Knorr-Bremse AG

(MDAX, Automobile & Parts)

WARBURG RESEARCH

Hold	
EUR 90.00	
Price	EUR 92.45
Downside	**-2.7 %**

Value Indicators:	EUR
DCF:	89.58
FCF-Value Potential 20e:	69.09
Peer group 20e:	73.34

Share data:	
Bloomberg:	KBX GR
Reuters:	KBX.DE
ISIN:	DE000KBX1006

Description:

Leading supplier for braking- & other safety critical rail and commercial vehicle systems

Market Snapshot:	EUR m
Market cap:	14,903
No. of shares (m):	161
EV:	16,390
Freefloat MC:	4,447
Ø Trad. Vol. (30d):	17.58 m

Shareholders:	
Freefloat	29.8 %
KB Holding GmbH	70.2 %

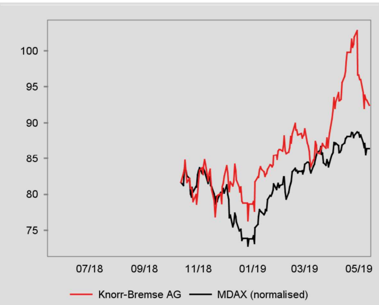
Risk Profile (WRe):	2019e
Beta:	1.2
Price / Book:	7.7 x
Equity Ratio:	30 %
Net Fin. Debt / EBITDA:	0.0 x
Net Debt / EBITDA:	0.3 x

World market leader trading at exaggerated levels; Initiation with Hold

We initiate our coverage with a **HOLD** rating and a DCF-based **PT of EUR 90** indicating a downside of ~3%. We believe the valuation reflects the quality of the business and an attractive investment proposition around strong organic growth, high returns on capital employed, a solid balance sheet, and below-average cyclicality, due to its exposure to rail & commercial vehicles and the high aftermarket content.

- **Competitiveness:** Knorr-Bremse is the world's leading manufacturer of brake systems, and a supplier of additional safety-critical sub-systems for rail (**RVS**) and commercial vehicles (**CVS**). Some 65% of revenues are generated in the OE business and the remainder in the less cyclical and higher-margin aftermarket business. In 2018 KB generated EUR 6.6bn sales and EUR 1.2bn EBITDA. KB dominates the industries with strong market shares in both divisions. **Barriers to entry** are relatively high considering the high initial capital spending required and the major homologation requirements. Moreover, there is strong resilience within the company structure as it is exposed to **different economic cycles** and different market drivers in RVS & CVS, a **diversified customer base** and a global footprint.
- **Returns:** Besides managing capital very efficiently, KB also offers decent profitability. A relatively strong capital turn constantly above 3x sales, combined with **strong EBITDA margins** ensure **high returns** on capital employed (ROCE ~36% average last 4Y).
- **Growth:** KB has an impressive top-line growth track record. In the period 2005-2018, it delivered a sales CAGR of 4.6% and 10.1% for CVS and RVS respectively (7% on group level) and proportionately stronger EBITDA growth with a **margin expansion** from 12.7% in 2005 to 18.1% in 2018 on group level. Our positive stance is based on the following rationale: Besides structural growth drivers like electrification, automated driving, increasing connectivity, urbanisation and digitisation, end markets should also be favourable in the short term. In RVS, KB has **record high order backlogs** while a relatively large installed base provides visibility for >11.1 months. In CVS, many OEMs are already booked for 2019 in NA. Truck production in Europe will remain on a high level while KB will benefit from the trend towards premium applications in China.
- **Risks:** In **RVS**, risks include the cooling-off of rail spending in China and, in the longer term, competitive risks considering KB's unique position with a very high market share in high-speed and a two-thirds share in metro in what is a strategic industry, with domestic players expanding in brakes. In **CVS**, risks include the late stages of the truck cycle, with the US probably peaking in 2019, Europe remaining flat and China already declining at a time where KB aims to increase investments. Customer concentration is relatively high in both segments. As a result of the JV dispute, Bosch will likely emerge as a competitor, which will not make the situation any easier for KB. Additionally, the acquisitions of KB's strongest CVS competitor WABCO by can be seen as a strategic risk as a major player in the race for automated driving systems emerged.

Valuation: Knorr-Bremse is trading at >20x earnings, at an EV / EBITDA multiple of >12x and a FCF potential yield of only ~5%. Overall, the market seems well aware of the excellent competitive position and its benefits from structural growth drivers. At this point, we do not see any triggers for earning estimate upgrades or for multiple expansion and initiate our coverage with a **HOLD** rating and a **PT of EUR 90** per share (target PE20 of ~20.5x).



Rel. Performance vs MDAX:	
1 month:	-2.8 %
6 months:	5.5 %
Year to date:	0.5 %
Trailing 12 months:	n/a

Company events:	
29.05.19	Q1 Fig
18.06.19	AGM

FY End: 31.12. in EUR m	CAGR (18-21e)	2015	2016	2017	2018	2019e	2020e	2021e
Sales	3.3 %	5,824	5,471	6,154	6,616	6,952	6,942	7,287
Change Sales yoy		n.a.	-6.0 %	12.5 %	7.5 %	5.1 %	-0.1 %	5.0 %
Gross profit margin		*53.0 %*	*53.2 %*	*52.2 %*	*51.1 %*	*51.0 %*	*51.4 %*	*51.8 %*
EBITDA	6.6 %	1,269	1,052	1,116	1,178	1,293	1,333	1,428
Margin		*21.8 %*	*19.2 %*	*18.1 %*	*17.8 %*	*18.6 %*	*19.2 %*	*19.6 %*
EBIT	6.3 %	1,099	886	904	972	1,088	1,101	1,167
Margin		*18.9 %*	*16.2 %*	*14.7 %*	*14.7 %*	*15.7 %*	*15.9 %*	*16.0 %*
Net income	7.8 %	653	526	536	593	704	711	744
EPS	7.8 %	4.05	3.26	3.32	3.68	4.37	4.41	4.61
EPS adj.	5.8 %	4.05	3.26	3.60	3.93	4.41	4.45	4.65
DPS	9.6 %	2.66	2.69	5.57	1.75	2.19	2.21	2.31
Dividend Yield		n.a.	n.a.	n.a.	2.2 %	2.4 %	2.4 %	2.5 %
FCFPS		4.49	3.24	2.79	2.48	4.02	3.78	4.10
FCF / Market cap		n.a.	n.a.	n.a.	2.7 %	4.3 %	4.1 %	4.4 %
EV / Sales		n.a.	n.a.	n.a.	2.3 x	2.4 x	2.3 x	2.2 x
EV / EBITDA		n.a.	n.a.	n.a.	12.7 x	12.7 x	12.1 x	11.1 x
EV / EBIT		n.a.	n.a.	n.a.	15.3 x	15.1 x	14.7 x	13.6 x
P / E		n.a.	n.a.	n.a.	22.1 x	21.2 x	21.0 x	20.1 x
P / E adj.		n.a.	n.a.	n.a.	20.7 x	21.0 x	20.8 x	19.9 x
FCF Potential Yield		n.a.	n.a.	n.a.	4.8 %	4.8 %	5.0 %	5.4 %
Net Debt		-279	-75	64	760	412	154	-133
ROCE (NOPAT)		n.a.	34.6 %	31.5 %	31.6 %	32.4 %	31.4 %	31.5 %
Guidance:	Revenue EURm 6,800-7,000; EBITDA margin 18-19%							

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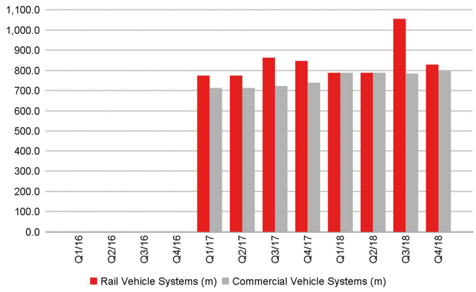
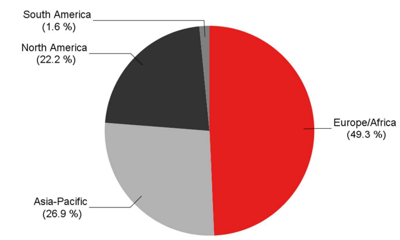
Sales development
in EUR m



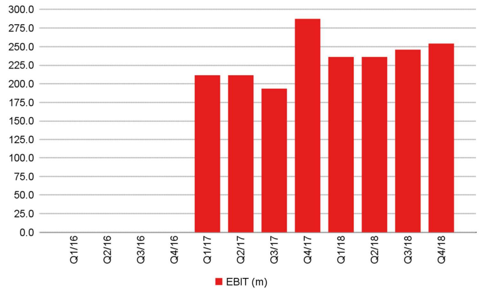
Source: Warburg Research

Sales by regions
2018; in %



Source: Warburg Research

EBIT development
in EUR m



Source: Warburg Research

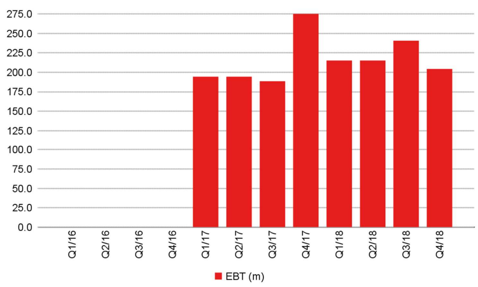
Company Background

- Knorr-Bremse is the world's leading manufacturer of brake systems and supplies additional safety-critical sub-systems for rail and commercial vehicles.
- Knorr-Bremse's larger segment Rail Vehicle Systems accounts for ~52% of group sales and ~60% of group EBIT. ~66% of RVS sales are generated with brake systems, ~9% with entrance systems and another ~6% with HVAC.
- KB's smaller segment Commercial Vehicle Systems accounts for ~48% of group sales and ~45% of EBIT. Brake systems generate ~71% of CVS sales, energy supply & distribution ~15% and fuel efficiency ~14%.
- ~65% of revenues are generated in the OE business and the remainder in the less cyclical and higher-margin aftermarket business.
- 70.16% of KB's shares are in the hands of KB Holding GmbH, the investment vehicle of former long-term CEO Mr. Thiele.

Competitive Quality

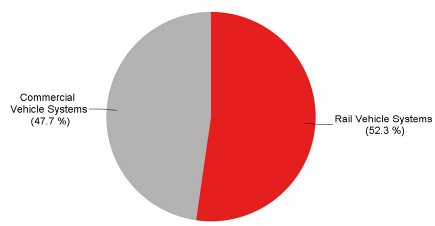
- The extremely high barriers to market entry include the immense homologation requirements and increasing regulation, a high number of variants, low unit volumes, and a high level of customisation.
- Synergies between the two segments mean KB can optimise its R&D investments and stay at the forefront of technological developments.
- KB has a resilient business model, based on two segments with different economic cycles, supported by broad geographical and customer diversification, high aftermarket exposure and strong localisation.
- Long-term contracts with customers (especially in RVS) guarantee high top-line visibility.
- With outstanding profitability and high capital efficiency, KB consistently earns ROCEs >30% (Average 2015-2018 ~36%).

EBT development
in EUR m



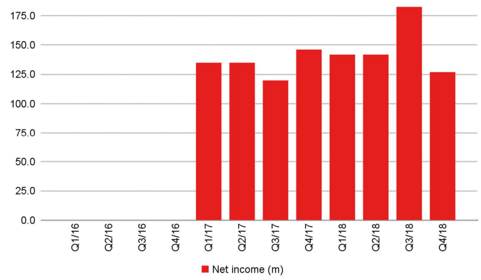
Source: Warburg Research

Sales by segments
2018; in %



Source: Warburg Research

Net income development
in EUR m



Source: Warburg Research

Summary of Investment Case

Investment triggers

- Valuation for KB is stretched. While we acknowledge the superior competitive quality and decent growth prospects of favourable end markets, we see no further fundamental upside potential.
- While the share prices of the majority of peers in the commercial vehicle industry came under strong pressure last year, KB still trades at >20x earnings. It seems as if investors are willing to pay a decent price for KB owing to its diversified business model. Nevertheless, KB is also operating in the extremely cyclical commercial vehicle industry which we regard as close to the peak.
- With our conservative assumptions for long-term top-line growth and our expectation of high investment needs for digitisation, electrification and autonomous solutions, we prefer to wait for a lower entry level.

Valuation

- **DCF:** Our DCF-based price target of **EUR 90** implies a PE multiple 2019 of 20.5x and offers no further upside potential. We expect top-line growth and an increasing EBIT margin from 14.7% in 2017 to 16.2% in 2022, driven by both segments. However, during the transitional phase EBIT margins will come down to 15% in 2031.
- **FCF Value Potential:** Keeping maintenance capex at two thirds of total capex and WC constant leaves us with a value of **EUR 69** per share for 2020e.
- **SOTP:** We benchmark **RVS** with multiples of peer Wabtec and **CVS** with multiples of WABCO (before ZF's takeover announcement), the most important competitors for the respective segments. KB will often be compared to those stocks/companies by investors, making this procedure straightforward. However, M&A activity by peers makes the valuation difficult to interpret and limits comparability.

Growth

- Orders already on hand for 2019 (4,563m) will boost top-line growth this year. We anticipate 5.1% in 2019 (4% organic & 1% resulting from the Hitachi acquisition). However, 2020 will be a tough year for truck markets (especially in North America). Therefore, while we forecast decreasing sales in CVS, this is counter-balanced by growth in RVS, resulting in flat group sales.
- Our conservative estimate for long-term growth in **RVS** is a CAGR of 2.9% in the period 2022-2032. This is based on a positive development of mass transit in Asia (mainly China, India), strong freight transport and urban transit in Europe and further strong growth in the aftermarket driven by all geographic regions.
- For **CVS** we forecast a CAGR of 2.6% for the period 2022-2032. Growth drivers include a) strong performance of North American truck and trailer production due to higher content-per-vehicle as fleet operators appreciate the benefits of disc brake technology, and b) favourable regulatory changes in China which benefit western component suppliers with proven technology at hand. Moreover, KB is set to benefit from megatrends like digitisation, telematics, or the realignment of the entire logistic supply chain to urbanisation as demand increases for heavy trucks & trailers and as opportunities arise to sell hardware + software as a package.

Competitive quality

- Barriers to market entry include the immense homologation requirements and increasing regulation, a high number of variants but low unit volumes, and a high level of customisation. Synergies between both segments mean that KB can optimise its R&D investments and stay at the forefront of technological developments.
- KB's resilient business model is based on two segments with different economic cycles, supported by broad geographical and customer diversification, high aftermarket exposure and strong localisation: Long-term contracts with customers (especially in RVS) guarantee high top-line visibility.
- Owing to outstanding profitability and high capital efficiency, KB consistently earns ROCEs >30% (Average 2015-2018 ~36% or ~ 5x its WACC).

Warburg versus consensus

Our forecast for 2019 is broadly in line with consensus. However, thereafter we are more cautious.

Company Overview

KNORR-BREMSE

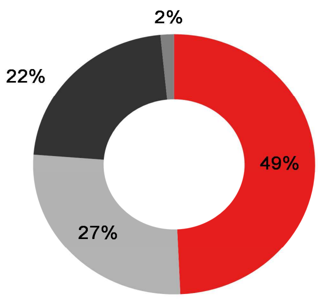
Segments	RVS	CVS	Remaining Segments	Group
Sales* in EUR m	3461.9	3160.1	-6.2	6615.8
in % of total	*52.3%*	*47.8%*	*-0.09%*	*100.0%*
EBIT in EUR m	585.2	434.4	-47.2	972.5
EBIT Margin	*16.9%*	*13.7%*	*760.7%*	*14.7%*

Segments	**Railway Vehicle Systems**	**Commercial Vehicle Service**
	Brake Systems, **Entrance Systems**, **HVAC**, **Train Control Management Systems**	**Fuel efficiency**, **Brake Systems & vehicle dynamics**
Product examples		
	Power electrics, **Auxiliary power supply**, **Signaling systems**	**Connectivity**, **Energy Supply & distribution**, **Electrification**
Service	**Modernisation and support**; **Aftermarket services**	**Aftermarket services including Alltrucks network**

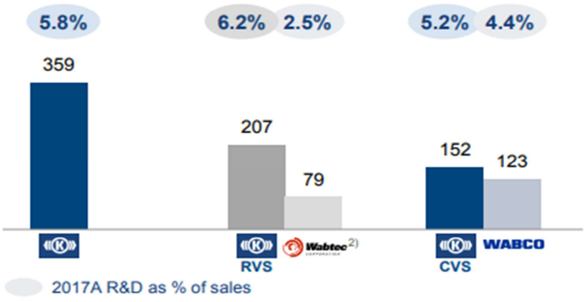
Market positions (market share)	Global brakes market share of ~ **50%**	Market Leader in Brake Systems & entrance Systems	Global pneumatic brake systems market share of **~ 42 %**	Market leader in Brake Systems & Vehicle dynamics, Energy Supply & Distribution and Fuel Efficiency
Competitors	Wabtec CORPORATION	~ 15 % market share	WABCO	~ 34 % market share
Customers	car builders: HITACHI, STADLER, Kawasaki, CAF, CRRC, SIEMENS, BOMBARDIER, ALSTOM	operators: 中国铁路总公司 CHINA RAILWAY, DB, MTA, ÖBB, TRENITALIA	VOLVO, ISUZU, Ford, VOLKSWAGEN TRUCK & BUS, PACCAR, NAVISTAR, DONGFENG	DAIMLER TRUCKS & BUSES

Global Footprint	**Industry Innovator**

Sales by Regions in 2018



Knorr Bremse invests more in R&D than ist peers



* All numbers relate to FY 2018

Source: Warburg Research

Competitive Quality

- KB dominates the industries with **strong market shares** in both divisions.
- **Barriers to entry** are relatively high as high initial capital spending is required and there are major homologation requirements.
- There is inherent resilience in the company structure as it is exposed to **different economic cycles** and **different market drivers** in RVS & CVS, has a **diversified customer base** and a **global footprint**

To understand Knorr-Bremse's competitive environment it is important not only to distinguish between the divisions Rail Vehicle and Commercial Vehicle Systems but also to take a closer look at the various product offerings.

Rail Vehicle Systems

The rail vehicle industry at a glance

Knorr-Bremse's larger segment Rail Vehicle Systems accounted for 52% of group sales and 60% of group EBIT in 2018. Historically, the divisional revenue split has been pretty stable.

KB is well protected by barriers to entry

Analysis of the Rail Vehicle Systems relevant market

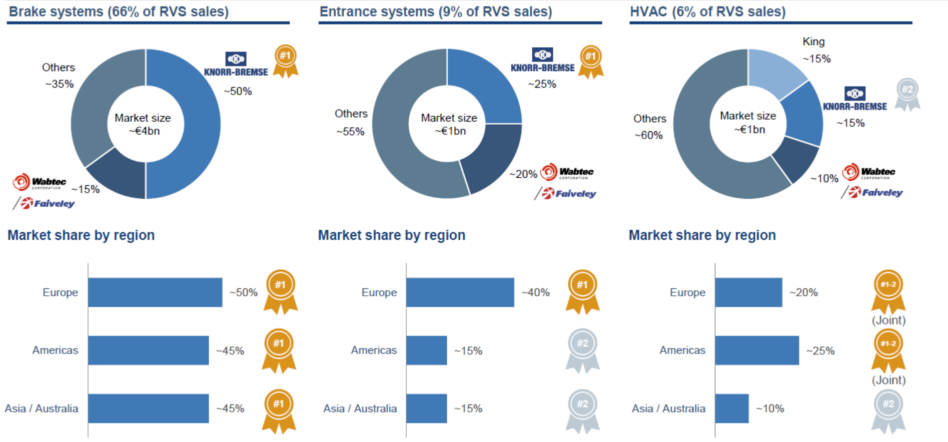
Force	Degree	Factors to consider
Threat of substitutes	***Medium***	▪ KB is the industry leader in R&D spending, thereby defending its existing product offering. ▪ Many products of KB are industry standard, substitutes are expensive to develop. ▪ KB has an extended aftermarket network enabling direct access to customers. ▪ KB holds IP-rights which also serve as a barrier of entry.
Rivalry	***Medium***	▪ Knorr Bremse & Wabtec dominate the market for their core products with high market shares. ▪ Price competition is limited because, once KB has won a bidding competition, products are normally single sourced.
Bargaining power of suppliers	***Low***	▪ The primary inputs (aluminium, steel, copper, zinc, rubber and plastics) underlying sourced components are commodities trading at world market prices. ▪ Supplier base is diversified with the five most important suppliers accounting for merely a single-digit percent.
Bargaining power of buyers	***Medium***	▪ 10 largest customers account for ~50% of division revenues. These customers command significant bargaining power due to project-specific sub-system procurement.
Threat of new entrants	***Low***	▪ Several complex homologation requirements serve the rail industry as a barrier to entry. ▪ Key to success in the aftermarkets business is a dense service network which is expensive to establish.

Source: Warburg Research

In recent years, suppliers of rolling stock components have been affected by consolidation processes, which have reduced the number of competitors in the market, so that single components are now produced by very few suppliers.

The industry is now characterized by a high concentration, especially in brakes and brake systems. Knorr-Bremse holds market leadership in all relevant product categories led by a ~50%-market share in its core business of brakes (see graph below). It's fair to say that Westinghouse Air Brake Technologies Corporation (Wabtec) (which acquired Faiveley) is by far the biggest competitor in the segment.

Strong global market shares in the relevant product categories (RVS)



Source: Knorr-Bremse Presentation

Besides Wabtec, KB is competing with a number of mostly product-specific OEM suppliers in its addressable Rail Vehicle Systems Market, but also certain vehicle manufacturers that manufacture certain sub-systems themselves or in cooperation with partners.

While KB has a particularly strong focus on the passenger segment (~84% of segment sales), its competitor Wabtec has a stronger focus on the freight segment (approximately 68% of 2017 sales were related to freight). From a regional perspective, KB has a leading position, especially in Europe while outstanding market shares are held within the most important product group, brake systems, across the globe.

Key metrics for Knorr-Bremse (RVS) and Wabtec

	Wabtec	KB (RVS)
Sales CAGR 2016-18	21.8%	7.8%
EBITDA CAGR 2016-18	12.2%	5.4%
EBITDA Margin (average last 3 Y)	16.3%	20.2%
R&D/Sales (2018)	2.5%	5.7%
Average Capex/Sales (last 3Y)	2.1%	3.6%
Aftermarket share	50.0%	40.0%
Market shares		
Brake/ Brake Systems	15%	50%
Entrance systems	20%	25%
HVAC	10%	10-15%

Source: Knorr-Bremse, Wabtec, Warburg Research

The relevant Rail Vehicle Systems market is, in our view, well protected by high entry barriers, including:

- low purchased volumes (it is expensive to produce components, since the development costs are spread among fewer parts),
- immense homologation requirements and typical lead times of 4-8 years (i.e., the freight market segment is characterized by global certification requirements — according to four major global standards [GOST, UIC, AAR, ARA] — there are also certification requirements for numerous components in the passenger market segment, which is complex and time-consuming),
- significant portfolio complexity, with seven unique configurations for different vehicle types, different sub-systems and more than a hundred safety-critical components with numerous country- and customer-specific variants,

- as well as high initial capital requirements and the relatively long lifecycle of relevant components and systems.

In addition, customers tend to maintain their loyalty to their incumbent suppliers, resulting in a long gestation for the aftermarket. Additionally, increasing regulatory requirements and highly-protected intellectual property also pose difficulties for potential new entrants. According to KB, it is the only supplier worldwide that is certified for all local standards and norms. Due to the long company history, KB's rail vehicle systems are installed in approximately 50% to 55% of all active rail vehicles globally (excluding freight cars).

Nevertheless, we are observing increasing price pressure in the industry. Firstly, there is a tendency towards product bundling in the procurement process of KB's customers which leads to lower prices. Secondly, a concentration of KB's customer base will lead to stronger customer bargaining power.

Competitiveness of suppliers is limited

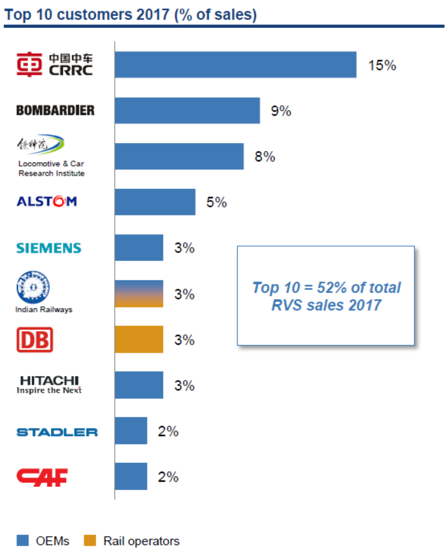
As costs for materials represent the largest cost item by far (see chapter Operating profitability) a diversified supplier base is crucial. KB purchases a broad range of components, parts and materials in connection with its manufacturing activities. Major items include electronic components and parts containing aluminium, steel, copper, zinc, rubber and plastics. The costs of components and parts, which reflect the cost of the raw materials used to produce them, represent a significant portion of total costs.

However, only a single-digit percentage is sourced from the five most important suppliers and a quarter of direct and indirect supplies are provided by the 50 most important suppliers. Procurement activities focus on sourcing from a balanced mix of materials from high-tech and best-cost countries.

For the Rail Vehicle Systems segment, procured materials stem from more than 40 locations and over 10 business units in three geographic areas and from more than 5,000 suppliers in over 50 countries.

Customer base

KB claims to be the preferred partner for all major OEMs and operators across the globe.



Other major Knorr-Bremse customers

Source: Knorr-Bremse Presentation Dec 2018

However, in recent years, customers of KB have increasingly decided to develop and produce certain components in-house. OEMs in the rail business often try to develop their own components and sub-systems in order to reduce dependency on their main suppliers. For example, major Chinese car builders in the rail industry tend to have a clear strategic focus on development in order to reduce their dependence on suppliers. Moreover, if components and systems are sourced from external suppliers, they tend to prefer Chinese suppliers. Another example is Siemens (KB's fifth-largest customer in RVS) which is also active in developing braking products for use in their own rail vehicles.

We see huge bargaining power on the customer side, especially for transit authorities, which invite tenders for large and complex (sub)-systems. This is a time-consuming process and requires upfront costs. If KB fails to win a bid for major systems, (which are generally linked to platforms with procurement processes taking place every five to 10 years), the customer is locked in by the competition.

Cyclicality of the industry

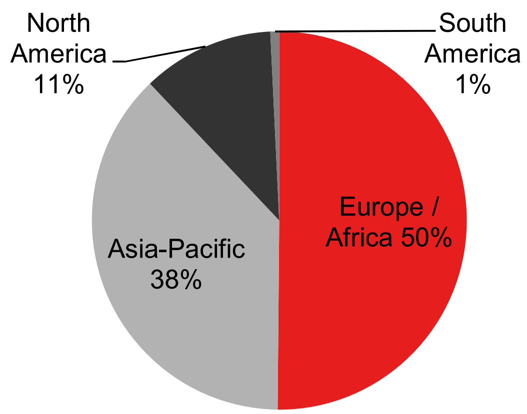
Investment in rail transportation depends on the overall health of a national economy and levels of public spending. Furthermore the segment is exposed to strong intrinsic cyclicality. Periods of investment in rail vehicles are typically followed by slower periods in which demand declines. For example, a high-speed rail accident in China in late 2011 led to a sharp deterioration in high-speed train and locomotive demand in 2012 and 2013, followed by a pronounced increase in demand in 2014 and, especially, in 2015. Also in 2016, a cyclical slowdown occurred in the freight car and locomotive business in the U.S. and Canada, which resulted in a decline in freight prices and volumes, which had a negative effect on KB's business in that region.

As investment in the rail vehicle industry depends heavily on public spending, it is important to understand that budgets of governments in KB's largest markets (China, Germany, USA) are critical for future business development. On the other hand, KB's significant aftermarket business (~40%) reduces the dependency on economic cycles which tend to primarily affect the original equipment business.

Clear focus on passenger segment

KB follows a clear strategy. It is regionally diversified with 50% of segment sales generated in Europe, 38% in Asia/Australia and 12% Americas.

Geographic RVS sales distribution (2018)



Source: Knorr-Bremse

KB pursues a strategy that is clearly focused on brake systems (~66% of sales) and other safety-critical systems which can be leveraged across segments.

Additionally, the company is targeting the passenger segment, rather than the freight segment, and enjoys slightly stronger margins than its most important peer, Wabtec. We admire this strategy as it allows KB to capitalise on its market-leading position, its technological leadership and limited competition.

Commercial Vehicle Systems

The commercial vehicle industry at a glance

In the fiscal year 2017, brake systems and vehicle dynamics, including driver assistance and automated driving, accounted for approximately 71% of the OE sales of the Commercial Vehicle Systems segment. The energy supply & distribution business accounted for approximately 15% and the fuel efficiency segment, 14%.

Analysis of the Commercial Vehicle Systems relevant market

Force	Degree	Factors to consider
Threat of substitutes	***Medium***	▪ KB is leading in R&D spending, thereby setting high benchmarks for competitors aiming to replace KB's products. ▪ Product cycles tend to be relatively long, and it is difficult to replace a product on an existing platform
Rivalry	***Medium***	▪ KB dominates the market with WABCO as the second largest player. Their combined market shares are 40% or higher.
Bargaining power of suppliers	***Low***	▪ KB has approximately 1,400 suppliers in more than 35 countries, switching costs are low and a high portion of sourced inputs are commodity-price driven.
Bargaining power of buyers	***High***	▪ As truck/trailer OEMs account for the biggest portion of segment revenues, we clearly see a risk of pricing pressure. ▪ We expect margin pressure due to increasing consolidation among KB's customers.
Threat of new entrants	***Low***	▪ Loyalty of customers is a major barrier to entry. ▪ Comprehensive and well protected intellectual property portfolios are built up over decades. ▪ A key success factor is adequate access to an aftermarket distribution network.

Source: Warburg Research

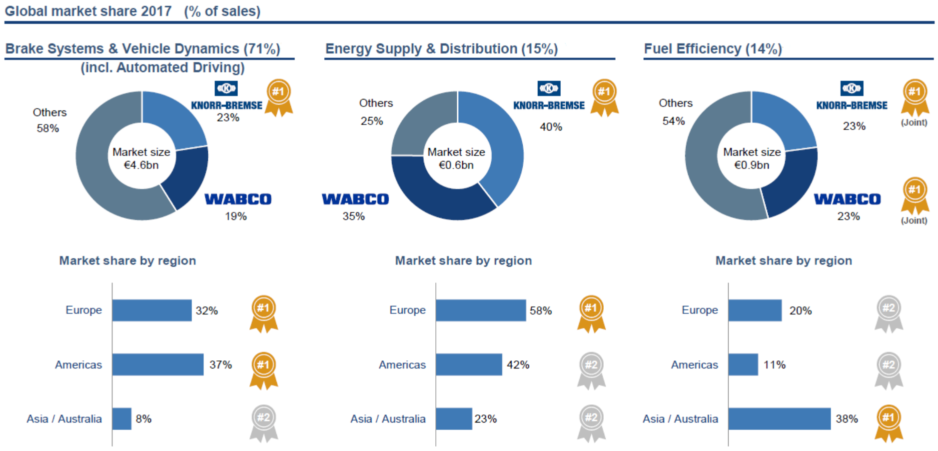
Knorr-Bremse is one of two global suppliers active in the relevant main product categories. The other is WABCO Holdings Inc., which is headquartered in Brussels, Belgium ("WABCO"). As with the RVS segment, markets for commercial vehicle suppliers are very mature and consolidated. For many products there are only a few providers active on a global scale. The commercial vehicle industry is characterized by:

- Ongoing technological advancement driven by fast-changing regulation due to the safety-critical nature of KB's products, which increases barriers to entry for both new entrants and existing competitors.
- Customer loyalty has solidified the market and the major players, especially in brake systems, are the same as 100 years ago.
- Generally long lifespans, resulting in the ability of incumbent market participants to offer products and services over the entire lifecycle, including long service periods in the aftermarket.
- Incumbent market participants have established comprehensive and well-protected intellectual property portfolios, which meet high standards of quality and safety.
- The need for adequate access to aftermarket distribution networks that allow for efficient provision of spare parts.

Together, these attributes represent significant barriers to entry, which makes it unlikely that KB's currently dominant position will be challenged by any new competitor.

Big is beautiful: trust and size matter in the industry

Strong global market shares in the relevant product categories (CVS)



Source: Knorr-Bremse Presentation

The company operates in a highly concentrated industry, in which the top players often account for more than 50% of the total market volume. KB estimates that its global market share in Commercial Vehicle Systems in 2017 was approximately 25%.

As in RVS, the most important product group within CVS is brake systems. However in CVS, KB's market share accounts for only 23% worldwide. Nevertheless, KB is the market leader in Europe and in the Americas, followed by WABCO. In the much smaller market of energy supply & distribution (~15% of divisional revenues), KB is market leader in Europe and accounts for ~40% of the total market, again followed by WABCO.

There is only one major rival in CVS – WABCO

While Knorr-Bremse's Commercial Vehicle Systems segment focuses almost exclusively on commercial vehicles (approximately 99% of 2017 division sales, with the remaining 1% mainly relating to stationary dampers for engines that may be installed in ships, power stations, etc.), a portion of WABCO's business (approximately 8% of 2017 OE sales) relates to passenger cars. However, at the end of March 2019, ZF Friedrichshafen announced a binding offer of $ 136.50 per share for WABCO.

Pre-acquisition, we think that KB's slightly higher margins can be explained by its bigger share of aftermarket revenues.

Knorr-Bremse and WABCO are direct competitors that dominate the market for Commercial Vehicle Systems. In most markets in which KB operates, the next competitor after the two big players has a much lower market share and is neither of significant importance nor does it pose a threat to KB. In Brake Systems & Vehicles, as well as in the Energy Supply Chain market, KB is ahead of WABCO at a global level.

In terms of regions, KB is better positioned in Europe in both markets and behind WABCO in the APAC region. In the Americas, KB is ahead of WABCO in the Brake systems & Vehicle Dynamics market and behind WABCO in the Energy Supply & Distribution market. Besides WABCO, Haldex and Meritor could also be mentioned as global competitors in the field of braking products.

The picture is different in the third market in which the two companies are competing, fuel efficiency products. In this market, KB and WABCO each hold a 23%-share but KB is better positioned in the APAC region with a market share of ~38% while WABCO is market leader in Europe and the Americas.

Key metrics for Knorr-Bremse (CVS) and WABCO		
	WABCO	**KB (CVS)**
Sales CAGR 2016-18	16.8%	12.6%
EBITDA CAGR 2016-18	10.5%	10.1%
EBITDA Margin (average last 3 Y)	16.0%	16.9%
R&D/Sales (2018)	4.4%	5.3%
Average Capex/Sales (last 3Y)	3.6%	4.4%
Aftermarket share	25.0%	27.0%
Market shares		
Brake Systems & Vehicles	19%	23%
Energy & Supply Chain	35%	40%
Fuel Efficiency	23%	23%

Source: Knorr-Bremse, WABCO, Warburg Research

Bosch and the JV dispute

A potential risk could be the JV buy-out dispute with Robert Bosch GmbH. Bosch might emerge as a new competitor in the future after exercising a put-option related to two joint ventures with KB (Bosch still holds 20% of the European and Japanese CVS business).

Bosch has a put option, which is classified as a financial liability in the group's balance sheet rather than a minority interest. The change in the value of the put option is accounted for annually on the financial income/expense line.

Bosch exercised the put option in 2018 claiming that KB violated a non-compete agreement when it entered the steering market. The parties are currently disputing the conditions of the exit and the potential future competition between Bosch and KB. While Bosch may not want to enter the consolidated truck brake market, we believe there is a conflict around the data and sensors involved that are important to both companies when it comes to overall truck (steering)systems. This dispute highlights risk to KB as it expands beyond its historical core.

Competitiveness of suppliers

As the cost of materials is the largest cost item, managing input costs through suppliers is key to producing outstanding returns. Within the Commercial Vehicle Systems segment, purchasing is carried out by a global organisation, managed along main purchasing categories with global mandates and responsibilities to lever the company's size.

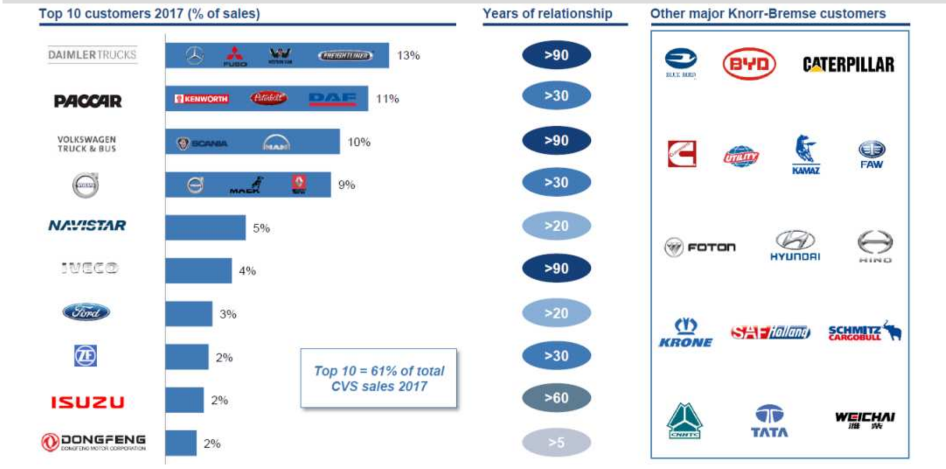
Besides some stand-alone contracts for specific topics, KB has master supply agreements in place with its suppliers. Such agreements are long-term contracts with terms typically ranging from one to five years. The specific pricing for individual part numbers is agreed on the basis of these contracts and is usually fixed for a limited term, which varies depending on the application.

Within CVS, KB procured material for more than 20 locations from approximately 1,400 suppliers in over 35 countries. Based on a high portion of commodities, relatively low switching costs for KB and a large number of suppliers, we rate the level of supplier bargaining power as low.

High degree of competitive strength in KB's customer base

In CVS, the 10 largest customers contribute approximately 60% to divisional revenues.

Major Knorr-Bremse customers



Source: Knorr-Bremse Presentation Dec 2018

While KB enjoys a close relationship with, and deep knowledge of, its customers, OEM customers command major bargaining power. An increasing degree of concentration can be observed among truck OEMs, which tends to increase the size of operations, and thus their relevance and bargaining power. A prime example is Scania and MAN, which combined form the third-largest customer of the CVS division. They have announced a joint procurement strategy under the umbrella of Traton Group.

Cyclicality of the industry

Looking at cyclical demand patterns, that could have a materially adverse effect on KB's business and results of operations, some specific issues should be taken into consideration:

- The commercial vehicle industry follows an intrinsic cyclical pattern which reflects the development of the overall economy in different regions and countries. Generally the intensity of commercial vehicle cycles is more pronounced than the overall economic cycle. A recent example was the market slowdown in Brazil which, however, had only a minor impact on KB (We estimate CVS sales of EUR ~90-100m from Brazil)
- Demand for trucks/trailers can be affected by new regulatory requirements, such as changes in emissions standards, with demand generally increasing prior to the effective date of the new requirements (referred to as "pre-buy"), followed by a corresponding decrease after such standards are implemented.
- The market for buses is also cyclical (we estimate the share of revenues related to buses in the low single-digits). New bus orders vary from year to year and are influenced, among other factors, by major replacement programmes and by the construction and expansion of transit systems and other networks by transit authorities, which in turn are dependent on public and private funding. Such projects can be curtailed or withdrawn as a result of changes in political, economic, or fiscal conditions.

Strategy

Overall, we welcome the company's strategy to expand global market share within its core product categories, in particular as a result of:

- the increasing adoption of new technologies such as Advanced Driver Assistance Systems (ADAS) and Automated Manual Transmission (AMT), for which KB's product portfolio is well-positioned;
- a further strong shift from foundation drum brakes to air disc brakes in North America, following a recent acceleration in this trend;

- and an increase in the level of content per vehicle in Asia with market share gains in established technologies as well as in new innovations. In China, the strategy foresees intensive localisation with key local players and an expansion of the aftermarket network. In the fast-growing Indian commercial vehicle market, KB plans to capitalise on strong business growth with major Indian customers by expanding its product portfolio.

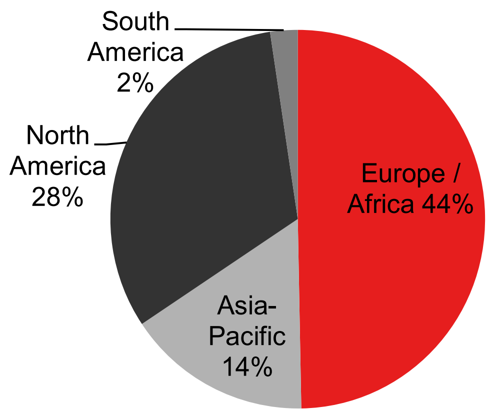
Cooperation and alliances enable KB to increasingly capitalise on the trend towards highly automated driving. Together with partners, the company develops solutions optimally designed for the needs of the commercial vehicle industry (control, sensors, steering, braking, electric on-board). KB serves as a system supplier, presenting one interface for customers as the system integrator, thereby boosting brand recognition. One example is the cooperation with automotive supplier Continental with the goal of becoming a leading automated driving supplier for commercial vehicles.

While KB already has a profound product portfolio of enablers for automated driving (especially brakes and sensors), we see clear potential to further boost its expertise in this regard. We very much welcome the implementation of the strategy to share upfront R&D costs with partners and to deliver customer value as a system integrator.

To achieve market penetration in markets that more difficult to access than the home market, like China and Russia, KB has established several joint ventures. The most recent, is DETC Commercial Vehicle Braking Technology Co. Ltd. in cooperation with Dongfeng Electronic and Technology Co. Ltd. for the application, development, manufacture and assembly of braking products and related parts and components for commercial vehicles in China.

To strengthen its position in Asia and make further progress in the field of automated driving, KB signed an agreement at the end of 2018 to acquire **Hitachi Automotive's** commercial vehicle steering business (closing end of March). The division, which is the market-leading manufacturer of steering systems in Japan, generated sales of EUR 100m in 2017 and has strong business relationships to Japanese OEMs. With this acquisition, KB achieves a further milestone on its way to becoming a provider of systems solutions for driver assistance and highly automated driving.

Regional CVS sales distribution (2018)



Source: Knorr-Bremse

WABCO is targeted by ZF

At the end of March 2019, ZF Friedrichshafen announced a binding offer of $ 136.50 per share for WABCO. This step would enable ZF to develop solutions for automated driving. Specifically, WABCO brake sensors would be combined with ZF's driving assistance systems to cover a large part of the value chain for automated driving (complete system of transmission & chassis + brake system). For electric commercial vehicles ZF & WABCO are even able to provide the complete powertrain including brakes and the electric engine.

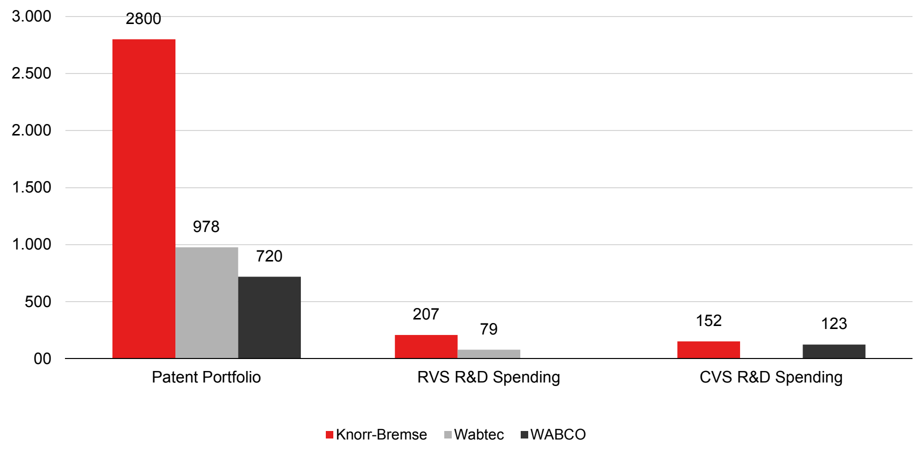
Furthermore, ZF's large distribution network would be an enormous lever to WABCO's products. Thus, we expect such a combined entity would make Knorr-Bremse's business far more difficult, would weigh on pricing power and would be the strongest competitor for the cooperation with Continental.

Synergies, benefits of scale & resilience

The industry innovator

- The pure size of Knorr-Bremse's business enables the company to spend much more on R&D in absolute terms than its main competitors. While KB had a 5.8% R&D to sales ratio in 2017 (and 5.5% in 2018) Wabtec showed only 2.5% and WABCO only 4.4%. By segment, the ratio in RVS was 6.2% and in CVS 5.2%, thus also beating its peers on a divisional basis.
- With regard to competitors, we see more synergies in a joint procurement organisation across divisions.
- An example for product synergies is the core braking competency and the newly acquired expertise in steering systems. These lay the foundation to take the complex driving functionalities of driver assistance systems and automated driving to the next level.
- KB's research capabilities are clear to be seen in the number of patents. According to the company it has 2,800 registered patents vs. Wabtec's 978 and WABCO's 720.

Higher R&D investments leads to larger patent portfolio (2017)



Source: Knorr-Bremse Presentation Dec 2018

Company structure provides for strong resilience

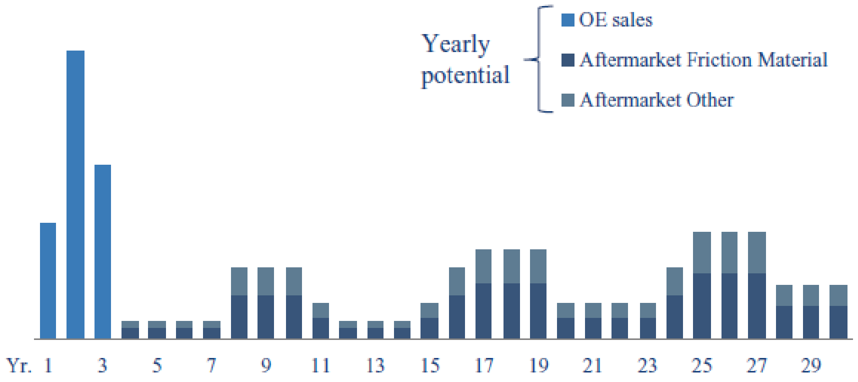
As KB focuses on two different end-markets, the group as a whole benefits from strong resilience based on the following factors:

- **Contrasting economic cycles** and **different market drivers** in each segment (short vs. long cycle, private vs. public spending),
- **diversified customer base** (partner to all major players in both segments, top five customers account for only ~30% of sales)
- and a **global footprint** (presence in 30+ countries with 100+ sites, a high level of local content in manufacturing, purchasing and R&D) with employees catering to local markets.

Access to distribution and aftermarket networks is key

Above all, the **high aftermarket share** due to a large installed base (2018: 40% in RVS & 27% in CVS) serves as a backbone to market-based volatility. We see recurring revenues from regulated maintenance intervals and based on longstanding customer partnerships (20-30 years). For example, according to KB, the total aftermarket potential could reach a value two to three times as high as the value of the respective OE for a given rail vehicle system over the lifetime of such a system.

Aftermarket potential



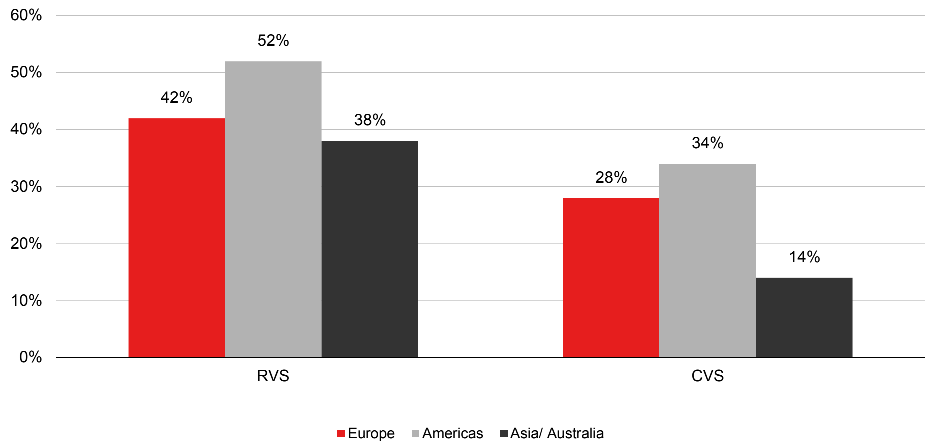
Source: Knorr-Bremse Prospectus

Key to benefitting from the aftermarket is a close relationship with the customer. With its dense network of service centres, workshops and certified service partners, KB successfully leverages its high installed base. As switching costs for customers are extremely high for most of the company's core products (the bulk of products are custom-built) and safety & quality is of critical importance, customers prefer to stay with an established partner.

It cannot be emphasised enough: Adequate access to aftermarket networks is the key success factor, especially, in the commercial vehicle industry. It is the top priority for fleet operators to decrease downtime of trucks and trailers. This means that spare parts have to be readily available and close to the customer.

The share of aftermarket sales per region shows the growth potential in Asia / Australia, especially in CVS.

Share of aftermarket in the different regions (2017)



Source: Knorr-Bremse Presentation Dec 2018

Analysis of return on capital

- With a capital turn constantly around 3x sales and net working capital ~15% of sales, KB manages capital very efficiently.
- Strong EBITDA margins serve as a backbone for high returns on capital employed.
- Knorr-Bremse delivers decent ROCEs of ~36% on average for the last four years

Cash generating business model boosts ROCEs

Knorr-Bremse is the world's leading manufacturer of brake systems and a supplier of additional safety-critical sub-systems for rail and commercial vehicles. As such the business is highly cash generative due to its strong pricing power. On average, KB has generated ROCEs of ~36% over the last four years.

In the following we examine the different ROCE drivers in greater detail.

Capital employed

KB has a broad product offering…

In **RVS,** KB offers a broad range of products for mass transit vehicles such as metro cars, light rail vehicles, freight cars, locomotives, mainline passenger trains and high-speed trains. In **CVS** KB offers products for trucks, buses, trailers and agricultural machinery.

KB manufactures its products at almost 70 production sites in more than 20 different countries around the world. The localised set-up of production facilities helps to address risks related to manufacturing a product in a single country or region, such as labour costs, foreign exchange rates or trade barriers. Production sites are located in Europe, North America, South America and Asia/Australia.

As asset-light as a manufacturer can be

Since KB's goal is to deliver complete systems to its customers, vertical integration is high and will probably increase even further with additional acquisitions.

Balance sheet same-size

in % of Balance Sheet Total	2015	2016	2017	2018	2019e	2020e	2021e
ASSETS							
Intangible assets	7.1%	8.9%	9.4%	11.7%	11.6%	11.5%	11.0%
thereof other intangible assets	2.0%	3.7%	4.2%	6.9%	7.0%	7.2%	7.0%
thereof Goodwill	3.8%	5.3%	5.2%	4.9%	4.5%	4.3%	4.0%
Property, plant & equipment	21.5%	20.2%	19.5%	18.6%	18.3%	18.3%	17.9%
Financial assets	0.3%	1.9%	1.9%	1.2%	1.1%	1.1%	1.0%
Fixed assets	**32.1%**	**33.5%**	**32.9%**	**33.4%**	**32.7%**	**32.5%**	**31.4%**
Inventories	13.3%	11.2%	13.1%	13.4%	11.4%	10.9%	10.6%
Accounts receivable	20.1%	17.9%	20.0%	19.8%	19.2%	18.2%	17.8%
Other Assets	5.7%	5.7%	6.1%	5.4%	5.3%	5.0%	4.9%
Liquid assets	28.9%	31.7%	27.9%	28.0%	31.4%	33.5%	35.2%
Current assets	**67.9%**	**66.5%**	**67.1%**	**66.6%**	**67.3%**	**67.5%**	**68.6%**
Total assets	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
LIABILITIES AND SHAREHOLDERS' EQUITY							
Subscribed capital	1.4%	1.2%	1.2%	2.6%	2.4%	2.3%	2.1%
Additional paid-in capital	0.0%	0.0%	0.0%	0.2%	0.2%	0.2%	0.2%
Surplus capital	1.7%	1.7%	1.9%	0.6%	0.6%	0.6%	0.5%
Other equity components	32.5%	30.3%	29.2%	20.6%	25.3%	29.1%	32.2%
Shareholders' equity	**35.7%**	**33.4%**	**32.3%**	**24.0%**	**28.5%**	**32.1%**	**35.0%**
Minority Interest	**3.3%**	**2.8%**	**2.6%**	**1.7%**	**1.6%**	**1.5%**	**1.4%**
Total equity	**39.0%**	**36.2%**	**34.8%**	**25.7%**	**30.0%**	**33.6%**	**36.4%**
Provision for pensions and similar obligations	7.0%	6.6%	6.2%	5.5%	5.3%	5.1%	5.0%
Provisions	**19.4%**	**17.7%**	**16.5%**	**15.2%**	**14.8%**	**14.0%**	**13.7%**
Financial liabilities	**16.0%**	**23.7%**	**22.9%**	**34.7%**	**32.2%**	**30.6%**	**28.5%**
Accounts payable	15.4%	13.9%	15.6%	15.9%	14.7%	13.9%	13.6%
Other liabilities	10.3%	8.5%	10.2%	8.6%	8.3%	7.9%	7.7%
Liabilities	**61.0%**	**63.8%**	**65.2%**	**74.3%**	**70.0%**	**66.4%**	**63.6%**
Total liabilities and shareholders' equity	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**

Source: Knorr-Bremse, Warburg Research

…but is as asset-light as a manufacturer can be

As a manufacturing company, one would expect the business to be rather capital intensive. However, PP&E as a percentage of total assets is stable and rather trending downwards. In absolute terms, PP&E stood at 1,167.2m in FY 2018 while acquisition and production costs amounted to 2,388.8m, demonstrating that it would be quite costly to replicate KB's set-up. Land, land rights and buildings form the largest share (436m) followed by technical equipment and machinery (375m) other equipment (181m) and advance payments and plant under construction (174m). In general, the company spends some 3.8% of sales on maintaining PP&E. While we recognise the major capital base, we rate a capital turn constantly around 3x sales as very good.

High capital turnover due to asset-light business model

Capital Intensity	2015	2016	2017	2018	2019e	2020e	2021e
PP&E	1,014.9	1,099.4	1,116.4	1,167.2	1,236.7	1,304.1	1,366.4
PP&E turnover	5.7 x	5.0 x	5.5 x	5.7 x	5.6 x	5.3 x	5.3 x
Capital employed	1,558.7	1,891.4	2,059.3	2,367.2	2,440.9	2,541.9	2,642.3
Average Capital employed	1,558.7	1,725.0	1,975.3	2,213.2	2,404.1	2,491.4	2,592.1
Capital employed turnover	3.7 x	3.2 x	3.1 x	3.0 x	2.9 x	2.8 x	2.8 x

Note: Computed metrics are based on average balance sheet values from 2016 onwards.

Source: Knorr-Bremse, Warburg Research

Intangibles account for ~10% with goodwill (306m) increasing from 3.8% in 2015 to 4.9% of total assets in 2018. The second largest position after goodwill is internally generated intangible assets (128m), followed by brands and customer relationships (57m) and licenses and acquired rights (52m).

Primarily, the increase in goodwill is due to various bolt-on acquisitions undertaken by the company. Acquisitions are an integral component of KB's business strategy. Larger goodwill positions include the share of GT Group acquired in 2016 (74.5m) as well as the share of Selectron Group (80.9m) acquired in 2015. In absolute terms goodwill has increased by >200m since the beginning of 2015.

Additions to brands and customer relationships in 2015 to 2018 in particular resulted from business combinations in these years. The intangible assets generated internally are primarily related to the capitalised costs of KB's development activities. To summarise, we regard the capital involved in the business as key to KB's competitive advantage, leaving new competitors behind.

Working capital leaves some room for upside

Working capital is significant and accounts for roughly 30% of total assets with ~13% attributable to inventories and ~20% to accounts receivables.

Overall, KB collects its receivables after some 63 days, whereas it pays its suppliers on average after 49 days, meaning that it pre-finances its customers, which we believe is due to the strong bargaining power of OEM customers. However, given the strength of its customers (especially the OEMs), receivables are by no means risky. One exception is Bombardier which has poor credit ratings (B3 / B- / B) and could be a potential risk for KB.

Working capital management

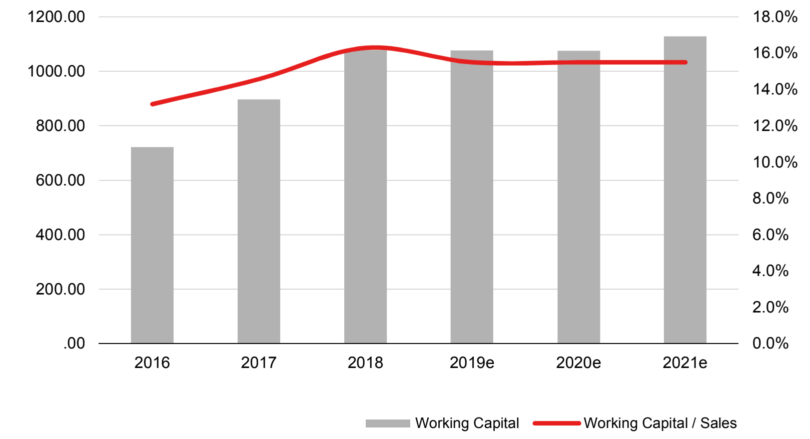
KNORR-BREMSE- Working Capital Management	2015	2016	2017	2018	2019e	2020e	2021e
Net Working Capital	709.7	719.3	782.0	861.9	849.7	848.5	890.5
Days Inventory on Hand (DOH)	39	41	40	44	42	41	40
Days Sales Outstanding (DSO)	59	64	63	66	67	68	66
Days Payable Outstanding (DPO)	46	49	49	52	52	52	51
Cash-Conversion-Cycle	**53**	**56**	**54**	**57**	**57**	**57**	**55**

Note: Computed metrics are based on average balance sheet values from 2016 onwards.

Source: Knorr-Bremse, Warburg Research

Working capital / sales has remained pretty constantly within the 13-16%-range, rising in 2018 due to an increase in inventories and receivables. While we believe that net working capital will remain in a range of 13% to 16% of sales going forward we think that there is potential to decrease DOH (WABCO 3Y average stands at ~30) and DSO which are currently extremely high owing to pressure on the supply chain in the commercial vehicle industry. Note that the company has a slightly different definition of NWC, also including the change of receivables from construction contracts. In our DCF model we use the company definition to make the comparison with management guidance more straightforward.

Working Capital Development



Source: Knorr-Bremse, Warburg Research

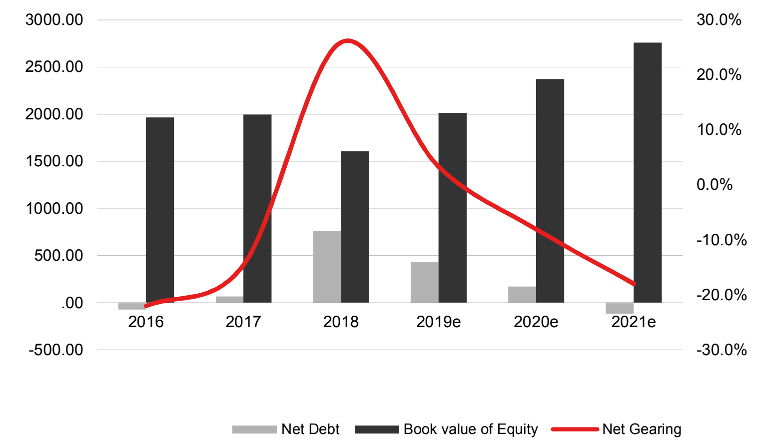
Extremely strong financial position…

What really stands out is the high portion of liquid assets (KB is carrying on its balance sheet (EUR ~1.8b cash on its balance sheet by the end of FY 2018, this leads to a net-debt position of over EUR 760m). This is despite the special dividend (~850m) paid to the former single shareholder before the IPO in October 2018. For our explicit forecast horizon we expect a gradual recovery to the historical figures as we expect a normalisation of dividend payments in line with KB's target of 40-50% of consolidated net income.

On the other side of the balance sheet the following debt financing existed as of 2018:

- Knorr-Bremse AG corporate bond of EUR 500m (maturity December 2021, coupon 0.5% p.a.)
- Knorr-Bremse AG corporate bond of EUR 750m (maturity June 2025, coupon 1.125% p.a.)
- Bank loans amounting to EUR ~230m
- Labilities from finance leases amounting to EUR 33m

Balance sheet quality



Source: Knorr-Bremse, Warburg Research

…provides flexibility for M&A activities

The regular bolt-on acquisitions conducted by Knorr-Bremse are normally financed from the cash flow. The rise in financial gearing in 2018 is based on the special dividend, which reduced the book value of equity and an increase in financial liabilities due to another bond issuance in 2018.

Overall, KB is ready for further acquisitions. Management is guiding for maximum net debt / EBITDA of 1x bringing KB's firepower to over EUR 1.2bn.

Pension liabilities are not a major factor

As of 2018, KB's fair value of plan assets amounted to 254.6m while defined benefit obligation was 533.8m resulting in net debt of 279.2m. Given KB's strong financial position we regard pensions financing as unproblematic.

Operating profitability

Same-size P&L

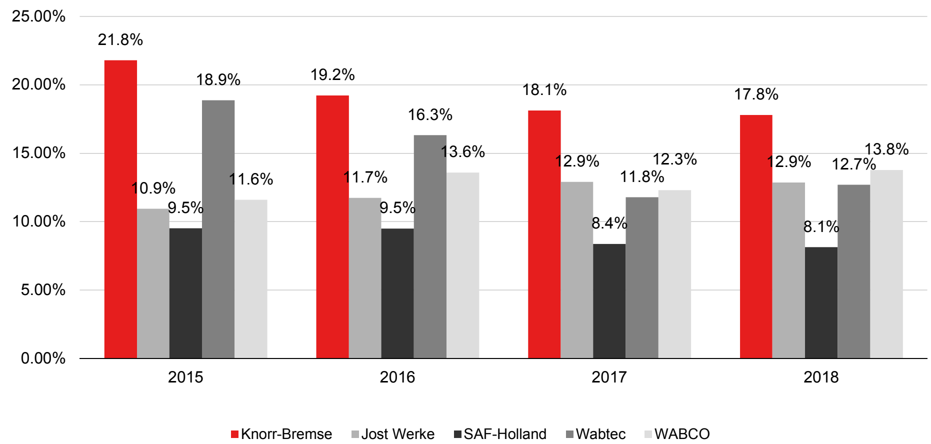
in % of Sales	2015	2016	2017	2018	2019e	2020e	2021e
Sales	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**	**100.0%**
Increase / decrease in inventory	-0.1%	-0.2%	0.6%	0.5%	0.5%	0.5%	0.5%
Own work capitalised	0.3%	0.4%	0.5%	0.7%	0.7%	0.7%	0.7%
Total sales	**100.2%**	**100.2%**	**101.1%**	**101.2%**	**101.2%**	**101.2%**	**101.2%**
Material Expenses	47.2%	47.0%	48.9%	50.2%	50.2%	49.8%	49.4%
Gross profit	**53.0%**	**53.2%**	**52.2%**	**51.1%**	**51.0%**	**51.4%**	**51.8%**
Personnel expenses	21.8%	23.3%	23.4%	22.6%	22.3%	22.5%	22.5%
Other operating income	1.5%	1.5%	1.3%	1.0%	1.6%	1.6%	1.6%
Other operating expenses	10.9%	12.2%	12.0%	11.7%	11.7%	11.3%	11.3%
Unfrequent items	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
EBITDA	**21.8%**	**19.2%**	**18.1%**	**17.8%**	**18.6%**	**19.2%**	**19.6%**

Source: Knorr-Bremse, Warburg Research

Knorr-Bremse has a track record of stable average gross margins of 52% for the last four years indicating a stable pricing environment. We expect that fluctuations (low in 2018 at 51.1%, high in 2016 at 53.2%) are mainly explained by material input price volatility (which KB can partly pass on to its customers with a time-lag of three to six months) and shifts in the mix between OE- and aftermarket sales.

The company differs from other original equipment suppliers in our coverage, such as Jost-Werke or SAF-Holland, in so far as KB is generally required to bid in competitive tenders to gain a place on truck or rail platforms, which are then normally in the form of single-source supply. This means that once KB has won the tender, there is less scope for the OEMs to strive for price concessions given the high complexity and the low production volumes. This is especially useful in times of falling volume when typical truck suppliers compete on price. A margin comparison clearly highlights the superior margin profile vs. selected peers:

EBITDA margin comparison

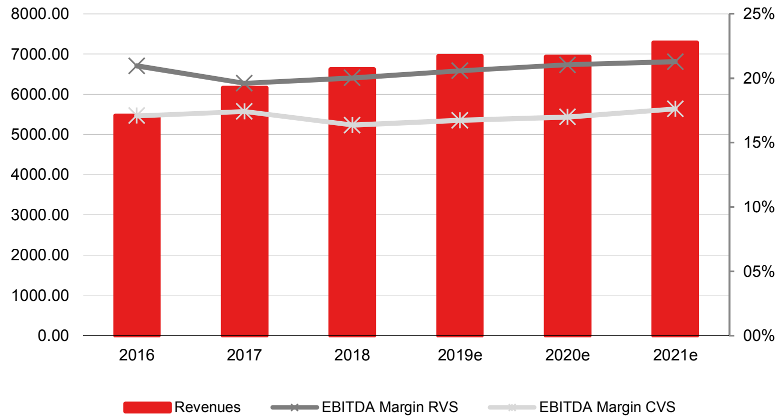


Source: Company Reports, Warburg Research

On EBITDA margin level, fluctuations can nevertheless be pronounced, as indicated by a downward swing of 399bps from 2015 to 2018. There were a variety of reasons for this development.

- The main driver of the decrease was the normalisation of high-margin high-speed train sales in China in the Rail Vehicle Systems segment in 2016, which had accounted for an extraordinarily high profit contribution in 2015. Furthermore, volume effects from the Chinese high-speed rail business affected the operating results. In addition, a cyclical slowdown in the freight car and locomotive business in North America affected revenues and development.
- In 2015 provisions to sales was only 1.85% compared to 4.5% and 4.7% in 2016 and 2017, respectively.
- In 2015 a 17.5m insurance compensation is included.
- 2017 earnings were impacted by a number of one-off burdens.
- R&D capitalisation net of amortization increased from ~13m in 2015 to ~40m in 2018.

Profitability development



Source: Knorr-Bremse, Warburg Research

Adjustments show a clearer picture of earnings power

While we welcome the approach of KB's management to focus its communication on an all-in margin, we also want to carry out adjustments to calculate a clean margin for comparison purposes (Jost-Werke and SAF-Holland provide investors with a figure adjusted for PPA and one-time restructuring costs). To better understand the underlying earnings power we provide an adjustment bridge and remove certain one-off effects. We add back

- PPA, which is amortization of intangibles resulting from previous acquisitions and are non-cash, or –in this case- related step-ups, (**WRe**: run-rate ~9m)
- Acquisition-related costs, such as the 20m one-off costs related to the failed Haldex takeover in 2017,
- One-time IPO/IFRS conversion costs / reimbursements which have impacted EBIT by ~15m in 2018 after ~10m in 2017 and
- One-off write-downs of assets for asset disposals, which impacted EBIT by ~25m in 2017 and ~32m in 2018.

Adjustment bridge

	2015	2016	2017	2018	2019e	2020e	2021e
Sales	**5,823.5**	**5,471.3**	**6,153.5**	**6,615.8**	**6,952.2**	**6,942.2**	**7,287.2**
reported EBIT	**1,098.5**	**886.4**	**904.0**	**972.5**	**1,088.4**	**1,101.0**	**1,167.3**
EBIT margin	*18.9%*	*16.2%*	*14.7%*	*14.7%*	*15.7%*	*15.9%*	*16.0%*
PPA (Step-ups)	-1.00	-8.00	-9.00	-9.00	-9.00	-9.00	-9.00
M&A	-	-	-45.30	-32.00	-	-	-
Other (IPO costs, etc.)	-	-	-10.00	-15.00	-	-	-
Sum	**-1.00**	**-8.00**	**-64.30**	**-56.00**	**-9.00**	**-9.00**	**-9.00**
Warburg adjusted EBIT	**1,099.5**	**894.4**	**968.3**	**1,028.5**	**1,097.4**	**1,110.0**	**1,176.3**
adjusted EBIT margin	*18.9%*	*16.3%*	*15.7%*	*15.5%*	*15.8%*	*16.0%*	*16.1%*
bp detoriation vs. 2015 peak margin							
EBIT margin			417	416	321		
adjusted EBIT margin			314	334	310		

Source: Knorr-Bremse, Warburg Research

After adjusting for the above-mentioned effects we can see that the EBIT margin shrunk by only 334bps from 2015 to 2018 compared to 416bps on reported EBIT level.

Overprovisioning in 2016-2017?

While we only have four years of data for provisioning, we made the following observations.

Net additions to provisions were only 1.85% in 2015, when KB delivered peak margins, and >4% in 2016-2017. At the same time, the utilisation of provisions also increased from 2.5% in 2015 to 4.6% in 2017. In 2018 net additions decreased to 2.7% of sales. With only a short time-horizon at hand it is difficult to determine which level is accurate - the current level or the 2015 level. However, a peer comparison shows that SAF-Holland and Jost-Werke have pretty stable net additions of ~1% and 1.4% respectively in the last 3Y on average.

In total, we expect net additions of ~ 3% going forward which is roughly in-line with 2018 numbers.

Provisioning fluctuates

Provisioning	2015	2016	2017	2018
Additions	**158.4**	**293.2**	**352.6**	**239.5**
thereof Warranty provisions	113.9	203.8	256.1	173.6
thereof Contractual provisions	11.6	8.5	33.4	21.9
Reversals	**-50.90**	**-47.84**	**-65.02**	**-60.98**
Additions net of Reversals	**107.50**	**245.39**	**287.59**	**178.50**
Net additions in % of Sales	*1.85%*	*4.49%*	*4.67%*	*2.70%*
Utilization	**145.7**	**212.7**	**285.3**	**192.7**
thereof Warranty provisions	88.7	151.2	227.8	136.4
thereof Contractual provisions	10.2	6.6	7.1	21.3
in % of net additions	*136%*	*87%*	*99%*	*108%*
in % of Sales	*2.5%*	*3.9%*	*4.6%*	*2.9%*

Source: Knorr-Bremse, Warburg Research

Returns

Having explored the components of capital employed and the drivers of profitability we now take a closer look at returns:

Detailed look at ROCE drivers

	2015	2016	2017	2018	2019e	2020e	2021e
+Equity	1,838.2	1,965.9	1,995.7	1,607.1	2,028.7	2,387.5	2,775.5
+Pensions	328.5	358.7	353.9	343.7	361.1	360.6	378.5
+Financial liabilities	752.7	1,287.6	1,309.7	2,172.5	2,172.5	2,172.5	2,172.5
-Liquid assets	1,360.7	1,720.9	1,600.0	1,756.0	2,121.4	2,378.6	2,684.3
=Capital employed	**1558.7**	**1891.4**	**2059.3**	**2367.2**	**2440.9**	**2541.9**	**2642.3**
yoy		*21%*	*9%*	*15%*	*3%*	*4%*	*4%*
Capital turn	*3.7 x*	*2.9 x*	*3.0 x*	*2.8 x*	*2.8 x*	*2.7 x*	*2.8 x*
EBIT	1,098.5	886.4	904.0	972.5	1,088.4	1,101.0	1,167.3
EBIT MARGIN	18.9%	16.2%	14.7%	14.7%	15.7%	15.9%	16.0%
Tax Rate	32.2%	32.6%	31.1%	28.1%	28.5%	29.0%	30.0%
NOPAT	**744.9**	**597.6**	**622.7**	**699.1**	**778.2**	**781.7**	**817.1**
avg. CE	1,558.7	1,725.0	1,975.3	2,213.2	2,404.1	2,491.4	2,592.1
ROCE (NOPAT)	**47.8%**	**34.6%**	**31.5%**	**31.6%**	**32.4%**	**31.4%**	**31.5%**
WACC	6.53%	6.53%	6.53%	6.53%	6.53%	6.53%	6.53%
WACC multiple	7.3 x	5.3 x	4.8 x	4.8 x	5.0 x	4.8 x	4.8 x

Note: Computed metrics are based on average balance sheet values from 2016 onwards.

Source: Knorr-Bremse, Warburg Research

KB has a track record of decent ROCEs between 48% in 2015 and 32% in 2018. The peak return reached in 2015 was a result of favourable margin development as well as a low capital employed figure. Additionally, a favourable tax rate, which noticeably decreased to below 30%, boosted returns.

Going forward, we believe ROCEs at the level of the last two years will be achievable. While we anticipate an increase in intangible assets due to R&D capitalisation and further acquisitions, we estimate rather slow growth for capital employed over the coming years. Strong cash conversion will enable KB to finance CE growth with internally generated funds. However, the main driver of even more attractive returns is set to be margin expansion and certainly not a lower capital base.

Strong cash conversion

Cash Conversion	2015	2016	2017	2018	2019e	2020e	2021e
EBITDA	1,269.0	1,052.1	1,115.5	1,178.0	1,293.1	1,332.9	1,428.3
Net Income	652.8	526.3	535.5	592.8	703.7	711.0	743.5
FCF	723.2	522.9	450.0	399.4	647.4	609.5	661.1
FCF in % of EBITDA	57%	50%	40%	34%	50%	46%	46%
FCF in % of NI	111%	99%	84%	67%	92%	86%	89%

Note: FCF = Cash flow from operating activities- CAPEX

Source: Knorr-Bremse, Warburg Research

While we do not have a history of quarterly Cash Flow statements, 2018 indicated that there is no clear seasonality pattern in FCF generation.

Conclusion

- KB operates a relatively capital-light business with a stable capital employed turn of approximately 3x over the 2015-2018 period.
- KB provides investors with decent margins, which are superior to other OE supplier companies in our coverage.
- We see even further ROCE potential driven by a margin expansion.
- The company is currently trading at ~6.5x its capital employed, which looks quite high. Nevertheless, bear in mind that ROCE is on average of ~5x its cost of capital

Growth / Financials

- KB has an impressive top-line growth track record, delivering a sales CAGR of 4.6% and 10.1% for CVS and RVS respectively (7% at group level) for the period 2005-18
- EBITDA growth was even stronger with a margin expansion from 12.7% in 2005 to 17.8% in 2018 on group level. Peak margins of 21.8% were reached in 2015.
- In the long term, we anticipate further growth in both divisions, driven by megatrends affecting both divisions.

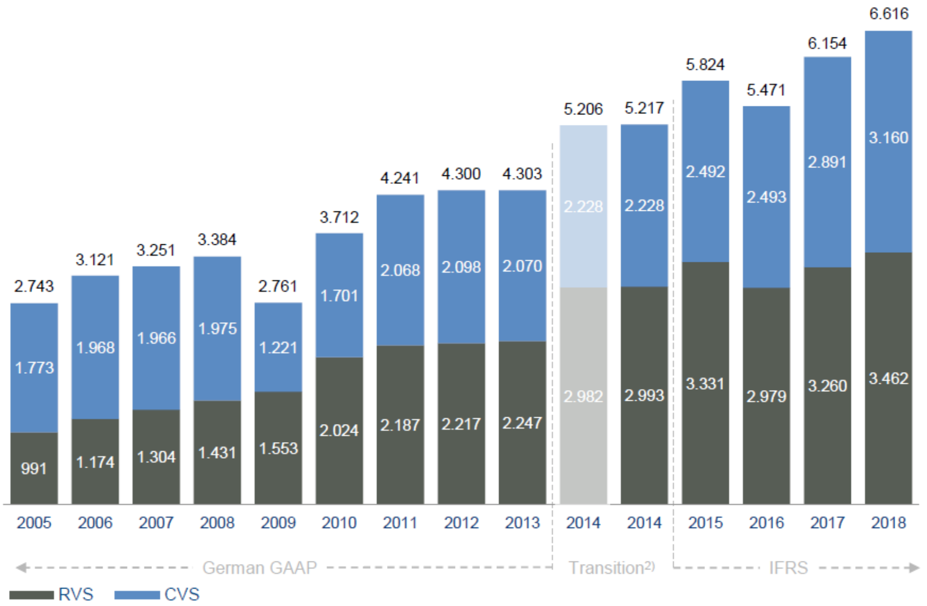
Historical growth

Impressive top-line growth in both segments…

Knorr-Bremse has an impressive growth story. While only four years of detailed financial history is available, the company provided figures for sales development starting in 2005 based on German GAAP. KB posted considerable sales CAGR of 4.6% and 10.1% for CVS and RVS respectively (7% on group level).

KB posted growth in 11 of the past 13 years

Sales development by division



Source: Knorr Bremse Presentation

Growth continued in 2018

FY 2018 revenues in the Rail Vehicles Systems segment stand at EUR 3,462m, which is 6.2% more than the year before. The aftermarket business accounted for a 40% share of revenue, which was a slight decline from 42% the previous year, owing to strong OE business.

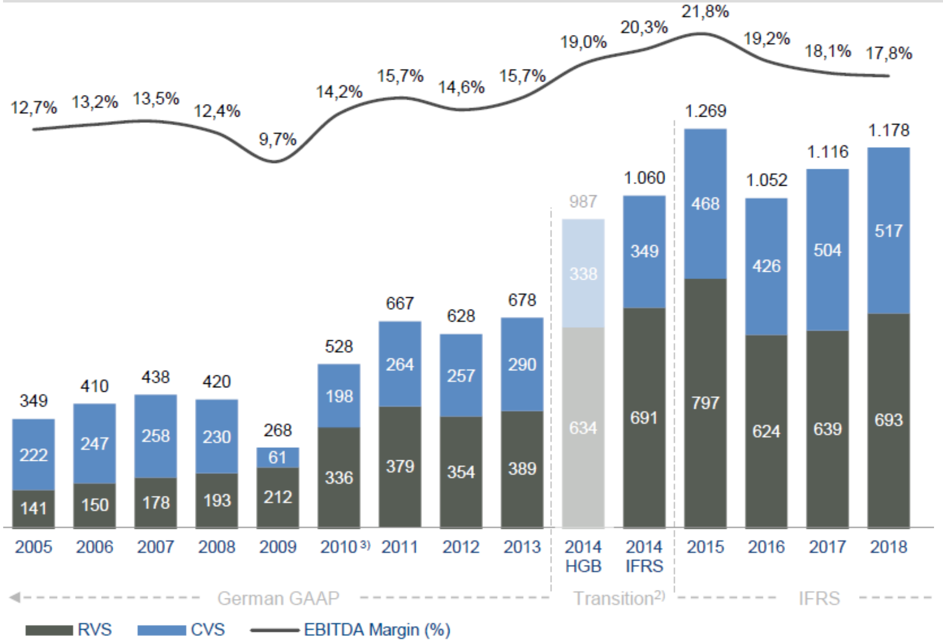
Revenues of EUR 3,160m generated in the Commercial Vehicle Systems segment were 9.3% higher yoy. Despite a slight decline in the aftermarket share from 28% to 27% of revenues, the segment generated solid profit, due mainly to the North American business.

…combined with increasing margins

KB's has a strong track record for margin growth. Margins increased from 12.7% in 2005 to 21.8% in 2015. However, the EBITDA margin decreased to 17.8% in 2018.

The company provides investors with strong margin resilience. Even during the recession in 2009, KB managed to earn a decent 9.7% EBITDA margin (on HGB basis) proving the effectiveness of the combination of the rail and commercial vehicle businesses.

EBITDA development was proportionately stronger



Source: Knorr Bremse Presentation

Strong margins in 2018

RVS EBITDA increased by 8.4% and led to an EBITDA-margin of 20.0%, which was mainly attributable to the positive contribution of the Asian business, especially in China and India. Furthermore, impairment write-downs of EUR 25 million in connection with sale of the Blueprint Sydac had a negative effect in the previous period. Compared to this, in 2018, the disposal & operating losses for the rail & simulator business amounted to EUR 32m. CVS EBITDA growth was even stronger (+9.3%) which led to an EBITDA margin of 16.4% (vs. 17.4 %). Headwinds from material price inflation and supply chain constraints weighed. Adjusting for one-off effects, the EBITDA margin stands at 18.5%.

Growth drivers: megatrends increase the appeal of the sector…

…and KB can capitalise on it

The following megatrends are driving Knorr-Bremse's business in both the Rail Vehicle Systems and Commercial Vehicle Systems operating segments.

- **Electrification**:
    - Electrification and other energy- and eco-friendly solutions result from growing energy demand that is coupled with growing public awareness of energy efficiency and changing public policies on energy, such as stricter emission laws.
    - As electrified vehicles offer high potential for emission-efficient mobility solutions in megacities, including light rail vehicle operations, city buses and green delivery trucks we also expect KB to participate fully in this development.
- **Automated driving…**
    - …may impact the rail and commercial vehicle industry significantly, depending on the speed of adjustment to regulatory challenges, the development of safe and reliable technical solutions and customer

acceptance of, and willingness to pay for, such solutions. Software and system expertise is a core competence of Knorr-Bremse and is of significant importance in enabling automated driving. Knorr-Bremse offers braking and steering systems and the corresponding system competence for automated driving - basically, everything that determines the direction of a vehicle.

  - In connection with this growing trend, new solutions such as the development of driver assistance functions are emerging with the aim of reducing accidents, transport costs and emissions.

- **Increasing connectivity…**
  - …of vehicles provide for opportunities in both the Rail and Commercial Vehicle Systems business. Knorr-Bremse's systems contribute to optimum fleet organisation, greater efficiency, higher active safety, effective driver coaching, and more efficient maintenance – leading to lower costs for fleet operators and boosting competiveness. The systems can be adapted to meet customer requirements and are designed for both tractor and trailer units. Safety direct systems can record and evaluate safety incidents while vehicles are on the road.
- **Urbanisation**
  - Growing population and urbanisation offer opportunities in both the Rail and Commercial Vehicles Systems business, as faster, safer, and more reliable modes of transportation are required.
- **Digitisation**
  - Digitisation promotes the connectivity of Rail Vehicle and Commercial Vehicle Systems and sub-systems which facilitates real-time data analytics and predictive maintenance solutions that aim to reduce life cycle costs. Other results of digitisation are automatic train operation, condition-based maintenance of rail vehicles and monitoring tools and telematics solutions for commercial vehicles.

The pace of regulatory requirements is expected to increase, boosting the content per vehicle, but also calling for a high level of R&D expenditure. Thus, all current megatrends offer growth potential for KB, especially as it has a strong focus on R&D and is known for its innovative leadership.

Stable growth of rail vehicle industry will continue

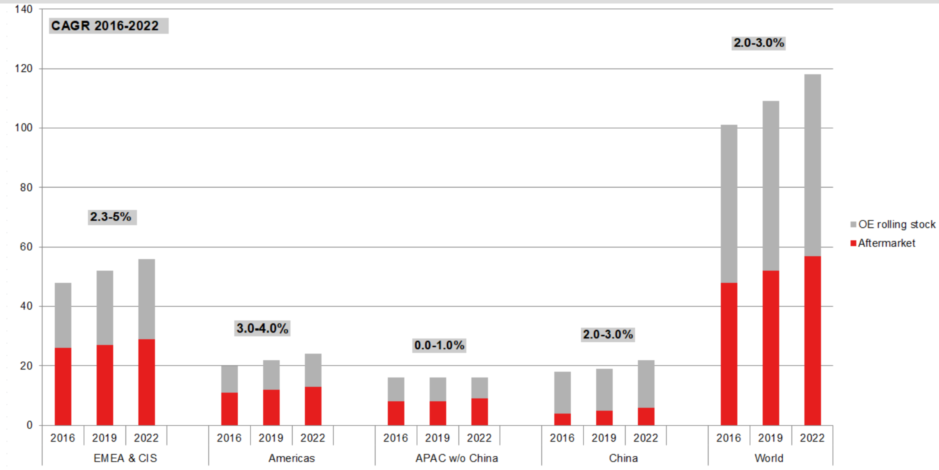
Our expectations for the rail market are underpinned by the UNIFE world rail market study in cooperation with Roland Berger. According to the study, the global rail vehicle market amounted to approximately EUR 101 billion in 2016 and is expected to grow at a CAGR of approximately 2.5% over the 2016-2022 period, to reach approximately EUR 118 billion in 2022. Growth in the OE rolling stock market segment is expected to be driven mainly by the EMEA+CIS region and by North America, while growth in the rail aftermarket/services segment is expected to stem mostly from North America and China. The regions in detail:

- The EMEA+CIS region is estimated to grow at a CAGR of approximately 2.5% to 3.5% in the period 2016-2022. As KB generates ~50% of RVS revenues in this region, it should benefit enormously from a growing market.
- Roland Berger projects that the region of strongest growth will be South America in the 2016-2022 forecast period, albeit from a rather low base, hence the volume in absolute numbers is still rather modest. As this region accounts for less than 1% of division sales, the impact will be negligible.
- North America, accounting for ~11% of division sales, is expected to grow at a CAGR of approximately 3% to 4% over the 2016-2022 period to reach a volume

of EUR 22 billion in 2022, thus becoming the second-largest of the regions considered.

- In APAC excluding China, Roland Berger expects weaker order intake for rolling stock over the 2016-2022 period ranging from -2.5% to -1.5% and forecasts that growth in India will be offset by a decline in other regions, for example in Australia. Overall, the market is expected to stay flat (0-1%). In China, which is expected to reach EUR 21 billion in 2022, growth is forecast to slow down to a CAGR of 2-3% over the 2016-2022 period. Combined, those regions make up ~38% of RVS sales.

Rail vehicle market forecast



Source: UNIFE, Roland Berger, Knorr-Bremse Prospectus

Generally the OE rolling stock market is largely dependent on the level of spending by governments and private operators on railway projects. While the freight transport segment typically shows a strong connection to overall economic development, passenger rail transport (mainline and urban) is generally less dependent on short-term economic cycles but rather on long-term trends and is generally based on publicly-funded projects. Mainline and urban rail transport trends may even show anti-cyclical patterns of investment as fiscal programmes are implemented by governments in a declining economic environment.

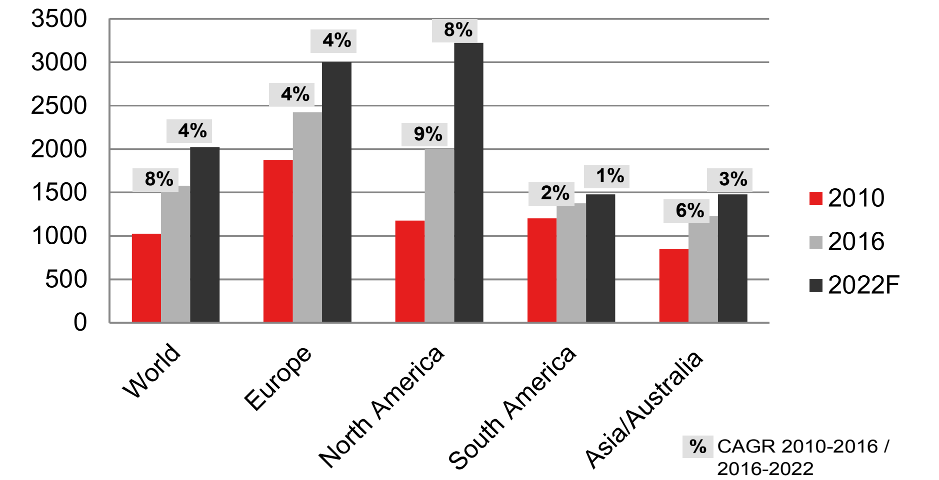
The passenger segment accounted for 84% of the OE sales of RVS in 2017, while 16% of such sales related to the freight segment.

In CVS, short-term drivers are playing into KB's hands

In the Commercial Vehicle Systems segment, a current trend of increasing content per vehicle is driven by ongoing global convergence towards air disk brakes, especially in North America, where this trend is still in full swing and where the content per vehicle has been historically lower than in Europe. We expect the content per vehicle to increase with the further adoption of air disc brakes and collision mitigation systems. Considering KB's well established technological expertise and strong brand, we expect the company to capitalise on this development.

The following charts shows estimates on future development of content per vehicle for four product categories (brake systems, steering systems, powertrain and ADAS).

Content per vehicle is set to increase

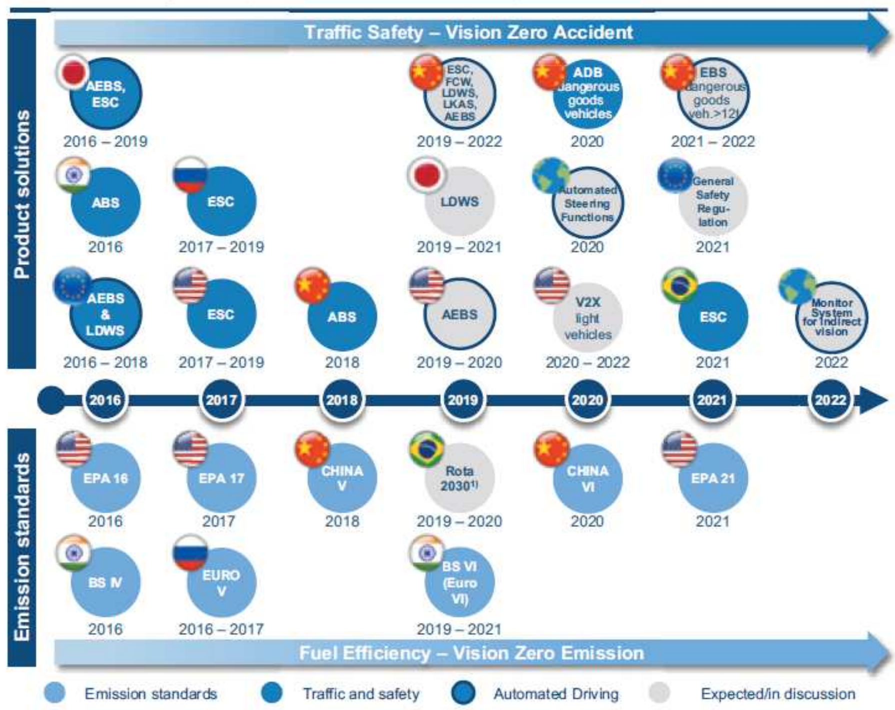


Source: Knorr Bremse Prospectus, Roland Berger

Moreover, new regulations are driving technology upgrades for trucks and buses. We believe these standards constitute a growth driver in light of zero and low emission zones for urban areas in key markets, such as Beijing in China. Such developments help KB to promote the technological excellence of its products in the Chinese market and exploit its position in electric vehicles. One example was the overload ban in China which boosted trailer sales and provided for an industry-wide special business cycle. Another new regulation came into effect in China in January 2018 that requires new trailers used for hazardous goods transportation as well as new sidewall and fence trailers to be equipped with disc brakes (starting from January 2019) and air suspension (starting from January 2020). We think that such regulations will keep demand at a high level for buses, trucks and trailers in the short- to mid-term.

There are more relevant regulations to come:

Regulatory environment is getting stricter



Source: Roland Berger

Group is actively seeking M&A targets

In addition to organic growth, KB will continue to pursue targeted acquisitions and joint ventures, especially to strengthen its market positions in China and North America.

According to management, the M&A pipeline comprises approximately 50 targets, of which some 25 are shortlisted. With a focused acquisition strategy, KB strives to expand its existing product and services portfolio, in order to strengthen system competence and acquire technology-enabled related business fields.

KB's M&A strategy will drive active market consolidation. Principally, we judge this to be the perfect opportunity to gain market share especially in **RVS**. As Wabtec has a heavy debt load after the latest acquisition, KB has to lead the consolidation process and gain access to the most important technologies by being faster than its competitors.

In **CVS** we could imagine a further expansion into the fields of automated driving and electrified vehicles. While the partnership with Continental is responsible for developing the technical expertise for trucks, KB could also have an increasing interest in trailer solutions.

RVS: mid-single-digit growth in line with medium-term guidance

Backlog at all rail OEMs is at high levels and given that backlogs in the industry often stretch over long periods (especially service/aftermarket orders), we also take a look at top-line estimates for rail OEMs. Both tables indicate further strong demand for KB's products.

Thus, we even see short-term upside potential to the 3% rolling stock CAGR forecasted by UNIFE.

Order backlog OEMs

	2017	2018	in %
Siemens Mobility	26,400	28,000	6.1%
Alstom	34,178	39,700	16.2%
Bombardier	34,400	34,500	0.3%

Source: Bloomberg, Company Reports

Sales growth OEMs

	2017	2018	2019e	2020e
Siemens Mobility	4%	8%	2%	3%
Alstom	5%	11%	4%	6%
Bombardier	12%	5%	4%	6%
CRRC	-7%	6%	13%	9%

Source: Bloomberg, Company Reports, Warburg Research

It is not only the order books of KB's customers that are looking healthy. Knorr-Bremse too reported strong order book growth of 11.7%. The book to bill ratio stands at 1.1x which translates in an increase of 7.4% yoy. In total, the company stated visibility of 11.1 months revenues in RVS.

Order book Knorr-Bremse

KNORR-BREMSE- Order Book	2015	2016	2017	2018	2019e	2020e	2021e
Order Intake RVS	3,158	3,144	3,536	3,798	3,600	3,750	3,900
Book to Bill RVS	0.9 x	1.1 x	1.1 x	1.1 x	1.0 x	1.0 x	1.0 x
Order Book RVS	2,435	2,601	2,876	3,212	3,228	3,372	3,502
y-o-y		*6.82%*	*10.57%*	*11.68%*	*0.48%*	*4.46%*	*3.87%*

Source: Knorr-Bremse, Warburg Research

The main reasons for short-term growth in RVS are:

- Positive development of mass transit and metro business in Asia (mainly in China, India, South East Asia, Hong Kong and Taiwan)
- as well as freight transport and urban transit in Europe, driven partly by the freight market in Germany and the recovering freight market in Russia, as well as passenger market segments in France and Poland. Additionally, high-speed in Spain and commuter brake / door business in the UK.
- We also expect growth in the aftermarket segment, mainly in mature markets such as Europe and North America.

The expected growth in passenger mainline and urban transit has a stronger positive impact on RVS (due to the broader scope of applications of relevant product categories in these transport segments, for which passenger doors and passenger HVAC systems are relevant) than growth in the freight business (which mainly has an impact on brake systems).

CVS: growth will decline on the back of truck market slowdown

The majority of KB's exposure in the commercial vehicle division is focused on heavy duty trucks. Currently we think that truck & trailer markets are near the peak of the cycle, especially in North America. We gathered together KB's peer assumptions (especially truck OEMs) to provide a clear picture of the different market conditions faced by KB. Truck manufacturers are anticipating a continuation of the market recovery in South America, driven by Brazil, while Europe and North America are expected to stay rather flat in 2019 but at a high level.

Truck market expectations for 2019 OEMs

	Daimler [1]	Navistar [2]	Paccar [3]	Traton [4]	Volvo [5]	WABCO [6]
Europe	flat		-10% to 0%	flat	-5%	-2% to 3%
North America	flat	-3% to 4%	-8% to 2%		0%	0% to 5%
Brazil	sign. up			sign. up	30%	0% to 10%
China					-15%	-15% to -10%
India					-5%	5% to 15%

1: Medium and Heavy Duty
2: Class 7,6,8 & school bus
3: >16t Truck
4: Medium and Heavy Duty
5: Heavy Duty
6: Medium and Heavy Duty

Source: Company Reports

Knorr Bremse's order book for the commercial vehicle systems division increased by 3.7% to 1,364m. Solid order bookings in key markets Europe and North America are cited as drivers of order intake and this puts the book to bill ratio at 1.02x. In total, the company stated visibility of 5.2 months revenue.

Order book Knorr-Bremse

KNORR-BREMSE- Order Book	2015	2016	2017	2018	2019e	2020e	2021e
Order Intake CVS	2,511	2,581	3,123	3,208	3,000	3,000	3,200
Book to Bill CVS	1.0 x	1.0 x	1.1 x	1.0 x	0.9 x	0.9 x	0.9 x
Order Book CVS	996	1,084	1,316	1,364	1,344	1,436	1,526
y-o-y		*8.84%*	*21.40%*	*3.65%*	*-1.46%*	*6.81%*	*6.27%*

Source: Knorr-Bremse, Warburg Research

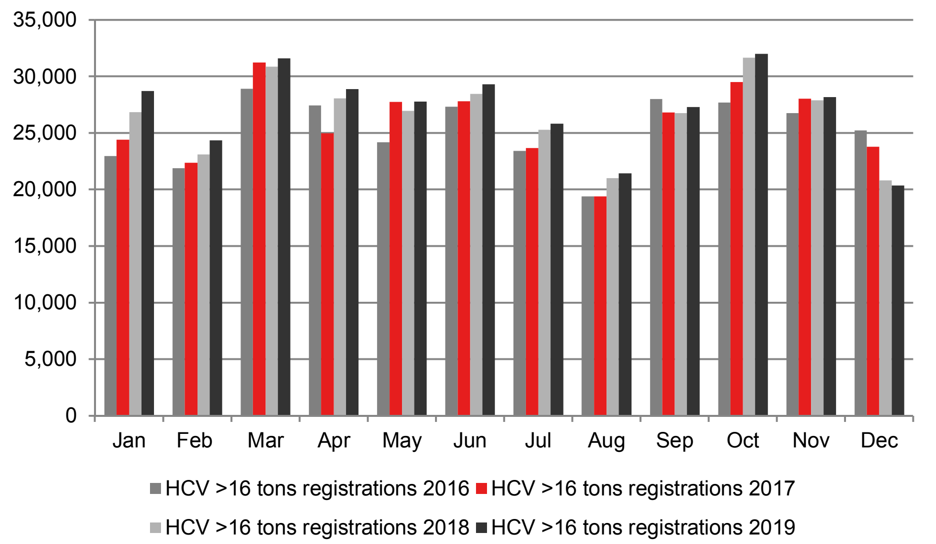
European truck production seen flat

Following several years of expansion in European truck production, we expect a slowdown, or rather flat production volumes at high levels in 2019 and 2020, which is in line with OEM sales outlook.

Furthermore we expect high replacement demand will keep production levels at a relatively strong level. Vehicles delivered during the years of very high demand – 2007 & 2008 – are beginning to be replaced.

Nevertheless, concerns about the truck cycle could be less pronounced for suppliers, with a history of content growth, than for OEMs. If we look at KB's long-term growth track record in CVS, we clearly see that in 2012 and 2014, when the market contracted, KB managed to boost divisional sales (we have no data on the geographical distribution).

HCV registrations



Source: ACEA, Warburg Research

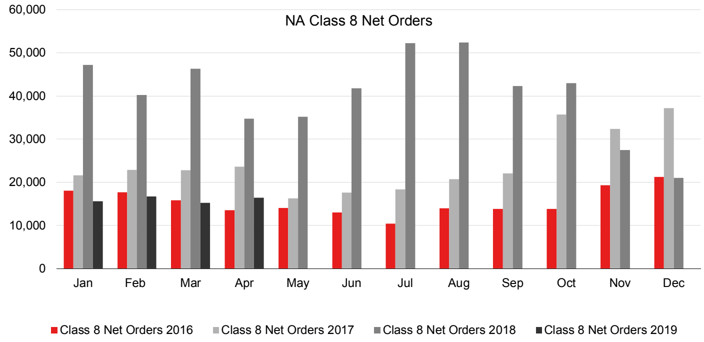
North America is likely to peak in 2019

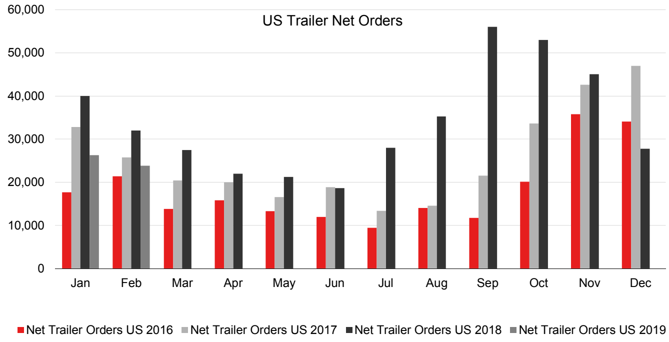
Since the beginning of 2018, investors have been concerned about US heavy truck orders hitting a peak. However, truck orders have surprised the market by reaching ever higher levels. Only at the end of 2018 did net orders slow, causing even more investor concern.

As industry experts (ACT Research) confirm, the large backlogs in the industry are to blame for slowing net orders. Softening freight growth and strong Class 8 capacity additions suggest that the supply-demand balance will become a story in 2019, but H1 seems to be a premature start to that tale. Additionally, a huge driver shortage is weighing on the trucking industry. According to the American Trucking Associations (ATA), about 51,000 more drivers are needed to meet the demand. Moreover the entire industry is struggling to find blue colour workers to meet the increased demand from 2018 net orders.

We are therefore anticipating flat Class 8 (heavy-duty trucks) production levels in 2019 and expect a material decrease in production in 2020.

Truck & Trailer Net Orders NA





Source: ACT, FTR, Warburg Research

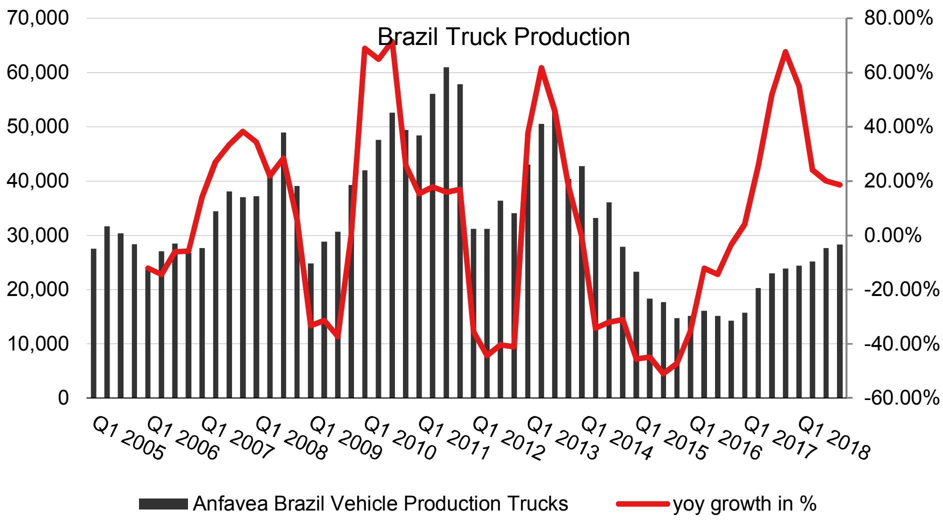
Market decline in China has begun while Brazil will continue to recover

China accounts for nearly half of global heavy truck production. However, the trucks are far cheaper and have far lower technological standards than in western markets. Even if truck production is weaker in the short term, the shift towards premium parts is still ongoing and is supportive for KB. Additionally there is still potential to increase sales in the aftermarket (aftermarket share in Asia / Pacific accounted for only 14% in 2017). In 2018 KB managed to increase sales in the region despite a weaker total production rate and we also expect the company to outperform the market in 2019.

Strong recovery in Brazil expected

A different picture can be seen in Brazil where truck markets are expected to recover, albeit from a low base. Most truck OEMs expect strong heavy truck growth in 2019.

Heavy duty truck production Brazil



Source: Anfavea, Warburg Research

Warburg truck & trailer market forecast

The tables below summarise the IHS long-term global medium & heavy vehicle production forecast, consensus top-line growth for truck & trailer peers and our expectations for truck markets which are embedded in our estimates:

Truck market expectations HIS (in m)

Global medium & heavy vehicle production summary by region

	2018	2019	2020	2021	2022	2023	2024	2025	CAGR
Europe	662	701	724	736	767	782	806	797	2.7%
Greater China	1,502	1,346	1,286	1,163	1,045	1,146	1,267	1,301	-2.0%
Japan/Korea	271	265	259	259	260	257	254	251	-1.1%
Middle East/Africa	1	1	1	1	1	1	1	1	2.5%
North America	602	639	561	561	570	576	593	599	-0.1%
South America	141	155	169	180	193	142	151	160	1.8%
South Asia	696	716	683	691	688	692	703	713	0.4%
Grand Total	**3,874**	**3,823**	**3,684**	**3,590**	**3,524**	**3,595**	**3,774**	**3,822**	**-0.2%**

Global medium & heavy vehicle production summary by region

	2018	2019	2020	2021	2022	2023	2024	2025
Europe		5.9%	3.3%	1.6%	4.3%	1.9%	3.1%	-1.1%
Greater China		-10.4%	-4.4%	-9.6%	-10.1%	9.6%	10.5%	2.7%
Japan/Korea		-2.0%	-2.3%	-0.2%	0.4%	-1.0%	-1.3%	-1.1%
Middle East/Africa		2.5%	2.4%	2.4%	2.3%	3.4%	2.2%	2.2%
North America		6.1%	-12.2%	0.1%	1.5%	1.1%	2.9%	1.0%
South America		10.2%	9.3%	6.1%	7.3%	-26.7%	6.6%	5.8%
South Asia		2.9%	-4.6%	1.1%	-0.4%	0.6%	1.6%	1.5%
Grand Total		**-1.3%**	**-3.6%**	**-2.5%**	**-1.9%**	**2.0%**	**5.0%**	**1.3%**

Source: IHS Markit (January 2019)

Truck & Trailer market expectations

TRUCK MARKETS	**2016**	**2017**	**2018**	**2019e**	**2020e**	**2021e**	**Ø 10Y**	**CAGR '17-21**
Europe (EU+EFTA)	290,260	304,958	314,427	309,711	309,711	319,002	**244,661**	***1.1%***
% yoy	*8.6%*	*5.1%*	*3.1%*	*-1.5%*	*0.0%*	*3.0%*		
Brazil	60,604	82,887	105,534	116,087	120,000	125,000	**132,176**	***10.8%***
% yoy	*-18.2%*	*36.8%*	*27.3%*	*10.0%*	*3.4%*	*4.2%*		
NA Class 8 Build	223,607	250,597	320,903	330,530	280,951	266,903	**244,141**	***1.6%***
% yoy	*-29.8%*	*12.1%*	*28.1%*	*3.0%*	*-15.0%*	*-5.0%*		
China	715,690	1,107,635	1,083,874	1,029,680	1,081,164	1,113,599	**969,066**	***0.1%***
% yoy		*54.8%*	*-2.1%*	*-5.0%*	*5.0%*	*3.0%*		
India	188,244	190,861	291,391	262,252	270,119	278,223	**223,499**	***9.9%***
% yoy		*1.4%*	*52.7%*	*-10.0%*	*3.0%*	*3.0%*		
TRAILER MARKETS								
North America Production	282,179	285,006	317,228	315,000	285,000	290,700	**231,284**	***0.5%***
% yoy	*-6.7%*	*1.0%*	*11.3%*	*-0.7%*	*-9.5%*	*2.0%*		
Western & Eastern Europe	298,883	303,250	322,847	297,019	282,168	296,277	**277,854**	***-0.6%***
% yoy	*6.7%*	*1.5%*	*6.5%*	*-8.0%*	*-5.0%*	*5.0%*		
China	366,400	590,000	461,000	391,850	431,035	452,587	**355,343**	***-6.4%***
% yoy	*35.7%*	*61.0%*	*-21.9%*	*-15.0%*	*10.0%*	*5.0%*		
India	40,700	43,151	54,100	51,395	50,367	52,885	**39,707**	***5.2%***
% yoy	*-32.2%*	*6.0%*	*25.4%*	*-5.0%*	*-2.0%*	*5.0%*		

Source: ACEA, Anfavea, Clear International, FTR, Haldex, IHS, Volvo Group, Warburg Research

Truck & Trailer peers

	2017	2018	2019e	2020e		2017	2018	2019e	2020e
Daimler Trucks					**Haldex**				
Sales	35,755.2	38,273.0	40,983.4	42,478.0	Sales	4,462.0	5,119.0	5,381.0	5,237.0
growth		*7%*	*7%*	*4%*	*growth*	*2%*	*15%*	*5%*	*-3%*
CNH Industrial					**Meritor Inc.**				
Sales	27,361.0	29,706.0	28,961.9	29,491.0	Sales	3,347.0	4,178.0	4,404.6	4,201.8
growth	*10%*	*9%*	*-3%*	*2%*	*growth*	*-24%*	*25%*	*5%*	*-5%*
Navistar					**Wabash**				
Sales	8,428.0	10,250.0	10,982.1	10,237.3	Sales	1,767.2	2,267.3	2,308.3	2,123.8
growth	*4%*	*22%*	*7%*	*-7%*	*growth*	*-4%*	*28%*	*2%*	*-8%*
Paccar					**WABCO**				
Sales	18,187.5	22,138.6	23,788.9	21,072.5	Sales	3,304.2	3,831.0	3,872.9	3,910.1
growth	*15%*	*22%*	*7%*	*-11%*	*growth*	*18%*	*16%*	*1%*	*1%*
Sinotruk					**Jost-Werke**				
Sales	68,805.4	72,077.0	73,377.6	75,325.1	Sales	700.0	752.6	772.5	783.7
growth	*85%*	*5%*	*2%*	*3%*	*growth*	-	*8%*	*3%*	*1%*
Volvo AB Class B					**SAF-Holland**				
Sales	334,748.0	390,834.0	408,228.6	392,429.3	Sales	1,139.0	1,300.8	1,363.1	1,363.5
growth	*11%*	*17%*	*4%*	*-4%*	*growth*	*9%*	*14%*	*5%*	*0%*

Source: Factset, Warburg Research Estimates; Data as of 13.05.2019

Outlook

Based on our market expectations we break down top line growth into 1) organic growth. 2) FX impact and 3) M&A (acquisition or divestments). We estimate the past FX impact on the geographical split of revenues and add M&A transactions as mentioned in the prospectus or announced afterwards. The following table summarises our assumptions for the group as well as for the segments.

Top line forecast per division

in EUR m	2015	2016	2017	2018	2019e	2020e	2021e
Rail Vehicle Systems							
Sales	**3,331.0**	**2,978.7**	**3,260.1**	**3,462.0**	**3,586.1**	**3,746.1**	**3,891.1**
Sales growth	11.3%	-10.6%	9.4%	6.2%	3.6%	4.5%	3.9%
Acquisitions	2%	0%	6%	-2%	-1%	0%	0%
FX	0%	-1%	-1%	-3%	0%	0%	0%
Organic	10%	-10%	4%	11%	5%	4%	4%
Commercial Vehicle Systems							
Sales	**2,491.8**	**2,493.0**	**2,890.6**	**3,160.0**	**3,360.3**	**3,190.3**	**3,390.3**
Sales growth	11.8%	0.0%	15.9%	9.3%	6.3%	-5.1%	6.3%
Acquisitions	0%	2%	3%	0%	2%	0%	0%
FX	0%	-1%	-1%	-3%	1%	0%	0%
Organic	12%	-1%	14%	13%	3%	-5%	6%
Consolidated group of companies							
Sales	**5,823.5**	**5,471.3**	**6,153.5**	**6,615.8**	**6,946.4**	**6,936.4**	**7,281.4**
Sales growth	11.5%	-6.0%	12.5%	7.5%	5.0%	-0.1%	5.0%
Acquisitions	0%	1%	5%	-1%	1%	0%	0%
FX	0%	-1%	-1%	-3%	0%	0%	0%
Organic	11%	-6%	8%	11%	4%	0%	5%

Source: Knorr-Bremse, Warburg Research

We expect RVS sales to grow by 5% organically in 2019 and 4% in 2020. However, the divestment of Blueprint and Sydac will weigh on top-line development in 2019. In CVS we forecast organic sales growth of some 3% in 2019 plus 75m revenues from the Hitachi acquisition but a -5% negative development in 2020 based on a sharp decrease in truck production in North America (~30% of division sales).

Profits expected to remain at a high level

While the top line shows a mixed picture, we expect margins to remain strong until 2020. As already explained, various factors weighed on operative margins in 2016 and 2017 and while there were also some one-offs in FY 2018 we expect a normalisation of group margins going forward.

2020 efficiency programme

KB targets 1-2% of sales growth as annual cost productivity needed to offset inflation and price pressure. In order to address pricing, as well as improving margins, KB launched the KB2020 initiative in Q4 2015. The goal is to achieve aggregate savings of a low triple-digit million by 2020. KB has not specified the costs of achieving the targeted savings. Restructuring charges, when needed, are included in the EBIT reported. As part of the programme, KB has already relocated some RVS production from Munich to other factories and is increasing production in Eastern Europe and India.

In the medium term, KB's management is targeting an EBITDA margin improvement of 150bps compared to 2017. This margin expansion should be driven by both divisions, with RVS slightly stronger than CVS. For the time being, we are taking a more cautious approach and are expecting a group EBITDA margin of 19.2% in 2020e followed by 19.6 in 2021e.

The following table shows our profitability assumptions on a divisional basis:

KNORR-BREMSE - segments

in EUR m	2015	2016	2017	2018	2019e	2020e	2021e
Rail Vehicle Systems							
Sales Rail Vehicle Systems	3,331.0	2,978.7	3,260.1	3,461.9	3,586.7	3,746.7	3,891.7
EBITDA Rail Vehicle Systems	797.3	624.0	639.3	693.1	738.1	788.1	828.1
Margin	23.9%	20.9%	19.6%	20.0%	20.6%	21.0%	21.3%
EBIT Rail Vehicle Systems	724.0	547.6	523.3	585.2	606.2	651.9	684.9
Margin	21.7%	18.4%	16.1%	16.9%	16.9%	17.4%	17.6%
Commercial Vehicle Systems							
Sales Commercial Vehicle Systems	2,491.8	2,493.0	2,890.6	3,160.1	3,365.5	3,195.5	3,395.5
EBITDA Commercial Vehicle Systems	468.1	425.7	503.7	516.4	561.4	541.4	596.4
Margin	18.8%	17.1%	17.4%	16.3%	16.7%	16.9%	17.6%
EBIT Commercial Vehicle Systems	398.0	357.8	421.5	434.4	488.0	472.9	516.1
Margin	16.0%	14.4%	14.6%	13.7%	14.5%	14.8%	15.2%
Consolidated group of companies							
Sales	5,823.5	5,471.3	6,153.5	6,615.8	6,952.2	6,942.2	7,287.2
EBITDA	1,269.0	1,052.1	1,115.5	1,178.0	1,293.1	1,332.9	1,428.3
Margin	21.8%	19.2%	18.1%	17.8%	18.6%	19.2%	19.6%
EBIT	1,098.5	886.4	904.0	972.5	1,088.4	1,101.0	1,167.3
Margin	18.9%	16.2%	14.7%	14.7%	15.7%	15.9%	16.0%

Source: Knorr-Bremse, Warburg Research

This compares to the management guidance as follows:

Warburg vs. guidance 2019

KNORR-BREMSE Guidance	2018		2019	yoy	Margin
		High	7,000.0	5.8%	
Sales stated	6,615.8	Warburg e	6,952.2	5.1%	
		Low	6,800.0	2.8%	
		High	7,000.0	6.9%	
Sales adjusted for disposals	6,547.8	Warburg e	6,952.2	6.2%	
		Low	6,800.0	3.9%	
		High	1,330.0	12.9%	19.0%
EBITDA	1,178.0	Warburg e	1,293.1	9.8%	18.6%
Margin	17.8%	Low	1,224.0	3.9%	18.0%
		High	1,330.0	8.6%	19.0%
EBITDA adjusted	1,225.0	Warburg e	1,293.1	5.6%	18.6%
Margin	18.5%	Low	1,224.0	-0.1%	18.0%

Source: Knorr-Bremse, Warburg Research

While the implied EBITDA growth range of 3.9% to 12.9% looks somewhat broad, we are confident that KB can deliver on the targets given the one-off effects incurred in 2018. Moreover, unlike our forecast, the top-line guidance does not yet include the Hitachi business (**WRe:** ~75m sales). However, we think the given range should be well achievable.

Non-operating drivers are substantial

Financial result

KB restructured its financial profile during the last year. Firstly, a new bond with a volume of EUR 705m was issued. Secondly, the company distributed some 850 million as a dividend in 2018. Interest expenses on outstanding bonds amount to 11.9m p.a. (500m*0.5% + 750*1.25%) plus ~2% on 233m in bank loans, summing up to 16.5m per year and are therefore negligible.

The larger amounts within the financial results are interest income / expenses on pension obligations, from options for minority interests and FX translation differences. As we assume a constant option value (resulting from the Bosch JV) and both of the other line items should balance out over the long term, we expect a rather stable financial result in future.

Financial result

Financial Result	2015	2016	2017	2018	2019e	2020e	2021e
Interest Income	21.7	19.2	24.0	20.1	27.8	27.8	29.1
Interest expenses	-29.2	-28.7	-38.8	-54.4	-34.8	-34.7	-36.4
Other financial income	125.8	74.5	68.2	45.2	69.5	69.4	72.9
Other financial expenses	-168.9	-110.2	-105.0	-108.0	-118.2	-118.0	-123.9
Financial Result	**-50.5**	**-45.2**	**-51.6**	**-97.0**	**-55.6**	**-55.5**	**-58.3**

Source: Knorr-Bremse, Warburg Research

Taxes

Taxes have come down due to a lower tax rate in the US. We forecast taxes to be 28.5%, 29.0% and 30% from 2018 to 2020. In the medium term, we are anticipating a tax rate of some 31.5%.

Minorities are a relatively large factor

Minority income accounted for a relatively large share of net income in the past. In 2017, minorities were some 9% of net income before minorities. However we expect minorities to further decrease due to 1) the buyback of the minority share of Knorr-Brake Holding Corporation (Truck) in 2018 where expenses were ~10.7m in 2017 and 2) because of a lower earnings contribution from Chinese entities in the short run.

Minority interest forecast

Minorities impact	2015	2016	2017	2018	2019e	2020e	2021e
Net Income before minorities	**710.6**	**567.1**	**587.2**	**629.4**	**738.5**	**742.2**	**776.3**
Minority interest	**57.9**	**40.8**	**51.7**	**36.6**	**34.8**	**31.2**	**32.8**
Net Income	**652.8**	**526.3**	**535.5**	**592.8**	**703.7**	**711.0**	**743.5**
Minority interest in % of NI before minorities	8%	7%	9%	6%	5%	4%	4%
Minority interest in % of NI	9%	8%	10%	6%	5%	4%	4%

Source: Knorr-Bremse, Warburg Research

Estimates are broadly in line with consensus

With our revenue projections, we are broadly in line with consensus:

Warburg vs. Consensus

KNORR-BREMSE - Consensus	Warburg Estimates				Consensus		
As of: 13.05.2019	**2018**	**2019e**	**2020e**	**2021e**	**2019e**	**2020e**	**2021e**
Sales	**6,615.8**	**6,952.2**	**6,942.2**	**7,287.2**	**6,979.4**	**7,196.8**	**7,525.7**
growth		*5.1%*	*-0.1%*	*5.0%*	*5.5%*	*3.1%*	*4.6%*
Delta WRe-Estimates (absolut)					-27.2	-254.6	-238.5
Delta WRe-Estimates (relativ)					*-0.4%*	*-3.5%*	*-3.2%*
EBITDA	**1,178.0**	**1,293.1**	**1,332.9**	**1,428.3**	**1,330.1**	**1,404.3**	**1,503.2**
EBITDA Margin	*17.8%*	*18.6%*	*19.2%*	*19.6%*	*19.1%*	*19.5%*	*20.0%*
Delta WRe-Estimates (absolut)					-37.0	-71.4	-74.9
Delta WRe-Estimates (relativ)					*-2.8%*	*-5.1%*	*-5.0%*
EBITDA adjusted	**1,225.0**	**1,293.1**	**1,332.9**	**1,428.3**	**1,325.3**	**1,411.6**	**1,510.5**
EBITDA adjusted Margin	*18.5%*	*18.6%*	*19.2%*	*19.6%*	*19.0%*	*19.6%*	*20.1%*
Delta WRe-Estimates (absolut)					-37.0	-71.4	-74.9
Delta WRe-Estimates (relativ)					*-2.4%*	*-5.6%*	*-5.4%*
EBIT	**972.5**	**1,088.4**	**1,101.0**	**1,167.3**	**1,099.4**	**1,163.8**	**1,243.6**
EBIT Margin	*14.7%*	*15.7%*	*15.9%*	*16.0%*	*15.8%*	*16.2%*	*16.5%*
Delta WRe-Estimates (absolut)					-11.0	-62.9	-76.3
Delta WRe-Estimates (relativ)					*-1.0%*	*-5.4%*	*-6.1%*
EBIT adjusted	**1,028.5**	**1,097.4**	**1,110.0**	**1,176.3**	**1,084.0**	**1,153.5**	**1,244.8**
EBIT adjusted Margin	*15.5%*	*15.8%*	*16.0%*	*16.1%*	*15.5%*	*16.0%*	*16.5%*
Delta WRe-Estimates (absolut)					-11.0	-62.9	-76.3
Delta WRe-Estimates (relativ)					*1.2%*	*-3.8%*	*-5.5%*
Net Income	**592.8**	**703.7**	**711.0**	**743.5**	**695.2**	**739.6**	**805.1**
Delta WRe-Estimates (absolut)					8.5	-28.5	-61.6
Delta WRe-Estimates (relativ)					*1.2%*	*-3.9%*	*-7.7%*
EPS	**3.68**	**4.37**	**4.41**	**4.61**	**4.33**	**4.59**	**5.02**
Delta WRe-Estimates (absolut)					0.04	-0.18	-0.41
Delta WRe-Estimates (relativ)					*0.8%*	*-4.0%*	*-8.2%*
DPS	**1.75**	**2.19**	**2.21**	**2.31**	**1.94**	**2.08**	**2.27**
Delta WRe-Estimates (absolut)					0.25	0.13	0.03
Delta WRe-Estimates (relativ)					*12.7%*	*6.0%*	*1.4%*
Payout ratio		*50.0%*	*50.0%*	*50.0%*	*44.7%*	*45.3%*	*45.3%*

Source: Factset, Warburg Research Estimates; Data as of 13.05.2019

Valuation

- We initiate KB with a price target of EUR 90, offering little downside based on our DCF model.
- FCF Potential indicates a value of EUR 69 per share in 2020.
- Peer benchmarking shows stronger profitability but also higher valuation multiples.

Fundamental valuation

DCF valuation

Our DCF model assumptions can be summarised as follows:

- **Revenue growth**: Management has published a mid-term guidance for 4.5-5.5% organic growth. In our DCF base case we take 5% growth as a starting point in 2022, decreasing over the transitional period to 1.5% for the terminal value calculation. These growth figures are derived from 5.5% growth in 2022 for RVS softening to 1.5% in perpetuity and 4.5% for CVS gradually declining to 1.5% in 2032. However, a look on our sensitivity table shows that our model is not excessively sensitive to terminal growth.
- **EBIT margin:** We forecast an EBITDA expansion of 150bps from 2017 until 2022, in line with management guidance. Accordingly, our EBIT margin forecast also increases from 14.7% in 2017 to 16% in 2021 driven by both segments. However, during the transitional phase, EBIT margins will come down to 15% in 2032. The margin levels enjoyed by KB in the past will not be sustainable, in our view, as competitors emulate the most profitable products as the IPO will increase transparency.
- **D&A**: At ~3.8% of sales, this is in line with the historical average.

Stretched valuation

- **Capex**: Investment in future technologies will stay at a high level, especially considering KB's ambition to remain at the forefront of technological development. We forecast that capex will stay at 4% in perpetuity.
- **WACC**: A qualitative beta of 1.28 is applied compared to an empirical beta (adjusted Bloomberg beta) versus MDAX of 0.937. We take into account the cyclical business environment CVS is exposed to (rated 1.2), liquidity considerations (1.2) due to only 30% free float, financial strength (1.0), transparency (1.3) and "other" (1.2). We think an interest rate of 1%, which we calculated from outstanding KB bonds, reflects the return expected from debt investors. Corporate tax rate is 31.5%. An expected market return of 7% and a risk-free return of 1.5%, combined with a target debt ratio of 20%, leads to a WACC of 6.53%.
- **Minorities**: We take into consideration the value of the Bosch put-option (379.6m). As its minority interest is relatively important (accounted for ~6% of net income before minorities in 2018 and ~9% in 2017) we calculate with 20x minority interest earnings which is roughly the target PE multiple of KB.
- Market value of investments: Are negligible.

DCF model

Figures in EUR m	Detailed forecast period 2019e	2020e	2021e	Transitional period 2022e	2023e	2024e	2025e	2026e	2027e	2028e	2029e	2030e	2031e	Term. Value
Sales	6,952	6,942	7,287	7,654	7,995	8,311	8,602	8,869	9,113	9,334	9,535	9,718	9,882	
Sales change	*5.1 %*	*-0.1 %*	*5.0 %*	*5.0 %*	*4.5 %*	*4.0 %*	*3.5 %*	*3.1 %*	*2.7 %*	*2.4 %*	*2.2 %*	*1.9 %*	*1.7 %*	*1.5 %*
EBIT	1,088	1,101	1,167	1,240	1,285	1,326	1,362	1,393	1,420	1,444	1,464	1,480	1,494	
EBIT-margin	*15.7 %*	*15.9 %*	*16.0 %*	*16.2 %*	*16.1 %*	*16.0 %*	*15.8 %*	*15.7 %*	*15.6 %*	*15.5 %*	*15.4 %*	*15.2 %*	*15.1 %*	
Tax rate (EBT)	*28.5 %*	*29.0 %*	*30.0 %*	*31.5 %*	*31.5 %*	*31.5 %*	*31.5 %*	*31.5 %*	*31.5 %*	*31.5 %*	*31.5 %*	*31.5 %*	*31.5 %*	
NOPAT	778	782	817	849	880	908	933	954	973	989	1,003	1,014	1,023	
Depreciation	205	232	261	276	289	302	315	326	337	347	357	365	373	
in % of Sales	*2.9 %*	*3.3 %*	*3.6 %*	*3.6 %*	*3.6 %*	*3.6 %*	*3.7 %*	*3.7 %*	*3.7 %*	*3.7 %*	*3.7 %*	*3.8 %*	*3.8 %*	
Changes in provisions	17	-1	18	4	17	16	15	13	12	11	10	9	8	
Change in Liquidity from														
- Working Capital	-12	-1	42	104	44	41	38	35	32	29	26	24	21	
- Capex	320	333	350	383	391	397	402	406	408	408	408	406	404	
Capex in % of Sales	*4.6 %*	*4.8 %*	*4.8 %*	*5.0 %*	*4.9 %*	*4.8 %*	*4.7 %*	*4.6 %*	*4.5 %*	*4.4 %*	*4.3 %*	*4.2 %*	*4.1 %*	
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	
Free Cash Flow (WACC Model)	692	681	704	643	752	788	822	854	883	910	935	958	979	999
PV of FCF	667	616	598	512	562	554	542	528	513	496	479	461	442	8,957
share of PVs	**11.81 %**			**31.95 %**										**56.24 %**

Model parameter

Derivation of WACC:		Derivation of Beta:	
Debt ratio	20.00 %	Financial Strength	1.00
Cost of debt (after tax)	0.7 %	Liquidity (share)	1.20
Market return	7.00 %	Cyclicality	1.20
Risk free rate	1.50 %	Transparency	1.30
		Others	1.20
WACC	**6.53 %**	**Beta**	**1.18**

Valuation (m)

Present values 2031e	6,971		
Terminal Value	8,957		
Financial liabilities	2,172		
Pension liabilities	361		
Hybrid capital	0		
Minority interest	1,075		
Market val. of investments	0		
Liquidity	2,121	No. of shares (m)	161.2
Equity Value	**14,440**	**Value per share (EUR)**	**89.58**

Sensitivity Value per Share (EUR)

Beta	WACC	Terminal Growth 0.75 %	1.00 %	1.25 %	**1.50 %**	1.75 %	2.00 %	2.25 %
1.41	7.5 %	68.26	69.67	71.18	72.82	74.60	76.55	78.67
1.29	7.0 %	74.75	76.49	78.38	80.44	82.69	85.17	87.91
1.24	6.8 %	78.40	80.34	82.47	84.79	87.34	90.17	93.30
1.18	6.5 %	82.37	84.56	86.95	**89.58**	92.49	95.71	99.32
1.12	6.3 %	86.71	89.17	91.88	94.87	98.20	101.91	106.08
1.07	6.0 %	91.46	94.25	97.33	100.76	104.58	108.88	113.75
0.95	5.5 %	102.48	106.11	110.17	114.73	119.89	125.79	132.59

Beta	WACC	Delta EBIT-margin -1.5 pp	-1.0 pp	-0.5 pp	**+0.0 pp**	+0.5 pp	+1.0 pp	+1.5 pp
1.41	7.5 %	64.15	67.04	69.93	72.82	75.71	78.60	81.49
1.29	7.0 %	70.98	74.13	77.28	80.44	83.59	86.74	89.89
1.24	6.8 %	74.88	78.18	81.49	84.79	88.09	91.40	94.70
1.18	6.5 %	79.17	82.64	86.11	**89.58**	93.05	96.52	99.99
1.12	6.3 %	83.92	87.57	91.22	94.87	98.53	102.18	105.83
1.07	6.0 %	89.19	93.05	96.90	100.76	104.61	108.47	112.32
0.95	5.5 %	101.72	106.06	110.39	114.73	119.07	123.40	127.74

- We forecast a gradual decrease in top-line growth from 5.5% (RVS) and 4.5% (CVS) in 2022 to 1.5% in perpetuity
- EBITDA margin will reach its peak in 2022 at 19.8% and will gradually soften to 18.8% in perpetuity
- Minority interests will be deducted at 20x earnings (ca. KB's PE multiple)+ 379.6m for the value of the Bosch put-option
- NWC=Inventory+ Accounts rec.+Rec. construction contracts-Accounts pay.-Liab. Construction contracts-Prepayments received

FCF Value Potential

Keeping maintenance capex at 2/3 of total capex and WC constant leaves us with a value of EUR 69 per share for 2020e. We regard our maintenance assumption as conservative given that KB historically spent only some 4.5% of sales on capex.

Capex spending

CAPEX spending	2015	2016	2017	2018	2019e	2020e	2021e
Capex	**236.3**	**246.3**	**229.9**	**371.4**	**319.8**	**333.2**	**349.8**
in % of sales	*4.1%*	*4.5%*	*3.7%*	*5.6%*	*4.6%*	*4.8%*	*4.8%*
D&A	**170.5**	**165.7**	**211.5**	**205.6**	**204.7**	**232.0**	**261.0**
in % of fixed assets	*11.3%*	*9.1%*	*11.2%*	*9.8%*	*9.3%*	*10.0%*	*10.9%*
in % of sales	*2.9%*	*3.0%*	*3.4%*	*3.1%*	*2.9%*	*3.3%*	*3.6%*
Difference Capex - D&A	**65.8**	**80.6**	**18.4**	**165.9**	**115.1**	**101.3**	**88.8**
in % of sales	*1.1%*	*1.5%*	*0.3%*	*2.5%*	*1.7%*	*1.5%*	*1.2%*

Source: Knorr-Bremse, Warburg Research

Free Cash Flow Value Potential

Warburg Research's valuation tool "FCF Value Potential" reflects the ability of the company to generate sustainable free cash flows. It is based on the "FCF potential" - a FCF "ex growth" figure - which assumes unchanged working capital and pure maintenance capex. A value indication is derived via the perpetuity of a given year's "FCF potential" with consideration of the weighted costs of capital. The fluctuating value indications over time add a timing element to the DCF model (our preferred valuation tool).

in EUR m	2015	2016	2017	2018	2019e	2020e	2021e
Net Income before minorities	711	567	587	629	738	742	776
+ Depreciation + Amortisation	171	166	211	206	205	232	261
- Net Interest Income	-51	-45	-52	-97	-56	-56	-58
- Maintenance Capex	158	164	153	216	213	222	233
+ Other	0	0	0	0	0	0	0
= Free Cash Flow Potential	**774**	**614**	**697**	**716**	**786**	**808**	**862**
FCF Potential Yield (on market EV)	n/a	n/a	n/a	4.8 %	4.8 %	5.0 %	5.4 %
WACC	6.53 %	6.53 %	6.53 %	6.53 %	6.53 %	6.53 %	6.53 %
= Enterprise Value (EV)	**n.a.**	**n.a.**	**n.a.**	**14,919**	**16,527**	**16,269**	**15,982**
= Fair Enterprise Value	**11,855**	**9,399**	**10,674**	**10,967**	**12,030**	**12,367**	**13,206**
- Net Debt (Cash)	416	416	416	416	51	-206	-512
- Pension Liabilities	344	344	344	344	361	361	379
- Other	0	0	0	0	0	0	0
- Market value of minorities	1,075	1,075	1,075	1,075	1,075	1,075	1,075
+ Market value of investments	0	0	0	0	0	0	0
= Fair Market Capitalisation	**10,020**	**7,564**	**8,839**	**9,132**	**10,543**	**11,138**	**12,265**
Number of shares, average	161	161	161	161	161	161	161
= Fair value per share (EUR)	**62.16**	**46.92**	**54.83**	**56.65**	**65.40**	**69.09**	**76.08**
premium (-) / discount (+) in %					-29.9 %	-25.9 %	-18.5 %

Sensitivity Fair value per Share (EUR)

		2015	2016	2017	2018	2019e	2020e	2021e
	9.53 %	39.01	28.57	33.99	35.24	41.91	44.94	50.30
	8.53 %	44.92	33.25	39.31	40.70	47.90	51.10	56.88
	7.53 %	52.39	39.18	46.04	47.62	55.49	58.90	65.21
WACC	**6.53 %**	**62.16**	**46.92**	**54.83**	**56.65**	**65.40**	**69.09**	**76.08**
	5.53 %	75.46	57.47	66.80	68.95	78.90	82.96	90.90
	4.53 %	94.62	72.67	84.06	86.69	98.35	102.96	112.25
	3.53 %	124.65	96.47	111.10	114.47	128.82	134.29	145.71

- We assume maintenance capex at 2/3 of total capex.
- Minority interest will be deducted at 20x earnings (ca. KB's PE multiple)+ 379.6m for the value of the Bosch put-option

Relative valuation

SOTP-Wabtec & WABCO

As Knorr-Bremse has a listed main competitor in each of its segments we want to examine the valuation multiples of each peer. We use consensus forecasts and EV multiples to account for differences in the capital structure.

Important: Wabtec has agreed to merge with GE's locomotives business on May 21 2018, which increases its exposure to the US freight market, a market that is less relevant for KB. This deal roughly doubles revenues for Wabtec and shifts the focus to the locomotive business. Only some analysts in the current consensus estimates for Wabtec may include the impact of the deal for the net debt calculations as well as for sales, and profits. On the other hand, its valuation is derived not only from the prospects for its component business that is in direct competition with RVS but also from the locomotive outlook, the potential deal synergies and other GE contributions. However, on the basis of this valuation we can see that Wabtec's valuation multiples are far lower after the merger.

Additionally, on March 28 WABCO has entered into a definitive merger agreement with ZF Friedrichshafen AG. The acquisition price of $136.5 per share represents a 13% premium to the closing stock price of $120.75 on February 26, 2019, the date prior to media reports and WABCO's confirmation that ZF had approached the company. The transaction also represents a premium of approximately 18% and 23% to the undisturbed volume weighted average price (VWAP) for the 30 and 90 days ended February 26, 2019, respectively. For our calculation we take the last meaningful closing stock price of $120.75 on February 26, 2019 into account.

Wabtec

Wabtec is the largest peer in the rail vehicles division. While KB has a particularly strong focus on the passenger segment (84% of segment sales), Wabtec has a stronger focus on the freight segment (approximately 68% of 2017 sales relate to the freight segment).

The competition between Wabtec and KB varies across product lines/markets and geographies. KB is strongest in its core business, the brake / brake systems market. The company has the largest market share by far in each region and globally. In the market for entrance systems, KB and Wabtec are more or less at the same level. Although KB has a slightly bigger market share worldwide, Wabtec has a stronger position in the Americas and APAC regions. In HVAC systems, both companies, are pursuing the same path and are among the top three suppliers globally, holding an equal market share in Europe and Americas, while Wabtec again has a slightly larger share in the APAC region. Overall, Wabtec has greater exposure to the American market while KB is more exposed to the European market. As Wabtec is heavily loaded with debt (~3,200m net debt 2020E; ~1.6xx Net Debt/EBITDA) after the closing of this deal, we think KB could capitalise on this opportunity to consolidate the market with further M&A activities.

WABCO

WABCO is by far the closest competitor for CVS. While Knorr-Bremse's Commercial Vehicle Systems segment focuses almost exclusively on commercial vehicles, a portion of WABCO's business (approximately 8% of 2017 sales,) relates to passenger cars. Europe represented approximately 52% of sales in 2017, with the remainder coming primarily from Asia (26%) and the Americas (21%).

KB and WABCO are the main global competitors for air brake systems, in the field of energy supply and distribution as well as in the area of fuel efficiency. All other competitors have only regional relevance. While KB states that it has a market share 1.4x larger than WABCO, we will closely track the development following the merger with ZF.

SOTP – Valuation

		WABCO			Wabtec	
	19e	20e	21e	19e	20e	21e
Market Cap	6,203.7	6,203.7	6,203.7	7,056.8	7,056.8	7,056.8
Net Debt (Cash)	-12.1	56.3	-140.9	1,870.4	2,159.3	3,219.1
Pension Liabilities	724.9	724.9	724.9	77.3	77.3	77.3
Others	0.0	0.0	0.0	0.0	0.0	0.0
Market value of minorities	304.5	304.5	304.5	-48.6	-48.6	-48.6
Enterprise Value	**7,221.0**	**7,289.4**	**7,092.2**	**8,955.8**	**9,244.7**	**10,304.5**
Sales	3,867.1	3,914.6	4,072.4	8,417.1	9,568.0	10,142.9
EBITDA	617.9	637.4	672.1	1537.7	1807.4	2042.6
EBIT	511.5	528.4	563.6	1179.4	1426.6	1579.0
EV / Sales	1.9 x	1.9 x	1.7 x	1.1 x	1.0 x	1.0 x
EV / EBITDA	11.7 x	11.4 x	10.6 x	5.8 x	5.1 x	5.0 x
EV / EBIT	14.1 x	13.8 x	12.6 x	7.6 x	6.5 x	6.5 x
		CVS			RVS	
Sales	3,365.5	3,195.5	3,395.5	3,461.9	3,586.7	3,746.7
EBITDA	561.4	541.4	596.4	693.1	738.1	788.1
EBIT	488.0	472.9	516.1	585.2	606.2	651.9
EV Calculation						
EV based on Sales multiple	6,284.5	5,950.4	5,913.4	3,683.5	3,465.5	3,806.4
EV based on EBITDA multiple	6,560.6	6,191.6	6,293.2	4,036.8	3,775.4	3,975.8
EV based on EBIT multiple	6,889.2	6,524.3	6,494.5	4,443.7	3,928.0	4,254.5
Segment EV (Average)	**6,578.1**	**6,222.1**	**6,233.7**	**4,054.7**	**3,723.0**	**4,012.2**
in % of total	62%	63%	61%	38%	37%	39%

Knorr Bremse EV based on SOTP		**10,632.8**	**9,945.1**	**10,245.9**
Net Debt (Cash)		51.1	-206.2	-511.8
Pension Liabilities		361.1	360.6	378.5
Others		0.0	0.0	0.0
Market value of minorities		1,074.8	1,074.8	1,074.8
Market value of investments		0.0	0.0	0.0
Market Capitalisation		**12,119.8**	**11,174.3**	**11,187.5**
No. of shares (m)		161.2	161.2	161.2
Fair value per share (SOTP)		75.19	69.32	69.40
Current Share Price	93.10			
Potential to SOTP value		-19.2%	-25.5%	-25.5%

Source: Factset, Warburg Research; Data as of 13.05.2019

Peer group

KB is not directly comparable to any listed company. However, we have presented a table of comparisons with companies active as suppliers in the rail and commercial vehicle industries. Furthermore, we included OEMs from both the rail and commercial vehicle industry to highlight valuation differences between KB and its customers. If we take the average of 2019e EV/EBITDA and EV/EBIT median multiples into account, this would indicate a share price of EUR 76.

Included in our peer analysis are JOST Werke and SAF-Holland which are also in our coverage. Due to the consolidated nature of the industry, there is very limited number of publicly-listed companies with comparable industry and product exposure. As KB has a business relationship to both companies, we want to briefly highlight some similarities, business relations and differences between the three stocks.

- While only 10% of KB's CVS sales are exposed to trailers, Jost reports 55% of trailer sales. For SAF, we estimate trailer exposure to be somewhere in the range of 70-80%.
- KB generates revenues of ~6.6bn, SAF ~1.3bn and Jost ~0.75bn.
- While all three are global market leaders, there are differences in their product focus and end-markets:
  - As described, KB plays a dominant role in brakes, energy supply and distribution and fuel efficiency systems.
  - SAF-Holland is a global player for trailer axles and suspension systems as well as fifth wheels.
  - JOST Werke is the worldwide market leader by far for landing gear and fifth wheels.
- For SAF-Holland, KB is the largest supplier.
- The difference in product exposure has strong implications for the margin profile (see table).

Overall, the calculations with our peer group confirm our view that Knorr-Bremse is trading on very high multiples, on an absolute level as well as benchmarked against comparable companies.

Peer Group – Key Figures

Company	Ticker	LW	Kurs in LC	MK in LC m	EV in LC m	Sales 19e	Sales 20e	Sales 21e	EBITDA 19e	EBITDA 20e	EBITDA 21e	EBIT 19e	EBIT 20e	EBIT 21e	FCF 19e	FCF 20e	FCF 21e
Westinghouse Air Brake Technologies Corporation	WAB-US	USD	73.04	7,056.8	13,396.7	8,417.1	9,568.0	10,142.9	1,537.7	1,807.4	2,042.6	1,179.4	1,426.6	1,579.0	369.8	850.9	1,225.0
WABCO Holdings Inc.	WBC	USD	132.17	6,771.5	6,997.4	3,867.1	3,914.6	4,072.4	617.9	637.4	672.1	511.5	528.4	563.6	370.5	393.3	398.0
CV/Rail Suppliers																	
SAF-HOLLAND S.A.	SFQ-DE	EUR	10.84	492.1	752.8	1,361.4	1,372.0	1,403.5	119.1	130.0	134.8	85.5	92.0	105.4	14.0	30.8	48.0
JOST Werke AG	JST-DE	EUR	30.45	453.7	543.9	775.4	783.6	797.2	101.4	104.9	104.5	83.9	86.1	63.6	63.0	67.3	65.3
Meritor, Inc.	MTOR	USD	21.98	1,835.2	2,674.5	4,419.6	4,160.5	4,145.9	516.3	478.3	457.7	377.5	357.6	363.2	187.6	199.4	
Haldex AB	HLDX-SE	SEK	70.00	3,094.3	3,973.3	5,381.0	5,237.0	5,486.0	595.0	541.0	576.0	371.0	314.0	346.0	120.0	193.0	180.0
Brembo S.p.A.	BRE-IT	EUR	10.86	3,531.5	3,952.0	2,715.5	2,893.5	2,979.0	525.7	552.6	567.0	346.8	367.2	388.0	149.0	207.0	243.0
Cummins Inc.	CMI	USD	165.39	26,047.6	27,836.0	24,515.0	23,361.0	23,684.3	4,027.5	3,636.5	3,746.9	3,311.0	3,013.0	3,126.1	2,190.0	2,066.4	2,059.0
Allison Transmission Holdings, Inc.	ALSN	USD	45.90	5,750.4	8,024.3	2,650.0	2,576.8	2,592.5	1,054.5	981.9	964.0	871.6	811.8	798.0	602.0	625.3	615.6
Schaltbau Holding AG	slt-ETR	EUR	27.80	245.9	366.0	507.0	530.0	559.0	35.0	42.0	46.0	23.0	30.0	34.0			
Nabtesco Corporation	6268-TKS	JPY	2992.00	371,266.8	380,769.2	307,859.5	320,250.0	327,800.0	40,700.0	46,000.0	48,500.0	30,000.0	32,500.0	34,400.0	4,000.0	15,000.0	18,000.0
OEMs																	
Alstom SA	ALO-PAR	EUR	38.63	8,636.6	8,924.0	8,546.1	9,058.9	9,465.0	774.5	835.0	924.4	604.3	675.1	754.3	343.5	433.6	480.5
PACCAR Inc	PCAR	USD	69.51	24,081.3	30,449.5	23,701.2	21,233.3	21,437.1	2,980.0	2,629.4	2,861.0	2,592.5	2,211.0	2,299.3	1,748.5	1,744.5	1,565.5
Navistar International Corporation	NAV	USD	30.50	3,021.5	7,205.7	11,026.3	10,329.0	9,968.7	883.0	815.0	836.4	760.7	665.0	603.1	289.0	384.0	327.0
Volvo AB Class B	VOLV.B-OME	SEK	140.05	284,709.1	386,838.7	409,215.0	389,663.0	392,491.6	60,685.0	54,144.2	52,364.1	43,911.2	36,697.0	37,537.0	29,354.0	30,267.0	29,482.0
Sinotruk Hong Kong Ltd.	3808-HKG	HKD	15.46	42,684.9	27,003.6	74,461.8	77,201.2	76,386.0	8,584.0	8,507.9	8,816.8	7,132.8	7,227.8	7,424.9	3,835.7	5,693.1	5,978.8
Bombardier Inc. Class B	BBD.B-TSE	CAD	2.13	5,186.3	16,740.1	22,885.0	26,106.1	27,639.4	1,978.1	2,723.7	3,032.3	1,374.1	1,994.6	2,325.2	-268.7	822.1	1,115.6
CRRC Corporation Limited Class H	1766-HKG	HKD	6.69	191,995.4	206,292.6	277,525.7	302,014.3	320,162.2	27,895.9	30,763.0	31,583.4	19,735.1	22,627.2	23,808.6	11,174.2	20,912.7	22,719.4
Talgo SA	TLGO-MCE	EUR	5.70	773.9	688.9	460.3	638.1	706.4	79.9	112.4	124.2	66.5	91.7	103.9	39.9	-9.8	129.9
Knorr-Bremse AG	**KBX-DE**	**EUR**	**93.10**	**15,007.7**	**13,520.7**	**6,952.2**	**6,942.2**	**7,287.2**	**1,293.1**	**1,332.9**	**1,428.3**	**1,088.4**	**1,101.0**	**1,167.3**	**692.1**	**681.1**	**704.1**

Company	Div Yield			Gross Margin			EBITDA Margin			EBIT Margin			FCF / Sales		
	19e	20e	21e	19e	20e	21e	19e	20e	21e	19e	20e	21e	19e	20e	21e
Westinghouse Air Brake Technologies Corporation	-	-	-	31.1%	31.7%	30.4%	18.3%	18.9%	20.1%	14.0%	16.9%	18.8%	4.4%	10.1%	14.6%
WABCO Holdings Inc.	0.0%	0.0%	0.0%	30.6%	30.7%	-	16.0%	16.3%	16.5%	13.2%	13.7%	14.6%	9.6%	10.2%	10.3%
CV/Rail Suppliers															
SAF-HOLLAND S.A.	4.6%	5.1%	5.5%	16.8%	17.5%	18.2%	8.7%	9.5%	9.6%	6.3%	6.8%	7.7%	1.0%	2.3%	3.5%
JOST Werke AG	3.6%	3.8%	3.8%	25.9%	26.6%	27.1%	13.1%	13.4%	13.1%	10.8%	11.1%	8.2%	8.1%	8.7%	8.4%
Meritor, Inc.	0.0%	0.0%	0.0%	14.6%	15.3%	15.8%	11.7%	11.5%	11.0%	8.5%	8.1%	8.2%	4.2%	4.5%	n.a.
Haldex AB	2.1%	2.1%	2.2%	26.3%	26.2%	26.3%	11.1%	10.3%	10.5%	6.9%	5.8%	6.4%	2.2%	3.6%	3.3%
Brembo S.p.A.	2.2%	2.3%	2.4%	-	-	-	19.4%	19.1%	19.0%	12.8%	13.5%	14.3%	5.5%	7.6%	8.9%
Cummins Inc.	2.8%	2.9%	2.9%	25.9%	25.9%	29.3%	16.4%	15.6%	15.8%	13.5%	12.3%	12.8%	8.9%	8.4%	8.4%
Allison Transmission Holdings, Inc.	1.3%	1.3%	1.3%	52.1%	50.5%	49.6%	39.8%	38.1%	37.2%	32.9%	30.6%	30.1%	22.7%	23.6%	23.2%
Schaltbau Holding AG	0.0%	0.0%	0.7%	-	-	-	6.9%	7.9%	8.2%	4.5%	5.9%	6.7%	n.a.	n.a.	n.a.
Nabtesco Corporation	2.4%	2.5%	2.5%	28.3%	28.8%	29.7%	13.2%	14.4%	14.8%	9.7%	10.6%	11.2%	1.3%	4.9%	5.8%
OEMs															
Alstom SA	1.4%	1.6%	1.9%	17.1%	17.2%	18.3%	9.1%	9.2%	9.8%	7.1%	7.9%	8.8%	4.0%	5.1%	5.6%
PACCAR Inc	4.7%	4.4%	4.2%	14.5%	14.2%	14.6%	12.6%	12.4%	13.3%	10.9%	9.3%	9.7%	7.4%	7.4%	6.6%
Navistar International Corporation	0.0%	0.0%	0.0%	18.9%	18.3%	22.3%	8.0%	7.9%	8.4%	6.9%	6.0%	5.5%	2.6%	3.5%	3.0%
Volvo AB Class B	3.8%	4.3%	4.6%	23.9%	24.1%	24.3%	14.8%	13.9%	13.3%	10.7%	9.0%	9.2%	7.2%	7.4%	7.2%
Sinotruk Hong Kong Ltd.	5.1%	5.2%	5.0%	18.7%	19.2%	19.2%	11.5%	11.0%	11.5%	9.6%	9.7%	10.0%	5.2%	7.6%	8.0%
Bombardier Inc. Class B	0.0%	0.0%	0.0%	16.8%	16.7%	-	8.6%	10.4%	11.0%	6.0%	8.7%	10.2%	-1.2%	3.6%	4.9%
CRRC Corporation Limited Class H	3.0%	3.4%	3.5%	23.0%	23.4%	23.8%	10.1%	10.2%	9.9%	7.1%	8.2%	8.6%	4.0%	7.5%	8.2%
Talgo SA	0.0%	0.5%	0.0%	-	-	-	17.4%	17.6%	17.6%	14.4%	19.9%	22.6%	8.7%	-2.1%	28.2%
Mean	2.1%	2.2%	2.3%	24.0%	24.1%	24.9%	14.0%	14.1%	14.3%	10.8%	11.3%	11.8%	5.9%	6.9%	9.3%
Median	2.1%	2.2%	2.3%	23.5%	23.7%	24.1%	12.6%	12.4%	13.1%	9.7%	9.3%	9.7%	4.8%	7.4%	8.0%
Knorr-Bremse AG	**1.9%**	**2.3%**	**2.4%**	**51.1%**	**51.0%**	**51.4%**	**18.6%**	**19.2%**	**19.6%**	**15.7%**	**15.8%**	**16.8%**	**10.0%**	**9.8%**	**10.1%**
Delta to mean in bp	-18bps	16bps	11bps	2704bps	2690bps	2652bps	457bps	512bps	535bps	481bps	457bps	503bps	407bps	292bps	82bps
Delta to median in bp	-25bps	15bps	6bps	2760bps	2730bps	2735bps	603bps	682bps	649bps	591bps	651bps	709bps	518bps	242bps	210bps

Source: Factset, Warburg Research; Data as of 13.05.2019

Peer Group – Valuation

Company	P/E			EV/Sales			EV / EBITDA			EV / EBIT			EV / FCF		
	19e	20e	21e	19e	20e	21e	19e	20e	21e	19e	20e	21e	19e	20e	21e
Westinghouse Air Brake Technologies Corporation	17.4 x	15.1 x	13.4 x	1.6 x	1.4 x	1.3 x	8.7 x	7.4 x	6.6 x	11.4 x	9.4 x	8.5 x	36.2 x	15.7 x	10.9 x
WABCO Holdings Inc.	17.2 x	16.6 x	14.4 x	1.8 x	1.8 x	1.7 x	11.3 x	11.0 x	10.4 x	13.7 x	13.2 x	12.4 x	18.9 x	17.8 x	17.6 x
CV/Rail Suppliers															
SAF-HOLLAND S.A.	8.5 x	7.7 x	7.1 x	0.6 x	0.5 x	0.5 x	6.3 x	5.8 x	5.6 x	8.8 x	8.2 x	7.1 x	n.a.	24.5 x	15.7 x
JOST Werke AG	9.1 x	8.4 x	7.9 x	0.7 x	0.7 x	0.7 x	5.4 x	5.2 x	5.2 x	6.5 x	6.3 x	8.6 x	8.6 x	8.1 x	8.3 x
Meritor, Inc.	6.2 x	6.6 x	6.1 x	0.6 x	0.6 x	0.6 x	5.2 x	5.6 x	5.8 x	7.1 x	7.5 x	7.4 x	14.3 x	13.4 x	n.a.
Haldex AB	13.4 x	17.1 x	15.1 x	0.7 x	0.8 x	0.7 x	6.7 x	7.3 x	6.9 x	10.7 x	12.7 x	11.5 x	33.1 x	20.6 x	22.1 x
Brembo S.p.A.	13.9 x	13.3 x	12.8 x	1.5 x	1.4 x	1.3 x	7.5 x	7.2 x	7.0 x	11.4 x	10.8 x	10.2 x	26.5 x	19.1 x	16.3 x
Cummins Inc.	10.2 x	11.1 x	10.4 x	1.1 x	1.2 x	1.2 x	6.9 x	7.7 x	7.4 x	8.4 x	9.2 x	8.9 x	12.7 x	13.5 x	13.5 x
Allison Transmission Holdings, Inc.	9.9 x	10.2 x	9.6 x	3.0 x	3.1 x	3.1 x	7.6 x	8.2 x	8.3 x	9.2 x	9.9 x	10.1 x	13.3 x	12.8 x	13.0 x
Schaltbau Holding AG	20.5 x	18.2 x	14.9 x	0.7 x	0.7 x	0.7 x	10.5 x	8.7 x	8.0 x	15.9 x	12.2 x	10.8 x	n.a.	n.a.	n.a.
Nabtesco Corporation	16.6 x	15.3 x	14.3 x	1.2 x	1.2 x	1.2 x	9.4 x	8.3 x	7.9 x	12.7 x	11.7 x	11.1 x	95.2 x	25.4 x	21.2 x
OEMs															
Alstom SA	18.1 x	16.2 x	14.0 x	1.0 x	1.0 x	0.9 x	11.5 x	10.7 x	9.7 x	14.8 x	13.2 x	11.8 x	26.0 x	20.6 x	18.6 x
PACCAR Inc	10.4 x	12.1 x	11.9 x	1.3 x	1.4 x	1.4 x	10.2 x	11.6 x	10.6 x	11.7 x	13.8 x	13.2 x	17.4 x	17.5 x	19.5 x
Navistar International Corporation	8.1 x	9.4 x	10.0 x	0.7 x	0.7 x	0.7 x	8.2 x	8.8 x	8.6 x	9.5 x	10.8 x	11.9 x	24.9 x	18.8 x	22.0 x
Volvo AB Class B	9.1 x	10.8 x	10.4 x	0.9 x	1.0 x	1.0 x	6.4 x	7.1 x	7.4 x	8.8 x	10.5 x	10.3 x	13.2 x	12.8 x	13.1 x
Sinotruk Hong Kong Ltd.	7.9 x	7.7 x	7.5 x	0.4 x	0.3 x	0.4 x	3.1 x	3.2 x	3.1 x	3.8 x	3.7 x	3.6 x	7.0 x	4.7 x	4.5 x
Bombardier Inc. Class B	-52.9 x	9.9 x	6.3 x	0.7 x	0.6 x	0.6 x	8.5 x	6.1 x	5.5 x	12.2 x	8.4 x	7.2 x	-62.3 x	20.4 x	15.0 x
CRRC Corporation Limited Class H	12.6 x	11.3 x	10.4 x	0.7 x	0.7 x	0.6 x	7.4 x	6.7 x	6.5 x	10.5 x	9.1 x	8.7 x	18.5 x	9.9 x	9.1 x
Talgo SA	16.5 x	11.3 x	9.1 x	1.5 x	1.1 x	1.0 x	8.6 x	6.1 x	5.5 x	10.4 x	7.5 x	6.6 x	17.3 x	-70.4 x	5.3 x
Mean	9.1 x	12.0 x	10.8 x	1.1 x	1.1 x	1.0 x	7.9 x	7.5 x	7.2 x	10.4 x	9.9 x	9.5 x	18.9 x	11.4 x	14.5 x
Median	10.4 x	11.3 x	10.4 x	0.9 x	1.0 x	0.9 x	7.6 x	7.3 x	7.0 x	10.5 x	9.9 x	10.1 x	17.4 x	16.6 x	15.0 x
Knorr-Bremse AG	**21.30 x**	**21.11 x**	**20.20 x**	**1.94 x**	**1.95 x**	**1.86 x**	**10.46 x**	**10.14 x**	**9.47 x**	**12.42 x**	**12.28 x**	**11.58 x**	**19.54 x**	**19.85 x**	**19.20 x**
Potential to mean in %	-57%	-43%	-46%	-44%	-45%	-44%	-25%	-26%	-24%	-16%	-19%	-18%	-3%	-43%	-25%
Potential to median in %	-51%	-47%	-49%	-51%	-49%	-49%	-27%	-28%	-26%	-16%	-20%	-13%	-11%	-16%	-22%
Fair value per share based on mean	**39.76**	**52.98**	**49.86**	**56.53**	**55.12**	**56.07**	**72.27**	**71.32**	**72.64**	**79.34**	**76.88**	**77.78**	**90.25**	**57.36**	**72.34**
Fair value per share based on median	**45.27**	**49.71**	**47.82**	**49.99**	**51.65**	**51.85**	**70.27**	**69.95**	**70.98**	**79.80**	**76.74**	**82.04**	**84.00**	**79.36**	**74.77**

Source: Factset, Warburg Research; Data as of 13.05.2019

Company & Products

A specialised and focused high-tech product portfolio

Knorr Bremse is the leading provider of safety-critical systems for rail and commercial vehicles:

In the segment Rail Vehicle Systems (**RVS**) KB offers a broad range of products for mass transit vehicles such as metro cars, light rail vehicles, freight cars, locomotives, mainline passenger trains and high-speed trains. Besides brake systems (which account for 66% of segment revenues) the product portfolio includes intelligent entrance systems (9% of sales), heating, ventilation and air conditioning ("HVAC") systems (6% of sales), auxiliary power supply systems, control components and windscreen wiper systems, platform screen doors, friction material, driver assistance systems, electrical traction equipment and control technology.

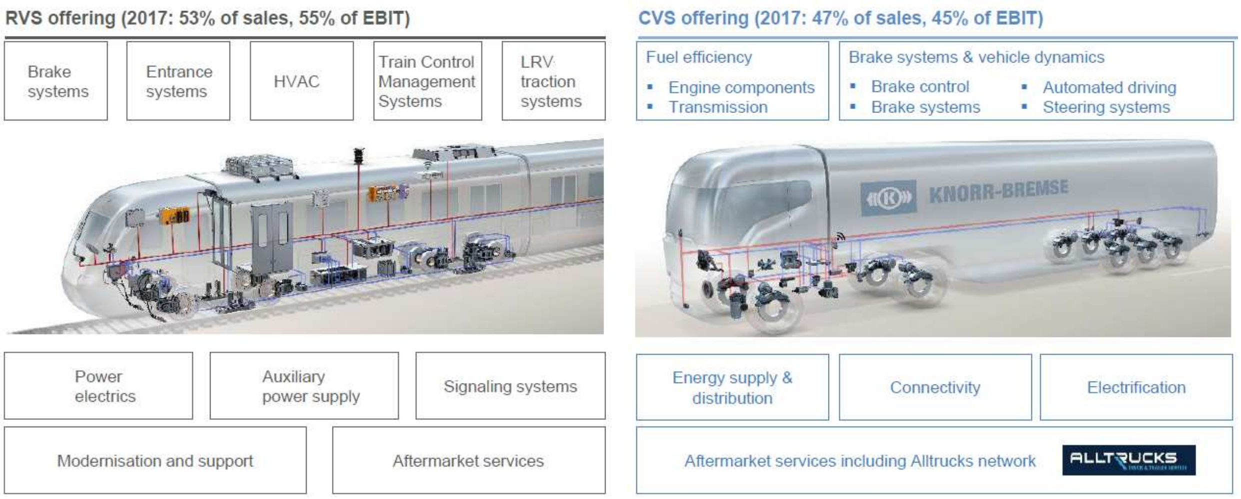
Additionally, in the aftermarket, KB provides maintenance, overhaul and repair services under the brand "RailServices".

Focus on brake systems

In the segment Commercial Vehicle Systems (**CVS**) KB offers products for trucks, buses, trailers and agricultural machinery. The product portfolio includes (i) brake systems and vehicle dynamics solutions including driver assistance and automated driving, brake control, brake systems, steering and electronic levelling control (i.e., driver assistance systems, anti-lock brake systems, emergency brake systems, air disc brakes, foundation drum brakes, actuators, valves/pedal units, steering systems, electronic levelling control, electronic stability programs and others) (which account for 71% of OE segment revenues), (ii) energy supply and distribution systems, including air compressors and air treatment (15% of sales), and (iii) fuel efficiency products, including engine components and transmission sub-systems (i.e., vibration dampers, engine air control, gear actuation and clutch actuation)(14% of sales).

Under the aftermarket brand, "TruckServices", KB supplies products and service solutions for commercial vehicles of all kinds and all ages. The Alltrucks network, which is a network of over 500 partners, completes the aftermarket service offer.

Leading supplier of safety-critical rail and commercial vehicle systems



Source: Knorr-Bremse Company Presentation

Rail Vehicle Systems

In the Rail Vehicle Systems (RVS), Knorr-Bremse offers high-quality and innovative products and services for local public transport vehicles such as metro cars, light rail vehicles, freight cars, locomotives, mainline passenger trains and high-speed trains. The portfolio of KB centres on key safety-critical systems within the rail vehicle such as brake systems (66% of sales), entrance systems (9% of sales) and HVAC systems (6% of sales). Additionally, the company offers auxiliary power supply systems, control components windscreen wiper systems, platform screen doors, friction material, driver advisory systems, traction systems and train control and monitoring systems. The product portfolio is completed by the digital 4.0 iCOM platform, with monitoring, driver assistance systems and energy metering and sanding systems. RVS focuses mainly on the passenger segment (84% of sales) and less on the freight segment (16% of sales).

Besides its main Knorr-Bremse brand, Rail Vehicle Systems and its subsidiaries operate under several other brands.

Multi-brand strategy

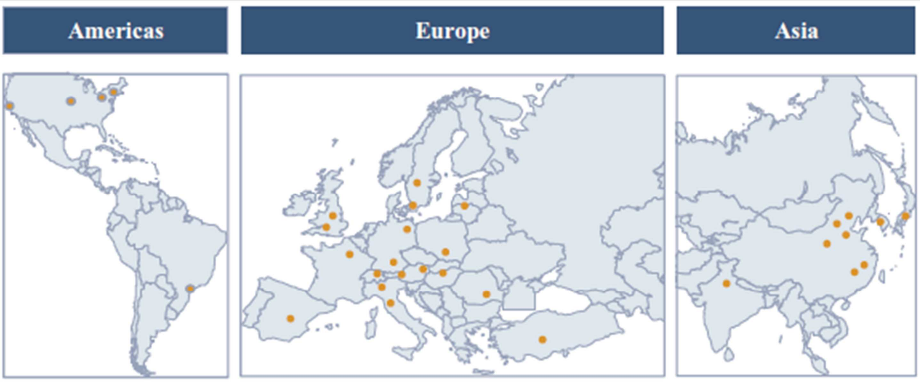
Brands of Knorr-Bremse

Source: Knorr-Bremse Website

Aftermarket: Under the ‘Railservices’ brand, KB bundles its global service activities in the aftermarket, offering tailored service packages with a focus on flexibility and customer need, including spare parts, repair and maintenance as well as overhaul services. 36 service centres worldwide provide state-of-the-art service and support. For the service network, KB Rail Vehicle Services employs 1900 FTEs, 200 of which are in the Americas, 1100 in Europe and 600 in Asia.

Market share ~50%

RVS service centres across the globe



Source: Knorr-Bremse prospectus

Focus on complete solutions

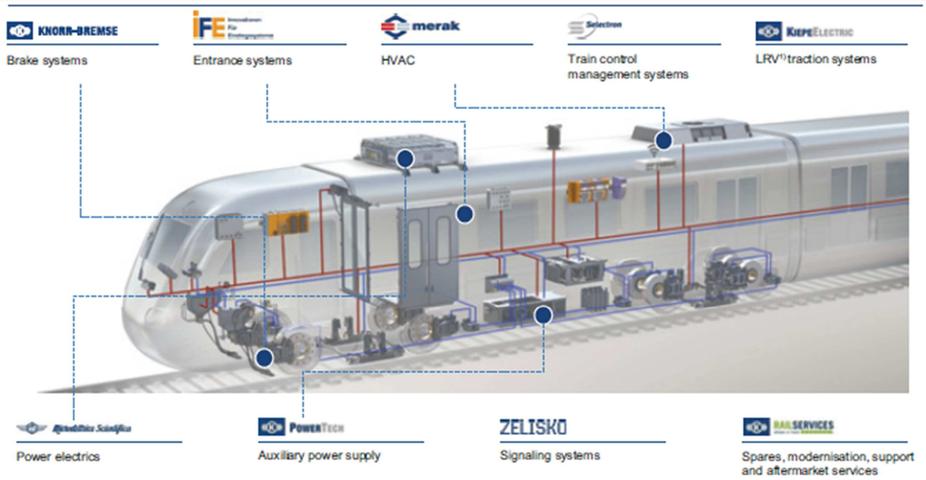
RVS product/services portfolio

Brake systems	On-Board systems	Off-Board systems	Railservices (Aftermarket)
Air supply	Train control management systems	Platform screen systems	On-site/ customer training
Bogie equipment	Auxiliary power supply systems	Signaling systems for level crossing	Modernization and engineering
Brake Control	Power Electrics		Maintenance
Sanding Systems	HVAC Systems		Spare parts and Logistics
Friction Material	LRV traction systems		
	Entrance Systems		
	Digital 4.0 iCOM platform		

Source: Knorr-Bremse Prospectus

The focus of RVS is to develop the connectivity of train subsystems with the use of electronics in order to satisfy the growing demand for safety, efficiency, comfort and diagnostic capabilities. KB, with its connected systems initiative, works towards complete solutions from a single source that generates technical and financial added value for vehicle manufacturers and operators. Matching hardware, and software for subsystems, equipping them with standardised interfaces and testing them prior to delivery, can benefit vehicle manufacturers with regard to improved project planning, more straightforward approval procedures, and therefore lower costs.

Integration of several subsystems in rail vehicles



Multi-brand strategy

Commercial Vehicle Systems

The Commercial Vehicle Systems (CVS) segment offers products for trucks, buses, trailers and agriculture machinery and develops innovative solutions for safe and efficient truck-trailer combinations in an increasingly mobile and connected society. The product portfolio includes:

- **Brake systems and vehicle dynamics solutions** including driver assistance and automated driving, brake control, steering and electronic levelling control (71% of CVS sales)
- **Energy supply and distribution systems** including air compressors and air treatment (15% of CVS sales), and
- **Fuel efficiency products** including engine components and transmission sub-systems (14% of CVS sales).

Knorr-Bremse Commercial Vehicles Systems pursues a multi-brand strategy with additional brands besides the main Knorr-Bremse brand, such as **TruckServices, Hasse & Wrede, Bendix and Bendix Spicer Foundation Brake**.

Customer retention through aftermarket sales and services

Knorr-Bremse provides state of the art services and support in the CVS field in more than 20 locations worldwide under its aftermarket brand TruckServices. Aftermarket sales and services account for 28% of CVS sales, which is lower than the aftermarket share of RVS. There are several reasons for this including,

- **Higher competitive intensity**, especially for spare parts, which include the best-selling product in the aftermarket, air disc brake pads. High competition is characterized by price pressure and results in a decline in revenues and margins which can be seen in the CVS aftermarket.
- With exit clauses, OEMs often retain the option to switch supplier or shift supply volumes to other suppliers during the term of an ongoing supply contract which means there is no longer a guarantee of supplying a customer for the entire life-cycle of a product.

High-margin aftermarket

Air disc brake pads and air treatment mean are the most frequent aftermarket products as they are most susceptible to wear and tear. In the first two quarters in 2018, these two product groups accounted to more than 60% of aftermarket sales in the EMEA region.

Knorr Bremse has continuously expanded its aftermarket capabilities in its Commercial Vehicle Systems segment, for instance by establishing the alliance **Alltrucks Truck & Trailer service** in conjunction with the suppliers Bosch and ZF Friedrichshafen. The joint venture offers multi-brand expertise in diagnostics, service, maintenance and repair of light to heavy commercial vehicles, trailers and others.

CVS aftermarket locations

Product/ Services portfolio CVS

Brake Systems & Vehicle Dynamics	**Energy Supply & Distribution Systems**	**Fuel Efficiency Systems**	**TruckServices (Aftermarket)**
Disc Brakes Slack Adjusters Drum Brakes Actuators Valves Electronic leveling control Steering systems Electronics Driver assistance systems Automated Driving	Air treatment Compressors	Transmission control for automatic shifting Clutch actuators Dampers	Service with new parts, remanufactured parts and service kits, web-shop, EDI interfaces Workshop conceps Commercial & technical support Diagnostic systems Fleet management solutions

Source: Knorr-Bremse Prospectus

Company history

Knorr-Bremse is a traditional German company and one of the leading braking technology companies worldwide. Its journey started in 1905…

- 1905: Georg Knorr founds Knorr-Bremse GmbH in Berlin, Germany.
- 1918 to 1926: The company rises to become the largest brake manufacturer for rail vehicles in Europe.
- 1922: The first air brakes for commercial vehicles are patented.
- 1960 to 1980: Knorr-Bremse enters the US market.
- 1985: Management buyout by Mr. Thiele.
- 1985 to 1990: Breakup of the legal corporate structure and creation of two divisions.
- 1990 to 2000: Creation of international production group through subsidiaries and acquisitions.
- 2000 to 2018: Global presence expanded and Knorr-Bremse develops into one of the world's leading braking technology companies.
- 2018: Knorr Bremse goes public.

M&A background

Knorr-Bremse has made several acquisitions, of which the following were of strategic significance in the last three years:

- **2016 Vossloh Kiepe (now Kiepe Electric)**: The aim of the acquisition was not only the expansion of the rail vehicle systems portfolio but also the commercial vehicle systems portfolio. As a systems supplier for electric busses, Kiepe offered new growth opportunities and potential applications in the segment of increasing electrification in the commercial vehicle sector.
- **2016 Haldex** attempt: With the attempt to buy Haldex, Knorr-Bremse aimed to join forces with Haldex to expand the product portfolio, particularly in the trailer brake and air suspension systems segment and actively pursue the development of systems solutions for **automated and / or autonomous driving** for truck-trailer combinations. Additionally, KB prevented ZF Friedrichshafen from entering the braking systems business by topping ZF's bid offer. However, due to antitrust requirements the acquisition failed. KB still holds an investment in Haldex AB and assigns it to the "at fair value through equity" category.
- **2018 Federal Mogul**: Expansion of rail vehicle friction material portfolio through acquisition of rail know-how and intellectual property rights. The aim was to strengthen systems competence and market position, primarily in the aftermarket sector.
- To strengthen its position in the Asian market and to advance in the field of automated driving, KB signed an agreement at the end of 2018, to acquire **Hitachi Automotive's** commercial vehicle steering business. The division, which had sales of EUR 100m in 2017, has strong business relationships to Japanese OEMs and is the market-leading manufacturer of steering systems in Japan. With the acquisition, KB passed a further milestone on its path towards providing systems solutions for driver assistance and highly automated driving.

Management & Corporate Governance

Vacant position (CEO)

Mr. Klaus Deller, ex-CEO of Knorr-Bremse AG (2009-2014 & 2015-2019), left the company as of 30 April 2019 by mutual agreement. The supervisory board has already initiated the search for a successor. The responsibilities of Mr. Deller have been assigned jointly to the remaining members of the executive board, Ralph Heuwing, Dr. Peter Laier and Dr. Jürgen Wilder, for this transitional period.

While we acknowledge that it was Mr. Deller who successfully steered the company through the last couple of years, we also believe KB's remaining management team is fully capable of temporarily taking the helm and we do not expect any leadership vacuum either in the divisions or on the non-operational side.

Ralph Heuwing (CFO)

Ralph Heuwing, has been with Knorr-Bremse since 2017. He brings with him substantial strategy and operational experience from his time as Dürr CFO. In 2018, Heuwing successfully listed Knorr-Bremse on the **stock exchange** in just a short period of time.

Dr. Peter Laier (Head of CVS)

Dr. Peter Laier took over as Head of CVS in 2015. He has longstanding leadership experience in the automotive industry, gained at Continental AG and Benteler International AG. Having previously worked for Continental in Asia and headed the Chassis & Safety division, his foreign experience and knowledge of the Asian market is advancing Knorr-Bremse's expansion in the **Asian market.**

Dr. Jürgen Wilder (Head of RVS)

Dr. Jürgen Wilder joined Knorr-Bremse in 2018 as Head of RVS. Prior to that he was CEO of DB Cargo AG and was responsible for the worldwide rail freight transport of Deutsche Bahn AG. His career started at Siemens AG, where he held various positions, including CEO of the global business unit Mainline Transportation. In this position, he reconstructed and expanded the high-speed, regional train and locomotive business.

Management remuneration

The remuneration of the members of the Executive Board comprises an annual fixed remuneration, pensions, other benefits, annual short-term variable compensation and a long-term incentive plan in the case of the New Service Agreements.

Non-performance-based components

The fixed part is equal for all members of the board except for the CEO, who receives double.

Performance-based components

The management receives an annual cash bonus as a **short-term incentive.** Again, the target amount is equal for all members of the board, except the CEO, for whom the target amount is 2 times that of the other board members. The effective amount is subject to the achievement of certain financial performance targets determined by the supervisory board for the respective fiscal year, which relate to sales, profit before tax, working capital and quality.

The **long-term incentive plan** is based on the development of the Economic Value Added in the course of a three-year performance period. A certain amount is granted as additional compensation for the respective period. The Economic Value Added is calculated by deducting the Capital Charge (defined as capital employed multiplied with a WACC of 8%) from the net operating profit after tax. The target value, a minimum value and a maximum value is determined by the supervisory board at the beginning of every performance period. While we do not know the exact targets, we can see that the company is well ahead of its capital charge.

Well ahead of the capital charge

EVA calculation for long-term incentives	2015	2016	2017	2018	2019e	2020e	2021e
+Equity	1,838.2	1,965.9	1,995.7	1,607.1	2,028.7	2,387.5	2,775.5
+Pensions	328.5	358.7	353.9	343.7	361.1	360.6	378.5
+Financial liabilities	752.7	1,287.6	1,309.7	2,172.5	2,172.5	2,172.5	2,172.5
-Liquid assets	1,360.7	1,720.9	1,600.0	1,756.0	2,121.4	2,378.6	2,684.3
=Capital employed	**1558.7**	**1891.4**	**2059.3**	**2367.2**	**2440.9**	**2541.9**	**2642.3**
yoy		*21%*	*9%*	*15%*	*3%*	*4%*	*4%*
EBIT	1,098.5	886.4	904.0	972.5	1,088.4	1,101.0	1,167.3
EBIT MARGIN	18.9%	16.2%	14.7%	14.7%	15.7%	15.9%	16.0%
Tax Rate	32.2%	32.6%	31.1%	28.1%	28.5%	29.0%	30.0%
NOPAT	**744.9**	**597.6**	**622.7**	**699.1**	**778.2**	**781.7**	**817.1**
avg. CE	1,558.7	1,725.0	1,975.3	2,213.2	2,404.1	2,491.4	2,592.1
WACC	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%	8.0%
Capital charge	**124.7**	**138.0**	**158.0**	**177.1**	**192.3**	**199.3**	**207.4**
Economic value added	**620.2**	**459.6**	**464.7**	**522.1**	**585.9**	**582.4**	**609.7**

Note: Computed metrics are based on average balance sheet values from 2016 onwards.

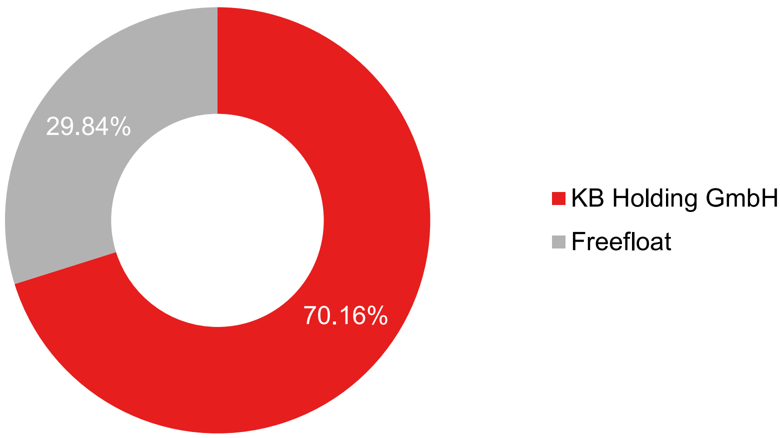
Source: Knorr-Bremse, Warburg Research

Thiele still holding the sceptre

When KB went public in 2018, ~30% of shares were floated on the stock exchange, leaving the owner Heinz Hermann Thiele with slightly more than 70% of ownership and voting rights. After the IPO, Thiele pledged to continue to ensure continuity and stability, which indicated his intention to continue wielding influence. Thiele starting working at KB as a payment attorney and worked his way through the ranks to CEO. In 1985 he successfully executed a management buyout and became the owner of KB.

Though Thiele has not held office at KB since 2016 and floated ~30% of shares on the stock exchange in 2018, companies affiliated with Thiele, such as Stella Holding and KB Holding, are leasing property to KB. The lease payments on these properties alone amounted to EUR 3.1 million in 2017. In addition, prior to the IPO, Thiele acquired assets such as a business jet from one of Knorr-Bremse’s subsidiaries. Additionally there is an agreement in place which entitles Thiele to exclusive rights to purchase certain lots of the Group’s Munich properties, if the group decides to sell them.

Shareholder structure



Source: Knorr Bremse

DCF model

Figures in EUR m	Detailed forecast period 2019e	2020e	2021e	Transitional period 2022e	2023e	2024e	2025e	2026e	2027e	2028e	2029e	2030e	2031e	Term. Value
Sales	6,952	6,942	7,287	7,654	7,995	8,311	8,602	8,869	9,113	9,334	9,535	9,718	9,882	
Sales change	*5.1 %*	*-0.1 %*	*5.0 %*	*5.0 %*	*4.5 %*	*4.0 %*	*3.5 %*	*3.1 %*	*2.7 %*	*2.4 %*	*2.2 %*	*1.9 %*	*1.7 %*	*1.5 %*
EBIT	1,088	1,101	1,167	1,240	1,285	1,326	1,362	1,393	1,420	1,444	1,464	1,480	1,494	
EBIT-margin	*15.7 %*	*15.9 %*	*16.0 %*	*16.2 %*	*16.1 %*	*16.0 %*	*15.8 %*	*15.7 %*	*15.6 %*	*15.5 %*	*15.4 %*	*15.2 %*	*15.1 %*	
Tax rate (EBT)	*28.5 %*	*29.0 %*	*30.0 %*	*31.5 %*	*31.5 %*	*31.5 %*	*31.5 %*	*31.5 %*	*31.5 %*	*31.5 %*	*31.5 %*	*31.5 %*	*31.5 %*	
NOPAT	778	782	817	849	880	908	933	954	973	989	1,003	1,014	1,023	
Depreciation	205	232	261	276	289	302	315	326	337	347	357	365	373	
in % of Sales	*2.9 %*	*3.3 %*	*3.6 %*	*3.6 %*	*3.6 %*	*3.6 %*	*3.7 %*	*3.7 %*	*3.7 %*	*3.7 %*	*3.7 %*	*3.8 %*	*3.8 %*	
Changes in provisions	17	-1	18	4	17	16	15	13	12	11	10	9	8	
Change in Liquidity from														
- Working Capital	-12	-1	42	104	44	41	38	35	32	29	26	24	21	
- Capex	320	333	350	383	391	397	402	406	408	408	408	406	404	
Capex in % of Sales	*4.6 %*	*4.8 %*	*4.8 %*	*5.0 %*	*4.9 %*	*4.8 %*	*4.7 %*	*4.6 %*	*4.5 %*	*4.4 %*	*4.3 %*	*4.2 %*	*4.1 %*	
Other	0	0	0	0	0	0	0	0	0	0	0	0	0	
Free Cash Flow (WACC Model)	692	681	704	643	752	788	822	854	883	910	935	958	979	999
PV of FCF	667	616	598	512	562	554	542	528	513	496	479	461	442	8,957
share of PVs	**11.81 %**			**31.95 %**										**56.24 %**

Model parameter

Derivation of WACC:		Derivation of Beta:	
Debt ratio	20.00 %	Financial Strength	1.00
Cost of debt (after tax)	0.7 %	Liquidity (share)	1.20
Market return	7.00 %	Cyclicality	1.20
Risk free rate	1.50 %	Transparency	1.30
		Others	1.20
WACC	**6.53 %**	**Beta**	**1.18**

Valuation (m)

Present values 2031e	6,971		
Terminal Value	8,957		
Financial liabilities	2,172		
Pension liabilities	361		
Hybrid capital	0		
Minority interest	1,075		
Market val. of investments	0		
Liquidity	2,121	No. of shares (m)	161.2
Equity Value	**14,440**	**Value per share (EUR)**	**89.58**

Sensitivity Value per Share (EUR)

Beta	WACC	Terminal Growth 0.75 %	1.00 %	1.25 %	**1.50 %**	1.75 %	2.00 %	2.25 %
1.41	7.5 %	68.26	69.67	71.18	72.82	74.60	76.55	78.67
1.29	7.0 %	74.75	76.49	78.38	80.44	82.69	85.17	87.91
1.24	6.8 %	78.40	80.34	82.47	84.79	87.34	90.17	93.30
1.18	6.5 %	82.37	84.56	86.95	**89.58**	92.49	95.71	99.32
1.12	6.3 %	86.71	89.17	91.88	94.87	98.20	101.91	106.08
1.07	6.0 %	91.46	94.25	97.33	100.76	104.58	108.88	113.75
0.95	5.5 %	102.48	106.11	110.17	114.73	119.89	125.79	132.59

Beta	WACC	Delta EBIT-margin -1.5 pp	-1.0 pp	-0.5 pp	**+0.0 pp**	+0.5 pp	+1.0 pp	+1.5 pp
1.41	7.5 %	64.15	67.04	69.93	72.82	75.71	78.60	81.49
1.29	7.0 %	70.98	74.13	77.28	80.44	83.59	86.74	89.89
1.24	6.8 %	74.88	78.18	81.49	84.79	88.09	91.40	94.70
1.18	6.5 %	79.17	82.64	86.11	**89.58**	93.05	96.52	99.99
1.12	6.3 %	83.92	87.57	91.22	94.87	98.53	102.18	105.83
1.07	6.0 %	89.19	93.05	96.90	100.76	104.61	108.47	112.32
0.95	5.5 %	101.72	106.06	110.39	114.73	119.07	123.40	127.74

- We forecast a gradual decrease in top-line growth from 5.5% (RVS) and 4.5% (CVS) in 2022 to 1.5% in perpetuity
- EBITDA margin will reach its peak in 2022 at 19.8% and will gradually soften to 18.8% in perpetuity
- Minority interests will be deducted at 20x earnings (ca. KB's PE multiple)+ 379.6m for the value of the Bosch put-option
- NWC=Inventory+ Accounts rec.+Rec. construction contracts-Accounts pay.-Liab. Construction contracts-Prepayments received

Free Cash Flow Value Potential

Warburg Research's valuation tool "FCF Value Potential" reflects the ability of the company to generate sustainable free cash flows. It is based on the "FCF potential" - a FCF "ex growth" figure - which assumes unchanged working capital and pure maintenance capex. A value indication is derived via the perpetuity of a given year's "FCF potential" with consideration of the weighted costs of capital. The fluctuating value indications over time add a timing element to the DCF model (our preferred valuation tool).

in EUR m	2015	2016	2017	2018	2019e	2020e	2021e
Net Income before minorities	711	567	587	629	738	742	776
+ Depreciation + Amortisation	171	166	211	206	205	232	261
- Net Interest Income	-51	-45	-52	-97	-56	-56	-58
- Maintenance Capex	158	164	153	216	213	222	233
+ Other	0	0	0	0	0	0	0
= Free Cash Flow Potential	**774**	**614**	**697**	**716**	**786**	**808**	**862**
FCF Potential Yield (on market EV)	n/a	n/a	n/a	4.8 %	4.8 %	5.0 %	5.4 %
WACC	6.53 %	6.53 %	6.53 %	6.53 %	6.53 %	6.53 %	6.53 %
= Enterprise Value (EV)	**n.a.**	**n.a.**	**n.a.**	**14,919**	**16,390**	**16,132**	**15,844**
= Fair Enterprise Value	**11,855**	**9,399**	**10,674**	**10,967**	**12,030**	**12,367**	**13,206**
- Net Debt (Cash)	416	416	416	416	51	-206	-512
- Pension Liabilities	344	344	344	344	361	361	379
- Other	0	0	0	0	0	0	0
- Market value of minorities	1,075	1,075	1,075	1,075	1,075	1,075	1,075
+ Market value of investments	0	0	0	0	0	0	0
= Fair Market Capitalisation	**10,020**	**7,564**	**8,839**	**9,132**	**10,543**	**11,138**	**12,265**
Number of shares, average	161	161	161	161	161	161	161
= Fair value per share (EUR)	**62.16**	**46.92**	**54.83**	**56.65**	**65.40**	**69.09**	**76.08**
premium (-) / discount (+) in %					-29.3 %	-25.3 %	-17.7 %

Sensitivity Fair value per Share (EUR)

	9.53 %	39.01	28.57	33.99	35.24	41.91	44.94	50.30
	8.53 %	44.92	33.25	39.31	40.70	47.90	51.10	56.88
	7.53 %	52.39	39.18	46.04	47.62	55.49	58.90	65.21
WACC	**6.53 %**	**62.16**	**46.92**	**54.83**	**56.65**	**65.40**	**69.09**	**76.08**
	5.53 %	75.46	57.47	66.80	68.95	78.90	82.96	90.90
	4.53 %	94.62	72.67	84.06	86.69	98.35	102.96	112.25
	3.53 %	124.65	96.47	111.10	114.47	128.82	134.29	145.71

- We assume maintenance capex at 2/3 of total capex.
- Minority interest will be deducted at 20x earnings (ca. KB's PE multiple)+ 379.6m for the value of the Bosch put-option

Valuation

	2015	2016	2017	2018	2019e	2020e	2021e
Price / Book	n.a.	n.a.	n.a.	8.7 x	7.7 x	6.5 x	5.6 x
Book value per share ex intangibles	8.38	8.24	8.11	4.76	7.09	9.10	11.35
EV / Sales	n.a.	n.a.	n.a.	2.3 x	2.4 x	2.3 x	2.2 x
EV / EBITDA	n.a.	n.a.	n.a.	12.7 x	12.7 x	12.1 x	11.1 x
EV / EBIT	n.a.	n.a.	n.a.	15.3 x	15.1 x	14.7 x	13.6 x
EV / EBIT adj.*	n.a.	n.a.	n.a.	14.5 x	14.9 x	14.5 x	13.5 x
P / FCF	n.a.	n.a.	n.a.	37.2 x	23.0 x	24.5 x	22.5 x
P / E	n.a.	n.a.	n.a.	22.1 x	21.2 x	21.0 x	20.1 x
P / E adj.*	n.a.	n.a.	n.a.	20.7 x	21.0 x	20.8 x	19.9 x
Dividend Yield	n.a.	n.a.	n.a.	2.2 %	2.4 %	2.4 %	2.5 %
FCF Potential Yield (on market EV)	n.a.	n.a.	n.a.	4.8 %	4.8 %	5.0 %	5.4 %

*Adjustments made for: PPA & one-offs

Company Specific Items

	2015	2016	2017	2018	2019e	2020e	2021e
Order Intake Rail Vehicle Systems	3,158	3,144	3,536	3,798	3,600	3,750	3,900
Book to Bill ratio (RVS)	0.9	1.1	1.1	1.1	1.0	1.0	1.0
Order Backlog (RVS)	2,435	2,601	2,876	3,212	3,228	3,372	3,503
Order Intake Commercial Vehicle Systems	2,511	2,581	3,123	3,208	3,000	3,000	3,200
Book to Bill ratio (CVS)	1.0	1.0	1.1	1.0	0.9	0.9	0.9
Order Backlog (CVS)	996	1,084	1,316	1,364	1,346	1,438	1,528
R&D Expenses	347	328	359	364	405	402	418
R&D Ratio	6.0 %	6.0 %	5.8 %	5.5 %	5.8 %	5.8 %	5.7 %

Consolidated profit & loss

In EUR m	2015	2016	2017	2018	2019e	2020e	2021e
Sales	**5,824**	**5,471**	**6,154**	**6,616**	**6,952**	**6,942**	**7,287**
Change Sales yoy	n.a.	-6.0 %	12.5 %	7.5 %	5.1 %	-0.1 %	5.0 %
Increase / decrease in inventory	-7	-11	39	34	36	36	38
Own work capitalised	19	21	32	48	50	50	53
Total Sales	**5,836**	**5,481**	**6,224**	**6,698**	**7,039**	**7,029**	**7,378**
Material expenses	2,747	2,571	3,010	3,318	3,490	3,457	3,600
Gross profit	**3,088**	**2,910**	**3,214**	**3,380**	**3,549**	**3,572**	**3,778**
Gross profit margin	*53.0 %*	*53.2 %*	*52.2 %*	*51.1 %*	*51.0 %*	*51.4 %*	*51.8 %*
Personnel expenses	1,272	1,272	1,439	1,497	1,550	1,562	1,640
Other operating income	89	83	81	66	111	108	113
Other operating expenses	636	669	741	771	817	784	823
Unfrequent items	0	0	0	0	0	0	0
EBITDA	**1,269**	**1,052**	**1,116**	**1,178**	**1,293**	**1,333**	**1,428**
Margin	*21.8 %*	*19.2 %*	*18.1 %*	*17.8 %*	*18.6 %*	*19.2 %*	*19.6 %*
Depreciation of fixed assets	140	134	143	146	160	176	193
EBITA	**1,129**	**918**	**973**	**1,032**	**1,133**	**1,157**	**1,236**
Amortisation of intangible assets	30	32	69	60	45	56	68
Goodwill amortisation	0	0	0	0	0	0	0
EBIT	**1,099**	**886**	**904**	**972**	**1,088**	**1,101**	**1,167**
Margin	*18.9 %*	*16.2 %*	*14.7 %*	*14.7 %*	*15.7 %*	*15.9 %*	*16.0 %*
EBIT adj.	**1,099**	**886**	**968**	**1,028**	**1,097**	**1,110**	**1,176**
Interest income	22	19	24	20	28	28	29
Interest expenses	29	29	39	54	35	35	36
Other financial income (loss)	-43	-36	-37	-63	-49	-49	-51
EBT	**1,048**	**841**	**852**	**876**	**1,033**	**1,045**	**1,109**
Margin	*18.0 %*	*15.4 %*	*13.9 %*	*13.2 %*	*14.9 %*	*15.1 %*	*15.2 %*
Total taxes	337	274	265	246	294	303	333
Net income from continuing operations	**711**	**567**	**587**	**629**	**738**	**742**	**776**
Income from discontinued operations (net of tax)	0	0	0	0	0	0	0
Net income before minorities	**711**	**567**	**587**	**629**	**738**	**742**	**776**
Minority interest	58	41	52	37	35	31	33
Net income	**653**	**526**	**536**	**593**	**704**	**711**	**744**
Margin	*11.2 %*	*9.6 %*	*8.7 %*	*9.0 %*	*10.1 %*	*10.2 %*	*10.2 %*
Number of shares, average	161	161	161	161	161	161	161
EPS	**4.05**	**3.26**	**3.32**	**3.68**	**4.37**	**4.41**	**4.61**
EPS adj.	4.05	3.26	3.60	3.93	4.41	4.45	4.65

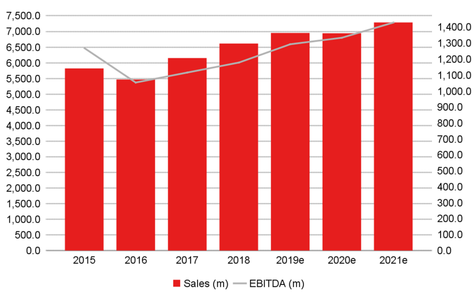
*Adjustments made for: PPA & one-offs

Guidance: Revenue EURm 6,800-7,000; EBITDA margin 18-19%

Financial Ratios

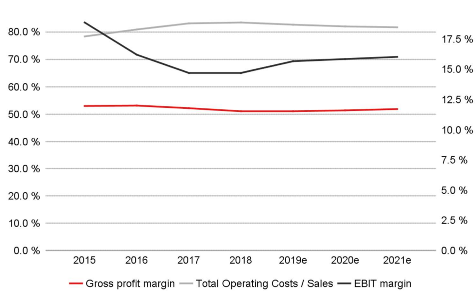
	2015	2016	2017	2018	2019e	2020e	2021e
Total Operating Costs / Sales	78.4 %	81.0 %	83.0 %	83.4 %	82.6 %	82.0 %	81.6 %
Operating Leverage	n.a.	3.2 x	0.2 x	1.0 x	2.3 x	-8.0 x	1.2 x
EBITDA / Interest expenses	43.5 x	36.7 x	28.7 x	21.7 x	37.2 x	38.4 x	39.2 x
Tax rate (EBT)	32.2 %	32.6 %	31.1 %	28.1 %	28.5 %	29.0 %	30.0 %
Dividend Payout Ratio	60.3 %	76.4 %	153.0 %	44.8 %	47.7 %	47.9 %	47.9 %
Sales per Employee	234,073	221,832	228,671	232,525	232,525	232,525	232,525

Sales, EBITDA
in EUR m



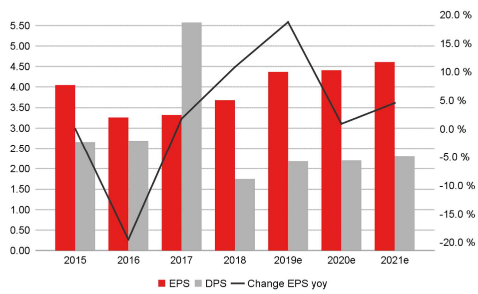
Source: Warburg Research

Operating Performance
in %



Source: Warburg Research

Performance per Share



Source: Warburg Research

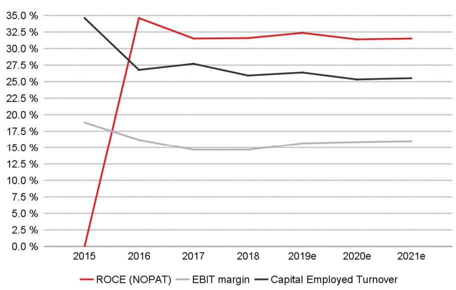
Consolidated balance sheet

In EUR m	2015	2016	2017	2018	2019e	2020e	2021e
Assets							
Goodwill and other intangible assets	334	484	540	735	781	815	841
thereof other intangible assets	95	124	149	337	383	417	443
thereof Goodwill	180	286	300	306	306	306	306
Property, plant and equipment	1,015	1,099	1,116	1,167	1,237	1,304	1,366
Financial assets	16	103	108	77	77	77	77
Other long-term assets	150	135	118	113	113	113	113
Fixed assets	**1,515**	**1,822**	**1,883**	**2,092**	**2,207**	**2,308**	**2,397**
Inventories	626	611	749	836	773	771	810
Accounts receivable	947	971	1,148	1,237	1,295	1,293	1,358
Liquid assets	1,361	1,721	1,600	1,756	2,121	2,379	2,684
Other short-term assets	266	310	348	341	358	357	375
Current assets	**3,200**	**3,614**	**3,845**	**4,170**	**4,547**	**4,801**	**5,227**
Total Assets	**4,715**	**5,435**	**5,727**	**6,262**	**6,754**	**7,109**	**7,624**
Liabilities and shareholders' equity							
Subscribed capital	68	68	68	161	161	161	161
Capital reserve	2	2	1	14	14	14	14
Retained earnings	81	95	107	40	40	40	40
Other equity components	1,533	1,649	1,672	1,287	1,708	2,067	2,455
Shareholders' equity	1,684	1,813	1,848	1,502	1,923	2,282	2,670
Minority interest	154	153	148	105	105	105	105
Total equity	**1,838**	**1,966**	**1,996**	**1,607**	**2,029**	**2,387**	**2,776**
Provisions	914	963	945	951	999	998	1,047
thereof provisions for pensions and similar obligations	329	359	354	344	361	361	379
Financial liabilities (total)	753	1,288	1,310	2,172	2,172	2,172	2,172
thereof short-term financial liabilities	491	531	571	643	643	643	643
Accounts payable	727	754	894	996	991	989	1,038
Other liabilities	483	464	583	536	563	562	590
Liabilities	**2,877**	**3,469**	**3,732**	**4,655**	**4,725**	**4,722**	**4,848**
Total liabilities and shareholders' equity	**4,715**	**5,435**	**5,727**	**6,262**	**6,754**	**7,109**	**7,624**

Financial Ratios

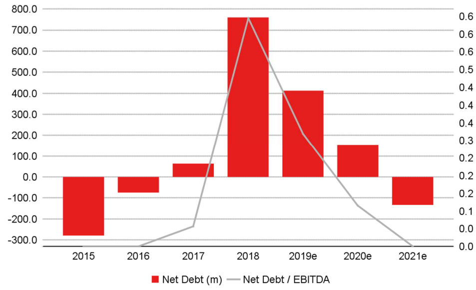
	2015	2016	2017	2018	2019e	2020e	2021e
Efficiency of Capital Employment							
Operating Assets Turnover	3.3 x	3.0 x	3.1 x	2.9 x	3.0 x	2.9 x	2.9 x
Capital Employed Turnover	3.7 x	2.9 x	3.0 x	2.8 x	2.8 x	2.7 x	2.8 x
ROA	43.1 %	28.9 %	28.4 %	28.3 %	31.9 %	30.8 %	31.0 %
Return on Capital							
ROCE (NOPAT)	n.a.	34.6 %	31.5 %	31.6 %	32.4 %	31.4 %	31.5 %
ROE	n.a.	30.1 %	29.3 %	35.4 %	41.1 %	33.8 %	30.0 %
Adj. ROE	n.a.	30.1 %	31.7 %	37.8 %	41.5 %	34.1 %	30.3 %
Balance sheet quality							
Net Debt	-279	-75	64	760	412	154	-133
Net Financial Debt	-608	-433	-290	416	51	-206	-512
Net Gearing	-15.2 %	-3.8 %	3.2 %	47.3 %	20.3 %	6.5 %	-4.8 %
Net Fin. Debt / EBITDA	n.a.	n.a.	n.a.	35.3 %	4.0 %	n.a.	n.a.
Book Value / Share	10.4	11.2	11.5	9.3	11.9	14.2	16.6
Book value per share ex intangibles	8.4	8.2	8.1	4.8	7.1	9.1	11.3

ROCE Development



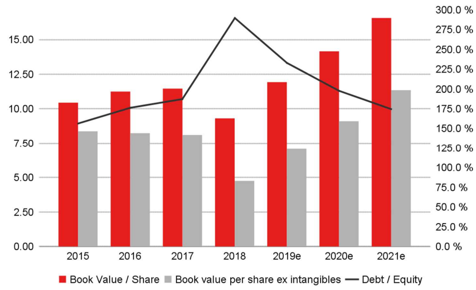
Source: Warburg Research

Net debt
in EUR m



Source: Warburg Research

Book Value per Share
in EUR



Source: Warburg Research

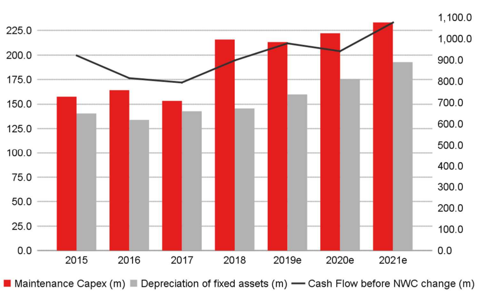
Consolidated cash flow statement

In EUR m	2015	2016	2017	2018	2019e	2020e	2021e
Net income	711	567	587	629	704	711	744
Depreciation of fixed assets	140	134	143	146	160	176	193
Amortisation of goodwill	0	0	0	0	0	0	0
Amortisation of intangible assets	30	32	69	60	45	56	68
Increase/decrease in long-term provisions	-19	54	-45	-10	17	-1	18
Other non-cash income and expenses	59	29	41	74	53	-2	55
Cash Flow before NWC change	**922**	**815**	**794**	**899**	**979**	**941**	**1,077**
Increase / decrease in inventory	34	14	-138	-88	64	1	-38
Increase / decrease in accounts receivable	0	35	-64	-90	-58	2	-64
Increase / decrease in accounts payable	4	-96	87	102	-5	-2	49
Increase / decrease in other working capital positions	0	0	0	-148	-13	0	-13
Increase / decrease in working capital (total)	38	-46	-114	-223	-12	2	-66
Net cash provided by operating activities [1]	**959**	**769**	**680**	**723**	**967**	**943**	**1,011**
Investments in intangible assets	-31	-46	-45	-136	-90	-90	-95
Investments in property, plant and equipment	-205	-200	-185	-235	-229	-243	-255
Payments for acquisitions	-83	-123	-77	-17	0	0	0
Financial investments	-16	79	-27	9	0	0	0
Income from asset disposals	0	0	0	29	0	0	0
Net cash provided by investing activities [2]	**-303**	**-448**	**-280**	**-320**	**-320**	**-333**	**-350**
Change in financial liabilities	7	458	-15	744	0	0	0
Dividends paid	-396	-429	-433	-898	-282	-352	-355
Purchase of own shares	0	0	0	0	0	0	0
Capital measures	0	2	0	-131	0	0	0
Other	-17	10	-12	18	0	0	0
Net cash provided by financing activities [3]	**-406**	**41**	**-460**	**-268**	**-282**	**-352**	**-355**
Change in liquid funds [1]+[2]+[3]	**251**	**362**	**-60**	**135**	**365**	**257**	**306**
Effects of exchange-rate changes on cash	21	10	-72	5	0	0	0
Cash and cash equivalent at end of period	1,339	1,732	1,589	1,719	2,084	2,341	2,647

Financial Ratios

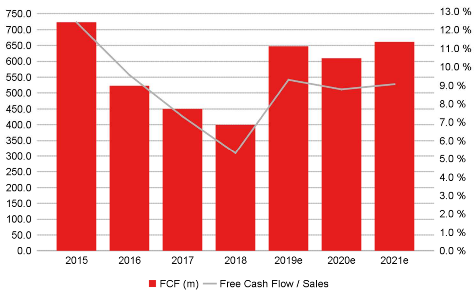
	2015	2016	2017	2018	2019e	2020e	2021e
Cash Flow							
FCF	723	523	450	399	647	609	661
Free Cash Flow / Sales	12.4 %	9.6 %	7.3 %	5.3 %	9.3 %	8.8 %	9.1 %
Free Cash Flow Potential	774	614	697	716	786	808	862
Free Cash Flow / Net Profit	110.8 %	99.3 %	84.0 %	59.3 %	92.0 %	85.7 %	88.9 %
Interest Received / Avg. Cash	n.a.	1.2 %	1.4 %	1.2 %	1.4 %	1.2 %	1.2 %
Interest Paid / Avg. Debt	n.a.	2.8 %	3.0 %	3.1 %	1.6 %	1.6 %	1.7 %
Management of Funds							
Investment ratio	4.1 %	4.5 %	3.7 %	5.6 %	4.6 %	4.8 %	4.8 %
Maint. Capex / Sales	2.7 %	3.0 %	2.5 %	3.3 %	3.1 %	3.2 %	3.2 %
Capex / Dep	138.6 %	148.6 %	108.7 %	180.7 %	156.2 %	143.7 %	134.0 %
Avg. Working Capital / Sales	n.a.	13.5 %	13.1 %	14.9 %	15.5 %	15.5 %	15.1 %
Trade Debtors / Trade Creditors	130.3 %	128.8 %	128.4 %	124.2 %	130.8 %	130.8 %	130.8 %
Inventory Turnover	4.4 x	4.2 x	4.0 x	4.0 x	4.5 x	4.5 x	4.4 x
Receivables collection period (days)	59	65	68	68	68	68	68
Payables payment period (days)	97	107	108	110	104	104	105
Cash conversion cycle (Days)	34	29	38	51	45	45	45

CAPEX and Cash Flow
in EUR m



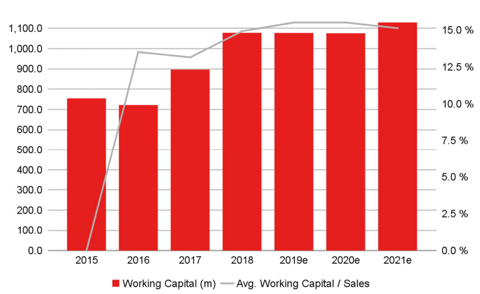
Source: Warburg Research

Free Cash Flow Generation



Source: Warburg Research

Working Capital



Source: Warburg Research

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Company	Disclosure	Link to the historical price targets and rating changes (last 12 months)
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"-"	**Rating suspended:**	The available information currently does not permit an evaluation of the company.

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Rating	Number of stocks	% of Universe
Buy	120	62
Hold	65	33
Sell	3	2
Rating suspended	7	4
Total	**195**	**100**

WARBURG RESEARCH GMBH – ANALYSED RESEARCH UNIVERSE BY RATING …

… taking into account only those companies which were provided with major investment services in the last twelve months.

Rating	Number of stocks	% of Universe
Buy	31	82
Hold	5	13
Sell	0	0
Rating suspended	2	5
Total	**38**	**100**

PRICE AND RATING HISTORY KNORR-BREMSE AG AS OF 14.05.2019

Markings in the chart show rating changes by Warburg Research GmbH in the last 12 months. Every marking details the date and closing price on the day of the rating change.

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