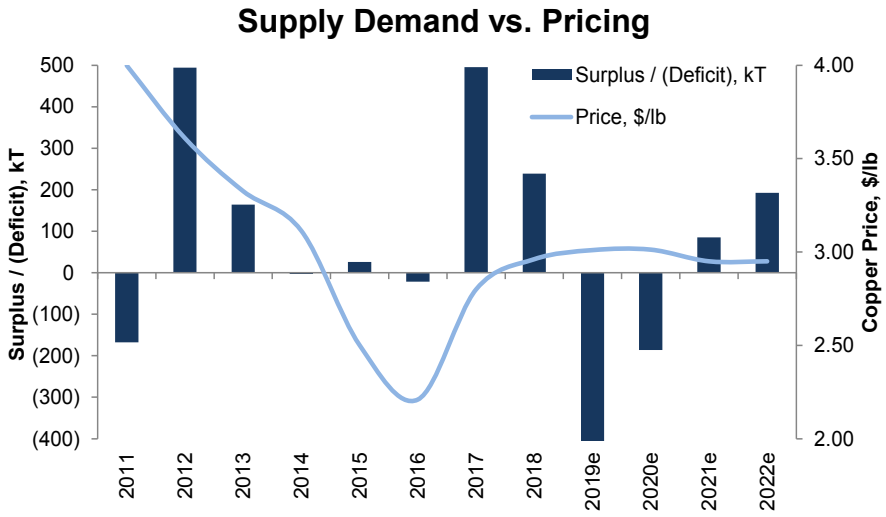


Source: Company Data, Morgan Stanley Research estimates. Note: Data is for European listed Metals & Mining Companies

Copper Market is in a 2-Year Deficit

We forecast a long-term price of $3.15/lb (nominal) in 2024 vs. spot below $3.00/lb

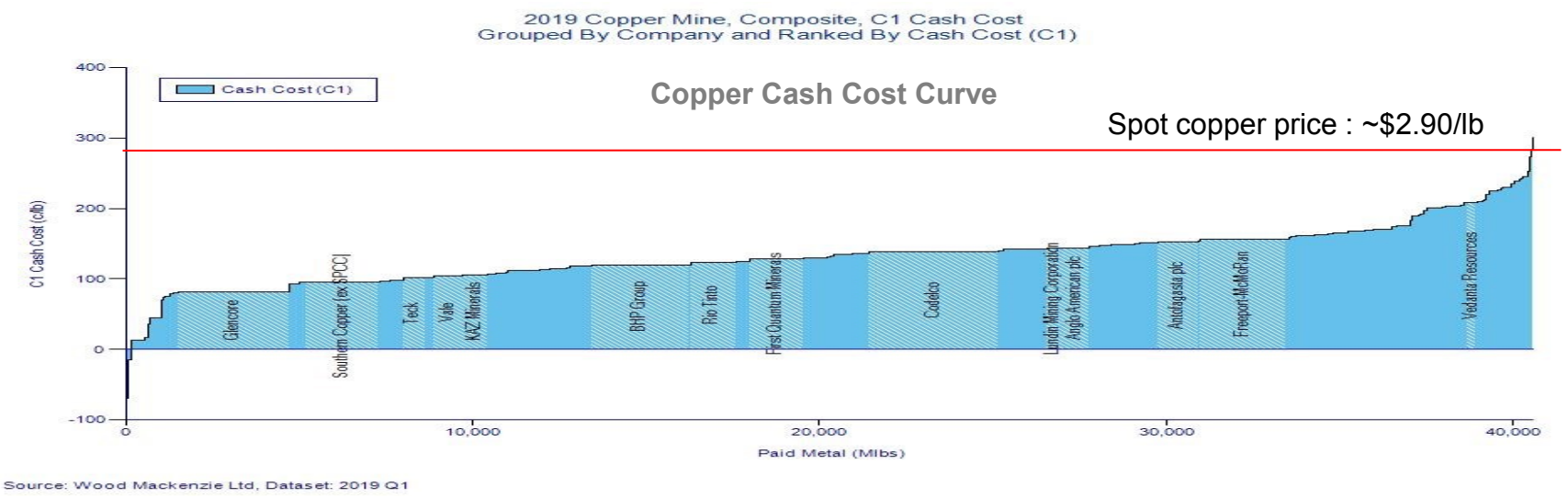
- Copper is one of the more challenging metals to mine, which hampers supply growth.
- In general, demand growth for copper is modestly below other metals as a result of substitution
- Expect a 2.4% fall in global mine supply this year
- Expect demand growth of 1.6% (China at 1.5% assuming a soft landing)
- Downside risk is limited – flat demand growth would result in a balanced market
- MS is more bullish than the Street





Source: Bloomberg, MS Commodity Team's Forecasts: The Price Deck – 2Q 2019

China is ~1/2 of Copper Demand, but ~1/10 of Production



Source: Wood Mackenzie Ltd, Dataset: 2019 Q1

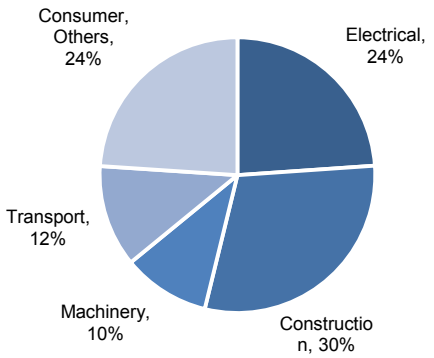
Top Suppliers

Country	2018 Mine Supply
Chile	28%
Peru	12%
China	8%
USA	6%
DRC	6%
ROW	40%
Total (kT)	**20,822**

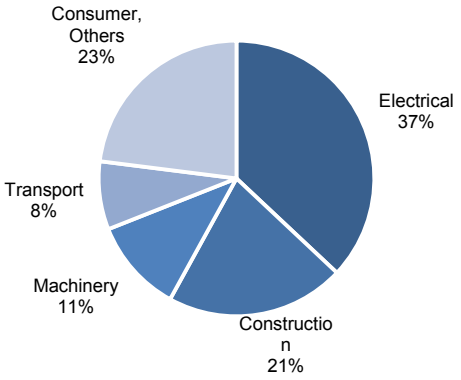
Top Consumers

Country	2018 Refined Demand
China	49%
USA	7%
Germany	5%
Japan	4%
South Korea	3%
ROW	31%
Total (kT)	**23,478**

Global End Markets



China End Markets



Source: Wood Mackenzie, MS Commodity Team's Forecasts: The Price Deck – 2Q 2019: Head Start

Key Metals Required to Meet Demand from EVs

Metal	Electic Vehicles (EV)				Infrastructure	
	Battery	Wiring	Drivetrain	Auto Body	EV Charging	Power Grid
Lithium	✓					
Cobalt	✓					
Nickel	✓					
Copper	✓	✓	✓		✓	✓
Aluminum		✓		✓	✓	✓
Steel				✓	✓	✓
Electrical Steels			✓			✓

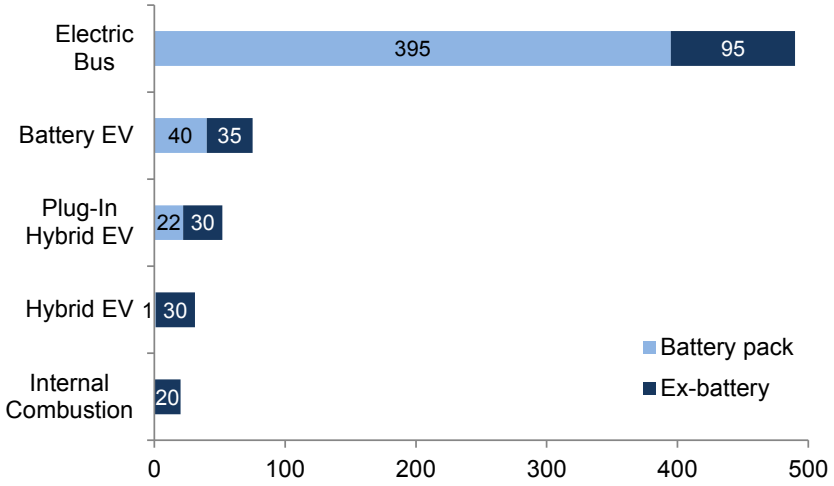
Source: Morgan Stanley Research

Copper and Aluminum Should Benefit from EV Demand

Copper – Batteries could be 4% of the market in 2025. Competition from aluminum in wiring

Aluminum – Beneficiary of light-weighting and charging/grid infrastructure

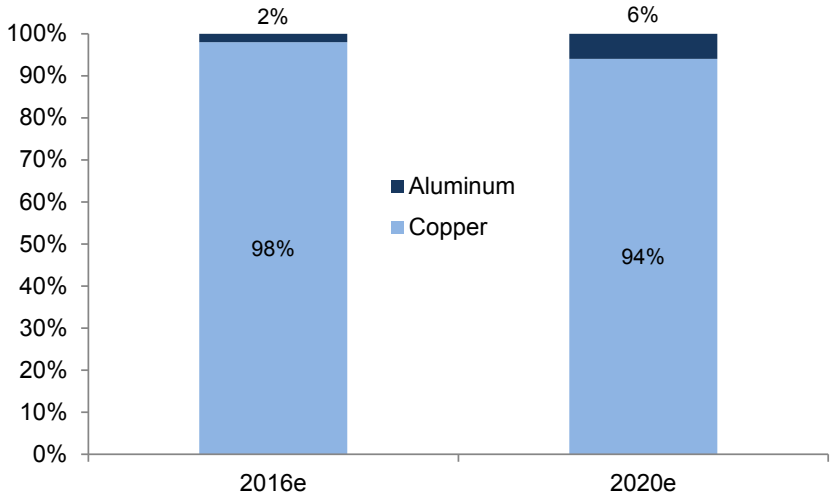
Copper Consumption by Vehicle Type (kg/vehicle)



Companies with Material Exposure

Positive Exposure	Negative Exposure
Glencore, GLEN- LN (Cu, Co, Ni)	Anglo Platinum, AMS-SJ (PGMs)
Sumitomo, 5713- JT (Cu, Ni, Co)	
China Moly, 603993-CH (Cu, Co)	**Mixed Exposure**
Freeport, FCX-US (Cu, Co)	Norilsk, MNOD-LI (Ni, Cu, Co, PGMs)
Tianqi Lithium, 002466-CH (Li)	Anglo American, AAL-LN (Cu, Ni, PGMs)
Mineral Resources, MIN- AU (Li)	
AK Steel, AKS-US (Electrical Steel)	

Copper Faces Some Substitution Threats in Wiring



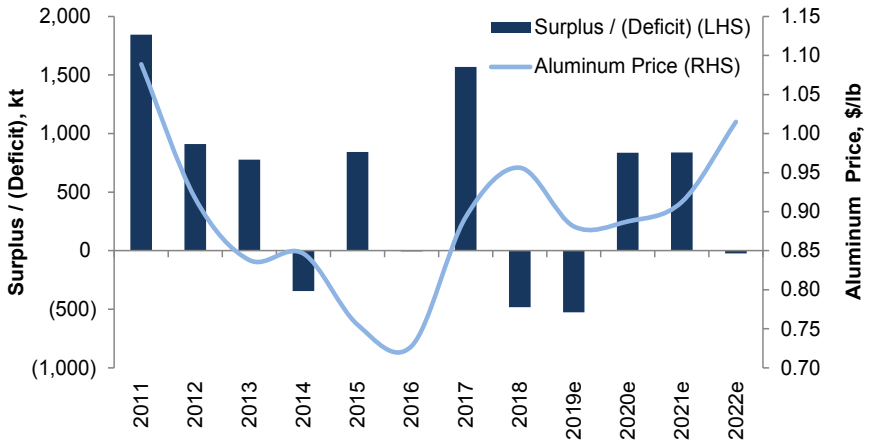
Source: International Copper Association, Morgan Stanley Research
Copper stocks will also benefit from EV-related infrastructure-build. Light-weighting is an important part of the process to extend the driving range offered by electric vehicles.

Aluminum- Better Fundamentals Longer Term

We forecast a long-term price of $1.06/lb (nominal) in 2024 vs. spot below $0.90/lb

- Aluminum demand typically tracks ahead of GDP as the metal continues to take share from steel and copper.
- The aluminum cost curve is heavily tied to power (coal) and crude oil costs.
- Aluminum's bearish combination of weak demand, excess supply, and high inventory have kept price below the marginal cost of production
- China's inventory is rising due to new supply entering the market, offsetting temporary cuts made by some producers, keeping output above year-ago levels

Supply Demand vs. Pricing



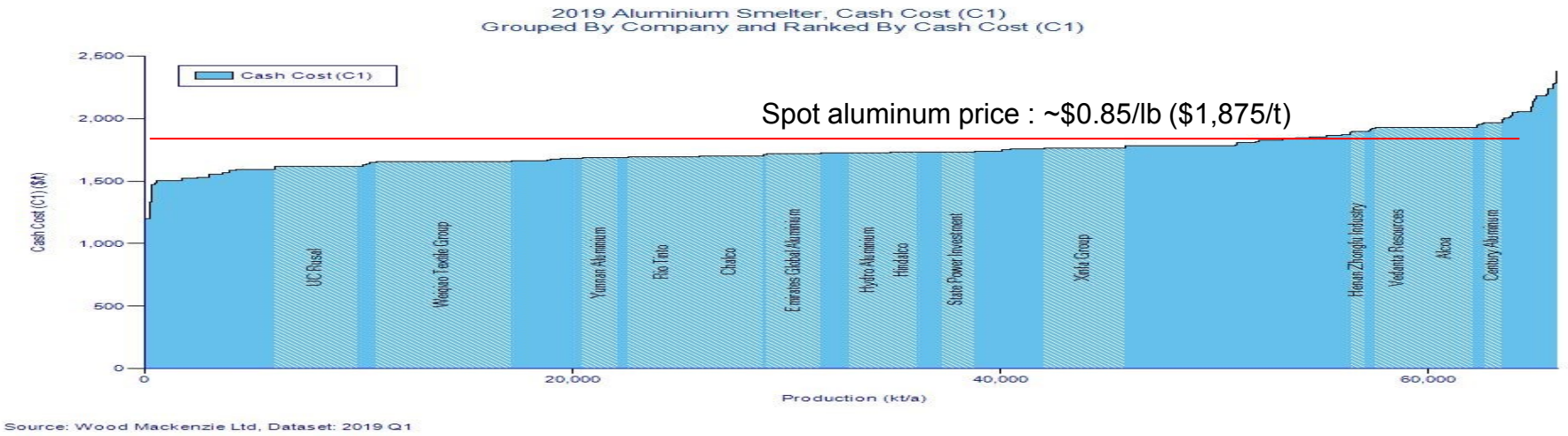
Aluminum Price Over Last 10 Years



Source: Bloomberg, MS Commodity Team's Forecasts: The Price Deck – 2Q 2019

Some Aluminum Companies Are Currently Unprofitable

Aluminum Cash Cost Curve



Source: Wood Mackenzie Ltd, Dataset: 2019 Q1

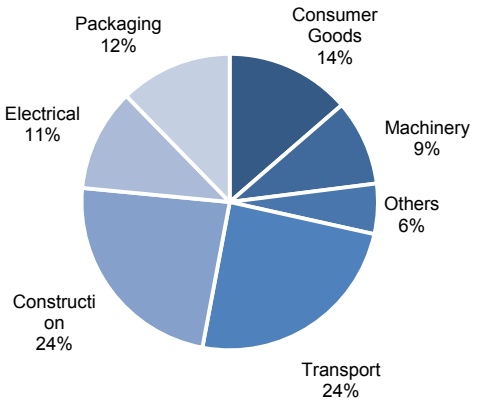
Top Suppliers

Country	2018 Smelter Production
China	57%
Russia	6%
Canada	4%
India	6%
Australia	2%
ROW	24%
Total (kT)	**64,338**

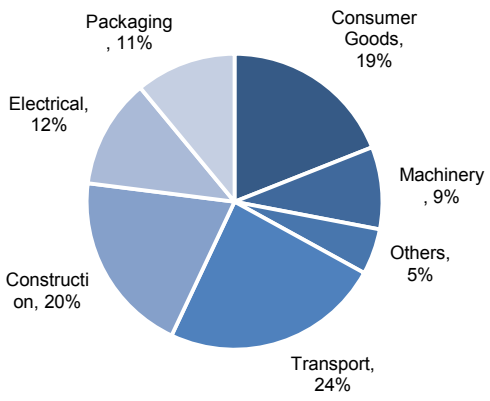
Top Consumers

Country	2018 Primary Demand
China	54%
USA	9%
Germany	3%
Japan	3%
India	4%
ROW	26%
Total (kT)	**64,821**

Global End Markets



China End Markets



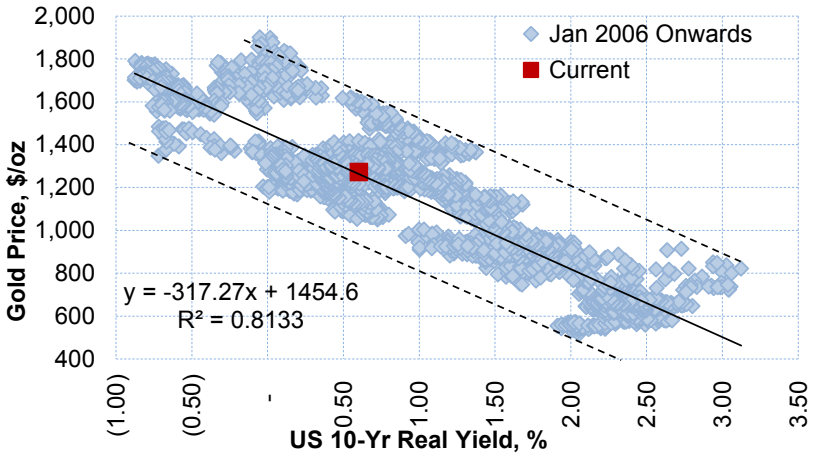
Source: Wood Mackenzie, MS Commodity Team's Forecasts: The Price Deck – 2Q 2019: Head Start

Gold- Driven by Real Rates

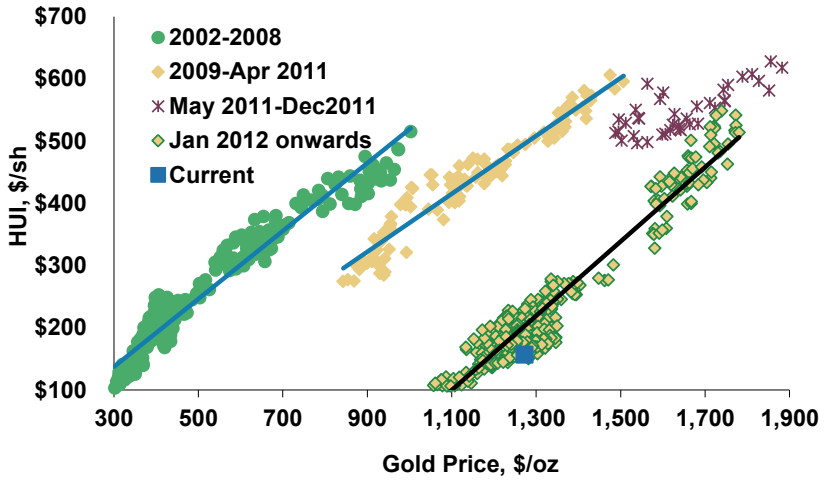
Ways to Invest in Gold

- Physical
- Physical backed ETF
- Gold miners (Stock-picker's market)
- Gold royalty/streaming companies
- Gold levered ETF

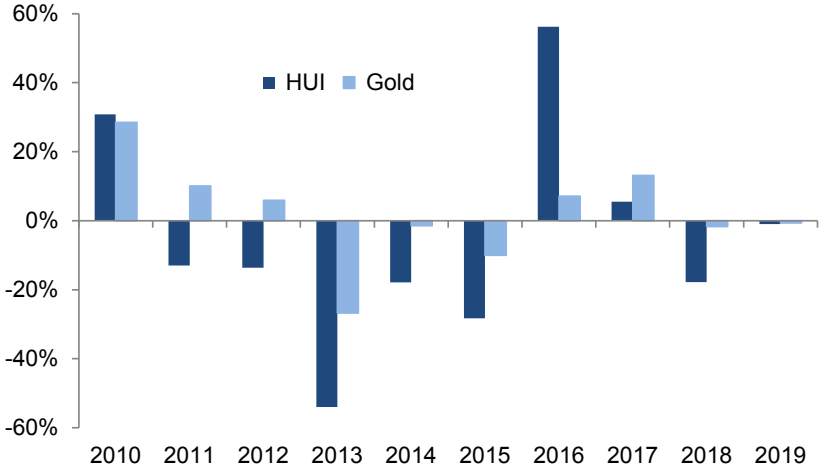
Gold vs. Real Yields



Gold Equities (HUI) Have De-rated vs. Historical Levels



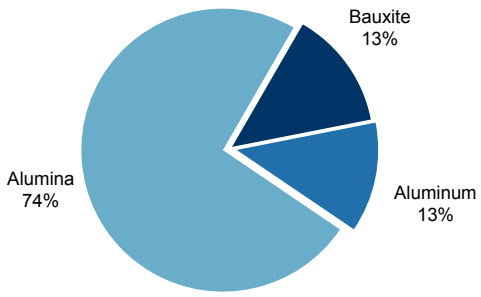
Gold Equities Yearly Performance vs. Gold



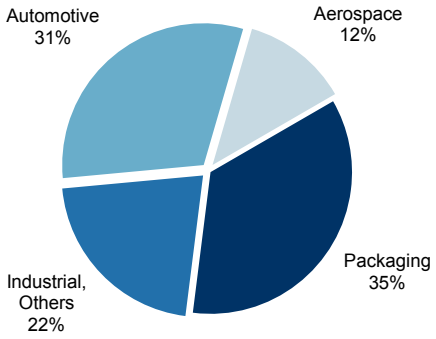
Source: Bloomberg, Thomson Reuters, Morgan Stanley Research

Revenue by Key End Markets/Commodities

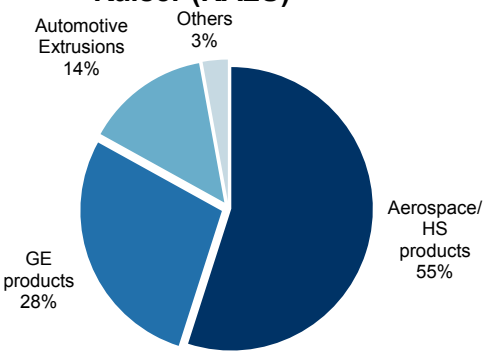
Alcoa (AA)



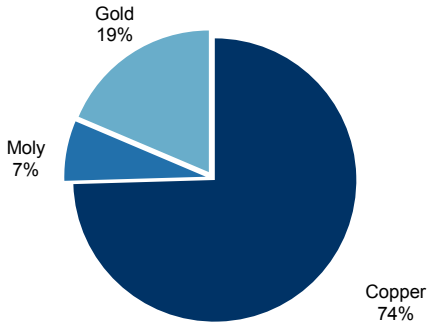
Constellium (CSTM)



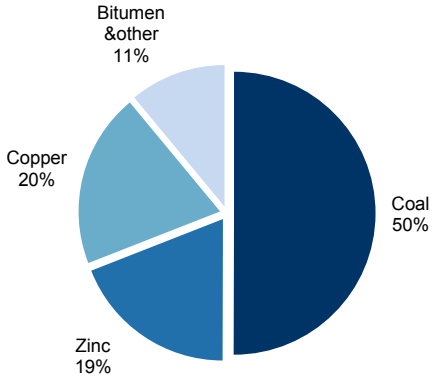
Kaiser (KALU)



Freeport (FCX)



Teck Resources (TECK)



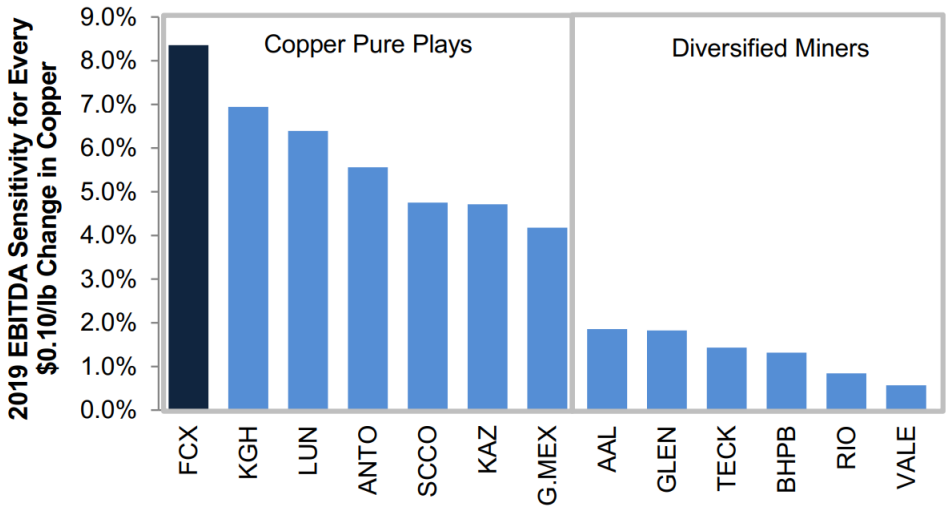
Source: Company Data, Morgan Stanley Research. Note: AA above shows EBITDA by commodities, TECK, KALU, FCX, and CSTM show Revenue by end markets/commodities

Freeport McMoRan Is Our Top Pick

OW: $14 PT for ~15% Upside

- Peer-leading earnings sensitivity to copper
- Indonesia mining contract risks are gone since Indonesia now gets 75% of mine economics
- In 2019, Indonesian mine is transitioning from open pit to underground
- FCX already reset 2019-20e expectations lower. Volume/cost disappointments are behind us
- With acrimonious government and labor relations behind them, FCX should start delivering near guidance again

FCX Leads Peers in Copper Price Sensitivity



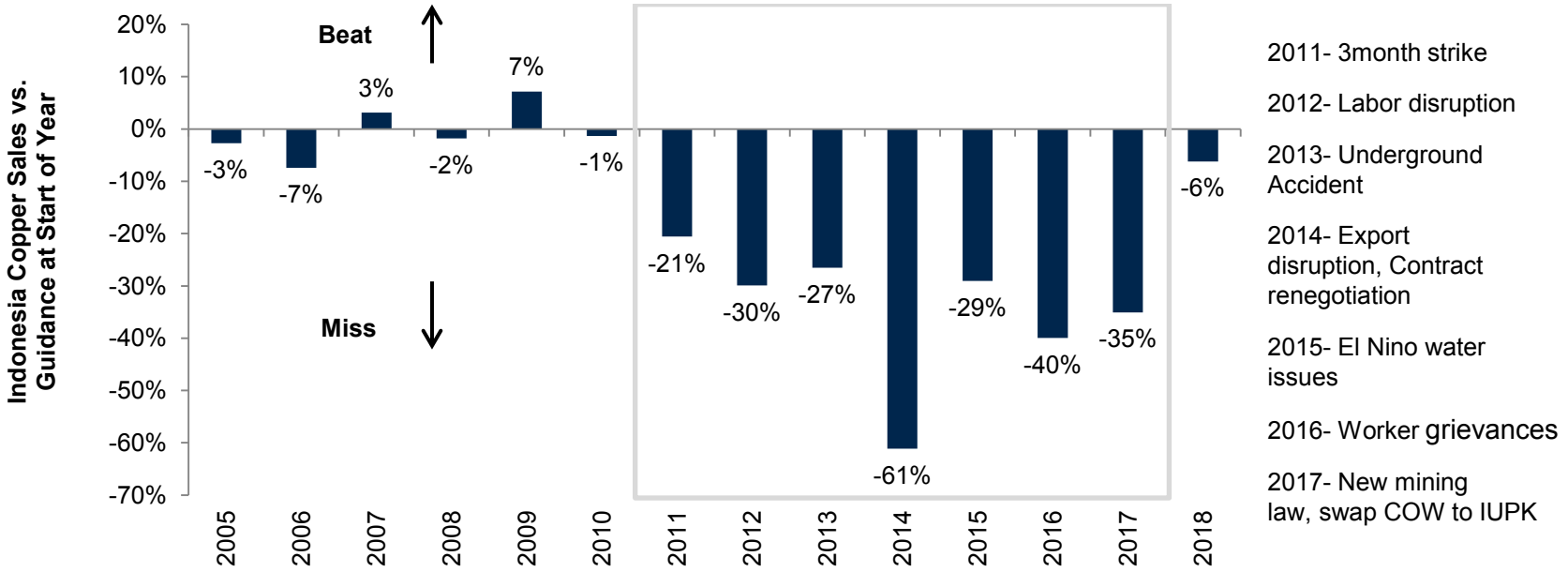
FCX's Operations Return to Normal in 2021

	2018	2019e	2020e	2021e	2022e
Copper Price ($/lb)	2.96	3.00	3.01	2.95	2.95
Indonesia Copper Sales (bn lbs)	1.1	0.6	0.8	1.4	1.7
Total Copper Sales (bn lbs)	3.8	3.2	3.5	4.2	4.5
EBITDA ($bn)	6.7	4.0	4.5	6.7	7.8
FCF, ex Working Capital ($bn)	2.0	(0.0)	0.1	1.7	2.7
FCF Yield (%)	11%	0%	1%	9%	15%

Source: Company data, Morgan Stanley Research estimates. Note: Copper price sensitivity analysis does not factor in any royalties or other copper price driven costs

FCX Can Deliver On Its 2019-21 Production Ramp

- FCX is a best in class operator
- With acrimonious government and labor relations behind them, should start delivering near guide again
- 2005-10, when there was no external interference, FCX delivered near guidance



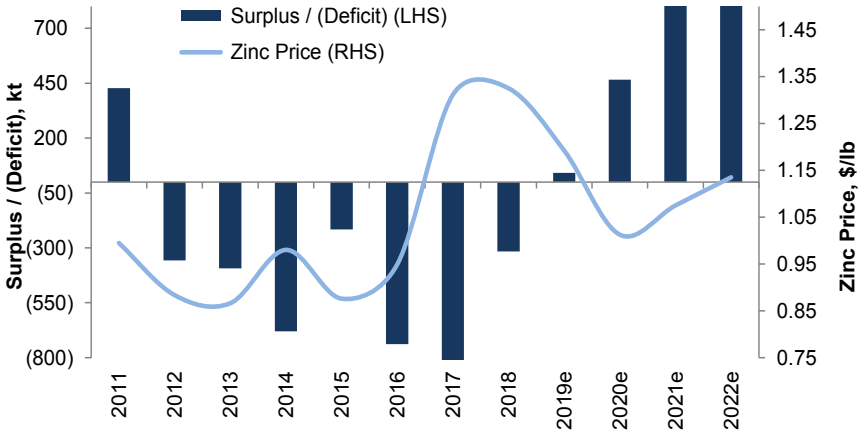
Source: Company data, Morgan Stanley Research estimates

Zinc- Tight Near Term on Some Bottlenecks

We forecast a long-term price of $1.18/lb (nominal) in 2024 vs. spot around $1.30/lb

- Zinc demand is tied to construction and auto since its primary use is a coating for outdoor steel.
- Zinc's rally could continue near-term on supply disruption, constrained smelting capacity, and dwindling LME inventory.
- However, the weak demand outlook and growing mine and smelter supply are expected to translate into a metal market surplus in zinc by year-end, driving price lower.

Supply Demand vs. Pricing

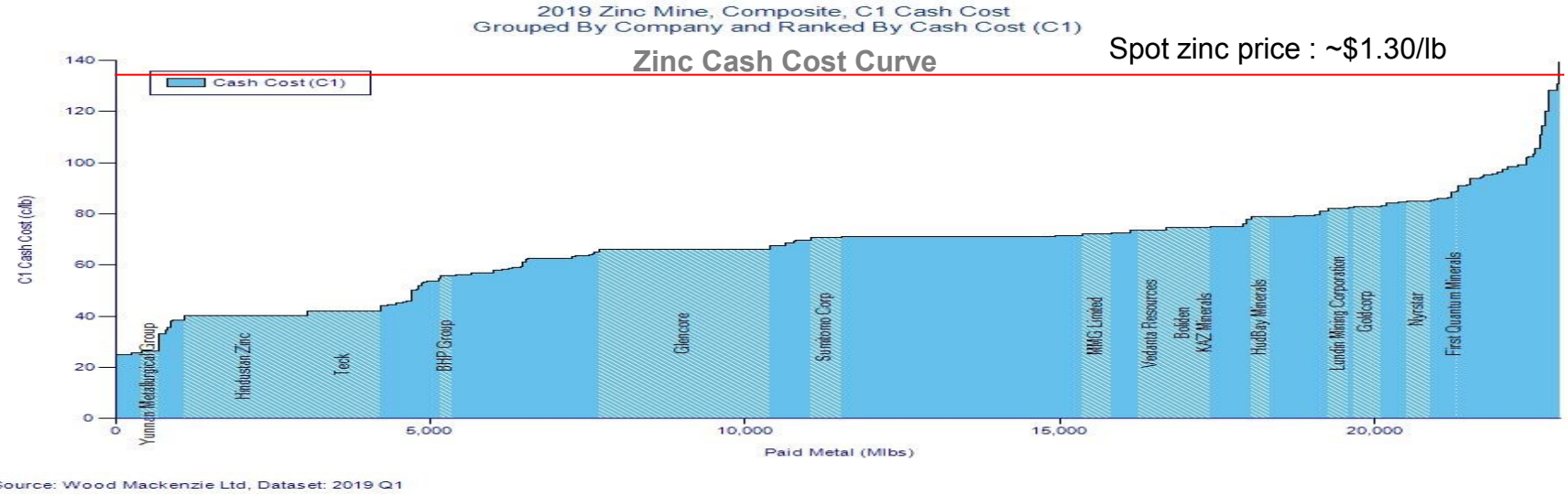


Zinc Price Over Last 10 Years



Source: Bloomberg, MS Commodity Team's Forecasts: The Price Deck – 2Q 2019

Zinc- End Market Demand in China Remains Weak



Source: Wood Mackenzie Ltd, Dataset: 2019 Q1

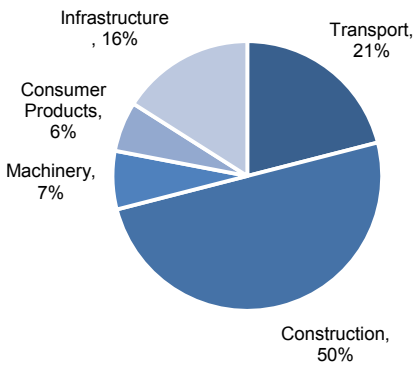
Top Suppliers

Country	2018 Mine Production
China	36%
Australia	9%
Peru	10%
India	6%
USA	6%
ROW	33%
Total (kT)	**13,157**

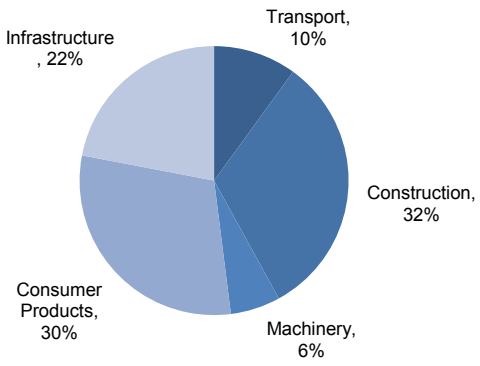
Top Consumers

Country	2018 Refined Demand
China	47%
USA	7%
South Korea	4%
India	5%
Germany	3%
ROW	33%
Total (kT)	**13,844**

Global End Markets



China End Markets



Source: Wood Mackenzie, MS Commodity Team's Forecasts: The Price Deck – 2Q 2019: Head Start

Iron Ore (Seaborne)

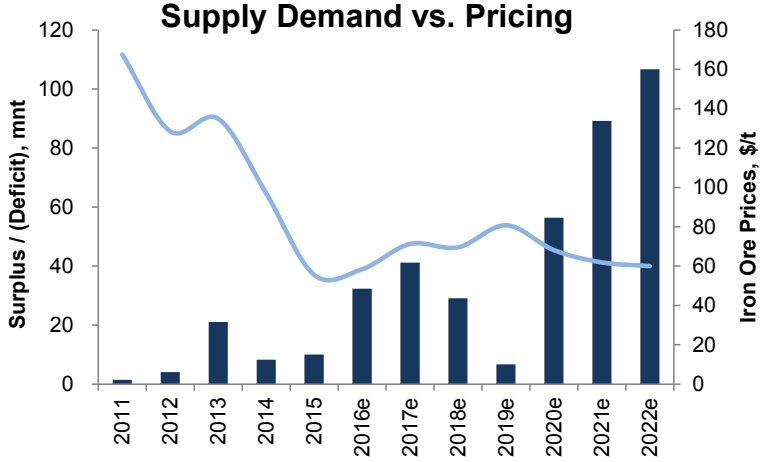
Top Suppliers

Country	2018 Supply
Australia	41%
Brazil	20%
China	8%
India	8%
N. America	5%
ROW	19%
Total (Mnt)	**2,191**

Top Consumers

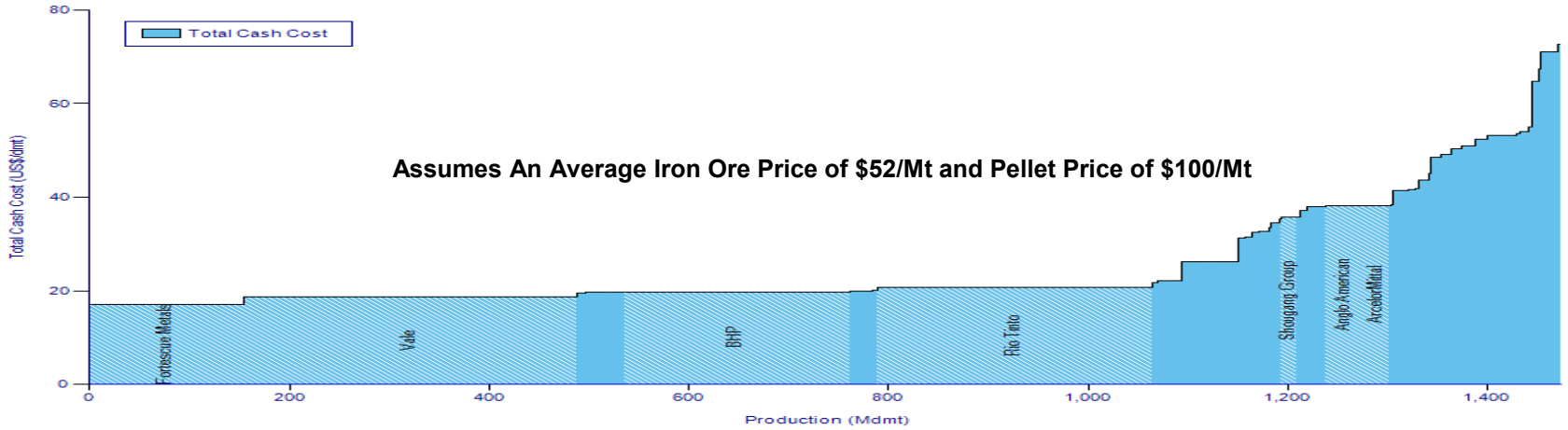
Country	2018 Demand
China	57%
EU-28	6%
CIS	6%
Japan	6%
India	8%
ROW	17%
Total (Mnt)	**2,186**

Supply Demand vs. Pricing



Seaborne Iron Ore Export Cost Curve

2019 Iron Ore Mine, Seaborne Export, All, Total Cash Cost
Grouped By Company and Ranked By Total Cash Cost



Source: Wood Mackenzie Ltd, Dataset: 2019 Q1
Source: Wood Mackenzie, MS Commodity Team's Forecasts: The Price Deck – 2Q 2019: Head Start

Metallurgical Coal (Seaborne)

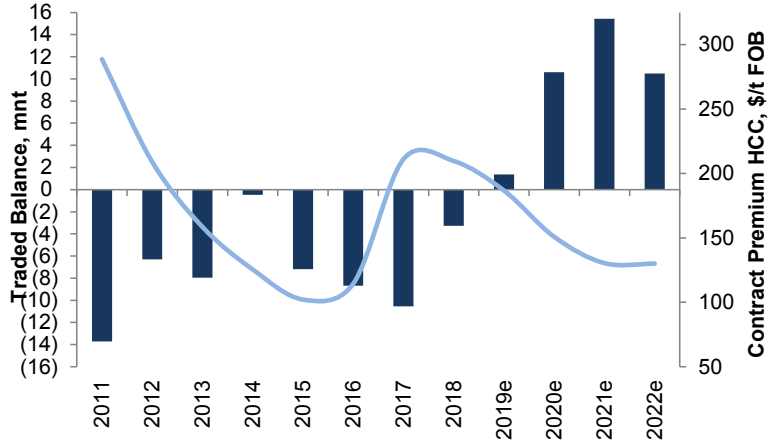
Top Suppliers

Country	2018 Supply
Australia	54%
USA	16%
Canada	9%
Mongolia	6%
Russia	9%
ROW	6%
Total (Mnt)	**328**

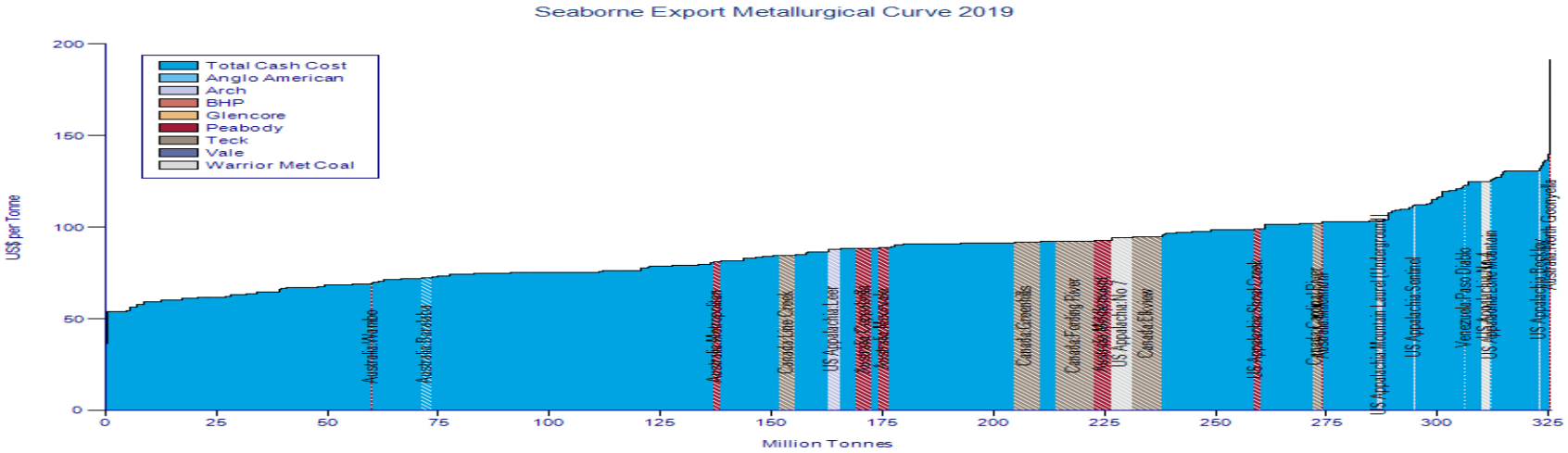
Top Consumers

Country	2018 Demand
EU-25	20%
Japan	16%
China	20%
India	17%
S. Korea	10%
ROW	17%
Total (Mnt)	**332**

Supply Demand vs. Pricing



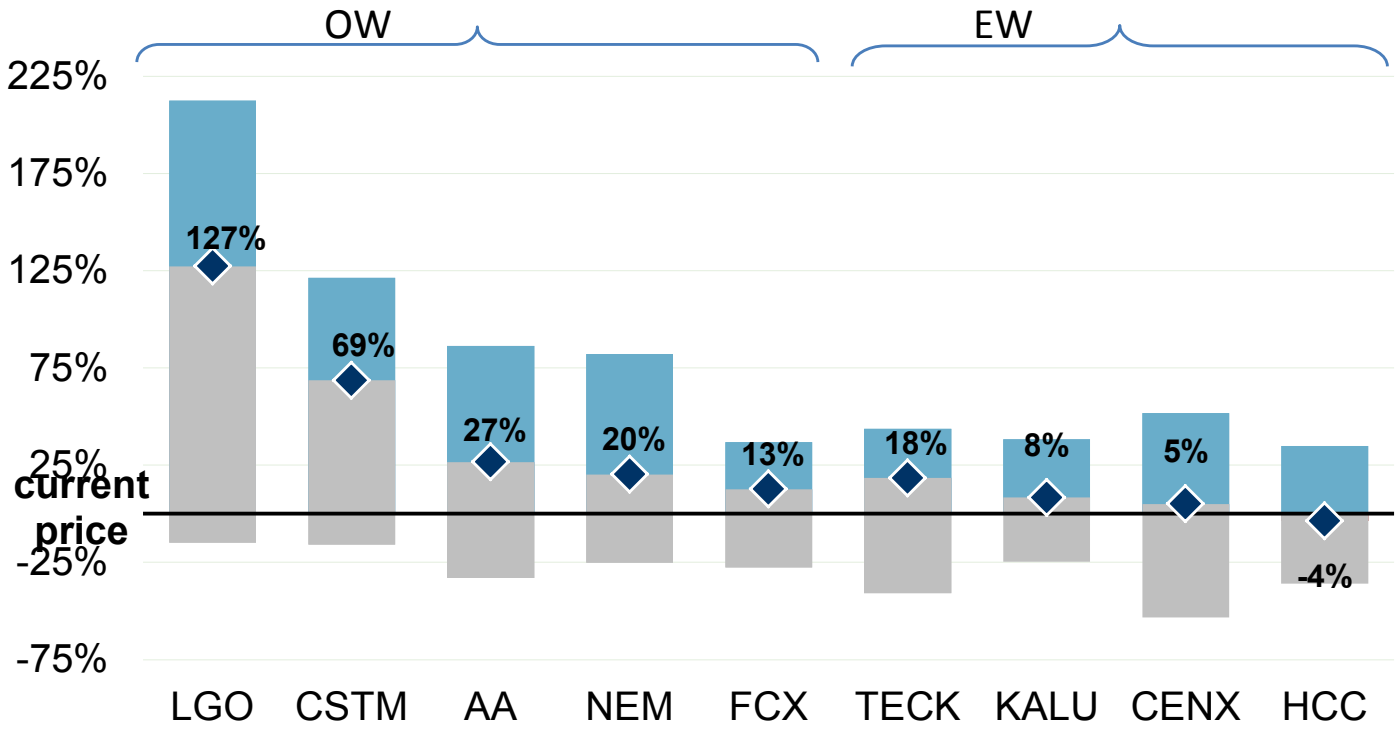
Met Coal Cash Cost Curve



Source: Wood Mackenzie Ltd, Dataset: February 2019

Source: Wood Mackenzie, MS Commodity Team's Forecasts: The Price Deck – 2Q 2019: Head Start

Risk Reward Across Metals & Mining Coverage



Source: Thomson One, Morgan Stanley Research estimates. Note: As of 4/29/2019 close

Investment Thesis – Metals Coverage

Alcoa (AA): Pure-play aluminum, alumina, and bauxite producer. OW

- Low cost alumina & bauxite. Optionality to grow production

Constellium (CSTM): Downstream aluminum company with focus on auto lightweighting and aerospace. OW

- Operational turnaround not fully priced in, but investor confidence is improving

Kaiser Aluminum (KALU): Downstream aluminum company with focus on aerospace and autos. EW

- Limited commodity price risk. Strong balance sheet and FCF generation

Century Aluminum (CENX): Primary aluminum maker with exposure to US market. EW

- US regional prices are healthy, but high raw-material spot prices are hurting profitability

Investment Thesis – Mining Coverage

Freeport McMoRan (FCX): Large scale copper producer. OW

- Emerging copper S/D deficits will support copper prices. Indonesia overhangs are gone. 2021 ramp-up is manageable

Newmont (NEM): Large gold miner. OW

- Strong organic pipeline with several projects averaging >20% IRR. Only gold miner in S&P 500

Largo Resources (LGO-T): Pure-play vanadium miner. OW

- High-quality, low-cost vanadium miner. Emerging deficits due to strong demand should help support prices

Cleveland-Cliffs (CLF): Pure-play iron ore miner. EW

- Iron ore prices should remain elevated in the near term due to supply disruptions. HBI project adds incremental EBITDA growth potential and diversifies customer base

Teck Resources (TECK): Met coal, zinc, and copper producer. EW

- Last investible large cap met coal and zinc equity play left in NA, positions the company to command valuation premium

Warrior Met Coal (HCC): Metallurgical coal miner. EW

- Produces near benchmark quality met coal with operating margins in the 2nd quartile of the global curve. Returning excess cash flow through special dividends

Comps

Company	Market Cap ($bn)	Current Price, $	MS PT, $	Upside to PT (%)	EPS (2019e)		EBITDA (2019e)		MSe Valuation (2019e)	
					MS	Cons	MS	Cons	P/E	EV/EBITDA
Steel Dynamics, Inc.	7,196	31.98	39	22%	3.68	3.94	1,507	1,573	8.7x	5.7x
NUCOR	17,370	56.88	65	14%	5.78	6.00	3,310	3,349	9.8x	6.2x
United States Steel	2,811	15.80	21	33%	2.09	2.12	1,108	1,118	7.6x	3.5x
STELCO	1,377	15.50	20	29%	2.18	3.35	240	361	7.1x	5.2x
Commercial Metals	2,074	17.43	21	20%	1.72	1.84	509	503	10.1x	6.1x
AK Steel	778	2.46	3	22%	0.50	0.50	506	506	4.9x	5.3x
CLIFFS	2,792	9.87	12	22%	1.34	1.73	625	743	7.4x	6.8x
Schnitzer	663	24.32	22	(10%)	2.41	2.29	150	145	10.1x	5.3x
ALCOA	4,981	26.85	34	27%	0.31	0.80	1,845	2,150	NM	4.0x
Century ALUMINUM	757	8.57	9	5%	(0.76)	(0.84)	32	31	NM	NM
FREEPORT-McMoRan	18,111	12.43	14	13%	0.58	0.41	4,022	3,618	21.5x	8.2x
Teck	18,279	23.65	28	18%	3.58	3.90	3,787	5,185	8.9x	5.6x
WARRIOR MET COAL	1,607	31.15	30	(4%)	5.38	5.57	504	464	5.8x	2.8x
Constellium	1,183	9.49	16	69%	0.70	0.94	607	544	12.2x	6.0x
KAISER ALUMINUM	1,589	96.89	105	8%	6.97	6.97	217	220	13.9x	8.1x
LARGO RESOURCES	1,147	1.76	4	127%	0.32	0.37	215	295	5.4x	3.9x
NEWMONT	16,518	30.76	37	20%	1.32	1.23	2,654	3,691	23.3x	6.3x

Source: Thomson Reuters, Morgan Stanley Research estimates. Note: As of 4/29/2019 close

Morgan Stanley

FOUNDATION

May 2019

Industrials Spring Training Teach-In

Chemicals

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Stock recommendations and disclosures in this report are as of May 3, 2019; stock prices as of April 30, 2019, unless otherwise noted.

90% of Investor Focus Is on These Themes

Petrochemicals (DWDP, LYB, OLN, WLK, etc.)

- Feedstocks: NGLs (ethane, propane, butane)
- Upstream: Ethylene/Propylene
- Downstream: Polyethylene/Polypropylene/Chlor-Alkali

Fertilizer (NTR, CF, IPI, MOS)

- Nitrogen
- Phosphate
- Potash

Industrial Gas (APD, PX)

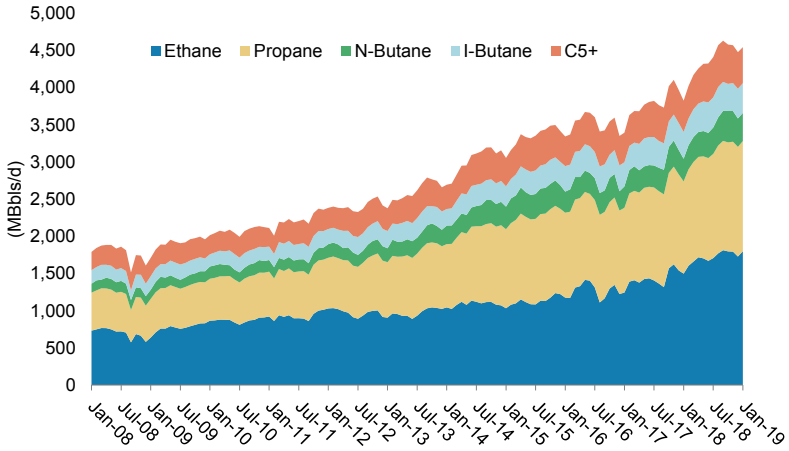
Paints & Coatings (PPG, RPM, SHW, AXTA)

Titanium Dioxide or TiO2 (CC, TROX, VNTR)

Natural Gas Liquids (NGLs)

NGLs – Overview

Composition of US NGL Production



Source: EIA, Morgan Stanley Research

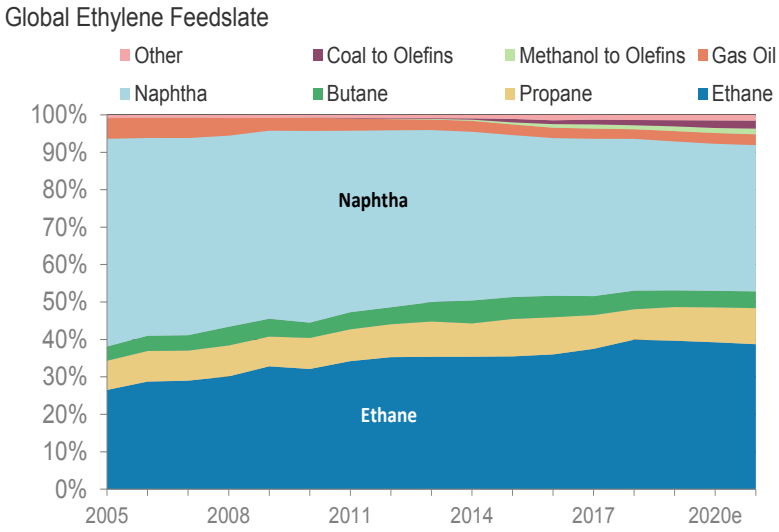
Shale Gas Production Increased NGL Supplies

- Although many ethylene producers have increased their NGL feedstock mix, the abundance of NGL output from shale plays has created a surplus of ethane.
- As ethylene crackers have come online, this surplus has been reduced and the ethane market is tightening in 2019.

What Are NGLs?

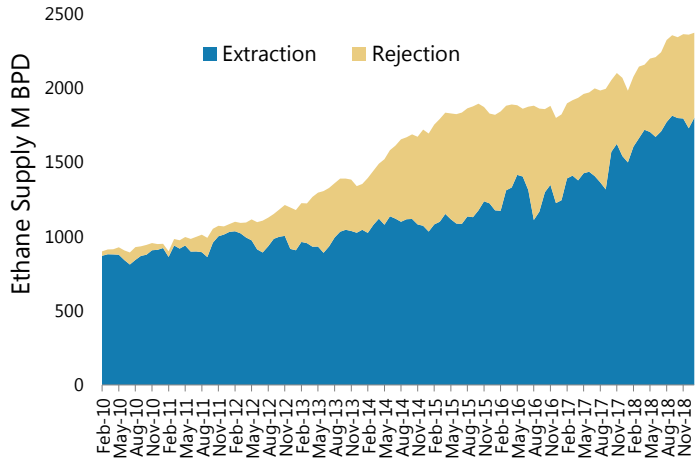
- Natural gas liquids (NGLs) include a mix of ethane, propane, butane, and pentanes (C5+), all derived from natural gas processing. NGLs exist naturally among deposits of natural gas.
- Raw gas from the wellhead is run through a fractionation process that separates the individual NGL factions.
- Ethane's primary use is a feedstock for ethylene production. However, in addition to being an ethylene feedstock, propane is consumed in heating and crop drying.

NGLs Account for an Increasing Share of Global Ethylene Production, Led by US Shale Boom



Source: Morgan Stanley Research, IHS

NGLs – Ethane



Source: EIA, Morgan Stanley Research

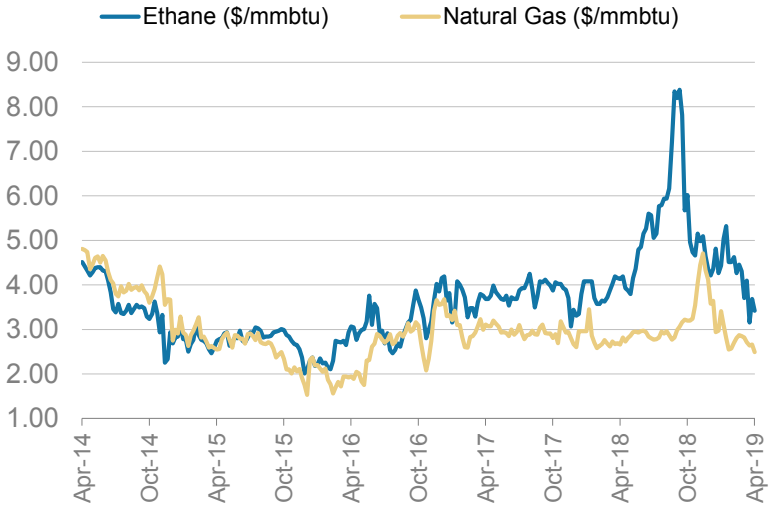
Ethane Prices ~ Fuel Value

- The oversupply of ethane has pushed its price closer to fuel value. When ethane is "rejected" it is introduced into the natural gas supply and sold as methane, thus the ethane market responds by setting the price near fuel value (in MMBTU equivalents).
- We model a 30c/gal ethane price in 2019+, or roughly a 10c/gal premium to fuel-value (FV) as new ethylene startups drive incremental ethane demand.

Ethane "Rejection"

- Ethane's primary use is as a feedstock for ethylene production.
- With no other commercial use in its raw form, gas producers are constrained by the amount of ethane that does not have a market (storage facilities do not exist at the wellhead).
- Ethane (C2) can be consumed by natural gas consumers (methane), subject to constraints set by pipeline specifications. When ethane is not sold as ethane, it is considered "rejected" and fed into the natural gas pipeline supply.

Ethane Prices at its "Fuel-Value" Equivalent When Oversupplied

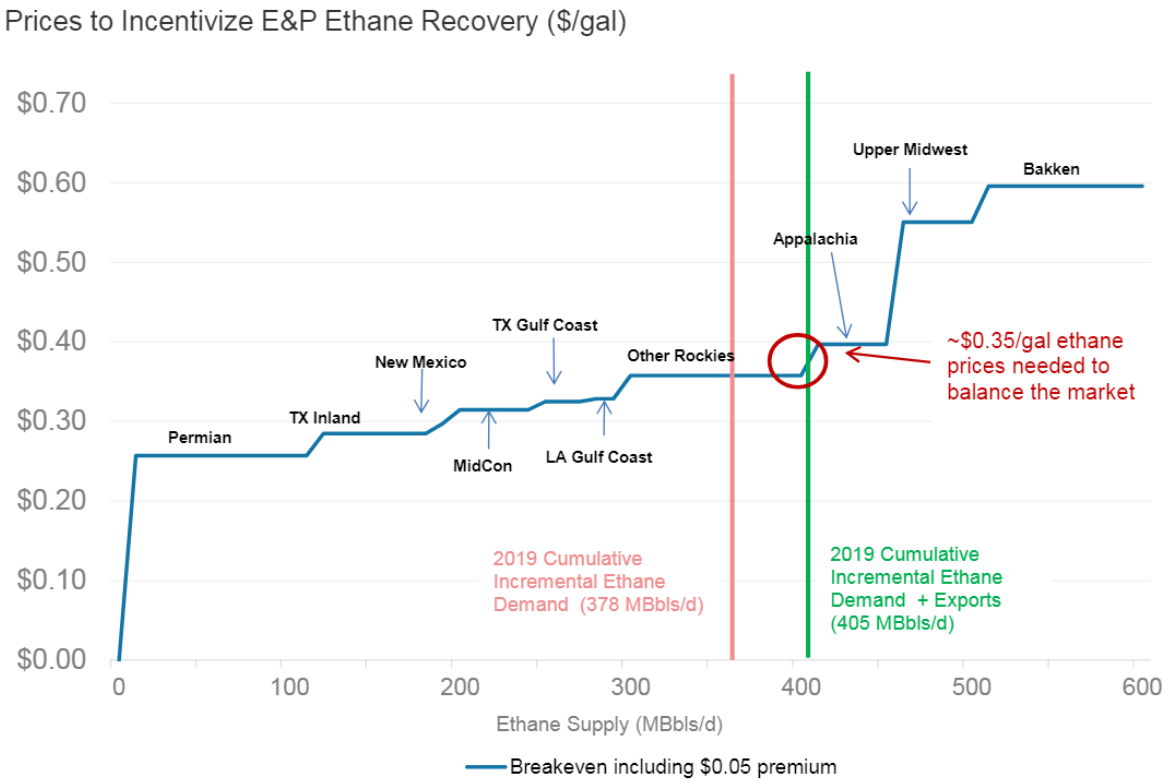


Source: Bloomberg, Morgan Stanley Research

NGLs – Ethane

Our estimated 30c/gal ethane forecast is less than many bears contend as we believe that:

- Sunk cost economics associated with bringing currently rejected ethane to market means lower incremental variable.
- The likely ramp time for incremental crackers to come online will be longer.
- Significant flex capacity exists to use both propane and butane instead of ethane when it is more economical

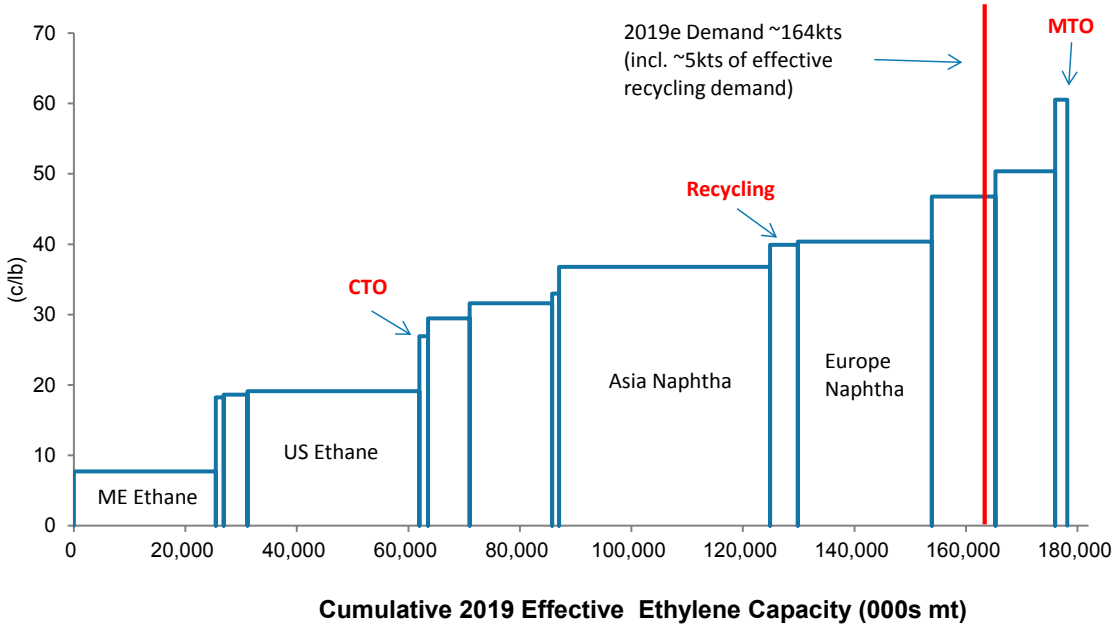


Source: Bloomberg, Platts, Envantage , Morgan Stanley Research

Ethylene

Ethylene – Industry Overview

Current Global Ethylene Cost Curve



Source: Morgan Stanley Research, IHS

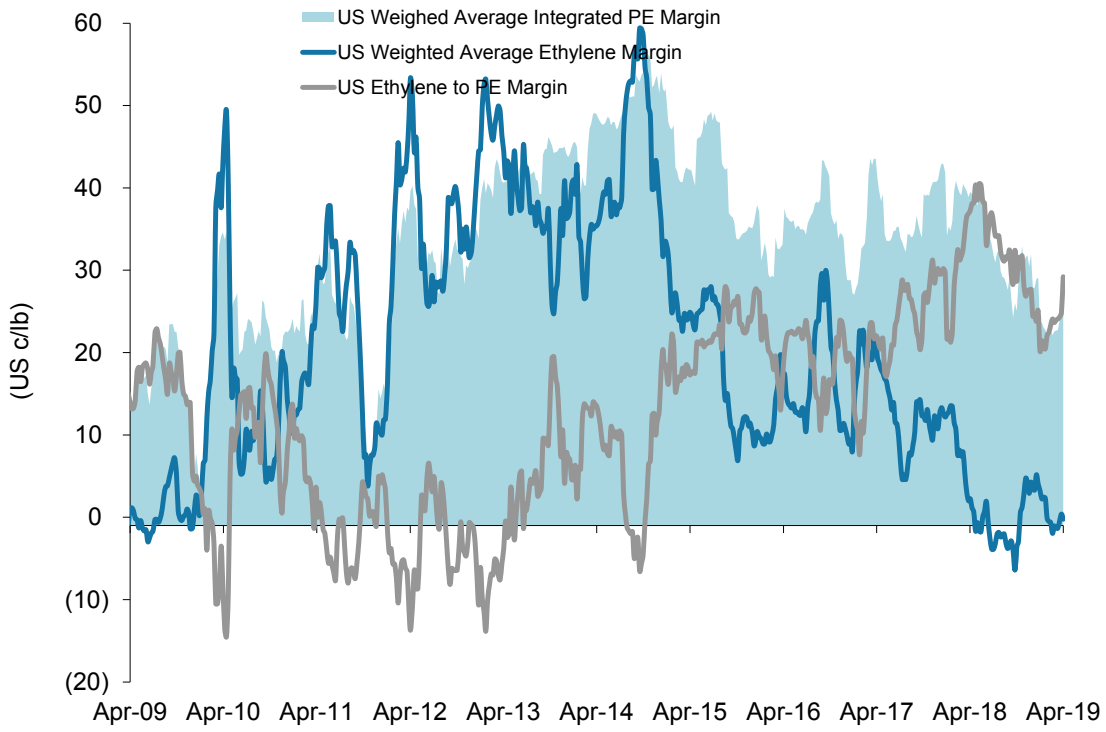
Cash Costs

- When analyzing the production economics of ethylene, it is important to factor in the true cash costs. As each feedstock has a unique yield of ethylene and co-products, the cost of the feedstock factors in the ability to sell the corresponding co-products.

Ethylene Cost Structure

- A number of different hydrocarbons can be used to produce ethylene, but the primary feedstocks are (in order from lowest to highest cost):
- **Ethane.** This is derived from natural gas and is considered a light feedstock. Pure ethane cracking produces the highest proportion of ethylene and relatively few co-products. The key regions using ethane feedstock are the US and Middle East. In the US, the natural gas price is typically an important driver of ethane prices as it provides an economic floor.
- **Natural Gas Liquids (NGLs).** These include a mix of ethane, propane and butane, all derived from natural gas. Propane and butane content produces a higher proportion of propylene and butylenes, but ethylene is stile the largest output. NGLs are more common in the US and Middle East.
- **Naphtha.** A liquid hydrocarbon mix derived from oil and is considered a heavy feedstock. Naphtha produces more aromatics (butylene and butadiene) and these play a key role in the economics of the facility. Naphtha is used primarily in Europe and much of Asia, and prices correlate with oil (Brent).

Ethylene – US Advantage



Source: IHS, Bloomberg, Morgan Stanley Research

What Is Ethylene?

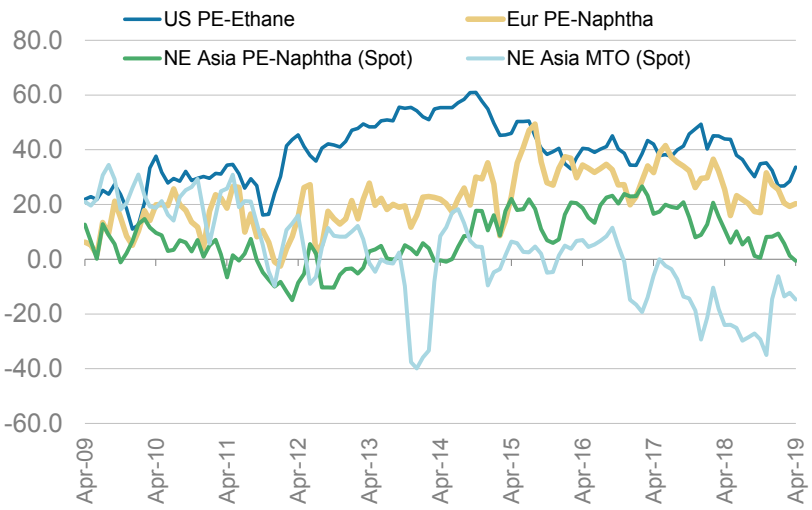
- Ethylene is the starting point for the petrochemical chain. It is the largest organic hydrocarbon produced and consumed globally (by volume).
- Ethylene is a highly explosive gas used entirely to produce downstream products ("ethylene derivatives"), which themselves are raw materials for a wide variety of industrial and consumer products.

US Integrated Margins Remain Elevated

- US ethylene producers enjoy an abundance of ethane feedstock.
- Ethylene's primary use is as a feedstock for production of polyethylene.
- Polyethylene pricing is linked to Brent crude oil (which drives pricing of naphtha), though PE prices have held up better since oil prices declined in 2014 than the historical relationship with oil would suggest.
- We believe tight market conditions, the ascendance of non-naphtha forms of production to the right of the cost curve (i.e. MTO/CTO/recycled), and the prices of substitute plastics have all contributed to today's comparatively high PE prices vs. oil.

Ethylene – Global Margin Structure

Integrated PE Margins by Geography (c/lbs)



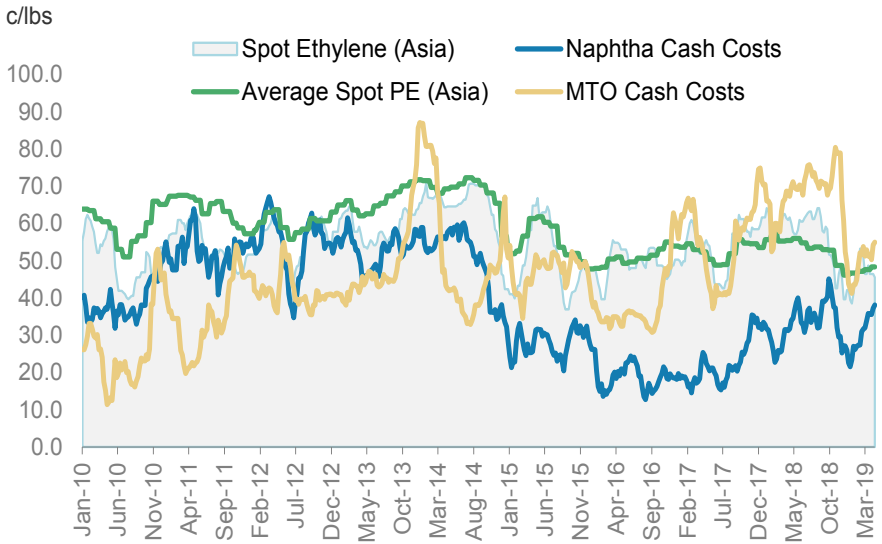
Source: IHS, Morgan Stanley Research

MTO Has Become High Cost Producers Since Oil Prices Declined

- Global PE prices closely tracked Asian naphtha based production costs until 2014.
- In addition to broadly tight market conditions, the ascendance of non-naphtha forms of production to the right of the cost curve (i.e. MTO/CTO/recycled) have helped to support high PE prices since 2014.

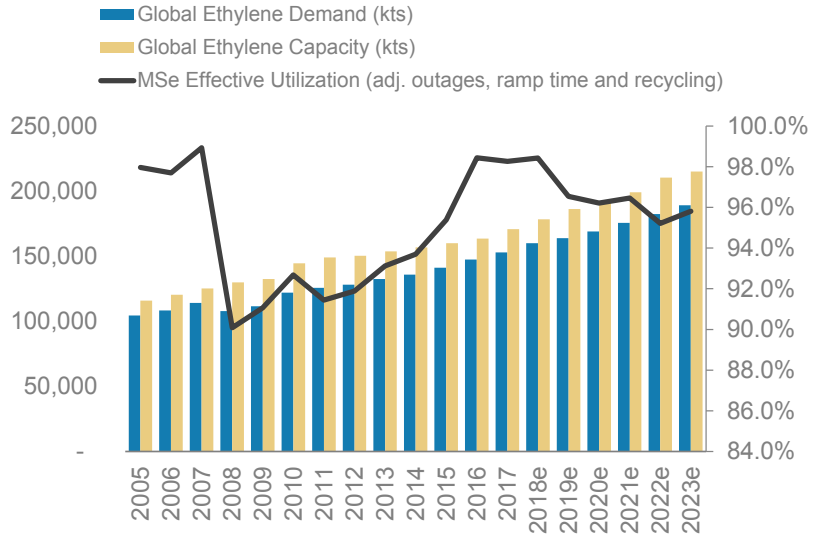
Integrated PE Margins

- Regional producers are benchmarked based on "integrated" polyethylene margins.
- Integrated margins factor the cost of producing both the ethylene and polyethylene and selling the polyethylene downstream.
- Low NGL feedstocks have lifted US margins above European and Asian producers since the shale boom.



Source: IHS, Morgan Stanley Research

Ethylene – Capacity Utilization Dynamics



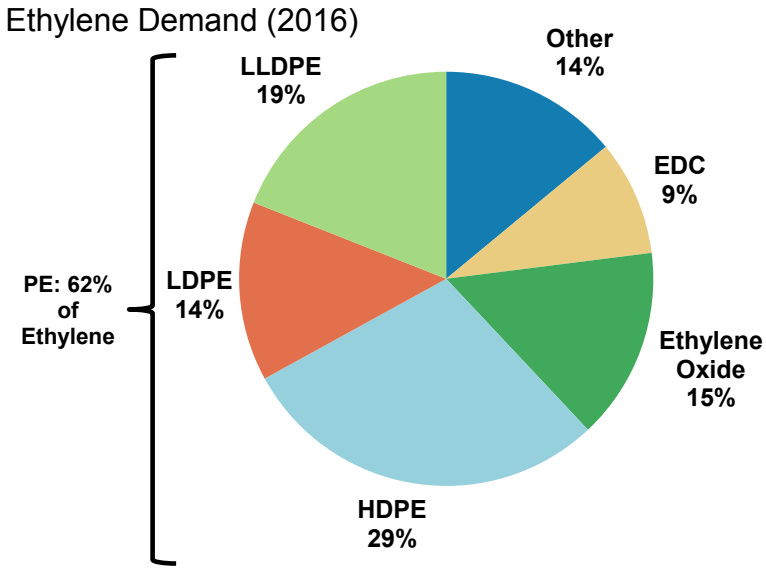
Source: IHS, Morgan Stanley Research

Ethylene Demand

- 62% of global ethylene demand is for polyethylene (HDPE, LDPE, LLDPE), the world's most prolific plastic resin.
- 15% of global ethylene demand is for ethylene oxide, which is used to make ethylene glycol (key ingredient in automotive antifreeze).
- 9% of global ethylene demand is for ethylene dichloride (EDC), which is used to make polyvinyl chloride (PVC), primarily used in building products and pipe manufacturing.

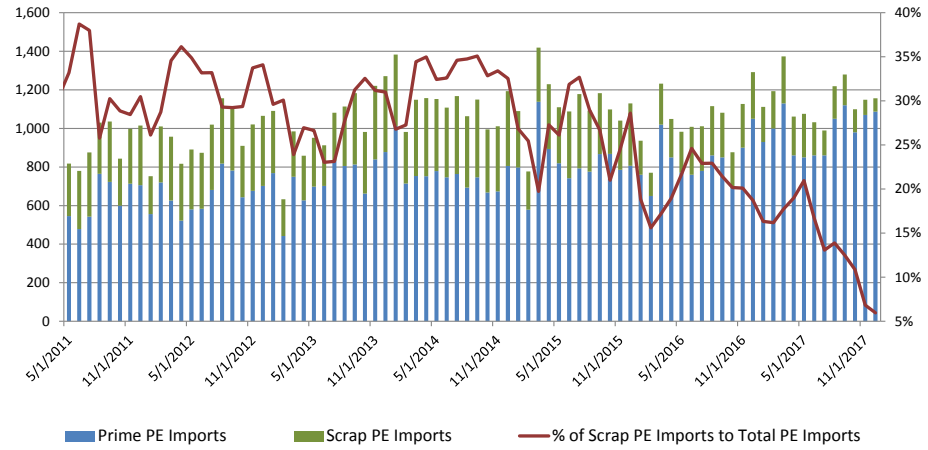
Plant Expansions on Horizon

- The abundance of low cost ethane is propelling large investments in ethylene infrastructure along the USGC petrochemical complex.
- We expect 4 further crackers to come online in the USGC during 2019.
- Utilization peaked in 2016 before the new crackers came online.



Source: IHS

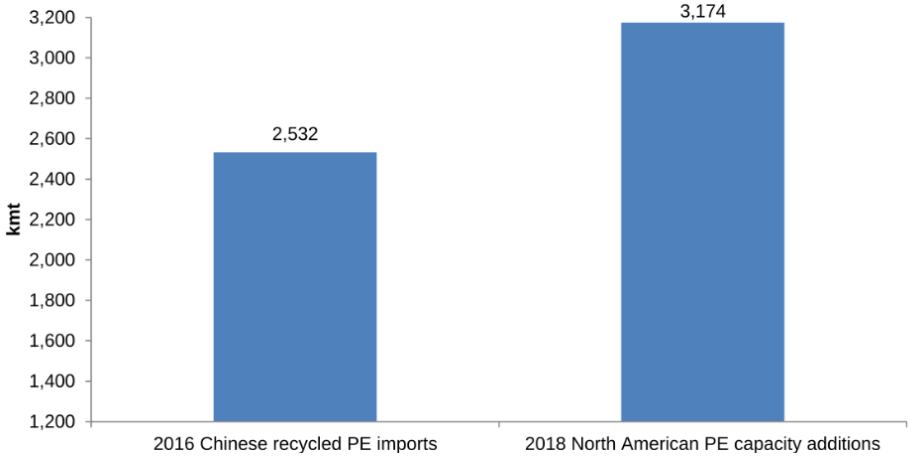
Ethylene – Recycling in Focus



Source: CEIC, Morgan Stanley Research

PE Recycling in Focus

- We believe that the decline in oil prices below $65 per barrel made previously cost advantaged recycled polyethylene uncompetitive versus higher quality virgin production, which together with environmental related closures in China, is likely to tighten global utilization rates by nearly 200 basis points.
- We do not believe that recycled polyethylene sets the marginal cost of production, but rather simply increases demand for virgin product
- Chinese government trade data shows a 56% decline in scrap polyethylene imports to China from 2014 to 2017.

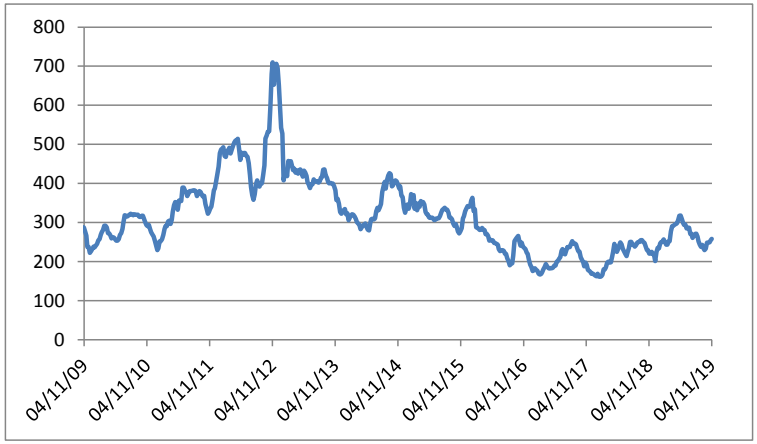


Source: IHS, CEIC, Morgan Stanley Research

Nitrogen

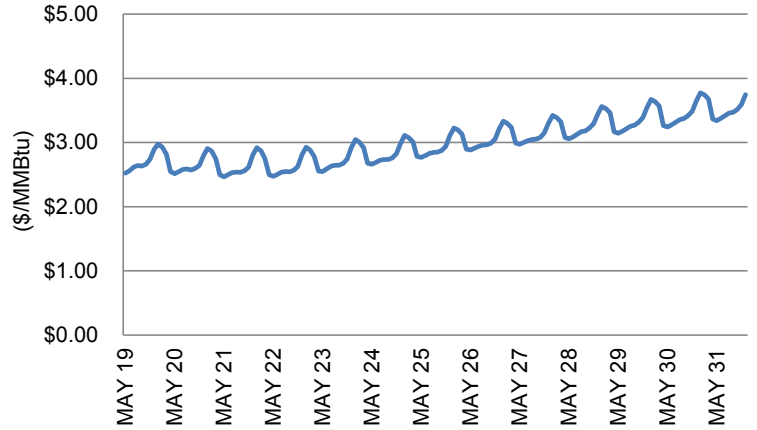
Nitrogen – Industry Overview

Urea NOLA Granular Barge (per ton)



Source: CRU, Morgan Stanley Research

Henry Hub Natural Gas Futures Curve



Source: CME Group

Key Nitrogen Debates

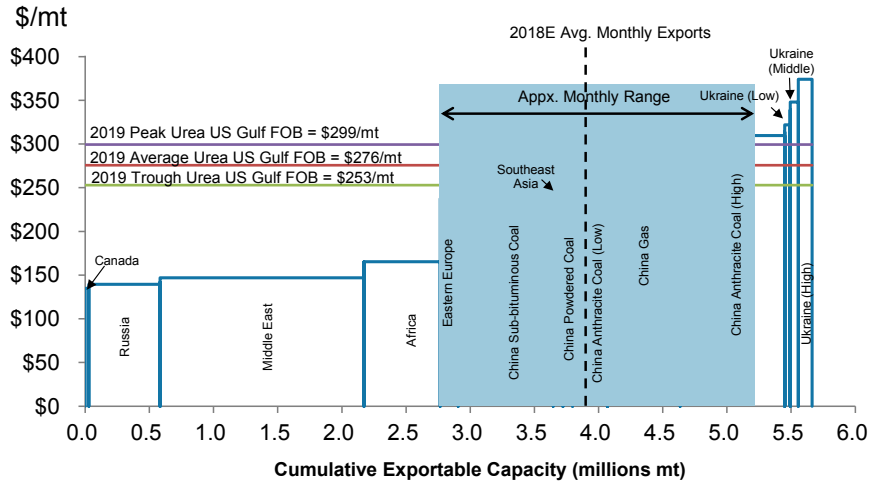
- Marginal Cost of Production
  - US Urea Prices vs. Marginal Cost of Production
  - Shifting marginal producer depending on time of year
  - How will the marginal cost of production evolve?
- Declining influence of China in global urea trade
- Influence of Iranian urea in global trade
- Declining US urea imports: What is the new normal and from which regions will the US import?
- Nitrogen stock valuations trading below replacement cost but above prior down cycle averages

What Is Nitrogen?

- Nitrogen COGS are ~80% natural gas.
- Nitrogen fertilizer is the primary driver of plant growth and must be applied each year to ensure optimal yields.
- Ammonia is the building block of all nitrogen fertilizers (~81% of global ammonia is used in fertilizer applications).
- Of the ammonia used in fertilizer applications, 54% is used in Urea.
- Urea is the key globally traded product, so investors focus on that.

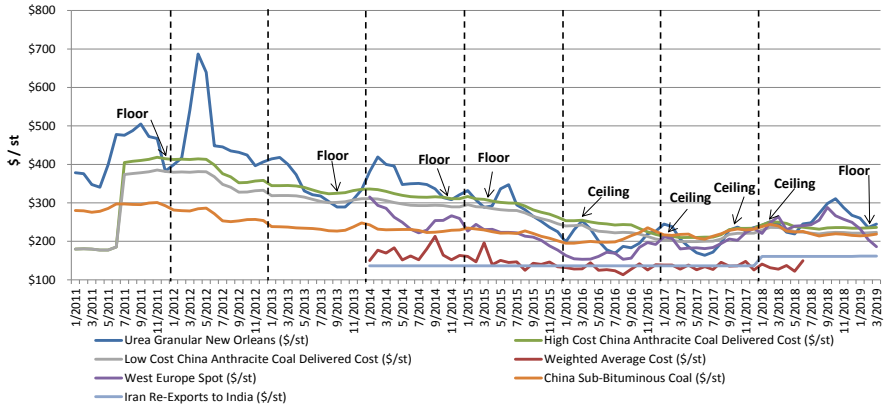
Nitrogen – Cost Curve

2018E Monthly Global Urea Export Curve (Delivered to US Gulf)



Source: CRU, Morgan Stanley Research

US Urea Price vs. Chinese Anthracite Coal Delivered Cost, Chinese Sub-Bituminous Coal, West Europe Spot



Source: CRU, Morgan Stanley Research

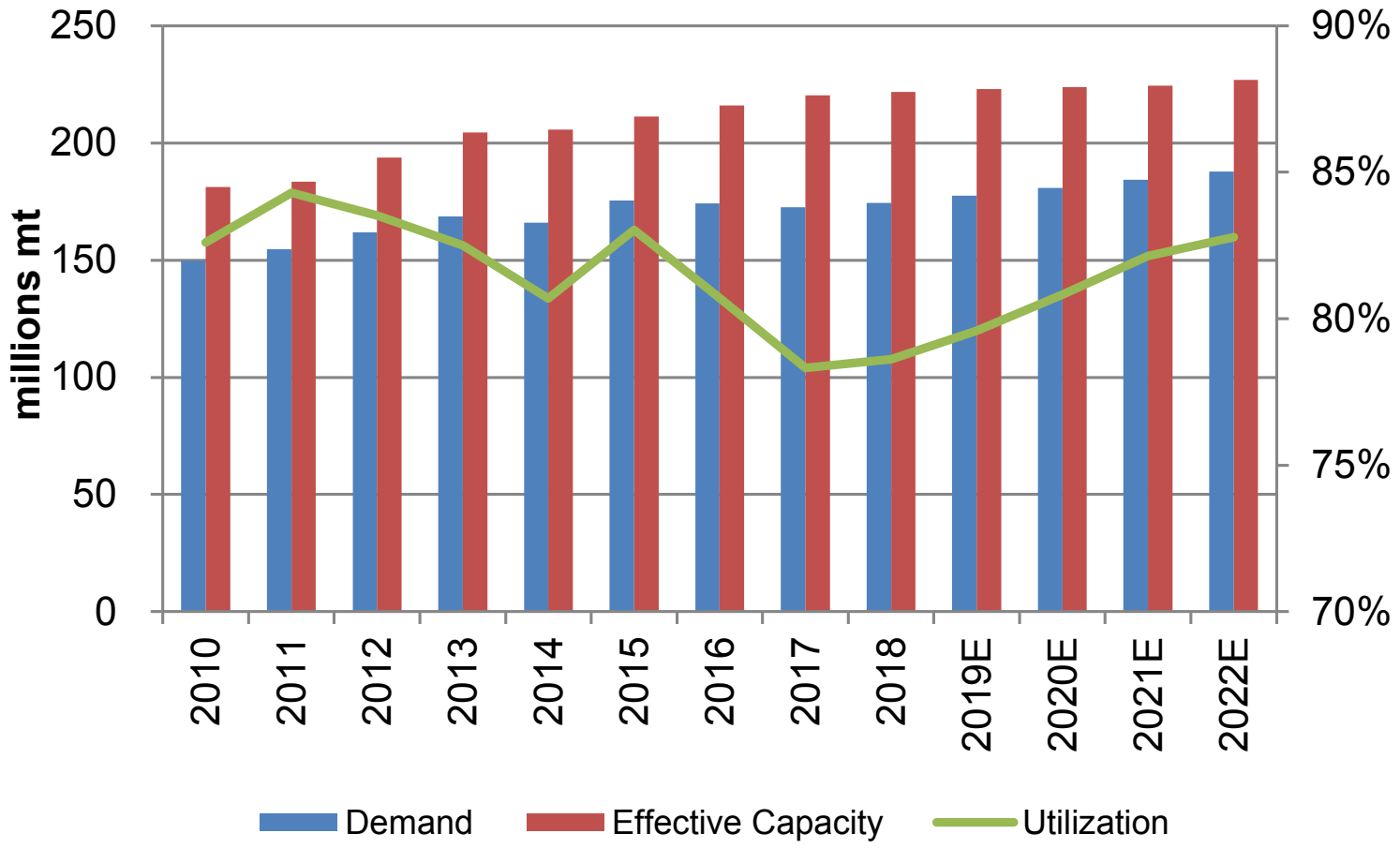
Marginal exporter sets the price in the urea market and this player changes depending on the month of the year

- China has effectively operated as the major swing producer in recent years, though its influence on the global market price has declined
- It has become apparent that the US no longer needs Chinese product year-round and that the marginal exporter shifts depending on monthly demand
- In some months (June - September, November) US production plus imports from low cost regions leave only limited amounts of import demand, and therefore no real need to go far up on the cost curve to satisfy it

Has the Chinese “Ceiling" Become the “Floor“ Again?

- Up until 3Q15, the marginal cost producer set the "floor" price in the US nitrogen market as that producer's tons were typically needed on a monthly basis to satisfy demand
- From 3Q15 through 1Q18, however, the Chinese anthracite coal price acted as the ceiling for US urea prices
- Now, it appears that the Chinese anthracite coal delivered price is once again acting as a floor for urea prices
- This is coincident with the significant increase in Chinese urea exports over the past few months (+345% YTD)

Nitrogen – Global Capacity Utilization

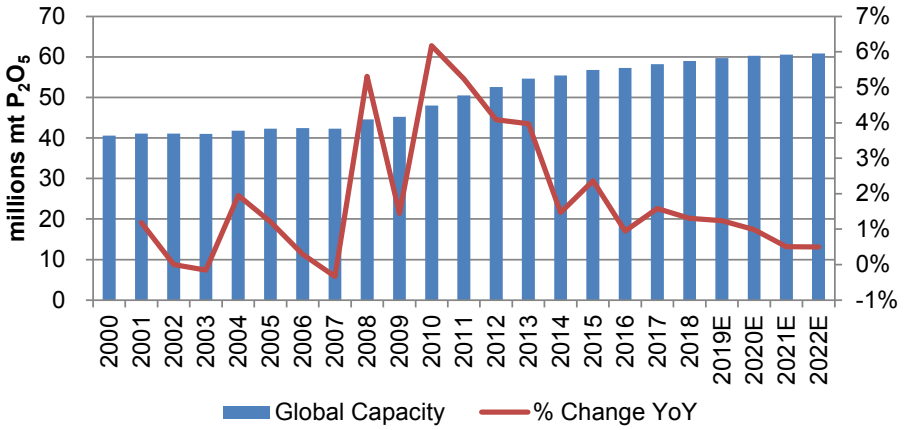


Source: CRU, Morgan Stanley Research

Phosphate

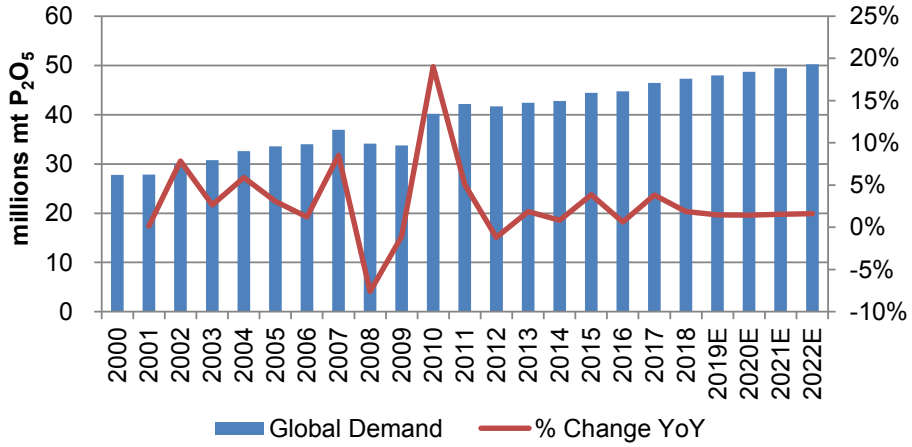
Phosphate – Industry Overview

Global Phosphoric Acid Nameplate Capacity



Source: Historical data per IFA and forecasts per Morgan Stanley.

Global Phosphoric Acid Demand



Source: Historical data per IFA and forecasts per Morgan Stanley.

Key Conclusions

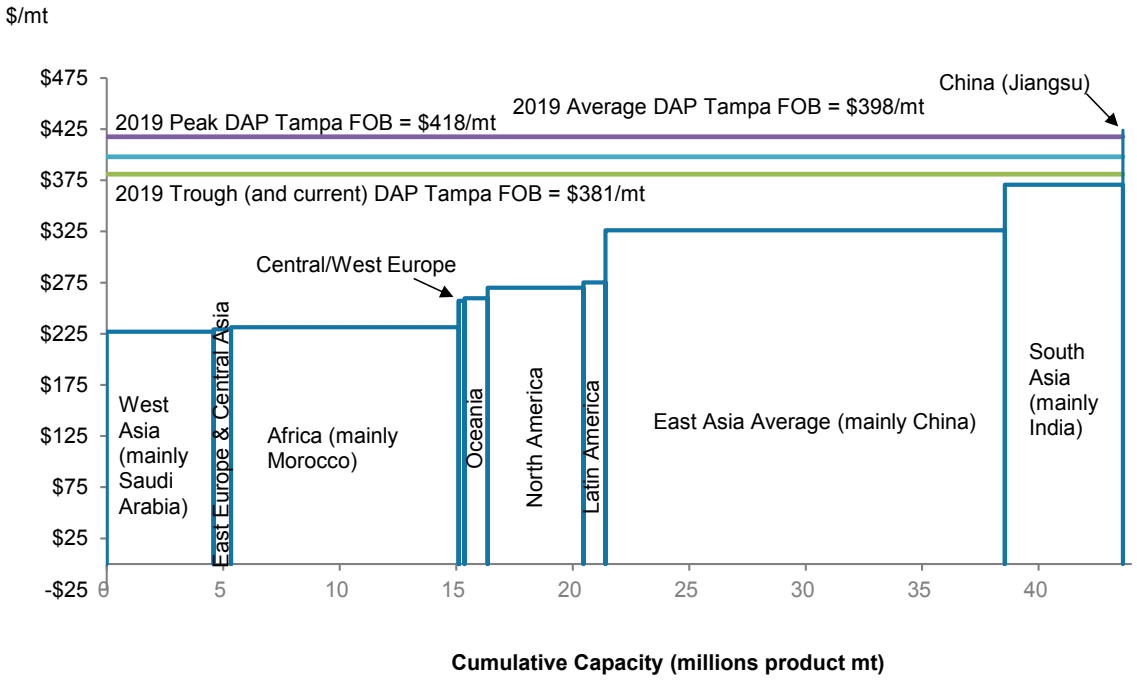
- Lower cost and export focused capacity ramping up in Morocco and Saudi Arabia will have implications for Chinese producers
- Chinese capacity rationalization and local demand will determine export levels
- Indian import demand, DAP subsidy, and local DAP production are key drivers going forward
- Phosphate rock costs no longer key driver of phosphate prices

What Is Phosphate?

- Phosphate's primary role is plant root development
- The major raw material to all finished phosphate fertilizer products is phosphoric acid, which is produced by adding sulfuric acid to phosphate rock
- China is the largest exporter of concentrated fertilizer (DAP and MAP) followed by Morocco, Russia, and the US
- India and Brazil are the largest importers
- DAP/MAP are the main phosphate-based fertilizers
  - Countries where DAP is used most commonly include China, India, and the US
  - Countries where MAP is used most commonly include China, Brazil, and the US

Phosphate – Cost Curve

Global DAP Cost Curve (Based on Effective Capacity)



South Asia is the marginal producer

- The marginal producers sit at the top of the end of the industry cost curve and consist of producers in South Asia
- In South Asia, producers are required to purchase phosphate on the open market and we estimate phosphate feedstock costs (either rock or acid) account for between 50% and 60% of the total ex-works cost of DAP production
- Depending on current market prices and supply/demand dynamics, marginal producers may choose to operate or idle capacity

China is still the largest DAP exporter

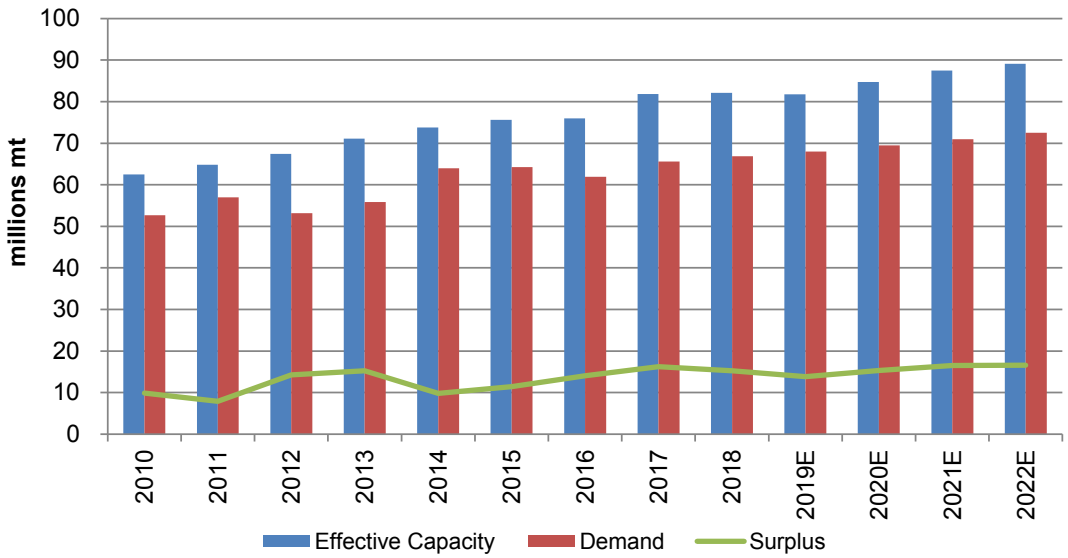
- Chinese DAP exports were ~7.5 million mt in 2018, ~17% higher y/y vs. 2017 driven by lower domestic demand and rising export prices
- Rationalization of Chinese capacity and production cuts could influence level of exports going forward
- There are reports that Chinese environmental enforcement (across the entire chemicals landscape) has been less strict YTD, which arguably has led to less DAP production curtailment and more exports.

Source: CRU, IFA, Morgan Stanley Research.

Potash

Potash – Industry Overview

Effective Capacity vs. Demand



Source: Morgan Stanley Research.

Key Conclusions

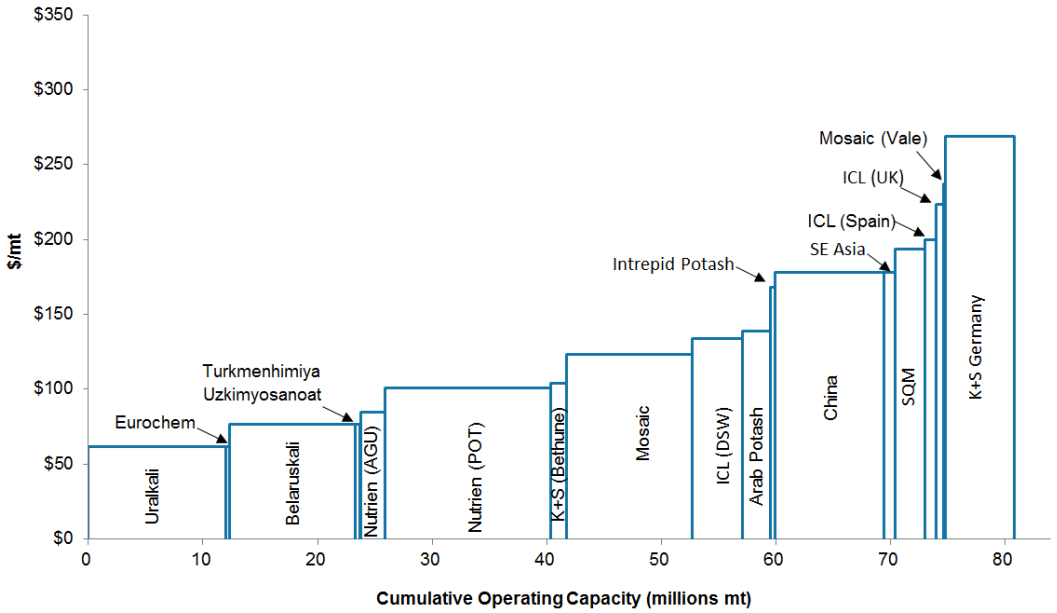
- We expect the potash market to continue to tighten in 2019, though expect lower utilization in '20-'21
- Global utilization rate is likely to average 82% over the next three years (2019-21E) if one counts all potential supply, or 87.5% if one excludes "shadow capacity" (i.e., capacity that exists but Nutrien/Mosaic have decided not to run in the near-term)
- We expect 2019 global potash shipments to increase to 68M mt versus 67M mt in 2018

What Is Potash?

- "Potash" refers to potassium fertilizers in general. Muriate of potash (MOP, or KCL) is the most widely used
- Potash is known as the "quality nutrient" as it improves the plant's water use, drought/disease tolerance and ripening of fruit/seeds
- Effect of potash must be considered over the long run as it takes years to enter/leave the soil (unlike nitrogen which has a more immediate impact)
- Potash reserves are concentrated in the former Soviet Union (FSU) and Canada

Potash – Cost Curve

Current Cash Costs/mt (incl. royalties, SGA, excl. freight) FOB Mine



Uralkali and EuroChem are at the lower end of the cost curve with most NA players at the next quartile

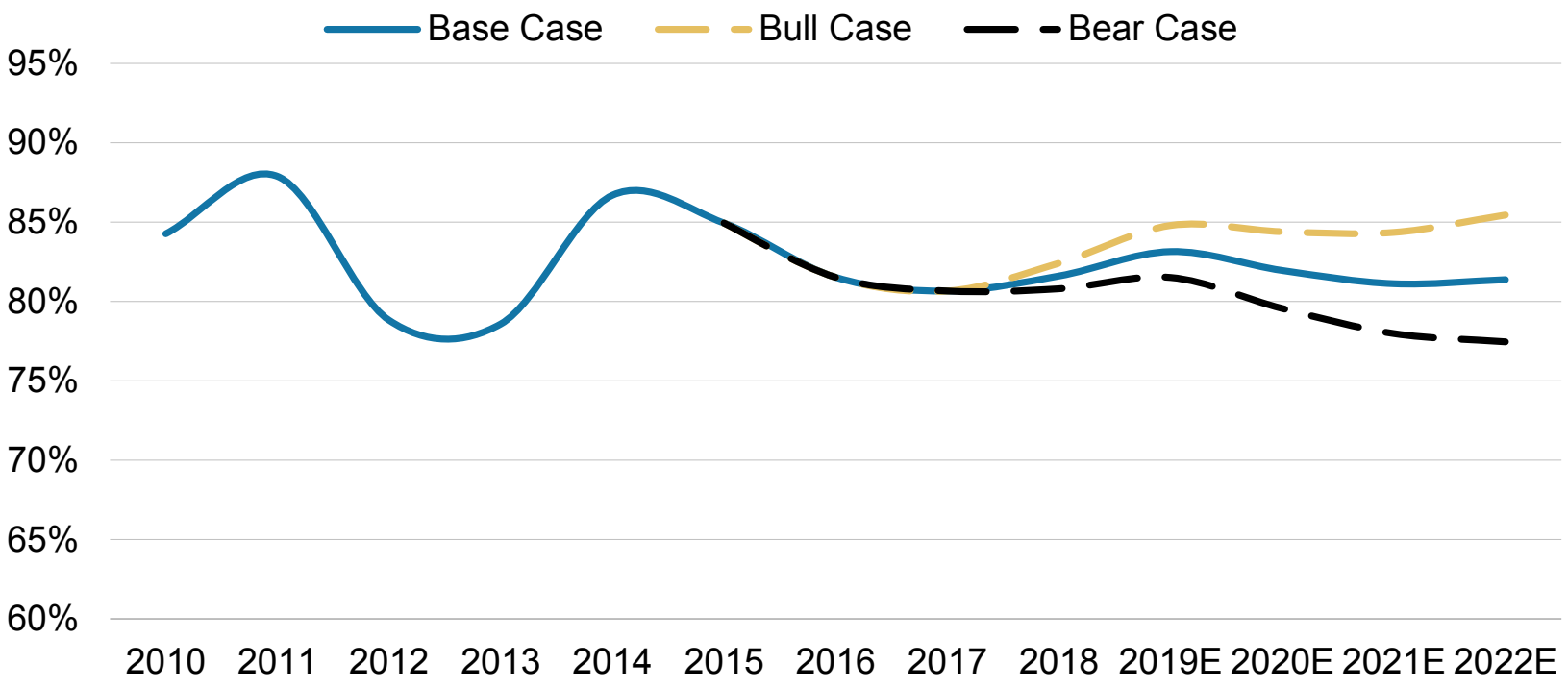
- Uralkali is the world's low cost producer along with EuroChem; Belaruskali is also advantaged
- Among North American producers, Nutrien is at the lower end of the cost curve, Mosaic towards the middle, and Intrepid is the highest cost producer
- Nutrien's costs should decline further as it continues to ramp its lowest-cost Rocanville mine
- Mosaic's costs should continue to decline as the company eliminates $100M+ in annual brine management costs by diverting production to the Esterhazy K3 mine

Eurochem and K+S greenfield projects ramping slower than anticipated

- Eurochem's new potash mines Usolskiy and VolgaKaliy came onstream in 2018, though slower than expected. The company targets a combined capacity of 8.3M mt by 2024
- We model Eurochem's two mines achieving cash costs near those of Uralkali
- The K+S Bethune mine reached 1.4M mt capacity by the end of 2018, and is ramping up to 2.86M mt by 2023

Source: Company Data, Morgan Stanley Research.

Potash – Global Capacity Utilization



Source: Company Data, Morgan Stanley Research

Ag Consolidation and R&D Implications

Ag Chem Sector Consolidation

2016 Actual Sales by Category										($ in millions)
	Monsanto	Syngenta	Bayer	Dupont	Dow	BASF	Adama	FMC	UPL	Arysta
Herbicides	$3,425	$3,676	$3,012	$1,082	$2,911	$2,393	$1,458	$1,001	$667	$551
Insecticides	$0	$2,473	$2,445	$1,039	$1,165	$913	$724	$887	$687	$625
Fungicides	$16	$3,732	$3,866	$726	$395	$2,760	$640	$273	$545	$355
Others	$55	$160	$155	$27	$170	$101	$55	$114	$121	$285
Seeds & Traits	$10,437	$2,657	$1,502	$6,642	$1,533	$0	$0	$0	$0	$0
Total Ag Sales	**$13,933**	**$12,698**	**$10,980**	**$9,516**	**$6,174**	**$6,167**	**$2,877**	**$2,275**	**$2,020**	**$1,816**

2017 PF Sales by Category							($ in millions)
	Bayer Monsanto	Corteva	Syngenta	BASF	FMC	Adama	UPL Arysta
Herbicides	$6,178	$2,682	$3,583	$3,230	$1,463	$1,675	$1,325
Insecticides	2,281	480	2,461	1,014	2,078	789	$1,195
Fungicides	3,532	1,278	3,523	2,784	278	737	$1,121
Others	208	176	172	110	152	59	$428
Seeds & Traits	11,158	7,766	3,012	1,371	0	0	$0
Total Ag Sales	**$23,357**	**$12,382**	**$12,751**	**$8,509**	**$3,971**	**$3,260**	**$4,069**

Market Share Change Following Acquisitions/Divestments, 2016-2017 PF							
	Bayer Monsanto	Corteva	Syngenta	BASF	FMC	Adama	UPL Arysta
Herbicides	-2.0%	-6.2%	-0.9%	3.3%	1.9%	0.7%	0.3%
Insecticides	-2.0%	-13.5%	-0.9%	0.5%	8.5%	0.2%	-1.3%
Fungicides	-2.1%	1.1%	-1.2%	0.3%	0.0%	0.7%	1.5%
Others	-1.1%	-2.0%	-0.1%	0.0%	1.4%	-0.1%	-0.8%
Seeds & Traits	-4.0%	-2.4%	0.5%	3.5%	0.0%	0.0%	0.0%

Ongoing Theme Has Been Major Ag Chem M&A

- ChemChina/Syngenta for $43bn (June 2017)
- Dow/DuPont on 9/1/17; Corteva (a combination of DuPont Pioneer, Dow AgroSciences, and DuPont Crop Protection) will be spun out on June 1, 2019
- Bayer/Monsanto for $66bn on June 7, 2018
- UPL/Arysta for $4.2bn on February 1, 2019

Source: PhillipsMcDougall, Morgan Stanley Research.

Ag Chemical Pipeline Analysis

- Ag Chem companies are spending significant amounts of money on R&D
- On average, it can take 10-14 years from discovery to product launch and can cost $200-300mn
- Corteva's crop protection pipeline is shown below. Corteva targets $2.2bn of sales by 2022 from new product launches and ~$3.8bn of peak sales.

Corteva Crop Protection Pipeline

Product	Crops	Primary Geographies	Phase	Initial Launch	Value Prop	Canibalize	Acres MM	Peak Sales ($mn)
WEED CONTROL								
Arylex Active	Cereal, oilseed rape, sunflower	NA/EMEA	6	2017			>100	$600-800
Enlist Duo	Corn/Oil Seed	US/LA	5	2017			50-100	100-500
Aminopyralid HL & XT		Latin America	6	2017			50-100	200
Rinskor Active	All crops	All Regions	6	2018			50-100	~400
"New" class of broad leaf weed control			0.5	2030			50-100	200
Three "new" classes weed control leads			0	2031			50-100	200
Total								
INSECT & NEMOTODE CONTROL								
Lumivia Seed Treatment	Rice, corn, oilseed	APAC	6	2017			50-100	$100-500
Lumiposa Seed Treatment	Corn, oilseed	EMEA	5.5	2017			<50	0-100
DuPont Pexalon (Pyraxalt Active)	Rice	APAC	5.5	2018			<50	~150
Spinetoram		EMEA	5.5	2018			50-100	200
Intrasect		Pakistan	4.5	2020			50-100	200
Reklemel Active	F&V, soy, sugarcane, oilseeds	All Regions	4	2021			50-100	100-500
Two "new" insect or nemotode control leads			0	2031			50-100	200
"New" class of insect control			0	2031			50-100	200
"New" mode of action of insect control			0	2031			50-100	200
Two "new" classes of insect control for piercing pests			0	2031			50-100	200
Total								
DISEASE CONTROL								
Isoclast Active	F&V, soy	All Regions	5.5	2017			50-100	~$350
Vessarya	Corn, oilseed, soy	Brazil	6	2017			50-100	~200
DuPont Zorvec Active	Vegetables, Grapes	All Regions	5.5	2017			50-100	>200
Lumisena Seed Treatment	Corn, oilseed, soy	All Regions	5	2018			<50	0-100
Inatreq Active	Cereal, Banana	EMEA	5	2018			50-100	~300
Adavelt	Cereal, vines, F&V, nuts	APAC	3	2023			50-100	200
Broad-spectrum disease control I	F&V, cereals		3	2023			>100	500+
Fungicide - Seed treatment			3	2023			<50	0-100
Broad-spectrum disease control II	F&V, cereals		2.5	2025			50-100	100-500
"New" MOA for control of soybean rust	Oilseeds		1.5	2028			50-100	200
Three "new" disease control leads			0	2031			50-100	200
Total								

Note: green shading indicates product has advanced in R&D Phase over the past 12 months. Orange shading indicates MSe.
Source: Company Data, Morgan Stanley Research estimates

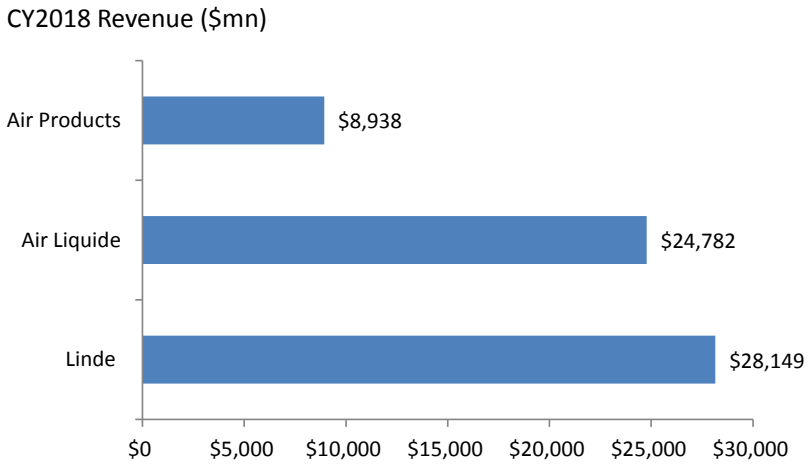
Industrial Gases

Industrial Gases – Industry Overview

What Are Industrial Gases?

- The global industrial gas industry represents over $65 billion of annual sales, principally comprising atmospheric gases like oxygen and nitrogen, specialty gases such as silane, hydrogen for the energy industry, as well as engineering, and distribution sales.
- The industry is highly concentrated, with dominant merchant and packaged gas networks enjoying high returns in local markets driven by strong barriers to entry.
- Growth is driven by industrial production, with an upside catalyst tied to regulation of carbon emissions.

Revenue by company (in millions)



Source: Company Data, Morgan Stanley Research

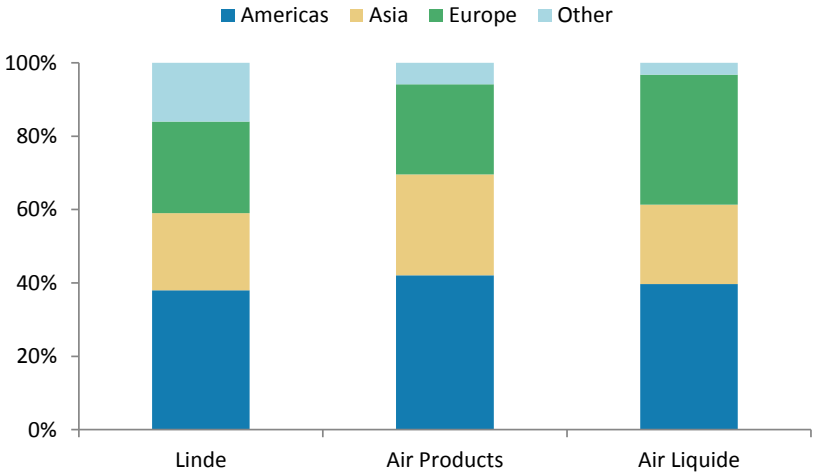
Atmospheric Gases

- Traditional industrial gas business, including oxygen, nitrogen, argon and other commercially necessary gases.
- Business model is to build large “on site” plants adjacent to heavy industrial customers, who sign 15- to 20-year take-or-pay contracts, thus locking in a minimum return on capital for the industrial gas company.
- Excess capacity is sold to smaller nearby customers via a merchant network, which can boost returns via asset utilization by 10-15%.
- Local density of the merchant market is key for high level returns.

Hydrogen/Carbon Monoxide

- Manufactured via natural gas processing in a steam methane reformer unit.
- Hydrogen is used to upgrade lower quality crude oil in the refining process (helps to remove sulfur).

Industrial Gases – Industry Overview



Source: Company Data, Morgan Stanley Research

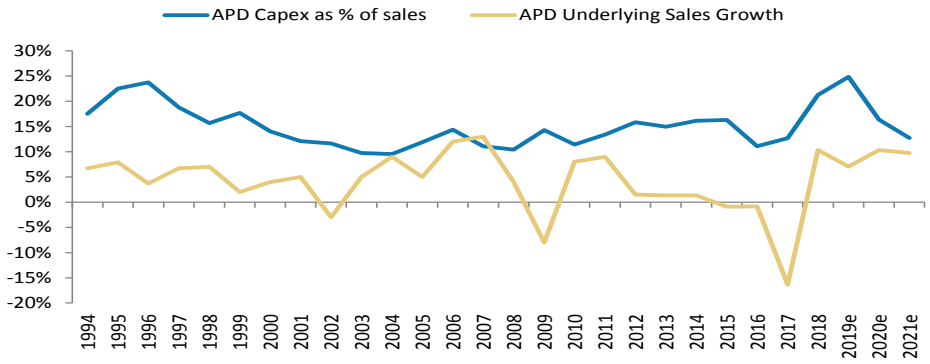
Geographical Diversity

- Industrial gas companies have established footprints across developed and developing markets.
- Developed markets require a steady supply of Industrial Gases, while developing markets demand an increasing supply as their industrial infrastructure and consumer markets develop.

Three Primary Contract Structures

- **Pipeline/On-site:** long-term take/pay contracts (typically 15-20 years). Pass-through escalation formulas help to protect against inflation and ensure target returns.
- **Merchant:** Truckload or less than truckload delivered from industrial gas-owned ASU. Medium-length contracts (typically 3-7 years). Low-cost energy and efficiency drive profitability.
- **Packaged:** Individual cylinders are refilled and delivered to customers (rented). Shorter term contracts (1-3 years) or individual purchase orders. This segment of business is most exposed to fragmentation (local mom/pop competition) and also makes up the majority of M&A activity in the industry.

Industrial Gases – Industry Overview



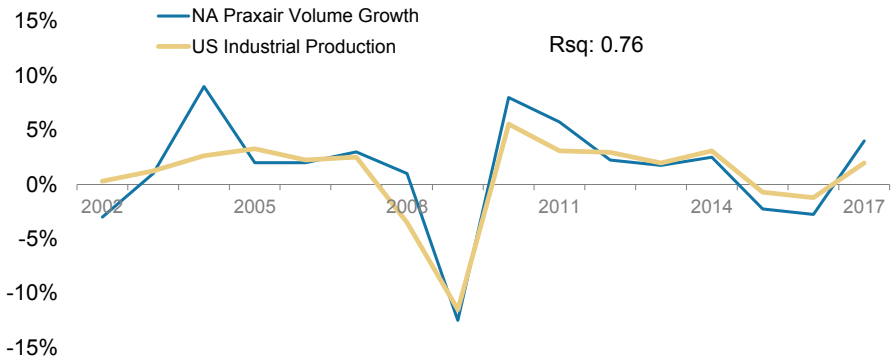
Capital Intensive/Stable Margins

- The Industrial gas business is capital intensive, though the spending is typically through specific client driven investments, so relatively transparent return spectrums are available.
- Industrial gas companies build large air separation plants (ASPs) either on-site or adjacent to customer sites.
- These asset additions support long-term contracts with stable margins, which dictates that earnings growth is driven primarily by capital deployment.

Source: Company Data, Morgan Stanley Research

Industrial Gas Consumption Has Historically Tracked Industrial Production

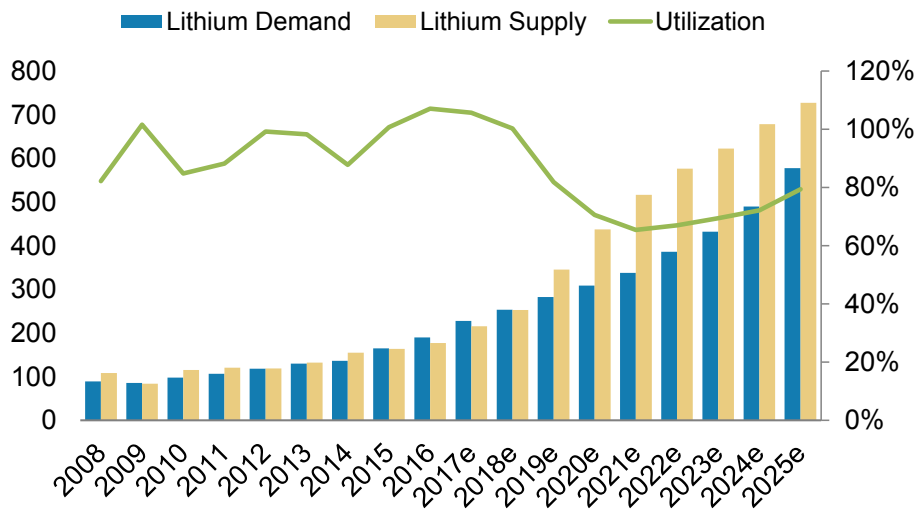
- Industrial gases are used in diverse end-markets and have a wide range of applications.
- Many industrial applications create value for customers either through driving efficiencies in manufacturing processes (throughput yields), or enhancing product quality.



Source: Company Data, Datastream, Morgan Stanley Research

Lithium

Lithium – Industry Overview



Source: Company Data, IHS, Roskill, Morgan Stanley Research

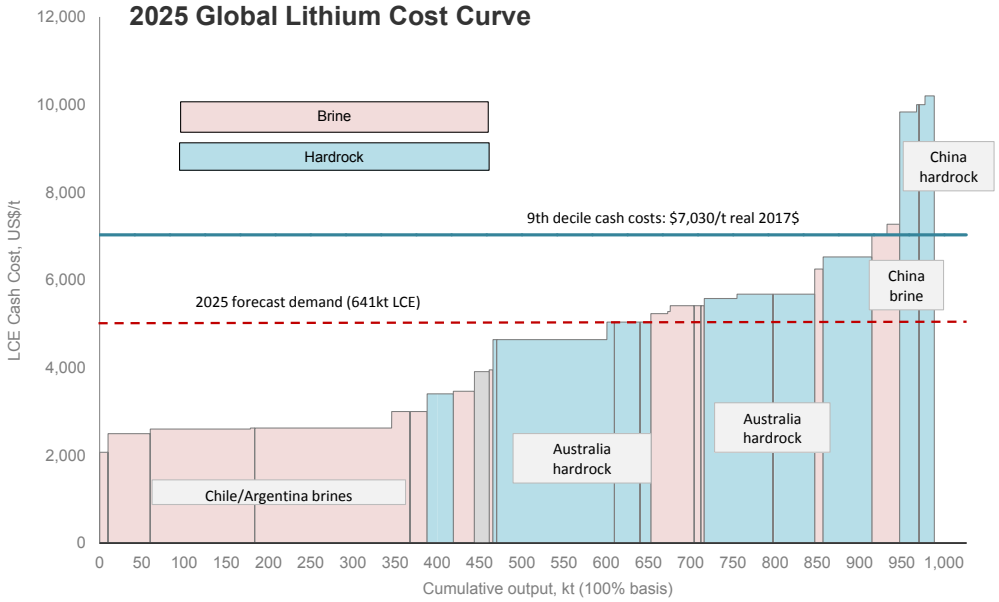
What is Lithium?

- Lithium is the lightest metal on the periodic table
- Raw lithium is rarely consumed for industrial purposes but is instead processed into a number of different chemicals (primarily lithium carbonate and lithium hydroxide)
- Lithium is produced from both brine and mineral sources

Key Lithium Debates

- Tension between rich multiples for lithium stocks like ALB and a significant 2025+ EV penetration story (i.e., will the market care if 2018/2019 are down years if 2020-2035 are up to the right?)
- Several years of near 100% capacity utilization versus a potential lithium supply/demand imbalance that we expect to emerge in late 2018 and 2019+
- The key debate is when the market for electric vehicles (EVs) will take off and how much lithium demand it will drive
    - Lithium S&D remains attractive until late 2018, when we think it starts to depend on aggressive EV adoption
    - If material EV demand plays out as bulls expect, out years' lithium supply will become the key debate

Lithium – Supply Overview



Source: Company Data, IHS, Roskill, Morgan Stanley Research

The discrete levels of the cost curve are dictated primarily by source of supply

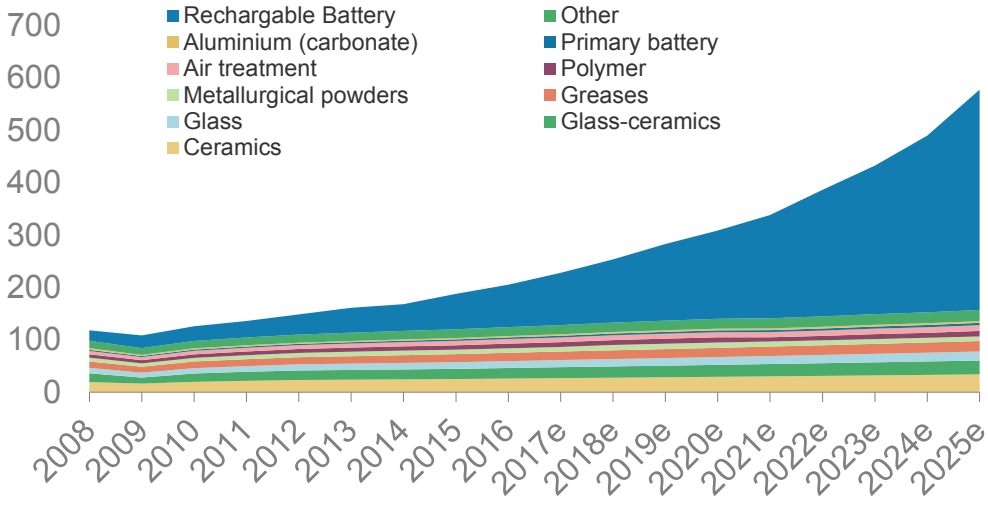
- There are three primary supplier types: Majors, China Mineral Converters, and Juniors
- Albemarle, Sociedad Quimica Y Minera, FMC and Sichuan Tianqi are the major suppliers
  - We expect ALB and SQM to add significant capacity in low-cost Chile, pushing marginal players off the cost curve
- Various independent mineral converters exist in China
- Juniors are speculative producers seeking to develop new sources of lithium supply
  - Orocobre achieved production in 2015 and continues to ramp up to nameplate
  - Mt. Cattlin and Mt. Marion in Australia also continue to ramp following production start-up delays versus their original 2016 targets

Brine and Mineral Ore are Primary Sources of Supply

- Lithium occurs naturally in subterranean brines, with the highest concentration existing in Argentina and Chile
- Brine sourced lithium is the lowest cost to produce
- Lithium also occurs naturally in hard rock ores, mainly found in Australia
- Mined ore is typically sold to mineral converters (primarily in China) who then produce lithium carbonate or hydroxide
- Ore sourced lithium is higher-cost

Lithium – Demand Overview

Sources of Lithium Demand (000s of mt LCE)



Source: Company Data, IHS, Roskill, CRU Morgan Stanley Research

Lithium Demand

- Lithium is consumed in various industrial and consumer applications, including: glass, ceramics and greases.
- More recently, lithium has increasingly been used as cathode material for rechargeable batteries in mobile devices, laptops and electric vehicles.
- Lithium's use in rechargeable batteries is driven by its desirable properties of high power density in a light package.

EV Demand

- The market is very enthusiastic about EV demand for lithium and other battery related components, driven particularly by aggressive targets laid out by the Chinese government for near-term (i.e. 2019/20) adoption.
- We believe current valuations inadequately discount lithium's long-term risks of an imbalance of lithium supply and EV demand in 2018+.
- Continued global SUV growth amid low oil prices stands largely at-odds with the narrative of aggressive EV penetration.
- Our autos team sees EV infrastructure (i.e. $2.7 trillion of investment needed by 2040) as a key gating factor to widespread adoption, in addition to consumer value proposition

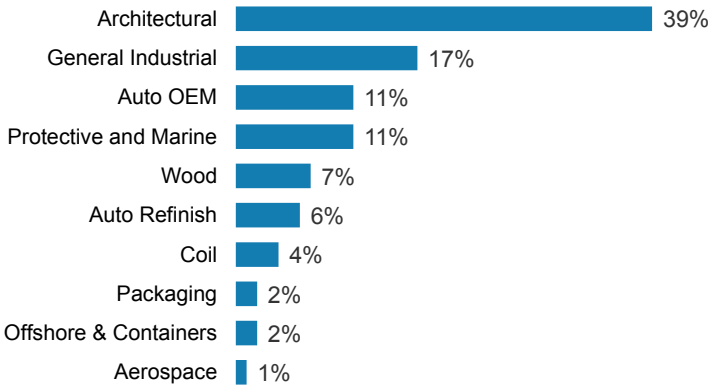
Paints and Coatings

Paints and Coatings – Industry Overview

Industry Overview

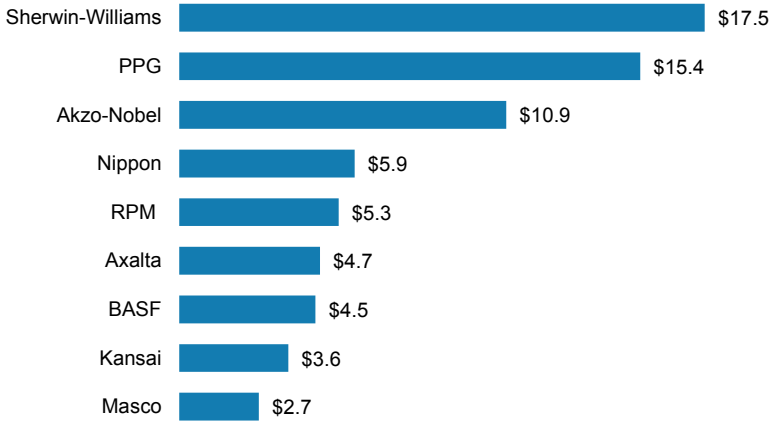
- The global paints and coatings industry accounted for ~$125bn in sales in 2018.
- The principal basic chemicals found in paints are titanium dioxide (TiO2) and acrylic acids (made from propylene), although the manufacturing process may also include a range of other substances, including resins, solvents, additives, pigments, and diluents.
- We believe there is good pricing discipline within the coatings industry. Coatings companies are exposed to raw material inflation, though are typically able to recover costs, albeit with a lag.

Global Coatings Industry by End Market



Source: Sherwin Williams, KNG research, Axalta

Global Coatings Industry by Manufacturer



Source: Company Data

Primary Industry Segments

- **Architectural** – largest market by volume at 41% of sales. Primarily used on buildings and residential dwellings and sold primarily through large-format home improvement stores, hardware stores, and dedicated paint stores.
- **Original Equipment Manufacture (OEM)** – 37% of industry sales, consumed downstream by automotive, aerospace, machinery, industrial products, shipbuilding, and furniture manufacturing.
- **Special purpose** – ~22% of industry sales; include those designed to withstand extreme conditions such as exposure to caustic or abrasive materials or severe temperatures.

Paints and Coatings – Cost Structure

Cost Structure

- Paints and Coatings manufacturers generally have a low fixed cost base and the industry is characterized by high variable costs.
- The majority of these variable costs are commodity raw materials whose pricing can be volatile (TiO2 in 2011 is a key example).
- The ability to manage cost inflation, and maintain pricing power over customers is critical to preserving operating margins.

Operating Cost Breakdown

Paints and Coatings Cost Structure

Cost Item	% of Operating Costs
Raw Materials	70% - 80%
Packaging and logistics	5% - 10%
Labor	7% - 8%
Fixed costs	10% - 20%

Source: Company Data, Morgan Stanley Research

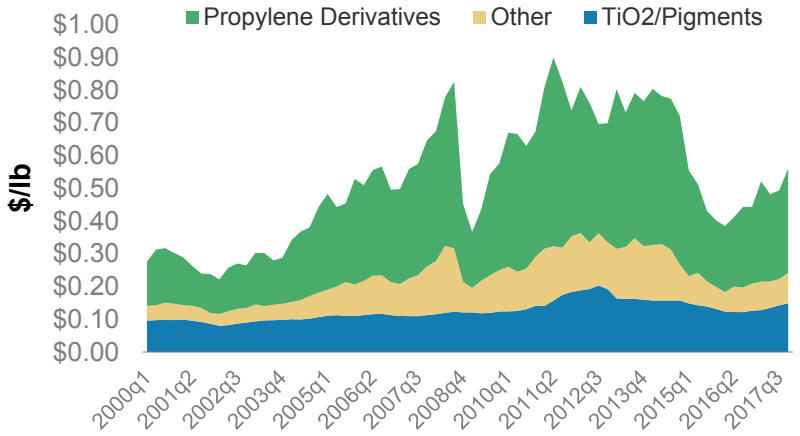
Key Raw Materials Used in Paints and Coatings

Key Raw Materials Used in Paints and Coatings

Raw Material	Architectural	Industrial
Titanium Dioxide (tiO2)	30% - 35%	10% - 15%
Resin and Monomer	30% - 40%	40% - 60%
Additives	10%	10%
Solvent	5% - 10%	15% - 20%
Other	20%	20%

Source: Company Data, Morgan Stanley Research

Simplified Raw Material Basket for Architectural Paint



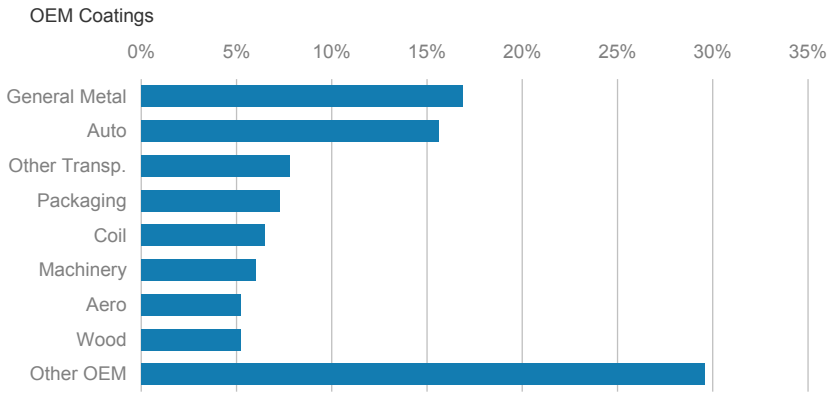
Source: ICIS, IHS, Company Data, Morgan Stanley Research

Paints and Coatings – OEM

OEM Market Overview

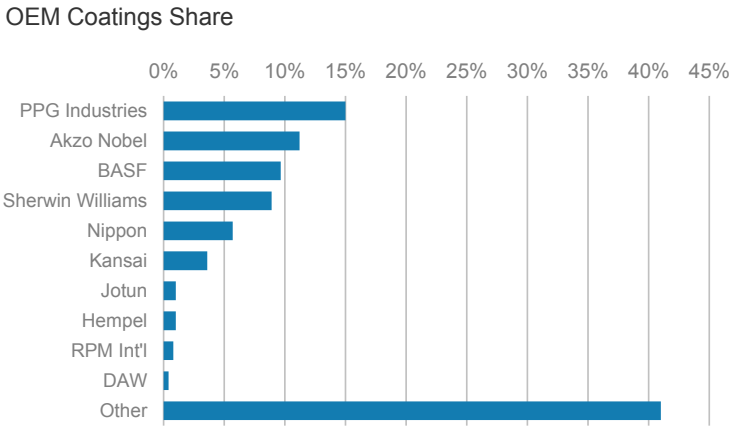
- The global OEM coatings market is worth ~$50bn. Much of the growth over the past five years has been driven by increasing demand in developing markets. That said, China and Europe auto builds fell -5% and -11% in 2H18 and have remained weak in early 2019.
- Automotive OEM is an oligopoly, with three global players controlling ~60% of the share. PPG is the global leader in the ~$10bn market.
- Unique to automotive among oligopoly structures is the relative lack of pricing power due to the concentrated nature of customer base (large automotive manufacturers).

Global OEM Coatings End Markets



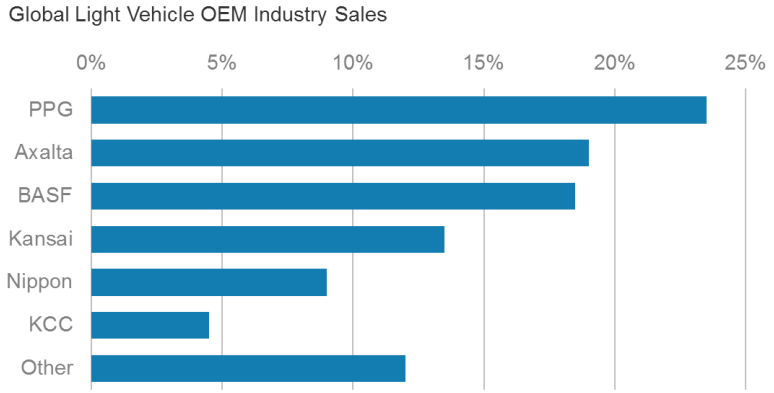
Source: Company Data, Morgan Stanley Research

Global OEM Market Shares



Source: Company Data, Morgan Stanley Research

Auto OEM Market Shares



Source: Company Data, Morgan Stanley Research

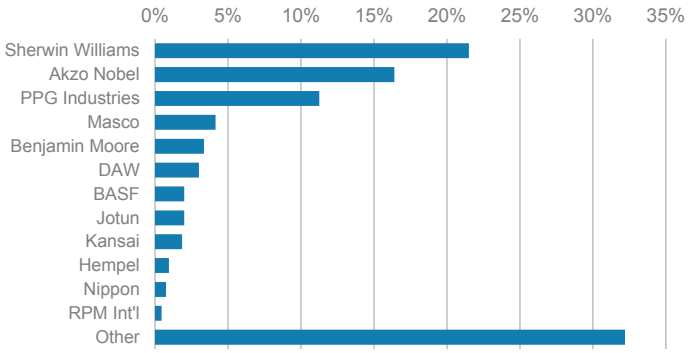
Paints and Coatings – Architectural

Architectural Coatings Market Overview

- Architectural or “decorative” coatings is a $49bn industry and represents the majority of coatings industry volume (nearly 60%), while only ~39% of value due to lower unit prices.
- Three primary drivers: home prices, existing home sales, and new construction.
- Repainting existing structures makes up the largest end market demand for architectural coatings.
- Contractor serviced architectural paint volumes represent ~61% of demand in N. America, and continue to grow in excess of the broader architectural paint market.

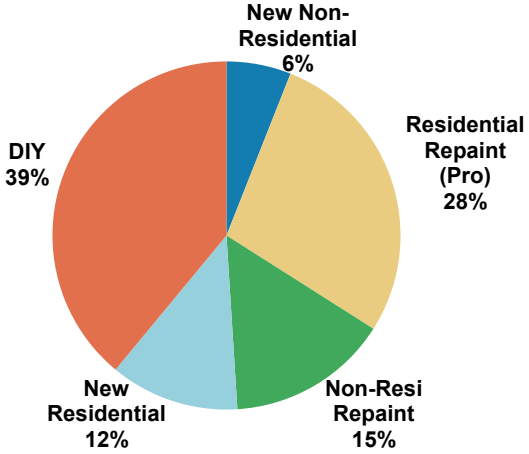
Global Architectural Coatings Market Share

Architectural Paint Share



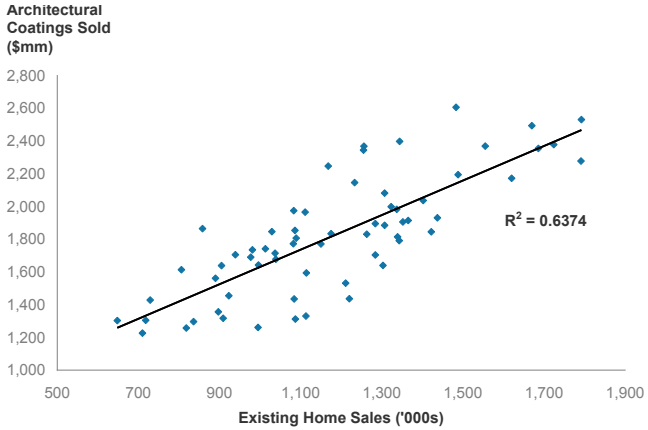
Source: Company Data, Morgan Stanley Research

Architectural End Market Usage – N. America



Source: Company Data, Morgan Stanley Research

Sales Linked to Existing Home Sales



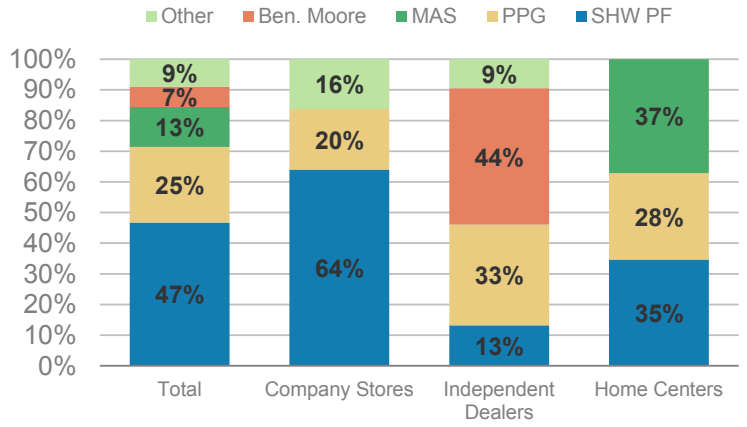
Source: US Census Bureau, Data, Morgan Stanley Research

Paints and Coatings – US Architectural

U.S. Architectural Coatings Market Overview

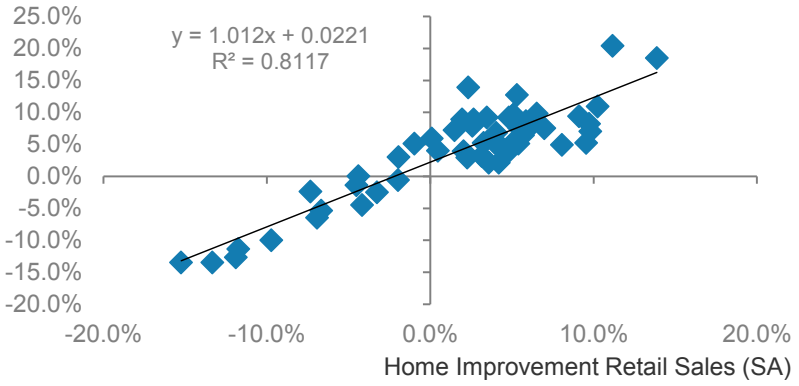
- Sherwin-Williams is the dominant incumbent within the U.S. architectural paint market, and continues to expand largely at the expense of independent dealer counterparts.
- We use Home Improvement Retail Sales (HIRS) as a proxy for broader architectural paint demand, which has historically been strongly correlated to Sherwin-Williams' Same-Store-Sales (Rsq = 0.81).
- Versus the prior peak, there is ~25% upside to Home Improvement Retail Sales per household on an inflation adjusted basis.

NA Architectural Market Share (2016)

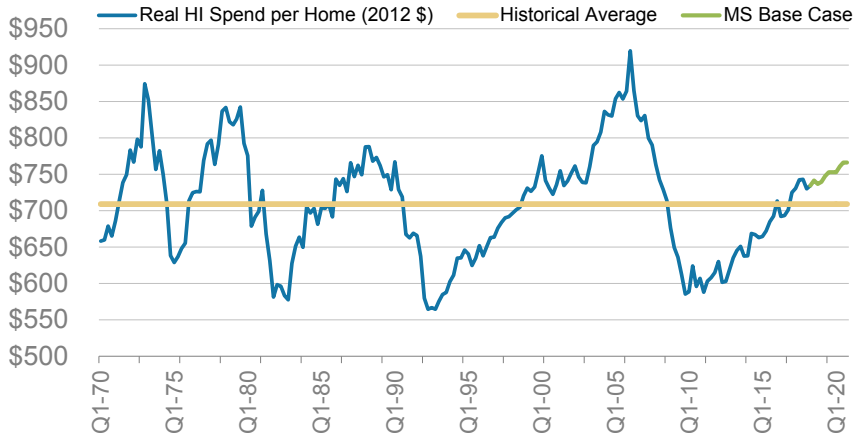


Source: Company Data, Morgan Stanley Research

Sherwin-Williams Same-Store-Sales



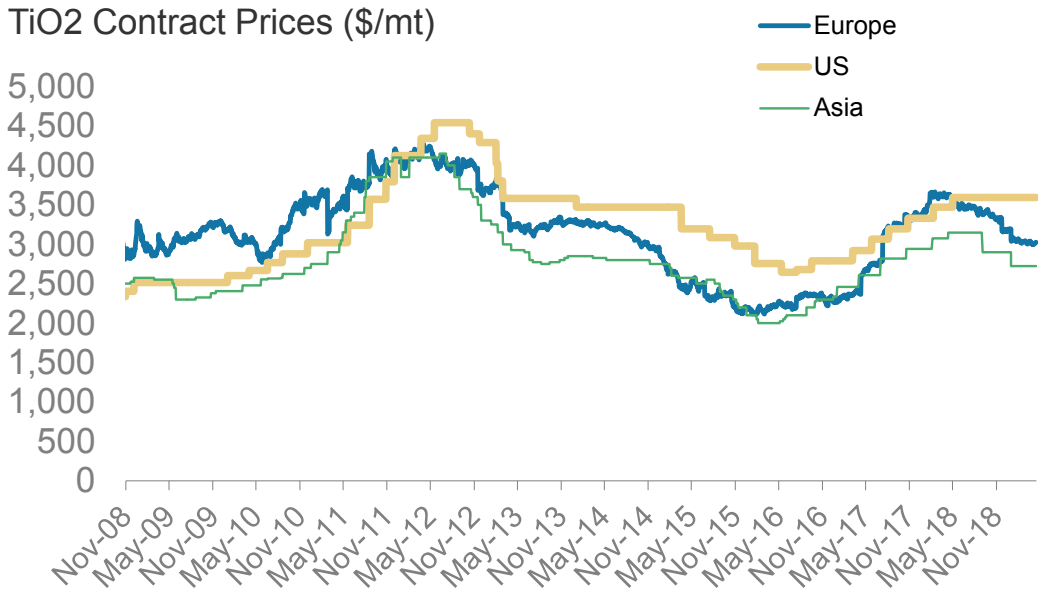
Source: Census Bureau, Company Data, Morgan Stanley Research



Source: Census Bureau, Morgan Stanley Research

Titanium Dioxide (TiO_2)

TiO2 – Cycle Overview



Source: ICIS, Morgan Stanley Research

Where Are We in the TiO2 Cycle?

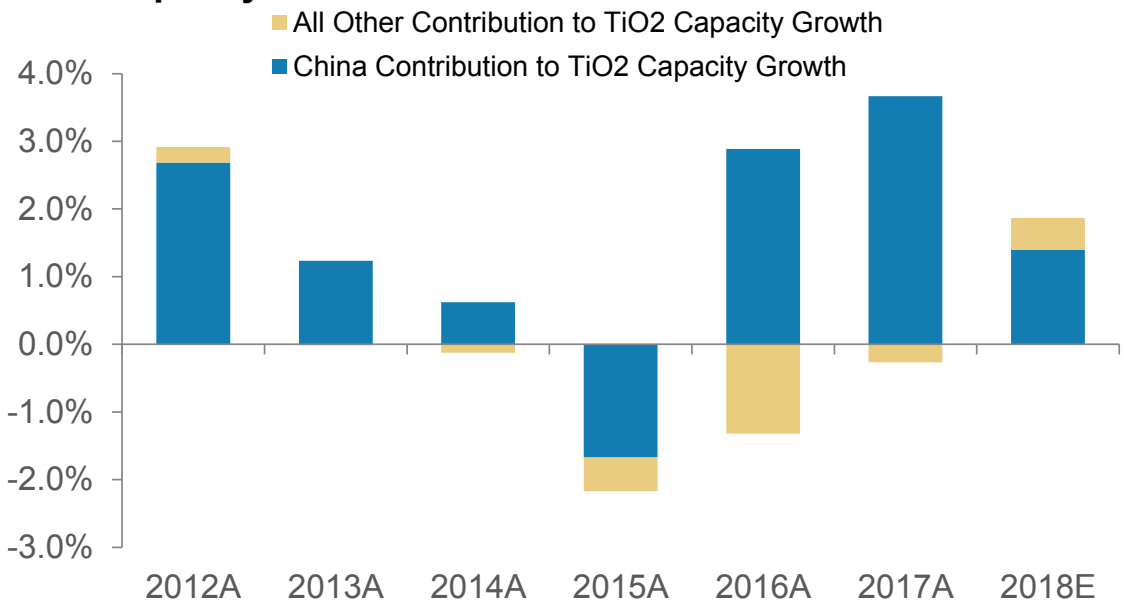
- Industry fundamentals firmed meaningfully relative to the early 2016 trough, with consistent price increases seen across geographies.
- While U.S. prices have remained stable, significant inventory destocking drove price weakness in Europe and Asia for much of 2018. Early indications point toward a stabilized pricing outlook across all regions in 2019.

What Is TiO2?

- Titanium dioxide (TiO2) is a pigment used to impart whiteness, brightness, opacity, and UV protection to paints, plastics, and paper. The industry is relatively concentrated, with the top five players representing about 52% capacity.

TiO2 – Supply Overview

TiO2 Capacity Growth



Source: CEIC, ICIS, Morgan Stanley Research

China Capacity Still a Threat

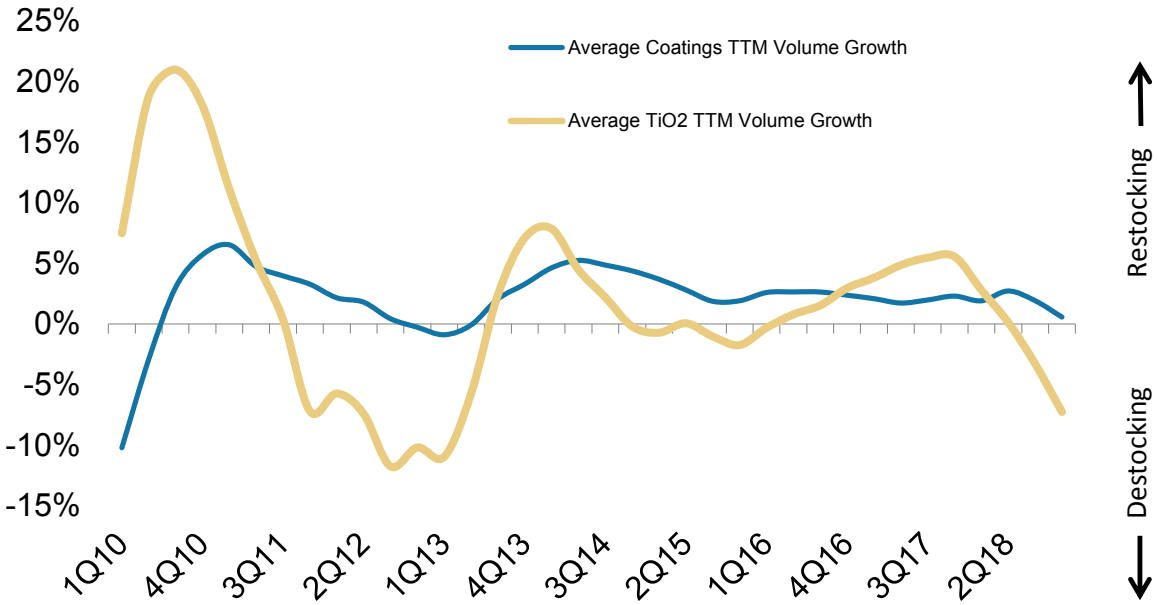
- China drove the majority of capacity growth following the recession through 2014 and has also played an outsized role since 2016. Environmental reform stringency remains a key swing factor in Chinese supply.
- Although quality issues do persist with Chinese pigment, the product is moving up the quality ladder.
- Chinese product continues to sell at a discount to Western product, though producers are narrowing this discount.
- China is pushing into chloride-based production, though high costs will prevent significant share gains.

Is China a Viable Source for Western Producers?

- Sherwin-Williams increased its use of lower-grade sulfate-based TiO2 to >20% following the 2011 TiO2 spike.
- PPG reported using about 10% of lower grade pigment.
- In general, paint makers reduced their demand for chloride-based TiO2 by ~15%-20% in favor of improved sulfate-based imports from China.

TiO2 – Demand Overview

Coatings vs TiO2 Volume Growth



Source: Company Data, Morgan Stanley Research

Demand Volatility Driven by Restocking and Destocking

- We believe coatings producers were de-stocking TiO2 for much of the 2012-2016 downcycle.
- Restocking aided a recovery in TiO2 volumes during 2017 and 1H2018. However, beginning in 2H18, substantial destocking drove mid-to-high single-digit declines in TiO2 industry volumes.
- We expect a ~1.9% core demand CAGR between 2019 and 2022, supplemented by ~130bps of restocking in 2019.

Weak Coatings Volumes Don't Impact TiO2 Price Power

- Coatings volumes grew <2% in 2017, but TiO2 prices still rose ~20%+ between Dec '16 and Dec '17.
- TiO2 producers are attempting to enter into longer-term pricing contracts to lock in low-to-mid-single-digit pricing, attempting to elongate the TiO2 cycle.
- We believe there is little incremental opportunity to shift away from chloride TiO2 following shifts in 2011-2016, reducing the negotiating leverage of coatings players.

Chemicals – Detailed Valuation Summary

	Ticker	MS Rating	MS Price Target	Last Price	Market Capitalization	Consensus P/E 2019e	Consensus P/E 2020e	Consensus EV/EBITDA 2019e	Consensus EV/EBITDA 2020e	Dividend Yield 2019e	Dividend Yield 2020e	Cons. EV/Sales 2019e	Cons. EV/Sales 2020e
Agriculture & Fertilizers													
Archer Daniels Midland	ADM-US	Equal-weight	47	44.07	24,686	13.4x	11.8x	8.2x	7.6x	3.22%	3.37%	0.4x	0.4x
Bunge Ltd.	BG-US	Equal-weight	65	52.16	7,379	18.7x	13.4x	-	-	4.06%	4.30%	-	-
CF Industries	CF-US	Equal-weight	48	43.29	9,628	21.0x	15.5x	9.7x	8.7x	2.79%	2.82%	3.5x	3.3x
Ingredion Inc.	INGR-US	NC	NC	92.19	6,147	13.1x	12.2x	7.9x	7.6x	2.65%	2.76%	1.4x	1.3x
Intrepid Potash, Inc.	IPI-US	Underweight	NA	3.61	473	18.2x	16.0x	7.4x	7.1x	0.00%	0.00%	2.5x	2.5x
Nutrien Ltd	NTR-US	Equal-weight	54	53.64	44,804	18.1x	15.6x	-	-	3.25%	3.44%	2.0x	1.9x
The Mosaic Corp.	MOS-US	Equal-weight	36	25.81	9,957	11.7x	10.0x	6.3x	5.8x	0.77%	0.84%	1.4x	1.3x
Israel Chemicals	ICL-US	NA	NA	5.16	23,980	13.2x	12.3x	7.9x	7.5x	3.68%	3.82%	1.6x	1.5x
Average					14,725	16.3x	13.5x	7.9x	7.3x	2.39%	2.51%	1.9x	1.8x
Chlor-alkali													
Olin Co.	OLN-US	Overweight	33	21.12	3,482	11.2x	8.5x	5.3x	4.8x	3.81%	3.83%	0.9x	0.9x
Westlake Chemical Co.	WLK-US	Equal-weight	88	67.81	8,720	10.5x	8.0x	5.9x	5.0x	1.44%	1.52%	1.3x	1.2x
Average					6,101	10.8x	8.2x	5.6x	4.9x	2.63%	2.67%	1.1x	1.0x
Diversified Chemicals													
Albemarle	ALB-US	Underweight	65	74.07	7,843	11.9x	10.9x	8.3x	7.5x	1.84%	1.91%	2.5x	2.3x
Ashland Inc.	ASH-US	NC	NC	75.63	4,736	23.8x	17.8x	12.2x	11.1x	1.35%	1.40%	2.7x	2.6x
Balchem Corp	BCPC-US	NC	NC	99.49	3,217	38.5x	33.6x	20.4x	19.3x	0.46%	0.50%	4.8x	4.4x
Cabot Corp	CBT-US	NC	NC	45.39	2,702	10.3x	9.1x	6.8x	6.2x	3.02%	3.09%	1.1x	1.1x
Celanese Corp.	CE-US	Equal-weight	102	105.83	13,399	10.0x	9.0x	8.4x	7.9x	2.24%	2.45%	2.4x	2.3x
Dow	DOW-US	Overweight	62	56.13	42,017	11.4x	9.7x	-	-	4.80%	5.24%	1.2x	1.2x
DowDuPont	DWDP-US	Overweight	43	37.31	83,812	16.7x	17.4x	-	-	2.29%	1.88%	2.4x	2.9x
Ecolab Inc.	ECL-US	Equal-weight	140	182.38	52,592	30.9x	27.5x	18.1x	16.7x	1.02%	1.10%	3.9x	3.7x
Eastman Chemical Co.	EMN-US	Overweight	90	78.55	10,902	9.1x	8.3x	7.6x	7.3x	3.13%	3.37%	1.7x	1.6x
FMC Corp.	FMC-US	NC	NC	76.98	10,131	13.5x	11.7x	10.8x	9.8x	2.08%	2.26%	2.8x	2.7x
W.R. Grace & Co.	GRA-US	NC	NC	75.01	5,019	16.4x	14.6x	11.3x	10.5x	1.15%	1.48%	3.3x	3.2x
Huntsman Corp.	HUN-US	NC	NC	21.15	4,932	7.8x	6.5x	5.5x	5.0x	3.19%	3.40%	0.8x	0.8x
International Flavors & Fragrances	IFF-US	NC	NC	137.82	14,696	21.7x	19.5x	16.3x	14.8x	2.01%	2.14%	3.6x	3.4x
Kraton Performance Polymers	KRA-US	NC	NC	32.07	1,027	8.1x	7.2x	6.8x	6.4x	0.00%	0.00%	1.3x	1.2x
PQ Group Holdings	PQG-US	Equal-weight	19	15.54	2,109	18.6x	15.7x	-	-	0.00%	0.00%	2.5x	2.4x
LyondellBasell Industries	LYB-US	++	++	86.47	32,022	8.3x	7.4x	6.2x	5.6x	4.86%	5.13%	1.0x	1.0x
Element Solutions Inc	ESI-US	Equal-weight	12	10.94	2,774	13.2x	11.4x	-	-	0.00%	0.00%	4.1x	3.9x
Trinseo	TSE-US	Equal-weight	49	43.29	1,772	6.6x	5.6x	-	-	3.81%	4.00%	0.5x	0.5x
Average					10,327	15.9x	13.9x	10.7x	9.8x	1.81%	1.94%	2.6x	2.4x

Source: Thomson Reuters, Morgan Stanley Research

Chemicals – Detailed Valuation Summary

	Ticker	MS Rating	MS Price Target	Last Price	Market Capitalization	Consensus P/E 2019e	Consensus P/E 2020e	Consensus EV/EBITDA 2019e	Consensus EV/EBITDA 2020e	Dividend Yield 2019e	Dividend Yield 2020e	Cons. EV/Sales 2019e	Cons. EV/Sales 2020e
Paints & Coatings													
Axalta Coating Systems	AXTA-US	Equal-weight	29	26.64	6,250	15.3x	14.2x	-	-	0.00%	0.00%	2.1x	2.0x
H.B. Fuller Inc.	FUL-US	NC	NC	47.36	2,410	14.4x	11.8x	9.7x	876.86%	1.34%	1.45%	1.5x	1.4x
Masco Corp.	MAS-US	NC	NC	39.31	11,539	14.7x	13.1x	10.0x	949.74%	1.21%	1.26%	1.7x	1.6x
PPG Industries	PPG-US	Equal-weight	102	115.47	27,263	18.3x	16.6x	12.3x	1159.13%	1.69%	1.81%	2.0x	2.0x
RPM International Inc.	RPM-US	Overweight	70	59.25	7,766	23.2x	17.7x	14.6x	1229.92%	2.27%	2.43%	1.8x	1.7x
Sherwin-Williams	SHW-US	Overweight	500	447.50	41,311	21.3x	18.4x	15.9x	1423.83%	0.95%	1.09%	2.8x	2.7x
Average					16,090	17.9x		12.5x		1.24%		2.0x	
Industrial Biotech													
Codexis, Inc.	CDXS-US	NC	NC	19.56	1,067	-84.3x	-349.3x	-92.4x	-21471.19%	-	-	14.3x	11.6x
Gevo Inc.	GEVO-US	NC	NC	2.12	25	-1.5x	-2.6x	-0.7x	2559.01%	-	-	0.1x	0.1x
Average					546	-42.9x		-46.5x		-		7.2x	
Industrial Gases													
Air Products	APD-US	Equal-weight	168	202.15	44,500	24.6x	21.6x	13.4x	1199.70%	2.25%	2.40%	5.0x	4.6x
Average					44,500	24.6x		13.4x		2.25%		5.0x	
Petrochemicals													
LyondellBasell Industries	LYB-US	++	++	86.47	32,022	8.3x	7.4x	6.2x	555.70%	4.86%	5.13%	1.0x	1.0x
Methanex Co.	MEOH-US	NC	NC	53.83	5,655	12.6x	8.9x	7.0x	605.15%	2.64%	2.83%	1.9x	1.8x
Westlake Chemical Co.	WLK-US	Equal-weight	88	67.81	8,720	10.5x	8.0x	5.9x	502.82%	1.44%	1.52%	1.3x	1.2x
Average					22,103	10.7x		6.4x		3.44%		1.4x	
Titanium Dioxide													
Kronos Worldwide Inc.	KRO-US	NC	NC	12.99	1,506	12.2x	9.5x	6.2x	545.87%	5.39%	5.85%	0.9x	0.9x
Chemours	CC-US	Equal-weight	47.0	34.81	5,788	7.7x	6.4x	-	-	2.87%	3.07%	1.3x	1.3x
Tronox Inc.	TROX-US	Equal-weight	16	13.23	1,781	11.0x	6.6x	-	-	1.34%	1.34%	1.2x	1.0x
Venator	VNTR-US	Equal-weight	10	5.76	614	9.5x	6.5x	-	-	0.00%	0.00%	0.6x	0.5x
Average					2,422	10.1x		6.2x		2.40%		1.0x	
Paper & Packaging													
Ball Corporation	BLL-US	Overweight	63	58.67	19,606	22.0x	19.4x	12.9x	1232.06%	0.69%	0.74%	2.2x	2.1x
Berry Global Group Inc	BERY-US	Equal-weight	60	58.75	7,661	15.2x	14.3x	8.8x	861.08%	0.00%	0.00%	1.6x	1.6x
Crown Holdings, Inc	CCK-US	Equal-weight	56	57.73	7,813	10.9x	10.0x	9.6x	918.35%	0.00%	0.00%	1.4x	1.4x
Sealed Air Corporation	SEE-US	Equal-weight	44	43.86	6,831	16.0x	14.3x	10.7x	1018.20%	1.50%	1.60%	2.1x	2.0x
Average					10,478	16.0x		10.5x		0.55%		1.8x	
Large Cap Average			92.67	107.89	29,937	20.3x		12.2x		1.16%		2.4x	
Small/Mid Cap Average			119.44	87.15	10,851	16.4x		10.7x		1.76%		2.6x	
US Average			92.89	79.13	16,852	16.6x		10.6x		2.01%		2.4x	
S&P 500	.SPX-UT			2923.73		17.1x	16.0x						
S&P Chemical 1500	SICHMD-SP			599.29									

Source: Thomson Reuters, Morgan Stanley Research

Morgan Stanley

FOUNDATION

May 2019

Industrials Spring Training Teach-In

Paper & Packaging and Mid-Cap Chemicals

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Stock recommendations and disclosures in this report are as of May 3, 2019; stock prices as of April 30, 2019, unless otherwise noted.

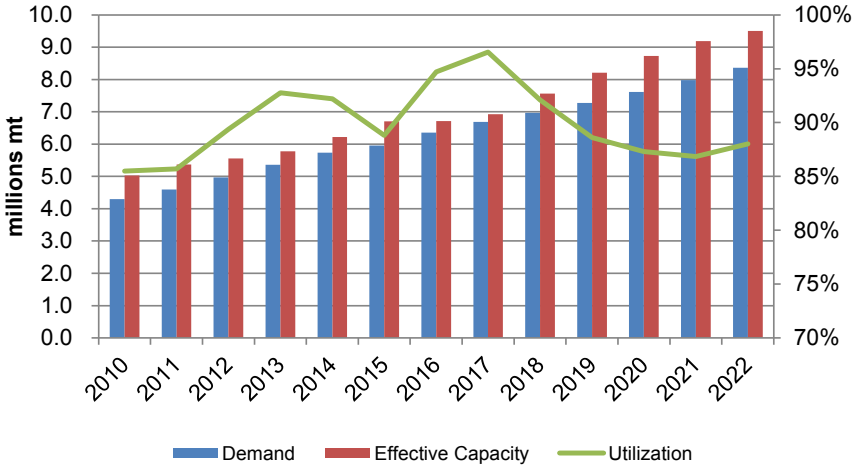
Agenda

1. Chemicals: MDI
2. Chemicals: Chlor-Alkali
3. Chemicals Top Pick: Olin (OLN) - OW
4. Paper & Packaging: Industry Overview
5. Paper & Packaging: Investment Characteristics
6. Paper & Packaging: Key Themes
7. Plastic Packaging
8. Metal Packaging
9. Paper & Packaging Top Pick: Ball (BLL) - OW

1. Chemicals: MDI

MDI Overview

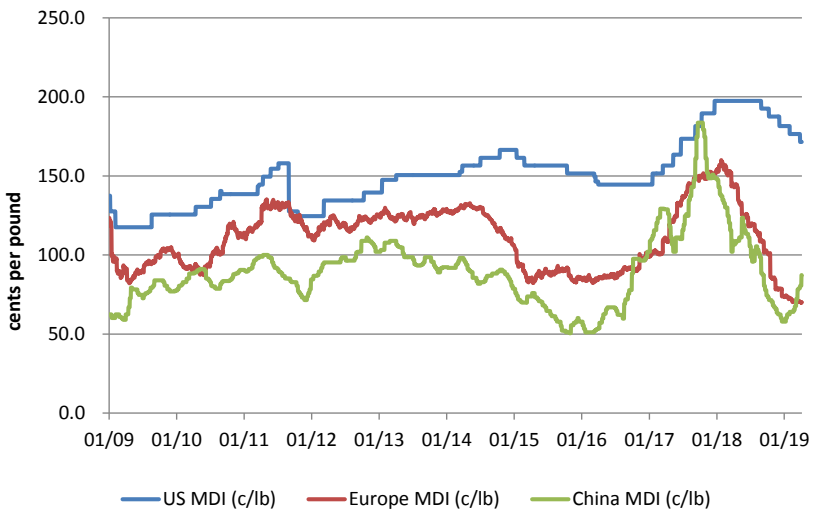
- **Key Players:** Huntsman, Dow
- Methylene diphenyl diisocyanate (MDI) is used primarily to make rigid polyurethane foams such as insulation for your home or refrigerator
- MDI sales generally peak in the spring and summer months in Northern Hemisphere given exposure to construction-related end markets
- The key raw material for making MDI is benzene
- Effective utilization expected to decline from ~92% in 2018 to ~87-89% in 2019-22
  - Capacity: We expect an MDI effective capacity CAGR of ~6% between 2017 and 2022
  - Demand: We expect an MDI CAGR of ~5%, in-line with past three years, due to growing demand for insulation foam and material substitution



Source: IHS, Morgan Stanley Research

MDI Prices Declined in 2018 Following Outages in 2017

- Significant increase in MDI prices in 2017 was driven by persistent supply shortages globally
  - ~8% of annual nameplate capacity was lost due to a variety of supply-side issues including Hurricane Harvey and raw material shortages
- MDI prices decreased ~8%, ~52%, and ~61% in 2018 in the US, Europe, and China, respectively
  - Supply-side pressures normalized in 2018 with less unplanned outages and an increase in new capacity
  - Demand also softened given destocking behavior and weakness in China
- MDI prices in Asia have rebounded ~50% YTD
  - Improving pricing is likely reflective of tight inventory levels at the start of the year and rising MDI demand
  - Several MDI plants in China are expected to undergo maintenance in coming months, which could further tighten the market



Source: IHS, Morgan Stanley Research

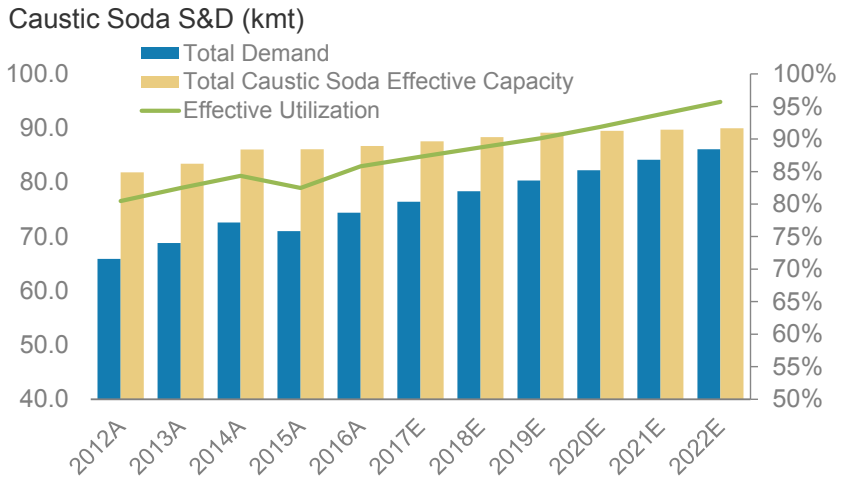
2. Chemicals: Chlor-Alkali

Chlor-Alkali Overview

- **Key Players:** Olin, Westlake

- Chlor-alkali is a commodity chemical subsector that produces chlorine and caustic soda, which are produced together in a ratio of 1.0 mt of chlorine per 1.1 mt of caustic soda
  - Chlorine: volatile, hard-to-transport gas; primarily used in construction applications like vinyls (PVC)
  - Caustic soda: typically shipped as an aqueous solution; primarily used in manufacturing (aluminum, pulp & paper)

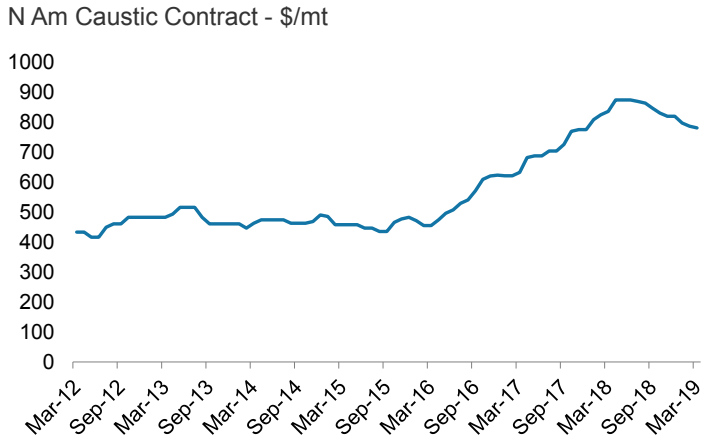
- Effective utilization currently in high-80s and should tighten to low-90s by the early 2020s
  - Capacity: Minimal global capacity growth expected as IRRs are not high enough to incentivize new capacity; new capacity would take 3-5 years to come online
  - Demand: Chlorine and caustic soda demand have a ~98% R-sq with global GDP

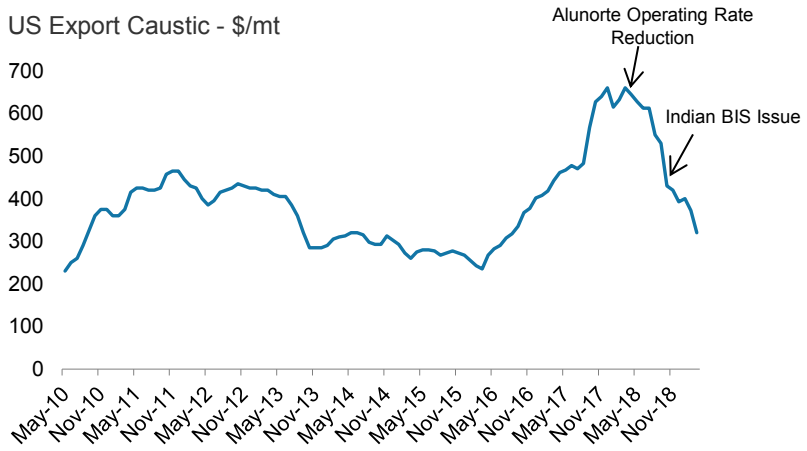


Source: IHS, Morgan Stanley Research

Caustic Prices Declined in 2018 from Demand Headwinds

- Caustic soda prices rose steadily from late 2015 to early 2018 due to tightening utilization rates
- While NA caustic contract prices have been flat since the beginning of 2018, US caustic spot export prices have declined ~50%
- Two demand headwinds impacted caustic export pricing in 2018
  - **March 2018:** ~50% reduction in operating rates at the Alunorte alumina plant in Brazil. World's largest alumina refinery consuming ~630,000 mt/year of caustic soda, all of which it imports from the US
  - **September 2018:** Indian government began enforcing all caustic to be certified by Bureau of Indian Standards (BIS). India imports ~500,000 mt of caustic annually. NE Asia exports were impacted



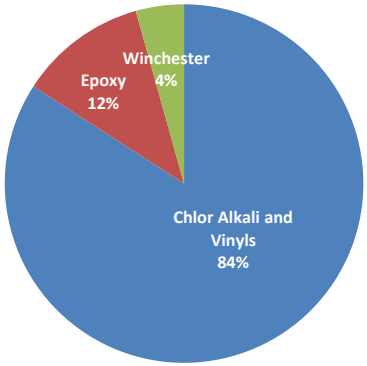


Source: IHS, Morgan Stanley Research

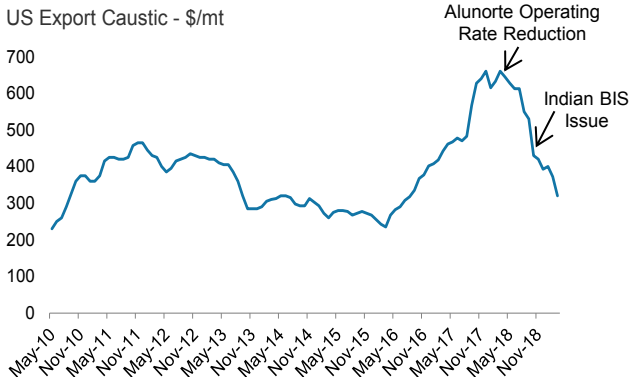
3. Chemicals Top Pick: Olin (OLN) - OW

Olin (OLN): Key Components of OW Thesis

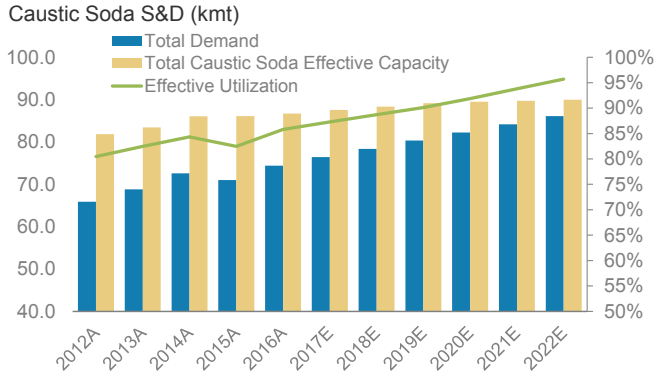
Olin has the highest pure-play exposure to Chlor-Alkali with ~84% of EBITDA



Short-term catalysts to drive caustic pricing include Alunorte restart & resolution of Indian BIS issue



Long-term caustic S&D fundamentals remain healthy



Olin is attractively valued with significant upside potential



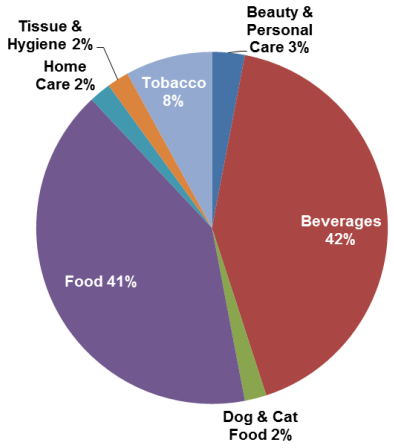
Source: IHS, Company Data, Morgan Stanley Research

4. Paper & Packaging: Industry Overview

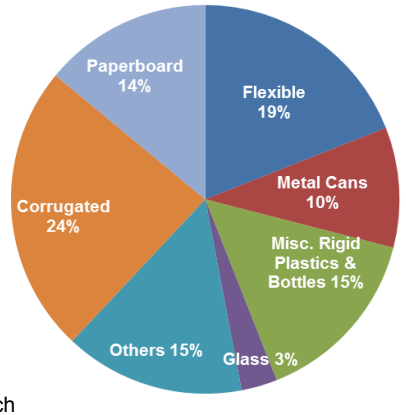
Paper & Packaging Industry Overview

- Packaging companies convert raw materials such as plastic, metal, or paper into products like plastic bottles or metal cans
- US packaging market valued at ~$167B in 2017
- Stable consumer end markets like beverage, food, and household & personal care
  - ~83% of US packaging demand is driven by the food & beverage market
- 4 key substrates utilized in the industry: metal, plastic, glass, & paper
- Generally divided between two subsectors: rigid packaging and flexible packaging
  - **Rigid:** High stiffness, impact resistance, barrier properties (metals cans, glass bottles)
  - **Flexible:** Package whose shape can be readily changed (plastic pouches, paper bags)

2017 US Packaging Industry by End Use (Retail)



2017 US Packaging Industry by Substrate



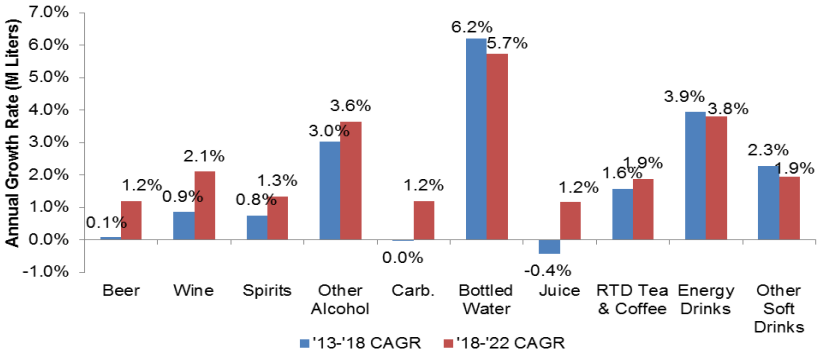
Source: U.S. Census Bureau 2016 ASM Census and FPA estimates for 2017 total revenue, Morgan Stanley Research

4 Key Substrates: Metal, Plastic, Glass, & Paper

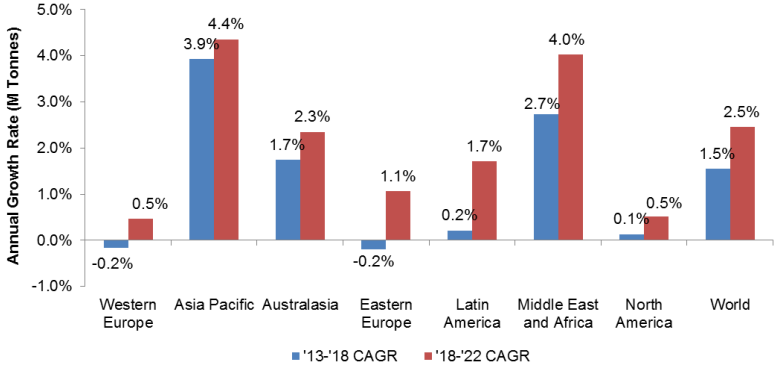


Key Trends by Packaging End Market

Beverages: Preferences for wine/spirits vs. beer and healthier alternatives to carbonated beverages



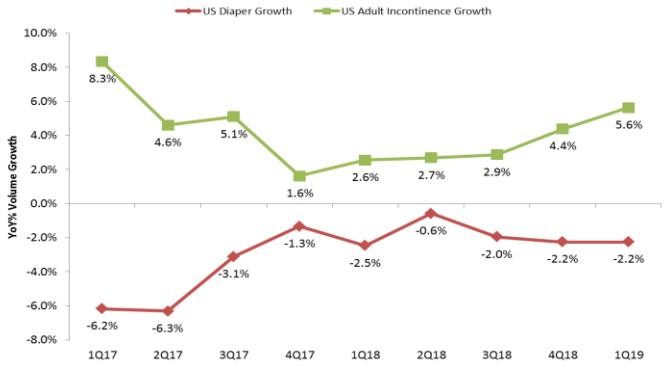
Packaged Food: Shift in consumption toward fresh foods vs. processed food



Fresh Food: In 2016-18, domestic consumption per capita has risen ~1-2% in chicken, beef, and pork



Personal Care: Domestic diaper growth has lagged due to declining birth rates while adult incontinence has accelerated from an aging population

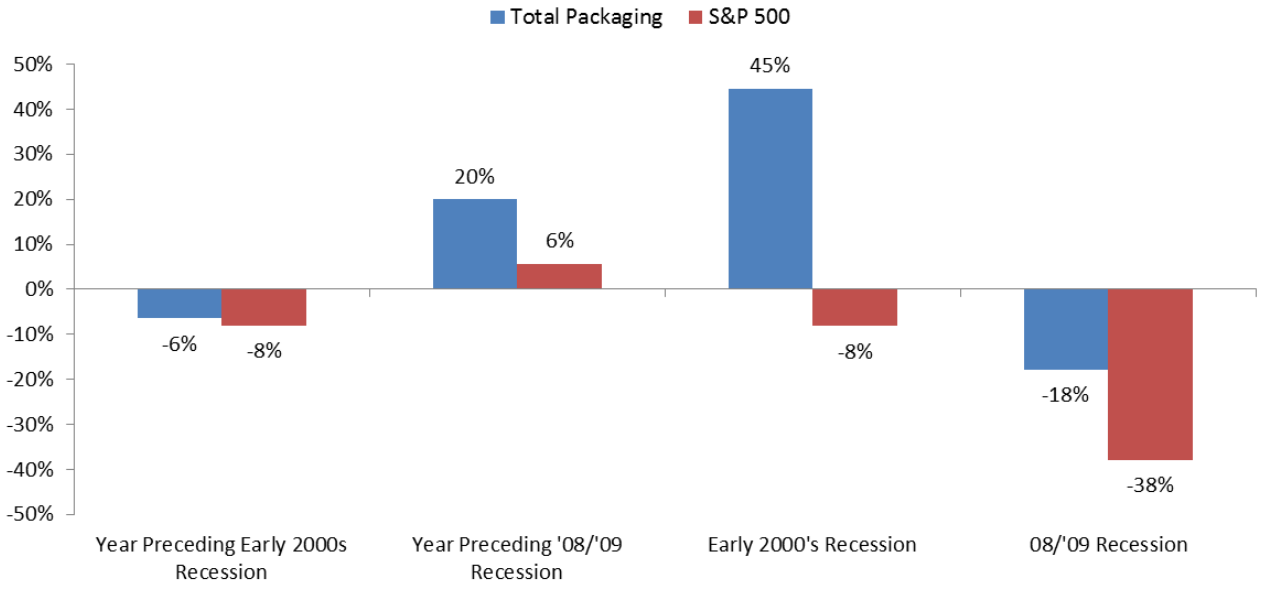


Source: Euromonitor, USDA, Nielsen, Morgan Stanley Research

5. Paper & Packaging: Investment Characteristics

Packaging Stocks Have Defensive Characteristics

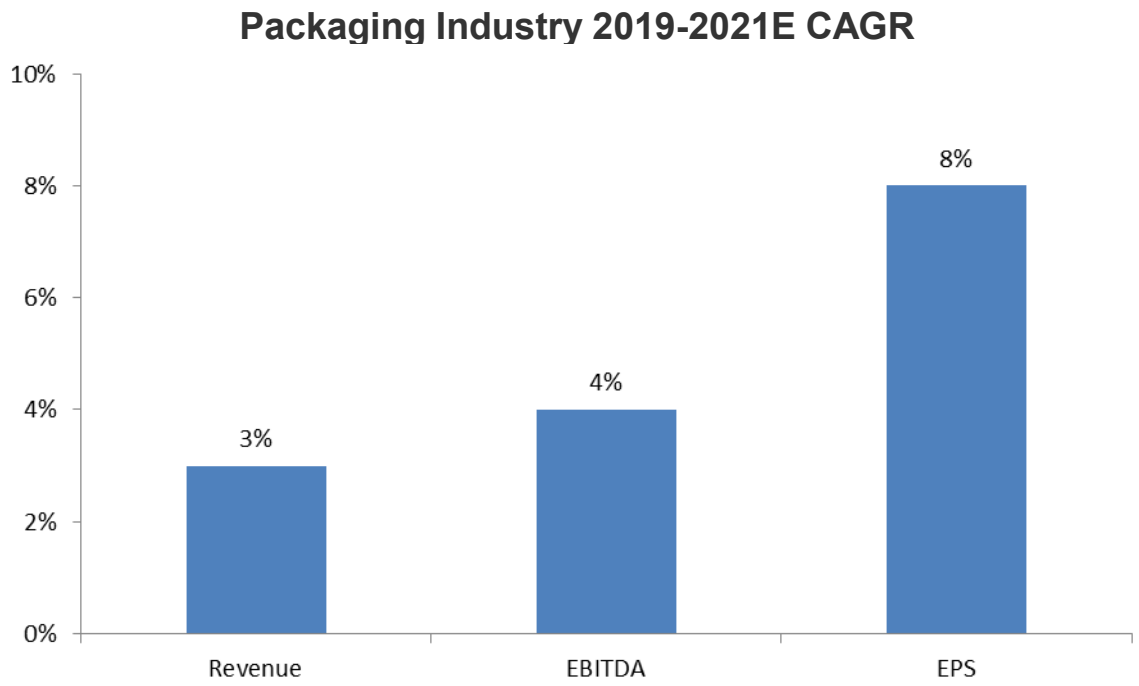
- Packaging is considered to be defensive due to: 1) end-market exposure to non-cyclical consumer staples, 2) raw material relief from commodity price declines in a weaker macro, 3) and capital return
- Packaging stocks have outperformed the S&P 500 during the past two recessions with outperformance of ~20% in the Great Recession in 2007-09 and ~53% in the 2001 recession
- Outperformed in the year leading up to these recessions by ~1.6% and ~14.2%, respectively



Source: Thomson One, Morgan Stanley Research

Packaging Stocks Offer Attractive Growth in a Difficult Macro

- For 2019-21, we expect the packaging industry to achieve CAGRs of ~3% in revenue, ~4% in EBITDA, and ~8% in EPS
- Strong growth and margin opportunities at a time when most industries are experiencing weakening demand and negative margin revisions

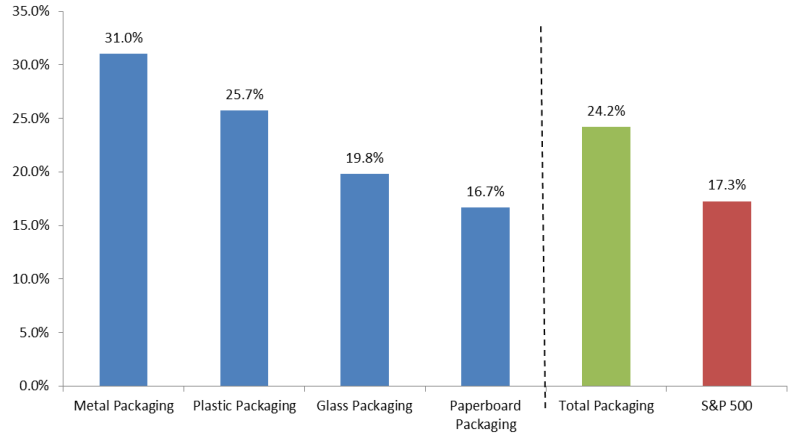


Source: Bloomberg, Thomson, Morgan Stanley Research

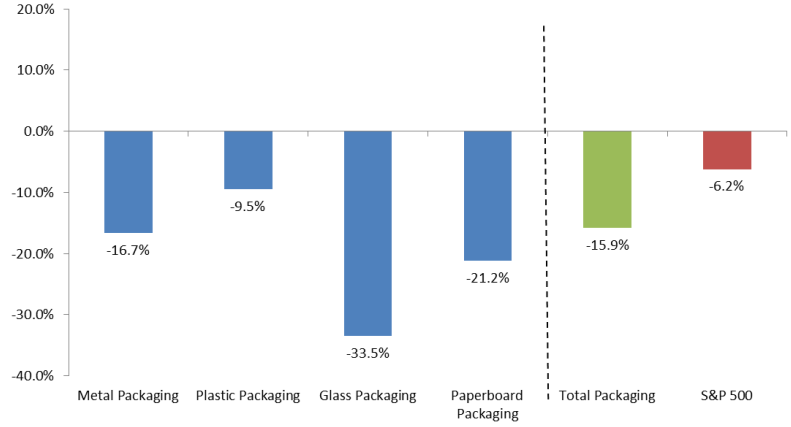
Packaging Stocks Have Outperformed YTD

- Packaging stocks have YTD gains of ~24% vs. ~17% for S&P 500 and have outperformed 10 of 11 S&P GICS subsectors
- Packaging stocks underperformed by ~10% in 2018
- Reasons for YTD outperformance:
  - Safer way to regain exposure to Materials vs. cyclically exposed subsectors like Chemicals or Metals & Mining
  - Declining raw material prices in 2019
  - Relatively more attractive valuation levels versus the S&P 500.

Packaging Performance - 2019



Packaging Performance - 2018



Source: Thomson, Morgan Stanley Research

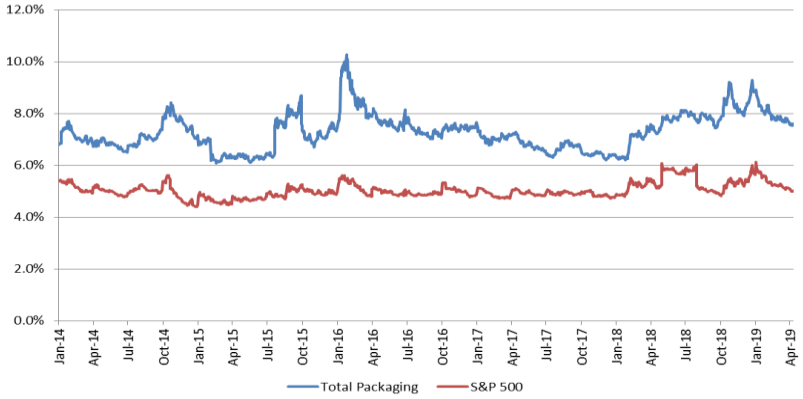
EV/EBITDA and FCF Yield are Primary Valuation Metrics

- **EV/EBITDA**
  - Packaging trades at ~9.0x NTM EBITDA vs. S&P 500 at ~11.6x
  - Current ~2.7x discount to the S&P 500 vs. its ~1.4x 5-year historical average
- **FCF Yield**
  - Packaging trades at a ~7.5% NTM FCF Yield vs. S&P 500 at ~5.0%
  - Current ~2.5% premium to the S&P 500 vs. ~2.3% 5-year historical average

EV/NTM EBITDA: Packaging vs. S&P 500



NTM FCF Yield: Packaging vs. S&P 500

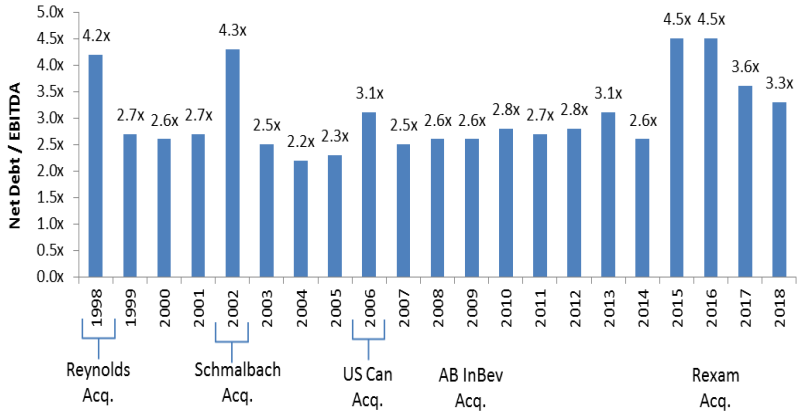


Source: Bloomberg, Thomson, Morgan Stanley Research

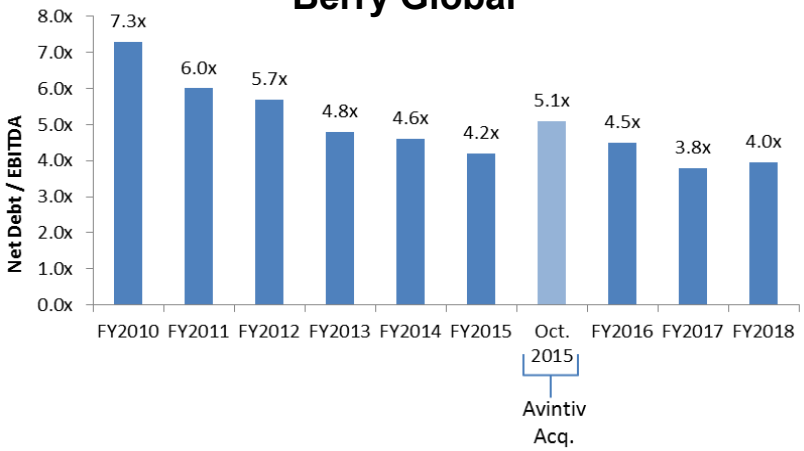
6. Paper & Packaging: Key Themes

Trend #1: Debt-Financed M&A and Gradual Delevering

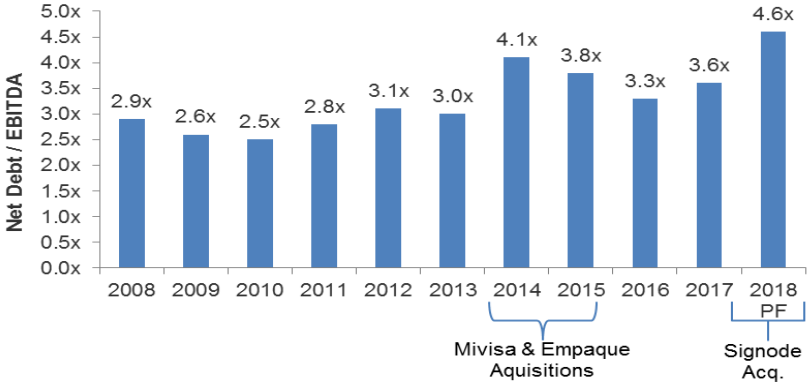
Ball Corp



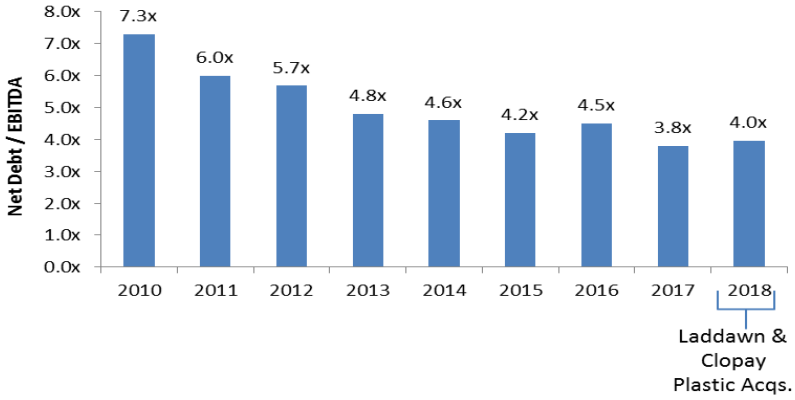
Berry Global



Crown Holdings



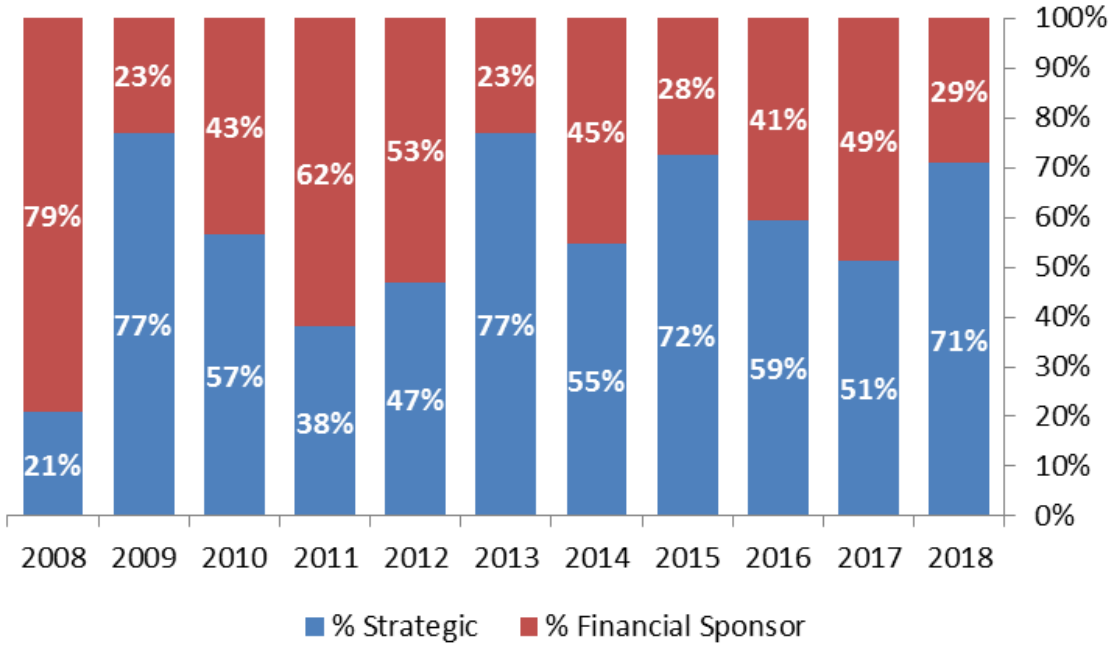
Sealed Air



Source: Company Data, Morgan Stanley Research

Trend #2: PE Involvement in Packaging Space

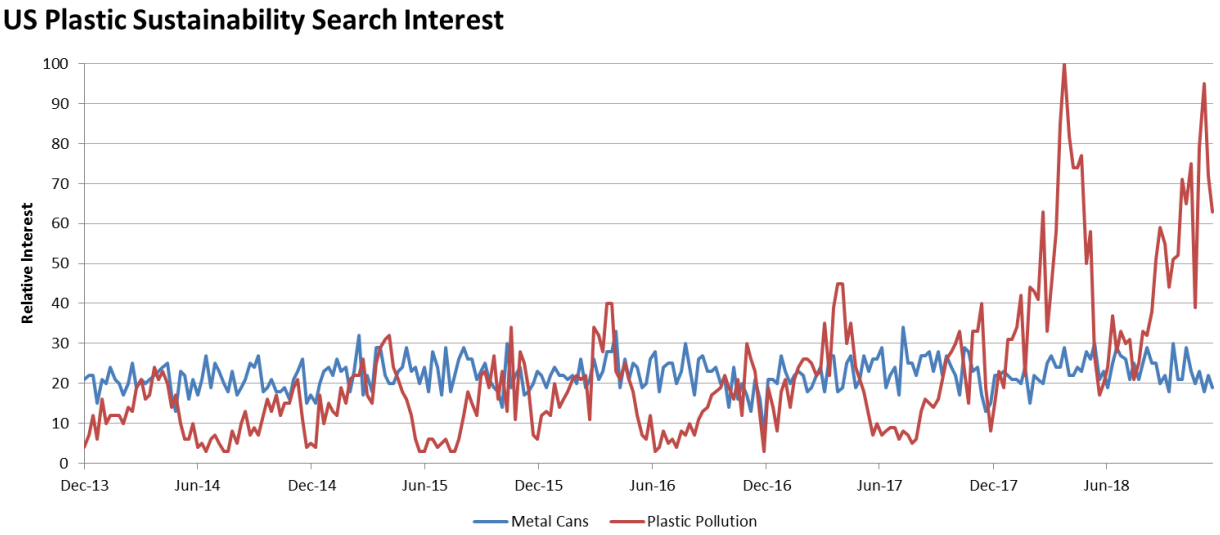
- On average ~40% of all Paper & Packaging M&A deals over the past 10 years have involved a financial sponsor or VC fund
- European packaging giant RPC garnered interest from Apollo and Bain prior to Berry's bid for the company



Source: Bloomberg, Morgan Stanley Research

Trend #3: Growing Importance of Sustainability & Innovation

- Consumer interest in plastic pollution spiked to an all-time high in 2018
- Increasing emphasis on sustainable packaging solutions that increase the life cycle of packaging products and reduce the environmental impact and ecological footprint
- Companies have reduced environmental impact through lightweighting, increasing recyclable material content, or changing to eco-friendly substrates
- Metal cans have benefited due to sustainability concerns as they are lightweight & infinitely recyclable



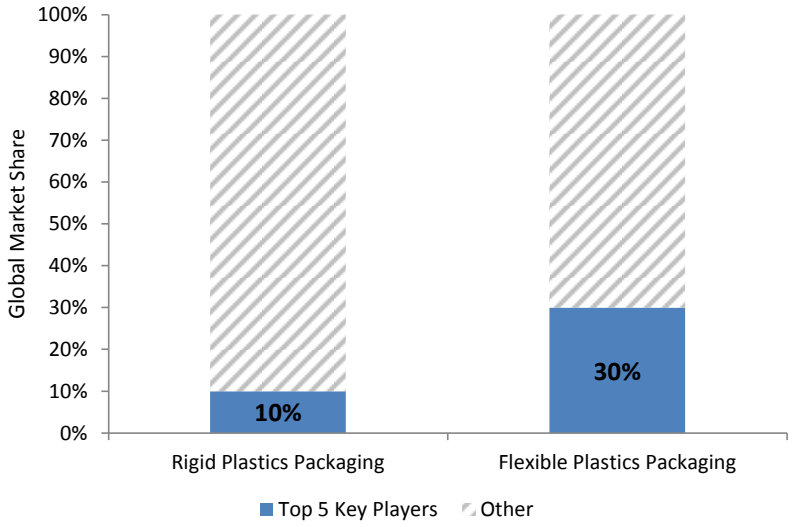
Source: Google Trends, Morgan Stanley Research

7. Plastic Packaging

Plastic Packaging Is a Fragmented Market

- **Key Domestic Players:** Berry, Sealed Air, Bemis, AptarGroup
- Plastic packaging is a much more fragmented market relative to metal, glass, or paper packaging
- Top 5 players in rigid plastics have ~10% global market share
- Top 5 players in flexible plastics have ~30% global market share
- We have seen recent M&A activity in plastic packaging
  - March 2019: Berry's ~$4.4B acquisition of RPC
  - August 2018: Amcor / Bemis ~$6.8B merger
- Berry has made 44 acquisitions to date

Global Plastic Packaging Market Share



Source: RPC Company Filings, Morgan Stanley Research.

Resins Are the Biggest % of COGS and a Pass-Through

- Resins represent the largest percentage of COGS for plastic packaging companies
  - Berry: Resins comprise ~50% of COGS; ~4.5B+ pounds purchased annually
  - Sealed Air: Resins comprise ~30% of COGS; ~1B pounds purchased annually
- Plastic packaging companies typically have partial pass through arrangements with their customers
  - Berry: ~75% of resins sold on a contract pass through basis with a 60-90 day lag
  - Sealed Air: ~25% of resins sold on a contract pass through basis with a 90-180 day lag

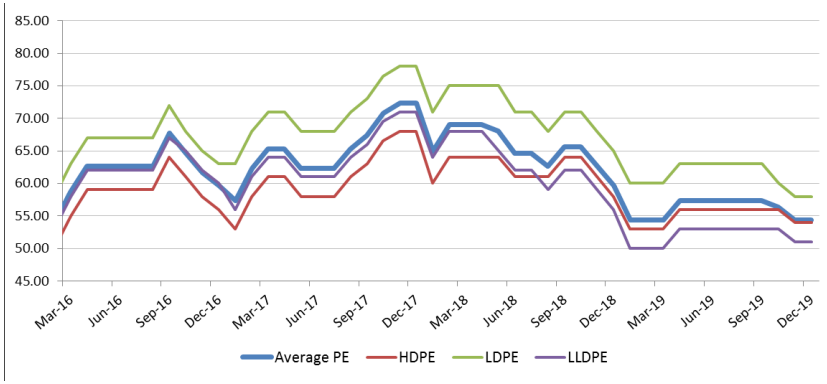
Resin Data			
	Annual Purchases (tons)	**Purchase Price Lag**	**Pass Through %**
Berry			
Consumer Packaging	1.0B - Polypropylene	2-3 Month Lag	*75.0%*
Health, Hygiene, & Spec.	1.0B - Polypropylene	2-3 Month Lag	*75.0%*
Engineered Materials	2.5B - Polyethylene	No Lag - Spot Contracts	*75.0%*
Total	**4.5B**	**Varies by Segment**	***75.0%***
Sealed Air			
Food Care[(1)]	.75B - Polyethylene	~3-6 Month Lag	*32.5%*
Product Care	.25B - Polyethylene	No Lag	*0.0%*
Total	**1.0B**	**~3-6 Month Lag**	***24.4%***

(1) 60-65% of Sealed Air's Food Care business within North America is on formula resin pass-through pricing, implying 30-35% of total Food Care.
Source: Company Data, Morgan Stanley Research

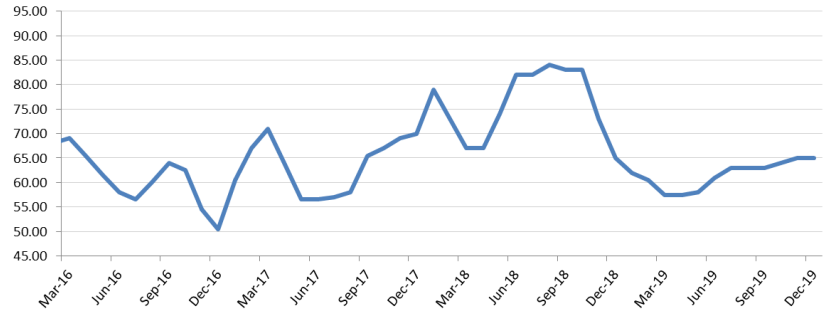
Resin Prices Have Declined YoY

- Packaging companies typically guide to flat resin pricing in their annual guidance
- Investors pay attention to resin prices given short-term impact on earnings despite partial pass through arrangements
- Polyethylene (PE) & polypropylene (PP) are the two key resins for plastic packaging companies
  - PE prices flat YTD and average 1Q pricing is ~13% lower YoY
  - PP prices down ~6.5 cpp YTD and average 1Q pricing is ~17% lower YoY

North American Polyethylene Prices (cpp)



North American Polypropylene Prices (cpp)



Source: IHS, Morgan Stanley Research

Organic Volume Growth Has Recently Been Muted

- Organic volumes have trended between -2% to +2% in recent quarters
- Segment growth rates by company have been driven by underlying end market trends and product innovation
  - **Berry Consumer Packaging:** Recent growth has been driven by strength in foodservice products, particularly the company's new polypropylene drink cup
  - **Berry Health, Hygiene & Specialties:** Recent weakness has been driven by demand headwinds in the diaper market
  - **Sealed Air Food Care:** Growth driven by continuing consumer preferences towards fresh food vs. processed food

Plastic Volume Growth Rates by Segment

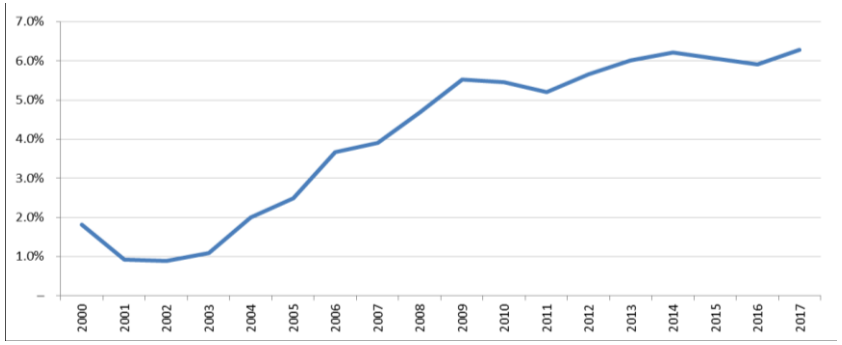
	1Q16	2Q16	3Q16	4Q16	1Q17	2Q17	3Q17	4Q17	1Q18	2Q18	3Q18	4Q18
Berry	***3.2%***	***1.4%***	***-2.0%***	***-1.3%***	***-6.0%***	***-0.6%***	***-3.2%***	***-2.2%***	***-1.3%***	***-1.7%***	***-0.7%***	***-1.8%***
Consumer Packaging	*4.0%*	*1.1%*	*-2.2%*	*-2.5%*	*-10.1%*	*-3.3%*	*-4.0%*	*-3.2%*	*-1.0%*	*-1.0%*	*4.0%*	*2.0%*
Health, Hygiene & Spec.	*-4.0%*	*-1.8%*	*-1.4%*	*0.0%*	*-1.0%*	*1.7%*	*0.0%*	*-0.5%*	*-1.0%*	*-1.0%*	*-3.0%*	*-1.9%*
Engineered Materials	*4.0%*	*3.0%*	*-1.8%*	*0.5%*	*-7.1%*	*0.0%*	*-7.0%*	*-3.0%*	*-2.0%*	*-3.0%*	*-2.7%*	*-5.0%*
Sealed Air	***0.9%***	***0.4%***	***0.5%***	***1.3%***	***3.8%***	***3.9%***	***5.2%***	***5.0%***	***2.3%***	***1.3%***	***1.0%***	***1.5%***
Food Care	*1.5%*	*0.7%*	*-0.1%*	*2.0%*	*3.1%*	*2.7%*	*4.6%*	*4.8%*	*2.0%*	*1.9%*	*2.7%*	*2.3%*
Product Care	*1.0%*	*0.4%*	*2.6%*	*1.5%*	*5.0%*	*6.1%*	*6.1%*	*5.3%*	*3.0%*	*0.3%*	*-2.0%*	*0.1%*

Source: LME, Morgan Stanley Research

Increasing Plastic Sustainability Awareness

- Among 80+ US & European corporations tracked by our Sustainability team, ~53% in the beverages and HPC sectors have targets for changing plastic use
- New regulations in Europe
  - UK plans to implement a tax on plastic packaging that doesn't contain at least 30% recycled content by 2022
  - EU is aiming for all plastic packaging to be reusable or recyclable by 2030
  - Restrictions on single-use plastic bags in several countries
- Limitations of current recycling processes
  - Recycled PET accounts for ~6.5% of overall plastic production
  - Low oil prices make the economics of plastic recycling less attractive (needs to remain significantly above $65 Brent)
  - High variation of plastic used, making the process inefficient and costly

Recycled PET as % of Total Production



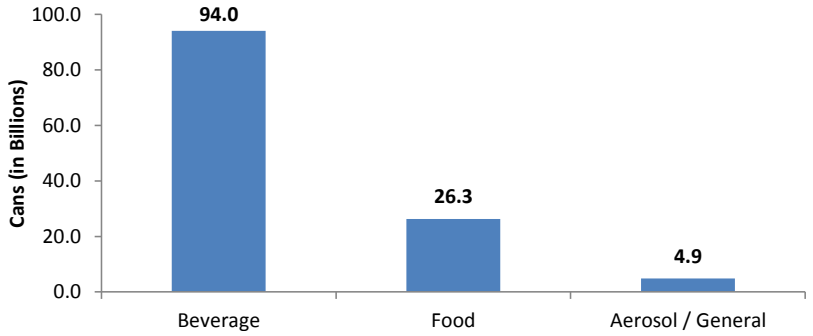
Source: IHS, Morgan Stanley Research

8. Metal Packaging

Metal Packaging Is a Consolidated Market

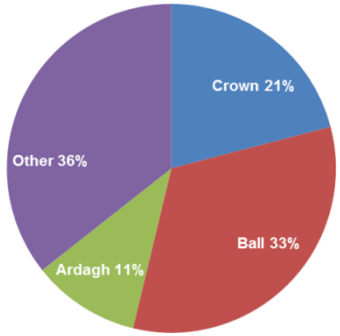
- **Key Players:** Ball, Crown, Ardagh, Silgan
- North American market for metal packaging is ~125B cans per year
  - Beverage: ~94B cans (non-alcoholic: ~58B cans; alcoholic: ~36B cans)
  - Food: ~26B cans
  - Aerosol and general line: ~5B cans
- Top 3 beverage can global share: ~65%
- Top 3 beverage can NA share: ~85%
- Ball is the beverage can market leader with ~33% global market share
  - Market share increased from 20% previously due to June 2016 acquisition of Rexam, the former #1 player

North American Cans: Beverages, Food, and General Use

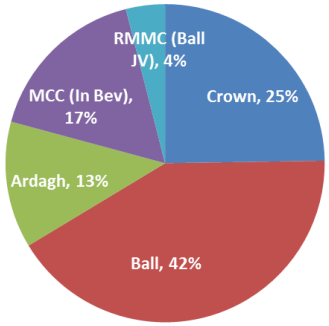


Beverage Can Market Share

Global



North America

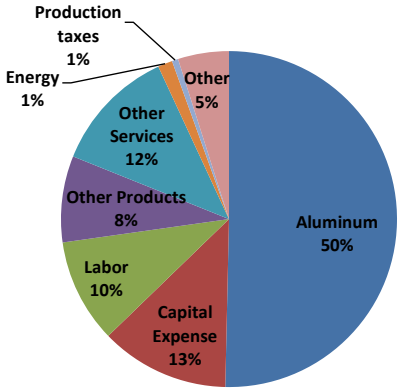


Source: CMI, Company Data, Morgan Stanley Research

Aluminum Is the Biggest % of COGS and a Pass-Through

- Aluminum represents ~50% of the cost of producing a beverage can
- Can producers limit raw material exposure by passing through nearly all metal prices to their end customers on a real-time basis
- Higher aluminum prices can artificially deflate margins due to the pass through (i.e., sales is higher but operating income does not change)
- Contracts also include annual selling price adjustments for non-metal raw materials to be passed through like freight, inks, and coatings based on a producer price index

Cost of a Beverage Can



LME Aluminum Prices ($/t)



Source: LME, Morgan Stanley Research

Beverage Can Organic Volumes Have Recently Increased

- Metal packaging stocks have performed favorably given a shift in narrative of 1-2% annual beverage can volume growth to 3-4%
- Ball and Crown experienced strong beverage can volume growth of ~4% and ~5% in 4Q18
- North America and Europe have experienced strong specialty can demand and a favorable packaging mix shift

Metal Volume Growth Rates by Region

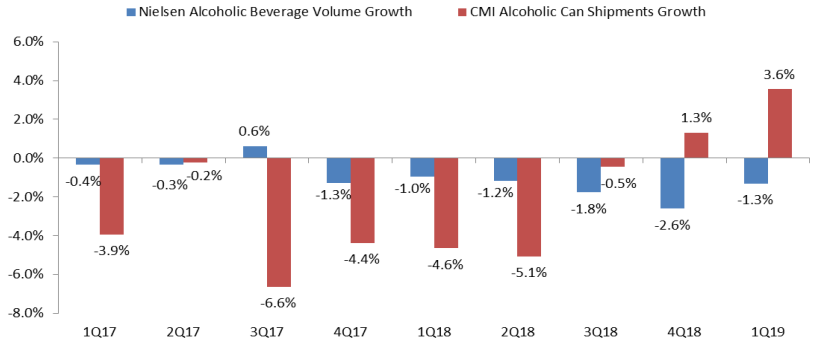
	1Q16	2Q16	3Q16	4Q16	1Q17	2Q17	3Q17	4Q17	1Q18	2Q18	3Q18	4Q18
Ball	***2.6%***	***3.2%***	***1.7%***	***-3.0%***	***2.0%***	***1.0%***	***2.0%***	***2.5%***	***2.0%***	***1.5%***	***2.6%***	***4.0%***
North/Central America	*5.0%*	*4.5%*	*1.5%*	*0.6%*	*5.0%*	*2.0%*	*0.0%*	*0.0%*	*-3.0%*	*-3.0%*	*2.3%*	*4.0%*
South America	*2.0%*	*-1.0%*	*0.0%*	*-15.0%*	*3.0%*	*4.0%*	*15.0%*	*14.0%*	*10.0%*	*5.0%*	*-2.7%*	*0.0%*
Europe	*-2.0%*	*2.0%*	*3.0%*	*1.0%*	*3.0%*	*1.0%*	*2.5%*	*5.0%*	*6.0%*	*6.0%*	*10.0%*	*10.0%*
Crown	***6.9%***	***1.3%***	***4.2%***	***2.0%***	***2.0%***	***2.2%***	***1.9%***	***4.5%***	***3.0%***	***4.0%***	***3.0%***	***5.0%***
Americas	*11.0%*	*3.7%*	*7.0%*	*3.0%*	*3.0%*	*1.0%*	*2.0%*	*6.1%*	*4.0%*	*6.0%*	*7.0%*	*5.0%*
Europe	*5.0%*	*-2.0%*	*0.9%*	*-3.3%*	*1.0%*	*3.0%*	*2.0%*	*1.7%*	*-1.0%*	*-6.0%*	*-4.0%*	*-2.0%*
Asia Pacific	*0.6%*	*0.0%*	*2.0%*	*5.7%*	*6.0%*	*7.0%*	*12.0%*	*19.0%*	*7.0%*	*5.0%*	*7.0%*	*12.0%*

Source: Company Data, Morgan Stanley Research

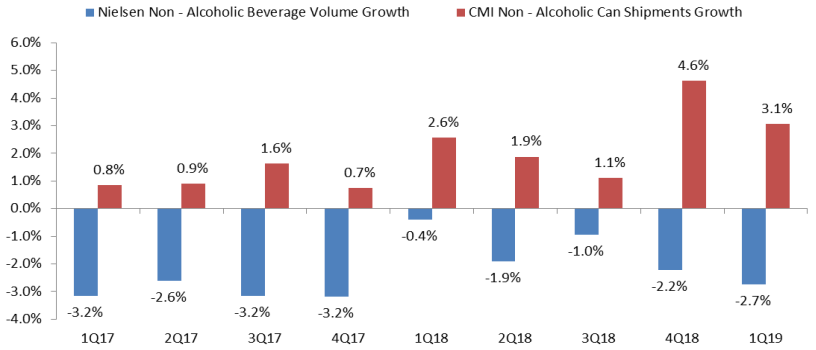
NA Can Shipments Have Outperformed Underlying Volumes

- Alcoholic cans have experienced 2 consecutive quarters of growth following 7 quarters of declines
- Non-alcoholic cans have experienced 11 consecutive quarters of growth
- Outperformance driven by growth in specialty cans (non -12oz) & penetration in emerging categories (energy drinks, sparkling water, etc)

Alcoholic Can Shipments vs. Underlying Beverage Growth



Non - Alcoholic Can Shipments vs. Underlying Beverage Growth

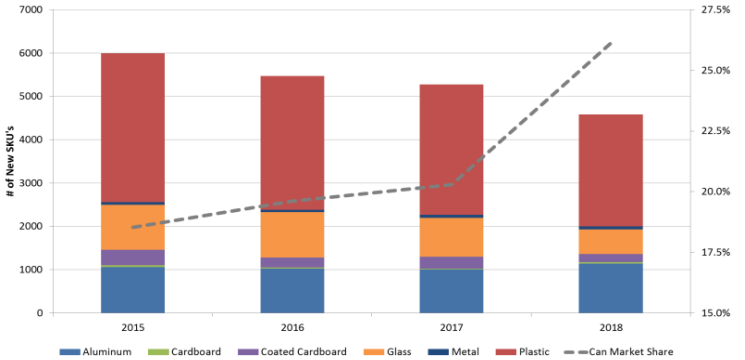


Source: Nielsen, Morgan Stanley Research

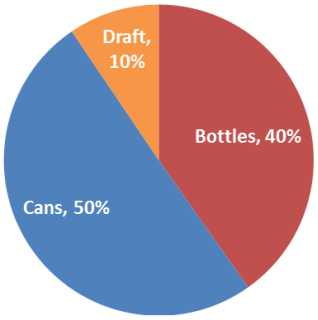
Increasing % of Cans in New & Mature Beverage Categories

- Cans accounted for ~26% of North American beverage product launches in 2018 compared to ~18% in 2015
  - While soft drink sales have declined in recent years, can share of new introductions has grown ~7% since 2015
  - Cans currently account for ~50% of new product introductions for sparkling water, compared to ~25% in 2015.
- In more mature categories like beer, cans have taken ~6% market share from glass over the past decade

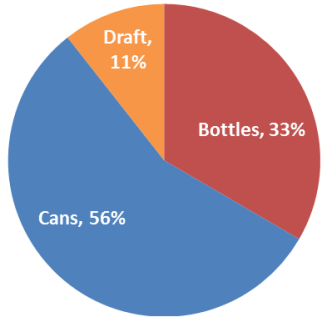
New Beverage Introductions: Can Market Share



2008 Beer Market Share by Substrate



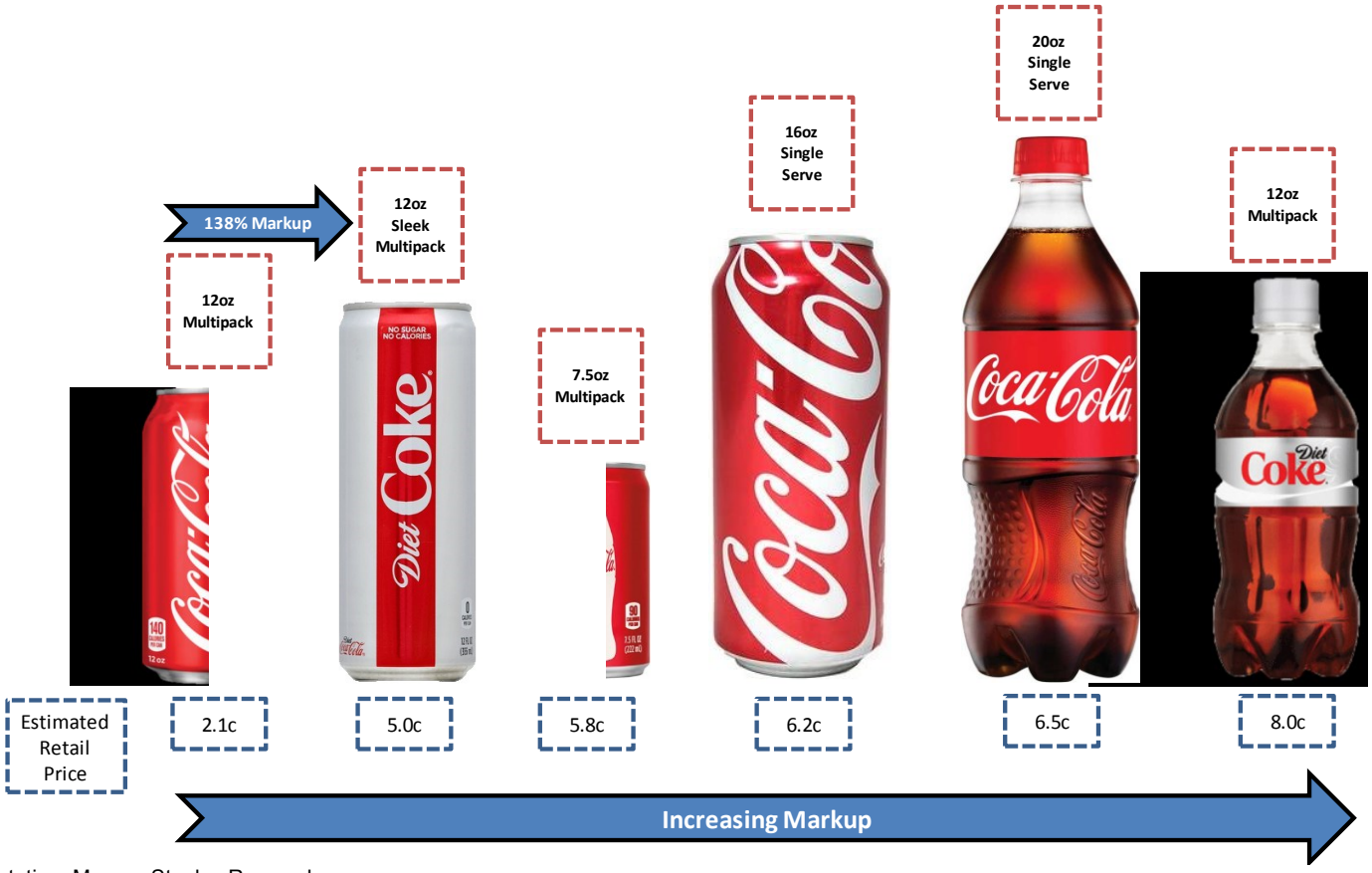
2017 Beer Market Share by Substrate



Source: Nielsen, Beer Institute, Morgan Stanley Research

Specialty Cans Have Narrowed Profit Gap vs. PET Bottles

- A key reason for cans taking share is due to the growth of specialty can sizes, which has narrowed the profit gap against plastic bottles

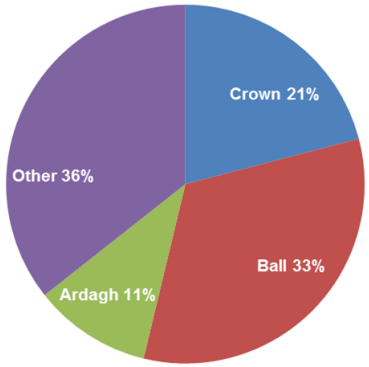


Source: Ball Presentation, Morgan Stanley Research

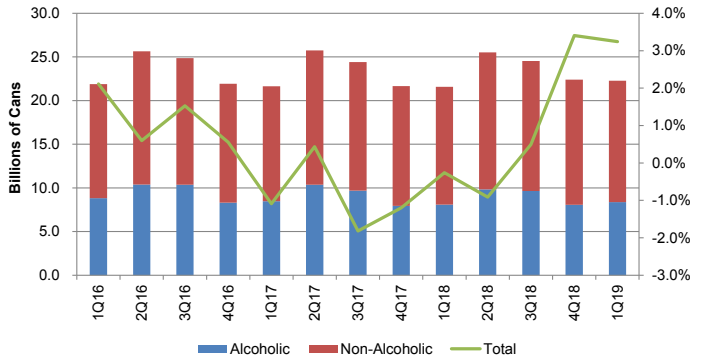
9. Paper & Packaging Top Pick: Ball (BLL) - OW

Ball Corp. (BLL): Key Components of OW Thesis

Ball has ~86% exposure to beverage cans and ~33% leading global market share



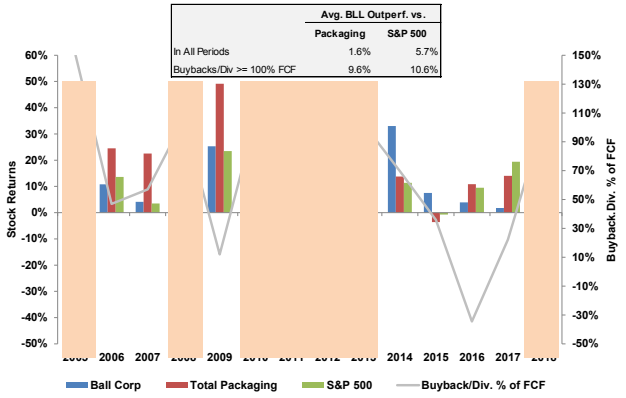
Tightening beverage can S&D with producers operating at capacity & improving NA can shipments



Ball's upcoming 2020+ contract renegotiations provide upside to consensus

	Low	High
Global Can Production	105.0	105.0
x % Renegotiated in 2020	15.0%	20.0%
Cans Up for Renegotiation (in billions)	**15.8**	**21.0**
/ NA Can Production (in billions)	46.0	46.0
% of NA Can Production	**34.2%**	**45.7%**
Cans up for Renegotiation (in billions)	15.8	21.0
x % Commodity Portfolio	70.0%	70.0%
Commodity Cans Up for Renegotiation (in billions)	**11.0**	**14.7**
2017 NA Price Per Commodity Can	$0.06	$0.07
Assumed % Uplift	5.0%	5.0%
Incremental Revenue per Can	**$0.003**	**$0.003**
Commodity Cans Up for Renegotiation (in billions)	11.0	14.7
x Incremental Revenue per Can	$0.003	$0.003
Total Incremental Revenue / EBITDA (in $M)	**$31**	**$51**

Ball's plan to return all FCF to shareholders has historically resulted in greater outperformance



Source: Thomson, CMI, Company Data, Morgan Stanley Research



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Industry Comps

Comparables

Company Name	Stock Price 4/29/19	Market Cap.	Ent. Value	Div. Yield	EBITDA Margin 2019E	EBITDA Margin 2020E	2019-2021E CAGR Revenue	2019-2021E CAGR EBITDA	2019-2021E CAGR EPS	EV / EBITDA 2019E	EV / EBITDA 2020E	Debt / EBITDA 2019E	Debt / EBITDA 2020E	FCF Yield 2019E	FCF Yield 2020E
Metal Packaging															
Ardagh Group SA	$13.87	$3,278	$11,279	4.0%	17%	17%	2%	3%	9%	7.4x	7.2x	5.6x	5.4x	17.3%	11.3%
Ball Corp	$59.63	$20,596	$26,406	0.7%	17%	17%	5%	6%	14%	13.2x	12.3x	3.4x	3.1x	4.9%	5.1%
Crown Holdings Inc	$58.33	$8,019	$16,748	0.0%	15%	15%	3%	3%	7%	9.5x	9.2x	4.9x	4.8x	9.8%	10.2%
Silgan Holdings Inc	$29.95	$3,329	$5,879	1.3%	14%	14%	1%	3%	7%	9.4x	9.1x	4.3x	4.2x	8.2%	8.7%
Peer Average				**1.5%**	**16%**	**16%**	**3%**	**4%**	**9%**	**9.9x**	**9.4x**	**4.5x**	**4.4x**	**10.0%**	**8.8%**
Peer Median				**1.0%**	**16%**	**16%**	**3%**	**3%**	**8%**	**9.4x**	**9.1x**	**4.6x**	**4.5x**	**9.0%**	**9.4%**
Peer Minimum				**0.0%**	**14%**	**14%**	**1%**	**3%**	**7%**	**7.4x**	**7.2x**	**3.4x**	**3.1x**	**4.9%**	**5.1%**
Peer Maximum				**4.0%**	**17%**	**17%**	**5%**	**6%**	**14%**	**13.2x**	**12.3x**	**5.6x**	**5.4x**	**17.3%**	**11.3%**
Plastic Packaging															
Aptargroup Inc	$111.32	$7,015	$8,043	1.2%	21%	21%	5%	6%	12%	12.9x	12.0x	2.1x	1.9x	3.0%	3.6%
Bemis Company Inc	$57.85	$5,277	$6,561	2.1%	15%	15%	1%	3%	6%	11.0x	10.7x	0.0x	0.0x	5.4%	6.0%
Berry Global Group Inc	$58.53	$7,907	$13,354	0.0%	18%	18%	1%	2%	4%	8.9x	8.8x	3.8x	3.8x	8.5%	9.0%
Sealed Air Corp	$46.55	$7,358	$10,561	1.4%	19%	20%	3%	5%	9%	11.3x	10.7x	3.7x	3.5x	3.4%	5.4%
Peer Average				**1.2%**	**18%**	**19%**	**3%**	**4%**	**8%**	**11.0x**	**10.5x**	**2.4x**	**2.3x**	**5.1%**	**6.0%**
Peer Median				**1.3%**	**19%**	**19%**	**2%**	**4%**	**8%**	**11.1x**	**10.7x**	**2.9x**	**2.7x**	**4.4%**	**5.7%**
Peer Minimum				**0.0%**	**15%**	**15%**	**1%**	**2%**	**4%**	**8.9x**	**8.8x**	**0.0x**	**0.0x**	**3.0%**	**3.6%**
Peer Maximum				**2.1%**	**21%**	**21%**	**5%**	**6%**	**12%**	**12.9x**	**12.0x**	**3.8x**	**3.8x**	**8.5%**	**9.0%**
Glass Packaging															
Owens-Illinois Inc	$19.45	$3,019	$8,000	0.3%	20%	20%	1%	2%	9%	5.8x	5.7x	3.9x	3.8x	8.1%	9.6%
Ardagh Group SA	$13.87	$3,278	$11,279	4.0%	17%	17%	2%	3%	9%	7.4x	7.2x	5.6x	5.4x	17.3%	11.3%
Peer Average				**2.1%**	**18%**	**19%**	**1%**	**3%**	**9%**	**6.6x**	**6.4x**	**4.7x**	**4.6x**	**12.7%**	**10.4%**
Peer Median				**2.1%**	**18%**	**19%**	**1%**	**3%**	**9%**	**6.6x**	**6.4x**	**4.7x**	**4.6x**	**12.7%**	**10.4%**
Peer Minimum				**0.3%**	**17%**	**17%**	**1%**	**2%**	**9%**	**5.8x**	**5.7x**	**3.9x**	**3.8x**	**8.1%**	**9.6%**
Peer Maximum				**4.0%**	**20%**	**20%**	**2%**	**3%**	**9%**	**7.4x**	**7.2x**	**5.6x**	**5.4x**	**17.3%**	**11.3%**
Paperboard Packaging															
Graphic Packaging Holding Co	$13.73	$4,054	$7,900	2.2%	16%	17%	2%	2%	12%	7.8x	7.5x	3.1x	3.0x	12.8%	13.9%
Sonoco Products Co	$62.98	$6,300	$7,600	2.6%	14%	14%	1%	2%	3%	9.7x	9.5x	1.8x	1.8x	6.3%	6.3%
Westrock Co	$37.05	$9,462	$20,037	4.9%	18%	18%	7%	6%	2%	6.7x	6.0x	2.1x	1.9x	10.5%	15.0%
Peer Average				**3.2%**	**16%**	**16%**	**3%**	**3%**	**6%**	**8.0x**	**7.7x**	**2.4x**	**2.2x**	**9.9%**	**11.7%**
Peer Median				**2.6%**	**16%**	**17%**	**2%**	**2%**	**3%**	**7.8x**	**7.5x**	**2.1x**	**1.9x**	**10.5%**	**13.9%**
Peer Minimum				**2.2%**	**14%**	**14%**	**1%**	**2%**	**2%**	**6.7x**	**6.0x**	**1.8x**	**1.8x**	**6.3%**	**6.3%**
Peer Maximum				**4.9%**	**18%**	**18%**	**7%**	**6%**	**12%**	**9.7x**	**9.5x**	**3.1x**	**3.0x**	**12.8%**	**15.0%**



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Valuation

BLL.N

Price Target $63: Our 2019 year-end price target of $63 is based on a ~12x 2020E Base Case EBITDA. This multiple is near the higher end of its historical EV/NTM EBITDA range of 10.8x - 12.1x since the closing of the Rexam transaction in June 2016. While Ball has consistently traded at a premium to packaging peers, its gap has recently widened. We see Ball's higher multiple as justified given increasing evidence of beverage substrate switching and the company's superior growth prospects versus peers.

Risks to Achieving Price Target:

•Decline in domestic beer and carbonated soft drink volumes

•Weaker than expected beverage can demand

•Lower than expected benefits from contract renegotiations

•Higher freight expenses

•FX headwinds

OLN.N

Price Target $33: Our $33 price target values Olin at ~6.5x 2019E Base Case EBITDA. Caustic prices improve in 2Q19 as Alunorte resumes full operations and Indian BIS certification issue is resolved. EDC prices remain flat to current levels. Average epoxy prices flat to 2018 levels but margins improve from lower turnarounds and lower raw materials. Company reaches target net leverage by 2019.

Risks to Achieving Price Target:

Alunorte continuing to run at reduced rates

Indian BIS certification issue

Announcement of material chlor-alkali capacity additions

Downturn in construction or manufacturing sector

Weak consumer gun purchasing behavior

High leverage

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Cisco Systems Inc, CNH Industrial NV, Cognex Corp, Colfax Corp, Commercial Metals Company, Constellium NV, Corning Inc, Crown Holdings, Inc., CSX Corporation, Cummins Inc., Cypress Semiconductor Corp, Deere & Co., Dell Technologies Inc., Delta Air Lines, Inc., Dover, DowDuPont Inc, Eastman Chemical Co, Eaton Corporation PLC, Echo Global Logistics Inc, Ecolab Inc., Electronics for Imaging Inc, Element Solutions Inc, Emerson Electric Co, Expeditors International of Washington I, F5 Networks Inc, Fastenal Co., FedEx Corporation, Ferrari NV, Fiat Chrysler Automobiles NV, Finisar Corporation, Fitbit Inc, Flowserve Corp, Ford Motor Company, Fortive Corp, Freeport-McMoRan Inc, Gardner Denver Holdings Inc., Garmin Ltd, Gates Industrial Corporation plc, General Dynamics Corp., General Motors Company, Genesee & Wyoming Inc., Goodyear Tire & Rubber Company, GoPro Inc, Group 1 Automotive, Inc, Harley-Davidson Inc, Hawaiian Holdings Inc, Heartland Express Inc., Hewlett Packard Enterprise, Honeywell International Inc, HP Inc., Hub Group Inc, Hubbell Inc., Huntsman Corp, IBM, II-VI Incorporated, Illinois Tool Works, Impinj Inc, Infinera Corp, Ingersoll Rand PLC, Inphi Corporation, Intel Corporation, International Flavors & Fragrances, Intrepid Potash, Israel Chemicals Ltd., J.B. Hunt Transport Services Inc., JetBlue Airways, Johnson Controls International Plc, Juniper Networks Inc, Kaiser Aluminum Corp, Kansas City Southern, Landstar System Inc, Largo Resources Ltd, Lear Corporation, Lennox International Inc, Lockheed Martin Corp., Lumentum Holdings Inc, LyondellBasell Industries N.V., Magna International Inc., Marvell Technology Group Ltd, Maxim Integrated Products Inc., Microchip Technology Inc., Micron Technology Inc., MobileIron, Mosaic Company, NCR Corp., NetApp Inc, Norfolk Southern Corp., Northrop Grumman Corp., Nutanix Inc, Nutrien Ltd, NVIDIA Corp., NXP Semiconductor NV, Old Dominion Freight Line Inc, ON Semiconductor Corp., Oshkosh Corp., PACCAR Inc, Parker-Hannifin Corp, Pentair plc, PPG Industries Inc., PQ Group Holdings Inc, Pure Storage Inc, Qorvo Inc, Qualcomm Inc., Quantenna Communications Inc, Raytheon Co, REV Group Inc., Rockwell Automation, Saia, Inc., Schneider National Inc., Seagate Technology, Sealed Air Corporation, Sensata Technologies Holding N.V., Sherwin-Williams Co., Skyworks Solutions Inc, Sonos Inc., Southwest Airlines, Spirit AeroSystems Holdings Inc, Spirit Airlines Inc., Stanley Black & Decker, Steel Dynamics, Stelco Holdings Inc., Sun Hydraulics Corp, Te Connectivity Ltd, Teck Resources Limited, Tenneco Inc., Teradata, Terex Corp., Tesla Inc, Texas Instruments, Textron Inc., TransDigm Group Inc., Trimble Inc., Trinseo S.A., Tronox Ltd, Union Pacific Corp., United Continental Holdings, Inc., United Parcel Service, United Rentals Inc., United Technologies Corp, US Steel Corporation, US Xpress Enterprises Inc, Viavi Solutions Inc, Visteon Corporation, W.W. Grainger Inc., Watsco Inc., Werner Enterprises, WestJet Airlines Ltd, Westlake Chemical Corp, WillScot Corporation, Xerox Corp, Xilinx, XPO Logistics, Inc., Zebra Technologies Corporation.

Within the last 12 months, Morgan Stanley has received compensation for products and services other than investment banking services from 3M Co., Advanced Micro Devices, AerCap Holdings NV, AGCO Corp, Air Canada, AK Steel Holding Corp., Albemarle Corporation, Ambarella Inc, American Airlines Group Inc, American Axle & Manufacturing Holdings Inc, Amphenol Corp., Analog Devices Inc., Apple, Inc., Aptiv Plc, Arconic Inc, Avis Budget Group Inc, Axalta Coating Systems Ltd, Ball Corporation, Berry Global Group Inc, Bombardier Inc., BorgWarner Inc., Broadcom Inc., C.H. Robinson Worldwide Inc., Canadian Pacific Railway Ltd., Caterpillar Inc., CDW Corporation, Celanese Corp., Century Aluminum Co, CF Industries, Chemours Co, Cisco Systems Inc, CNH Industrial NV, CommScope Holding Company Inc, Constellium NV, Corning Inc, Crown Holdings, Inc., CSX Corporation, Cypress Semiconductor Corp, Dell Technologies Inc., Delta Air Lines, Inc., Dover, Dow Inc., DowDuPont Inc, Eastman Chemical Co, Eaton Corporation PLC, Echo Global Logistics Inc, Ecolab Inc., Electronics for Imaging Inc, Element Solutions Inc, Fiat Chrysler Automobiles NV, Fitbit Inc, Flowserve Corp, Ford Motor Company, Fortive Corp, Freeport-McMoRan Inc, Gardner Denver Holdings Inc., Gates Industrial Corporation plc, General Motors Company, Genesee & Wyoming Inc., Goodyear Tire & Rubber Company, Harley-Davidson Inc, Hawaiian Holdings Inc, Hewlett Packard Enterprise, Honeywell International Inc, HP Inc., Hubbell Inc., Huntsman Corp, IBM, Illinois Tool Works, Intel Corporation, International Flavors & Fragrances, Israel Chemicals Ltd., J.B. Hunt Transport Services Inc., Johnson Controls International Plc, Kaiser Aluminum Corp, Kansas City Southern, Lear Corporation, Linde PLC, Lockheed Martin Corp., LyondellBasell Industries N.V., Marvell Technology Group Ltd, Maxim Integrated Products Inc., Micron Technology Inc., Mosaic Company, NCR Corp., NetApp Inc, Norfolk Southern Corp., Northrop Grumman Corp., Nutrien Ltd, NVIDIA Corp., NXP Semiconductor NV, Old Dominion Freight Line Inc, ON Semiconductor Corp., Oshkosh Corp., Parker-Hannifin Corp, PPG Industries Inc.,

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PQ Group Holdings Inc, Qualcomm Inc., Raytheon Co, Schnitzer Steel Industries, Seagate Technology, Sealed Air Corporation, Sensata Technologies Holding N.V., Southwest Airlines, Spirit AeroSystems Holdings Inc, Stanley Black & Decker, Steel Dynamics, Te Connectivity Ltd, Tenneco Inc., Terex Corp., Texas Instruments, Textron Inc., TransDigm Group Inc., Union Pacific Corp., United Continental Holdings, Inc., United Parcel Service, United Rentals Inc., US Steel Corporation, Viavi Solutions Inc, Visteon Corporation, W.W. Grainger Inc., Westlake Chemical Corp, WillScot Corporation, Xerox Corp, XPO Logistics, Inc..

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Disclosure Section (Cont.)

Inphi Corporation, Intel Corporation, International Flavors & Fragrances, J.B. Hunt Transport Services Inc., JetBlue Airways, Johnson Controls International Plc, Juniper Networks Inc, Kansas City Southern, Knight-Swift Transportation Holdings Inc, Lear Corporation, Lithia Motors Inc., Lockheed Martin Corp., Lumentum Holdings Inc, LyondellBasell Industries N.V., Magna International Inc., Marvell Technology Group Ltd, Maxim Integrated Products Inc., Microchip Technology Inc., Micron Technology Inc., Mosaic Company, NCR Corp., NetApp Inc, Norfolk Southern Corp., Northrop Grumman Corp., NVIDIA Corp., NXP Semiconductor NV, Old Dominion Freight Line Inc, Olin Corp., ON Semiconductor Corp., Oshkosh Corp., PACCAR Inc, Parker-Hannifin Corp, Penske Automotive Group, Inc, Pentair plc, PPG Industries Inc., Pure Storage Inc, Qorvo Inc, Qualcomm Inc., Quantenna Communications Inc, Raytheon Co, Rockwell Automation, RPM International Inc., Saia, Inc., Schnitzer Steel Industries, Seagate Technology, Sealed Air Corporation, Sensata Technologies Holding N.V., Sherwin-Williams Co., Skyworks Solutions Inc, Sonic Automotive Inc, Sonos Inc., Southwest Airlines, Spirit AeroSystems Holdings Inc, Spirit Airlines Inc., Stanley Black & Decker, Steel Dynamics, Sun Hydraulics Corp, Te Connectivity Ltd, Teck Resources Limited, Tenneco Inc., Teradata, Terex Corp., Tesla Inc, Texas Instruments, Textron Inc., Trimble Inc., Trinseo S.A., Tronox Ltd, Union Pacific Corp., United Continental Holdings, Inc., United Parcel Service, United Rentals Inc., United Technologies Corp, US Steel Corporation, Viavi Solutions Inc, Visteon Corporation, WABCO Holdings Inc, Werner Enterprises, Western Digital, Westlake Chemical Corp, Xerox Corp, Xilinx, XPO Logistics, Inc..

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Global Stock Ratings Distribution

(as of April 30, 2019)

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Disclosure Section (Cont.)

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	COVERAGE UNIVERSE		INVESTMENT BANKING CLIENTS (IBC)			OTHER MATERIAL INVESTMENT SERVICES CLIENTS (MISC)	
STOCK RATING CATEGORY	COUNT	% OF TOTAL	COUNT	% OF TOTAL IBC	% OF RATING CATEGORY	COUNT	% OF TOTAL OTHER MISC
Overweight/Buy	**1143**	**36%**	**309**	**43%**	**27%**	**534**	**38%**
Equal-weight/Hold	**1408**	**44%**	**317**	**45%**	**23%**	**649**	**46%**
Not-Rated/Hold	**46**	**1%**	**5**	**1%**	**11%**	**6**	**0%**
Underweight/Sell	**593**	**19%**	**81**	**11%**	**14%**	**233**	**16%**
TOTAL	**3,190**		**712**			**1422**	

Data include common stock and ADRs currently assigned ratings. Investment Banking Clients are companies from whom Morgan Stanley received investment banking compensation in the last 12 months. Due to rounding off of decimals, the percentages provided in the "% of total" column may not add up to exactly 100 percent.

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Overweight (O). The stock's total return is expected to exceed the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Equal-weight (E). The stock's total return is expected to be in line with the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Not-Rated (NR). Currently the analyst does not have adequate conviction about the stock's total return relative to the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Underweight (U). The stock's total return is expected to be below the average total return of the analyst's industry (or industry team's) coverage universe, on a risk-adjusted basis, over the next 12-18 months.

Unless otherwise specified, the time frame for price targets included in Morgan Stanley Research is 12 to 18 months.

Disclosure Section (Cont.)

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Benchmarks for each region are as follows: North America - S&P 500; Latin America - relevant MSCI country index or MSCI Latin America Index; Europe - MSCI Europe; Japan - TOPIX; Asia - relevant MSCI country index or MSCI sub-regional index or MSCI AC Asia Pacific ex Japan Index.

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INDUSTRY COVERAGE: Multi-Industry

COMPANY (TICKER)	RATING (AS OF)	PRICE* (05/03/2019)
Joshua C Pokrzywinski		
3M Co. (MMM.N)	E (08/20/2018)	$185.22
Allegion PLC (ALLE.N)	E (08/20/2018)	$102.19
Ametek Inc. (AME.N)	O (12/18/2018)	$87.35
Cognex Corp (CGNX.O)	E (08/20/2018)	$49.02
Colfax Corp (CFX.N)	E (08/20/2018)	$30.27
Dover (DOV.N)	E (12/18/2018)	$99.37
Eaton Corporation PLC (ETN.N)	E (08/20/2018)	$82.80
Emerson Electric Co (EMR.N)	O (08/20/2018)	$71.10
Fastenal Co. (FAST.O)	E (12/18/2018)	$70.87
Flowserve Corp (FLS.N)	U (12/18/2018)	$52.00
Fortive Corp (FTV.N)	O (12/18/2018)	$86.57
Gardner Denver Holdings Inc. (GDI.N)	O (11/09/2018)	$34.70
Gates Industrial Corporation plc (GTES.N)	E (12/18/2018)	$16.03
Honeywell International Inc (HON.N)	O (08/20/2018)	$173.54
Hubbell Inc. (HUBB.N)	E (12/18/2018)	$129.68
Illinois Tool Works (ITW.N)	U (12/18/2018)	$157.41
Ingersoll Rand PLC (IR.N)	O (08/20/2018)	$124.69
Johnson Controls International Plc (JCI.N)	E (08/20/2018)	$39.58
Lennox International Inc (LII.N)	U (08/20/2018)	$272.01
Parker-Hannifin Corp (PH.N)	E (08/20/2018)	$179.85
Pentair plc (PNR.N)	E (12/18/2018)	$39.48
Rockwell Automation (ROK.N)	U (08/20/2018)	$178.77
Stanley Black & Decker (SWK.N)	O (08/20/2018)	$153.08
Sun Hydraulics Corp (SNHY.O)	E (12/18/2018)	$49.94
W.W. Grainger Inc. (GWW.N)	U (12/18/2018)	$283.55
Watsco Inc. (WSO.N)	E (12/18/2018)	$160.39

Stock Ratings are subject to change. Please see latest research for each company.
* Historical prices are not split adjusted.

INDUSTRY COVERAGE: Autos & Shared Mobility

COMPANY (TICKER)	RATING (AS OF)	PRICE* (05/03/2019)
Adam Jonas, CFA		
Avis Budget Group Inc (CAR.O)	U (06/26/2018)	$37.15
Ferrari NV (RACE.N)	E (08/02/2018)	$134.14
Fiat Chrysler Automobiles NV (FCHA.MI)	O (02/24/2016)	€13.86
Fiat Chrysler Automobiles NV (FCAU.N)	O (02/24/2016)	$15.86
Ford Motor Company (F.N)	E (10/19/2018)	$10.41
General Motors Company (GM.N)	O (04/09/2018)	$38.80
Harley-Davidson Inc (HOG.N)	O (05/06/2013)	$37.21
Hertz Global Holdings Inc (HTZ.N)	U (09/14/2017)	$19.61
Tesla Inc (TSLA.O)	E (05/15/2017)	$255.03
Armintas Sinkevicius, CFA, CPA		
Adient PLC (ADNT.N)	U (07/31/2018)	$24.89
American Axle & Manufacturing Holdings Inc (AXL.N)	O (03/22/2018)	$13.61
Aptiv Plc (APTV.N)	U (12/05/2017)	$80.18
Asbury Automotive Group Inc (ABG.N)	E (07/10/2018)	$80.45
AutoNation Inc. (AN.N)	U (07/10/2018)	$41.69
BorgWarner Inc. (BWA.N)	O (03/22/2018)	$41.29
Carmax Inc (KMX.N)	O (07/10/2018)	$78.62
Carvana Co (CVNA.N)	U (01/14/2019)	$72.18
Delphi Technologies PLC (DLPH.N)	E (10/15/2018)	$22.46
Goodyear Tire & Rubber Company (GT.O)	E (08/13/2018)	$18.40
Group 1 Automotive, Inc (GPI.N)	O (05/06/2019)	$78.01
Lear Corporation (LEA.N)	O (07/31/2018)	$146.24
Lithia Motors Inc. (LAD.N)	O (07/10/2018)	$114.44
Magna International Inc. (MGA.N)	U (03/22/2018)	$54.78
Penske Automotive Group, Inc (PAG.N)	O (07/10/2018)	$46.13
Sonic Automotive Inc (SAH.N)	U (07/10/2018)	$19.93
Tenneco Inc. (TEN.N)	U (11/14/2018)	$21.47
Visteon Corporation (VC.O)	U (03/22/2018)	$64.73

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Disclosure Section (Cont.)

INDUSTRY COVERAGE: Freight Transportation

COMPANY (TICKER)	RATING (AS OF)	PRICE* (05/03/2019)
Ravi Shanker		
ArcBest Corp (ARCB.O)	E (10/06/2011)	$30.20
C.H. Robinson Worldwide Inc. (CHRW.O)	U (06/09/2013)	$83.90
Canadian National Railway Co. (CNR.TO)	O (02/23/2016)	C$125.35
Canadian Pacific Railway Ltd. (CP.TO)	O (06/03/2016)	C$299.02
CSX Corporation (CSX.O)	U (10/02/2017)	$80.52
Echo Global Logistics Inc (ECHO.O)	E (03/05/2019)	$23.70
Expeditors International of Washington I (EXPD.O)	E (02/25/2015)	$79.16
FedEx Corporation (FDX.N)	E (06/20/2013)	$188.06
Genesee & Wyoming Inc. (GWR.N)	U (10/22/2018)	$90.01
Heartland Express Inc. (HTLD.O)	U (05/06/2011)	$19.93
Hub Group Inc (HUBG.O)	E (02/13/2018)	$46.85
J.B. Hunt Transport Services Inc. (JBHT.O)	E (05/06/2011)	$95.96
Kansas City Southern (KSU.N)	E (02/23/2016)	$125.25
Knight-Swift Transportation Holdings Inc (KNX.N)	O (12/13/2017)	$33.30
Landstar System Inc (LSTR.O)	U (02/23/2016)	$112.08
Norfolk Southern Corp. (NSC.N)	U (06/03/2016)	$205.06
Old Dominion Freight Line Inc (ODFL.O)	E (10/22/2018)	$153.29
Saia, Inc. (SAIA.O)	U (02/23/2016)	$68.27
Schneider National Inc. (SNDR.N)	O (05/01/2017)	$20.78
Union Pacific Corp. (UNP.N)	U (10/22/2018)	$179.20
United Parcel Service (UPS.N)	U (02/23/2016)	$106.65
US Xpress Enterprises Inc (USX.N)	O (07/09/2018)	$6.01
Werner Enterprises (WERN.O)	O (02/23/2016)	$33.48
XPO Logistics, Inc. (XPO.N)	E (02/19/2019)	$64.45

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INDUSTRY COVERAGE: Airlines

COMPANY (TICKER)	RATING (AS OF)	PRICE* (05/03/2019)
Rajeev Lalwani, CFA		
Air Canada (AC.TO)	O (04/05/2019)	C$33.62
Alaska Air Group Inc (ALK.N)	O (06/23/2015)	$62.48
Allegiant Travel (ALGT.O)	E (06/23/2015)	$147.26
American Airlines Group Inc (AAL.O)	E (03/22/2017)	$34.79
Delta Air Lines, Inc. (DAL.N)	O (06/23/2015)	$57.80
Hawaiian Holdings Inc (HA.O)	U (06/23/2015)	$28.05
JetBlue Airways (JBLU.O)	E (06/23/2015)	$18.71
Southwest Airlines (LUV.N)	O (01/05/2017)	$53.62
Spirit Airlines Inc. (SAVE.N)	E (10/16/2015)	$52.50
United Continental Holdings, Inc. (UAL.N)	E (01/05/2017)	$88.43
WestJet Airlines Ltd (WJA.TO)	U (04/05/2019)	C$18.48

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INDUSTRY COVERAGE: Aerospace & Defense

COMPANY (TICKER)	RATING (AS OF)	PRICE* (05/03/2019)
Rajeev Lalwani, CFA		
AerCap Holdings NV (AER.N)	U (04/06/2017)	$51.79
Air Lease Corp (AL.N)	E (04/06/2017)	$39.58
Arconic Inc (ARNC.N)	E (06/13/2017)	$22.41
Boeing Co. (BA.N)	O (01/09/2019)	$376.46
Bombardier Inc. (BBDb.TO)	E (04/05/2019)	C$2.29
General Dynamics Corp. (GD.N)	U (08/07/2017)	$176.69
Lockheed Martin Corp. (LMT.N)	E (01/09/2019)	$334.07
Northrop Grumman Corp. (NOC.N)	E (08/07/2017)	$292.04
Raytheon Co (RTN.N)	O (08/07/2017)	$179.30
Spirit AeroSystems Holdings Inc (SPR.N)	O (06/22/2016)	$88.81
Textron Inc. (TXT.N)	E (01/31/2018)	$53.30
TransDigm Group Inc. (TDG.N)		$478.35
United Technologies Corp (UTX.N)	O (06/14/2018)	$141.63

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INDUSTRY COVERAGE: Machinery

COMPANY (TICKER)	RATING (AS OF)	PRICE* (05/03/2019)
Courtney Yakavonis, CFA		
AGCO Corp (AGCO.N)	U (03/02/2018)	$74.82
Caterpillar Inc. (CAT.N)	O (03/02/2018)	$139.06
CNH Industrial NV (CNHI.N)	E (03/02/2018)	$10.81
Cummins Inc. (CMI.N)	E (03/02/2018)	$169.19
Deere & Co. (DE.N)	O (03/02/2018)	$166.91
Oshkosh Corp. (OSK.N)	E (03/02/2018)	$81.14
PACCAR Inc (PCAR.O)	U (03/02/2018)	$71.38
REV Group Inc. (REVG.N)	E (03/02/2018)	$12.71
Terex Corp. (TEX.N)	E (03/02/2018)	$32.57
United Rentals Inc. (URI.N)	O (03/02/2018)	$140.24
WABCO Holdings Inc (WBC.N)	E (12/17/2018)	$133.16
WillScot Corporation (WSC.O)	O (10/01/2018)	$14.45

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Disclosure Section (Cont.)

INDUSTRY COVERAGE: Metals & Mining

COMPANY (TICKER)	RATING (AS OF)	PRICE* (05/03/2019)
Piyush Sood		
ALCOA CORP (AA.N)	O (11/07/2016)	$26.68
Century Aluminum Co (CENX.O)	E (12/21/2018)	$8.37
Constellium NV (CSTM.N)	O (11/16/2017)	$9.58
Freeport-McMoRan Inc (FCX.N)	O (02/12/2019)	$11.95
Kaiser Aluminum Corp (KALU.O)	E (03/03/2016)	$98.85
Largo Resources Ltd (LGO.TO)	O (10/24/2018)	C$1.71
Stelco Holdings Inc. (STLC.TO)	E (03/05/2019)	C$14.96
Teck Resources Limited (TECK.N)	E (09/15/2016)	$22.99

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INDUSTRY COVERAGE: Paper & Packaging

COMPANY (TICKER)	RATING (AS OF)	PRICE* (05/03/2019)
Neel Kumar, CFA		
Ball Corporation (BLL.N)	O (01/16/2019)	$61.54
Berry Global Group Inc (BERY.N)	E (01/16/2019)	$53.97
Crown Holdings, Inc. (CCK.N)	E (01/16/2019)	$60.45
Sealed Air Corporation (SEE.N)	E (01/16/2019)	$45.03

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INDUSTRY COVERAGE: Chemicals

COMPANY (TICKER)	RATING (AS OF)	PRICE* (05/03/2019)
Alexandra Thrum		
International Flavors & Fragrances (IFF.N)	E (12/11/2018)	$139.91
Neel Kumar, CFA		
Element Solutions Inc (ESI.N)	E (01/30/2017)	$11.27
Huntsman Corp (HUN.N)	E (09/25/2018)	$21.58
Olin Corp. (OLN.N)	O (01/09/2018)	$21.34
Westlake Chemical Corp (WLK.N)	E (01/09/2018)	$63.50
Vincent Andrews		
Air Products and Chemicals Inc. (APD.N)	E (04/26/2012)	$209.58
Albemarle Corporation (ALB.N)	U (02/26/2018)	$77.05
Axalta Coating Systems Ltd (AXTA.N)	E (12/09/2015)	$26.89
Celanese Corp. (CE.N)	E (10/08/2012)	$108.77
CF Industries (CF.N)	E (05/25/2016)	$44.22
Chemours Co (CC.N)	E (01/30/2018)	$34.18
DowDuPont Inc (DWDP.N)	O (09/06/2017)	$34.89
Dow Inc. (DOW.N)	O (04/02/2019)	$53.30
Eastman Chemical Co (EMN.N)	O (01/17/2019)	$79.55
Ecolab Inc. (ECL.N)	E (08/15/2017)	$185.00
Intrepid Potash (IPI.N)	U (10/03/2013)	$3.64
Israel Chemicals Ltd. (ICL.N)	E (11/03/2014)	$5.19
Linde PLC (LIN.N)	NA (11/27/2017)	$180.96
LyondellBasell Industries N.V. (LYB.N)	++	$87.02
Mosaic Company (MOS.N)	E (03/16/2016)	$25.62
Nutrien Ltd (NTR.N)	E (12/11/2018)	$53.99
PPG Industries Inc. (PPG.N)	E (02/03/2015)	$117.63
PQ Group Holdings Inc (PQG.N)	E (10/24/2017)	$16.01
RPM International Inc. (RPM.N)	O (03/19/2014)	$61.21
Sherwin-Williams Co. (SHW.N)	O (03/19/2014)	$455.91
Trinseo S.A. (TSE.N)	E (07/22/2014)	$46.46
Tronox Ltd (TROX.N)	E (01/30/2018)	$13.38
Venator Materials PLC (VNTR.N)	E (01/30/2018)	$6.15

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Disclosure Section (Cont.)

INDUSTRY COVERAGE: Telecom & Networking Equipment

COMPANY (TICKER)	RATING (AS OF)	PRICE* (05/03/2019)
James E Faucette		
Arista Networks (ANET.N)	E (04/23/2019)	$278.41
Axon Enterprise Inc (AAXN.O)	O (07/01/2018)	$65.30
BlackBerry Ltd (BB.N)	E (03/22/2019)	$9.39
Cisco Systems Inc (CSCO.O)	E (02/12/2019)	$54.94
Corning Inc (GLW.N)	O (05/31/2018)	$31.99
F5 Networks Inc (FFIV.O)	U (07/18/2018)	$154.37
Juniper Networks Inc (JNPR.N)	U (11/01/2016)	$27.65
Mobileiron (MOBL.O)	E (04/23/2015)	$6.07
Qualcomm Inc. (QCOM.O)	O (04/23/2019)	$89.29
Trimble Inc. (TRMB.O)	E (09/21/2015)	$43.35
Zebra Technologies Corporation (ZBRA.O)	E (05/31/2017)	$206.46
Meta A Marshall		
Acacia Communications Inc (ACIA.O)	U (03/27/2019)	$59.00
Avaya Holdings Corp (AVYA.N)	E (01/07/2019)	$18.79
Bandwidth Inc (BAND.O)	E (07/02/2018)	$69.52
Casa Systems Inc (CASA.O)	E (01/17/2019)	$7.40
Ciena Corporation (CIEN.N)	E (09/13/2018)	$38.79
CommScope Holding Company Inc (COMM.O)	E (04/30/2018)	$24.25
Finisar Corporation (FNSR.O)	E (09/13/2018)	$24.32
II-VI Incorporated (IIVI.O)	E (07/02/2018)	$40.40
Infinera Corp (INFN.O)	E (11/13/2018)	$4.43
Lumentum Holdings Inc (LITE.O)	O (03/27/2019)	$63.74
Viavi Solutions Inc (VIAV.O)	E (05/20/2015)	$13.74

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* Historical prices are not split adjusted.

INDUSTRY COVERAGE: IT Hardware

COMPANY (TICKER)	RATING (AS OF)	PRICE* (05/03/2019)
Erik W Woodring		
Garmin Ltd (GRMN.O)	E (01/07/2015)	$79.55
GoPro Inc (GPRO.O)	U (01/23/2018)	$6.03
Katy L. Huberty, CFA		
Apple, Inc. (AAPL.O)	O (05/26/2009)	$211.75
CDW Corporation (CDW.O)	E (08/06/2013)	$109.09
Dell Technologies Inc. (DELL.N)	E (01/15/2019)	$68.70
Electronics for Imaging Inc (EFII.O)	++	$37.30
Fitbit Inc (FIT.N)	U (04/01/2018)	$5.09
Hewlett Packard Enterprise (HPE.N)	E (01/15/2019)	$15.93
HP Inc. (HPQ.N)	E (01/23/2018)	$20.29
IBM (IBM.N)	++	$140.25
NCR Corp. (NCR.N)	E (09/25/2011)	$29.06
NetApp Inc (NTAP.O)	U (01/15/2019)	$72.16
Nutanix Inc (NTNX.O)	O (01/15/2019)	$39.35
Pure Storage Inc (PSTG.N)	E (05/18/2017)	$22.65
Seagate Technology (STX.O)	O (04/09/2018)	$49.60
Sonos Inc. (SONO.O)	O (01/28/2019)	$11.26
Teradata (TDC.N)	O (01/15/2019)	$39.33
Xerox Corp (XRX.N)	++	$32.95

Stock Ratings are subject to change. Please see latest research for each company.
* Historical prices are not split adjusted.

Disclosure Section (Cont.)

INDUSTRY COVERAGE: Semiconductors

COMPANY (TICKER)	RATING (AS OF)	PRICE* (05/03/2019)
Craig Hettenbach		
Amphenol Corp. (APH.N)	O (08/09/2018)	$100.01
Analog Devices Inc. (ADI.O)	E (12/18/2018)	$116.95
Broadcom Inc. (AVGO.O)	E (11/28/2018)	$315.71
Cypress Semiconductor Corp (CY.O)	U (03/30/2017)	$17.57
Impinj Inc (PI.OQ)	E (06/19/2017)	$29.64
Maxim Integrated Products Inc. (MXIM.O)	E (01/30/2018)	$60.55
Microchip Technology Inc. (MCHP.O)	E (11/01/2017)	$100.75
NXP Semiconductor NV (NXPI.O)	E (03/19/2018)	$108.08
ON Semiconductor Corp. (ON.O)	U (08/09/2018)	$23.52
Qorvo Inc (QRVO.O)	E (06/27/2016)	$75.18
Sensata Technologies Holding N.V. (ST.N)	U (09/17/2018)	$51.79
Skyworks Solutions Inc (SWKS.O)	E (11/28/2018)	$87.60
Te Connectivity Ltd (TEL.N)	O (09/10/2014)	$95.65
Joseph Moore		
Advanced Micro Devices (AMD.O)	U (10/30/2017)	$28.22
Ambarella Inc (AMBA.O)	O (03/29/2016)	$51.13
Aquantia Corp (AQ.N)	E (02/13/2019)	$9.56
Inphi Corporation (IPHI.N)	E (01/19/2018)	$51.13
Intel Corporation (INTC.O)	O (02/22/2019)	$51.75
Marvell Technology Group Ltd (MRVL.O)	E (09/14/2015)	$24.69
Micron Technology Inc. (MU.O)	U (04/04/2019)	$43.33
NVIDIA Corp. (NVDA.O)	E (01/29/2019)	$183.01
Quantenna Communications Inc (QTNA.O)	E (03/28/2019)	$24.46
Texas Instruments (TXN.O)	E (05/30/2012)	$117.47
Western Digital (WDC.O)	E (11/26/2017)	$50.80
Xilinx (XLNX.O)	O (12/14/2016)	$119.02

Stock Ratings are subject to change. Please see latest research for each company.
* Historical prices are not split adjusted.

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