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Jungheinrich AG JUN3 (XDUS) | ★★★

Last Price	Fair Value	Uncertainty	Economic Moat™	Moat Trend™	Stewardship	Industry Group
37.08 EUR	36.00 EUR	Medium	Narrow	Stable	Standard	Industrial Products

Jungheinrich's Forklift and Warehouse Equipment Demand Benefiting From E-Commerce

See Page 2 for the full Analyst Note from 08 Aug 2017

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The primary analyst covering this company does not own its stock.

Research as of 08 Aug 2017
Estimates as of 01 May 2017
Pricing data through 07 Sep 2017
Rating updated as of 07 Sep 2017

Currency amounts expressed with "$" are in U.S. dollars (USD) unless otherwise denoted.

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Investment Thesis 01 May 2017

Forklift manufacturer Jungheinrich should grow well above the GDP rate in its core market, Europe, benefiting from commerce growth. The European Commission forecasts imply nominal GDP growth of around 3.5% over the next two years. We expect Jungheinrich's revenue to grow at 2 times that rate, driven by our expectation that e-commerce will expand by 10% annually through 2020. Increased e-commerce traffic should create demand for new warehouse space that will require forklifts to move goods inside a warehouse's storage and sorting systems.

As the industry pie for forklifts expands, we think Jungheinrich is well placed to take its share of the growth, given its strong niche in the wholesale and retail industries with a special focus in grocery, with customers such as Lidl and Tesco. Because its forklifts are made to order according to the specifications of each warehouse, which can differ in layout, process, and product, Jungheinrich needs to work closely with customers to understand the challenges of each warehouse. This information advantage puts it in a natural position to capture new business from warehouse space expansion in its niche.

The company also offers warehouse automation systems, including its own stacker cranes, as well as third-party equipment, which should benefit from a structural shift toward increased warehouse automation. This includes integrating driverless forklifts that deliver product to various storage and sorting stations within a warehouse. Jungheinrich offers software to manage the product flow within a warehouse, including forklift movements. We expect that the transition to warehouse automation will be gradual, owing to the complexity of fully automating existing warehouses. However, we believe that full automation is still in the early stages, offering a long runway of future growth.

Vital Statistics

Market Cap (EUR Mil)	5,986
52-Week High (EUR)	37.08
52-Week Low (EUR)	24.30
52-Week Total Return %	29.8
YTD Total Return %	37.7
Last Fiscal Year End	31 Dec 2016
5-Yr Forward Revenue CAGR %	7.7
5-Yr Forward EPS CAGR %	10.3
Price/Fair Value	1.03

Valuation Summary and Forecasts

Fiscal Year:	2015	2016	*2017(E)*	*2018(E)*
Price/Earnings	18.7	18.0	*22.2*	*20.0*
EV/EBITDA	9.2	14.1	*17.9*	*16.4*
EV/EBIT	11.8	18.4	*23.1*	*21.0*
Free Cash Flow Yield %	1.8	1.7	*1.6*	*2.1*
Dividend Yield %	1.3	0.9	*0.8*	*0.9*

Financial Summary and Forecasts (EUR Mil)

Fiscal Year:	2015	2016	*2017(E)*	*2018(E)*
Revenue	2,754	3,085	*3,422*	*3,687*
Revenue YoY %	10.3	12.0	*10.9*	*7.8*
EBIT	213	235	*261*	*286*
EBIT YoY %	10.6	10.3	*10.9*	*9.9*
Net Income, Adjusted	138	154	*170*	*189*
Net Income YoY %	9.4	12.2	*10.4*	*10.8*
Diluted EPS	1.35	1.51	*1.67*	*1.85*
Diluted EPS YoY %	9.4	12.2	*10.4*	*10.8*
Free Cash Flow	-13	56	*106*	*121*
Free Cash Flow YoY %	-145.3	-518.4	*89.3*	*14.7*

Historical/forecast data sources are Morningstar Estimates and may reflect adjustments.

Profile

Jungheinrich is Europe's second-largest forklift manufacturer with a niche carved out in the retail and wholesale segment, including a stronghold in supermarkets. The firm was founded in 1953 by Friedrich Jungheinrich, and control of the company remains in his descendants' hands through special voting shares. Globally, the company ranks number three behind Toyota and Kion Group, but nearly 90% of its sales comes from Europe, which still accounts for more than 30% of the global forklift industry production.

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Morningstar Analysis

Jungheinrich's Forklift and Warehouse Equipment Demand Benefiting From E-Commerce 08 Aug 2017

Jungheinrich reported first-half 14% revenue growth and a flat EBIT margin of 7.6% versus year-end 2016. The market for global forklift demand has been exceptionally strong this year, rising in the double digits, and pulling Jungheinrich along with it; nevertheless, we think market demand can continue to grow in the high single digits for the medium term. We see Jungheinrich as a beneficiary of this and forecast high-single-digit revenue growth for the medium term, but with a flattish EBIT margin, gaining only 50 basis points in the next five years. Management increased its 2017 order, revenue, and EBIT guidance by 1%-2%. We were already above previous guidance and are in line with new guidance, so we are not making changes to our forecasts or our EUR 36 fair value estimate. We see Jungheinrich's shares as fairly valued and maintain our narrow moat rating. We prefer Kion Group as a play on forklift growth and warehouse automation.

Globally, the market for forklifts grew 18% in the first half, but that included 30%-40% growth in China and Eastern Europe. Excluding those markets, global forklift demand grew 9%, slightly better than the 7%-8% growth in three of the last four years. We think e-commerce is one of the key drivers behind this above-GDP growth rate and believe it will continue to drive high-single-digit forklift demand growth in the medium term.

The exceptional growth in Eastern Europe was led by a pickup in warehouse space in Russia. We think the Russian market will continue to outgrow the global forklift market in the next few quarters, as there are still a number of big warehouse projects to come on line this year, and in Moscow space is attractively priced with industrial space vacancy rates relatively high at 10%. To put this into perspective, European vacancy rates are just under 6%, and in one of the tightest markets globally, Los Angeles County, vacancy rates for logistics space are just 1%. Globally, we think e-commerce demand for same-day and next-day delivery is pushing warehouses into more expensive urban areas where forklifts and automation equipment can increase warehouse operational efficiency and increase volume/space ratios.

Jungheinrich's warehouse equipment sales rose 44% in the first half. We note that this is a contract-based business with lumpy growth, as the timing of orders booked in the year can be uneven, so we would not expect this level of growth for the full year. Warehouse equipment or "logistics systems" equipment is just 15% of group sales, but we expect it to outpace forklift sales in the medium term as warehouse automation equipment can increase warehouse volume processing efficiency in critical functions, like order picking, by 3-10 times over manual processing. In its second-quarter call, Prologis, one of the leading global companies providing logistics space, said customers are moving into more urban areas and using technology to increase volume in the same space, reaffirming our view. We note the Prologis counts Amazon, FedEx, and Samsung among its customers.

Valuation, Growth and Profitability 01 May 2017

We have raised our fair value estimate for Jungheinrich to EUR 36 from EUR 31 per share, adjusting for the time value of money and our more optimistic view of growth in the company's logistics systems equipment business. We expect European e-commerce to grow by 10% annually through 2020, underpinning our forecasts for Jungheinrich's primary business, selling warehouse forklifts in Europe. As Jungheinrich is the second-largest forklift manufacturer in Europe, demand for its products should expand as retailers and other businesses seek out new warehouse space to accommodate increased e-commerce/online-driven volume. We forecast around 7% revenue growth annually through 2021. Increased truck production volume should give a modest annual boost to the EBIT margin, improving a cumulative 60 basis points from 2016 to 2021 to 8.2%.

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Scenario Analysis

In our bull-case scenario, Jungheinrich shares would be worth EUR 45 per share, with greater revenue growth and margin expansion than our base case. In this scenario, we forecast revenue growth of 8% on average, about 100 basis points above our base case. We think this level of growth would be possible if the company's forklift business were to grow at 7%, 100 basis points above our base case, and if warehouse automation were to grow by twice the rate of the forklift business, or about 14%. The former would require a very robust medium-term expansion in European warehouse space. The second would require Jungheinrich's warehouse automation business to grow at a pace close to what we expect for the industry, a level we do not believe it achieved organically in 2015. Our EBIT margin under this scenario would benefit from volume growth and expand by 240 basis points to 10.1% by 2021.

The valuation for our bear-case scenario is EUR 28 per share, based on the assumption of a significant slowdown in revenue growth from a lacklustre economic environment. Our revenue growth assumption is a modest 4% average rate in this scenario. We would still expect some increase in investment for product development, and with low revenue growth causing manufacturing capacity underutilization, our EBIT margin would contract by 70 basis points to 6.3% by 2021.

Economic Moat

We assign Jungheinrich a narrow moat rating that stems from its well-established brand, customer relationships, intangible assets, and switching costs.

We think Jungheinrich's brand value is clear after 60 years of premium forklift production. It holds a number-two market share position in its core market, Europe, which provides 90% of sales, and a number-three ranking globally. This market share has remained remarkably stable for at least the past 10 years.

The company supports its brand by providing around-the-clock support through its service engineers, who make up about a third of its 14,000 employees. Jungheinrich derives around 28% of revenue from service contracts and spare parts, providing a stable recurring revenue base to support margins and returns. About 70% of its 1 million forklifts in service are on contracts, but that is diluted by about 400,000 trucks that are 10 years old or older and unlikely to be on service contracts.

Since the useful life of a forklift truck is only 10-15 years, depending on the intensity of its usage, the older trucks tend to be operated by smaller businesses that are willing to invest only in piecemeal and low-cost repairs. Looking at just the truck base that is younger than 10 years old, the portion under service contracts would be higher than 70%.

Jungheinrich mainly uses its own direct salesforce, which also offers financing as another form of support. Kion Group, its main competitor, tends to use more third-party distribution, although often exclusive, and this accounts for part of the gap in EBIT margins between the two companies.

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There are two basic categories of forklifts: warehouse and counterbalanced. Warehouse forklifts are used indoors and are primarily electric. Because every warehouse is different in terms of size, internal organization, product handling, and degree of automation, most warehouse trucks are made to order. Eighty percent of Jungheinrich's forklift trucks are warehouse trucks. Counterbalanced trucks are used for heavier loads, can have any engine type, and are used indoors or outdoors.

Premium warehouse trucks, such as those made by Jungheinrich and Kion Group, can be made to order, with variations on engines, forklift lengths, distance from the ground, wheels, materials to reduce wear or energy consumption, and many software-driven features like automatic speed reduction around corners.

We also believe the company's customers have high switching costs due to the level of information sharing and collaboration that comes with forklift purchases. Because Jungheinrich's trucks are made to order, customers must work closely with the manufacturer to explain the challenges that the forklift will need to accommodate, such as narrow aisles, rough flooring, very high shelving, or heavy products. This leads to a degree of investment on behalf of the customer to achieve the right level of modifications. Warehouses usually last for 20-30 years before they are completely overhauled. In that time, forklifts can be upgraded several times during their 10-year average lifespan to take advantage of improvements in energy efficiency or functionality.

Jungheinrich also makes customised forklifts, working with customers to come up with new features that it will then produce in a small series just for that customer at its plant in Luneburg, Germany. The customised trucks can later be sold as a regular series if there is demand. This development with customers enhances Jungheinrich's information advantage over competitors and enables it to offer superior forklifts with more significant value-added features. We think this is the reason behind the company's strong niche in the retail and wholesale sector in Europe. Within this niche, it has a stronghold in the grocery segment, serving customers such as Lidl and Tesco. It supports this niche with its own dedicated team of people to manage customer support.

We think there is also a degree of stickiness with its service contracts, which are often tied to financing contracts and are five years in length. The stickiness comes in the limitations that third parties have in servicing any of the electronic and software-driven features of the forklifts, which creates a dependency on Jungheinrich for most repairs and spare parts. Nearly all of Jungheinrich's products have electrical or software-driven features.

We do not believe that Jungheinrich is well positioned enough to merit a wide moat in the context of the coming structural shift in warehouse management that will require greater automation and integration of forklifts and warehouse automation systems. Here, it has only a partial solution, whereas Kion has a fully integrated and superior offering. We see this shift unfolding over the next several years as warehouses are built and upgraded.

Moat Trend

We think Jungheinrich has a stable trend, with no imminent threats from existing or new competitors disrupting its market share position. The industry has been remarkably stable, but we will be watching for signs of competitive threats from the structural shift toward greater warehouse automation, where Jungheinrich is not as strong as its main competitor, Kion Group.

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Bulls Say/Bears Say

Bulls Say

- E-commerce is still in its early stages in Europe, and Jungheinrich, as the number-two competitor in Europe, should reap the benefits, with earnings growth exceeding that of GDP.
- Jungheinrich's EBIT margin has room to expand and could offer future upside.
- The company's number-three position in forklifts puts it in a better position to develop its warehouse automation business compared with weaker forklift competitors.

Bears Say

- With all the voting shares held by descendants of Jungheinrich's founder, other shareholders have limited means of righting potentially poor capital-allocation practices.
- The company's caution in investing more aggressively in its warehouse automation business could put it at a longer-term disadvantage versus peers.
- Jungheinrich will need to swim upstream to expand its lagging EBIT margins, as the industry is demanding increased investment in software and technology-driven products.

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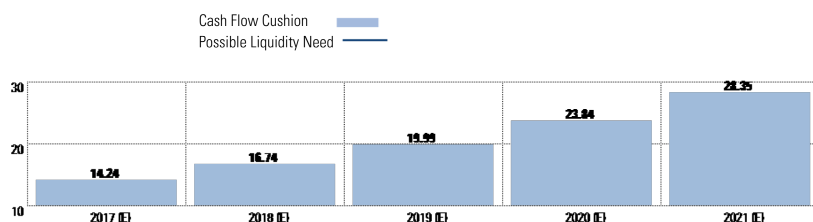
Five Year Adjusted Cash Flow Forecast (EUR Mil)

	2017(E)	2018(E)	2019(E)	2020(E)	2021(E)
Cash and Equivalents (beginning of period)	214	253	301	364	439
Adjusted Available Cash Flow	62	72	87	98	111
Total Cash Available before Debt Service	276	325	388	463	550
Principal Payments	—	—	—	—	—
Interest Payments	-19	-19	-19	-19	-19
Other Cash Obligations and Commitments	—	—	—	—	—
Total Cash Obligations and Commitments	-19	-19	-19	-19	-19

Cumulative Annual Cash Flow Cushion



Adjusted Cash Flow Summary

	EUR Millions	% of Commitments
Beginning Cash Balance	214	220.7
Sum of 5-Year Adjusted Free Cash Flow	430	443.5
Sum of Cash and 5-Year Cash Generation	644	664.2
Revolver Availability	—	—
Asset Adjusted Borrowings (Repayment)	—	—
Sum of Cash, 5-Year Cash Generation, Revolver and Adjustments	644	664.2
Sum of 5-Year Cash Commitments	-97	—

Financial Health

Jungheinrich manages its balance sheet on a conservative basis that gives it ample room to cover its debt and regular investment needs for its business. Net debt/EBITDA for fiscal 2016 was less than 0.5 times. Gross debt totalled EUR 319 million, a sum that we think the company could pay down with its free cash flow within three years if necessary. In addition, it ended the year with EUR 100 million in cash and a medium-term unused credit facility of EUR 225 million. On our forecasts, it should generate at least 100 million in annual free cash flow over the medium term.

Enterprise Risk

We believe a structural shift toward end-to-end warehouse automation will drive demand for warehouse forklifts, Jungheinrich's sweet spot. In warehouse automation, we think Jungheinrich may have more gaps to fill in its product offering, which includes third-party solutions, than some of its larger competitors. We view the company's warehouse automation offering as less competitive than its forklift trucks. Jungheinrich derives less than 20% of its revenue from warehouse automation and has a weaker market share position than in its forklift business, with a top 20 market share position in warehouse automation globally, compared with the number-three spot in forklifts.Jungheinrich may need to step up investments, including acquisitions, to keep pace with competitors' warehouse solutions or risk falling behind. The risk posed by the latter scenario is obvious, a slippage in market share, but with the former, we are more concerned about the potential for high premiums on technology-driven acquisitions.The company also lacks geographic diversification, with a dependency on Europe for nearly 90% of its revenue. Although we still expect European forklift demand to grow because of expanding e-commerce, we expect Asia to become a more significant part of global growth than it has in the past as the nascent e-commerce industry takes off. Without greater exposure to important e-commerce markets like Asia and North

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America, Jungheinrich is likely to see greater volatility in its revenue and earnings growth from cyclical peaks and troughs than some of its more diversified peers.

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Management & Ownership

Management Activity

Name	Position	Shares Held	Report Date*	InsiderActivity
NA	NA	NA	NA	NA

*Represents the date on which the owner's name, position, and common shares held were reported by the holder or issuer.

Fund Ownership

Top Owners	% of Shares Held	% of Fund Assets	Change (k)	Portfolio Date
Groupama Avenir Euro	0.87	2.26	-8	31 Mar 2017
AXA WF Frm Europe Small Cap	0.75	2.73	—	30 Jun 2017
Pioneer Fds Eurpn Potential	0.61	1.94	-32	31 May 2017
BNP Paribas Smallcap Euroland	0.62	2.21	15	30 Jun 2017
Vanguard Total Intl Stock Idx Fund	0.59	0.01	—	30 Jun 2017
Concentrated Holders				
Fourton Odysseus	0.26	4.37	—	30 Jun 2017
Fondita European Small Cap	0.12	3.88	—	31 May 2017
Fondita European Top Picks	0.03	3.80	—	31 May 2017
PineBridge Europe Small Cap Equity	0.11	3.60	—	30 Apr 2017
ASN Duurzaam S&Mid Cap	0.09	3.48	-1	31 Jul 2017

Institutional Transactions

Top 5 Buyers	% of Shares Held	% of Fund Assets	Shares Bought/ Sold (k)	Portfolio Date
Government Pension Fund of Norway - Global	3.54	0.01	778	31 Dec 2013
Fidelity Institutional Asset Management	0.40	1.56	342	31 Mar 2017
Candriam Belgium	0.57	0.74	104	30 Jun 2017
Manning & Napier Advisors, LLC	0.11	0.07	91	31 Jul 2017
KBC Asset Management SA	0.09	0.45	91	31 Dec 2016
Top 5 Sellers				
Deka Investment GmbH	0.03	0.50	-481	31 Mar 2017
Vanguard Investments Australia Ltd	—	0.02	-89	30 Jun 2017
Credit Suisse AG	0.05	0.08	-44	31 Jul 2017
Allianz Nederland Asset Management BV	0.07	0.15	-43	30 Jun 2017
Anima Sgr S.p.A	0.02	0.17	-37	31 Jul 2017

Management 20 Jan 2017

We give Jungheinrich a Standard stewardship rating; however, the company falls short in two areas versus competitors. First, Jungheinrich's voting shares rest exclusively in the hands of its founder's descendants in the form of ordinary shares. Second, the company has a policy of not disclosing the details of management compensation.

On the first point, while the structure presents a greater agency risk for misallocation of capital, this does not appear to be a problem so far. Management is headed by Hans-Georg Frey, who has been at the helm as chairman of the management board since 2007, and Volker Hues, head of finance, since 2009. During their tenures, capital allocation has been cautiously managed, with the company maintaining a small net cash position in most years.

The company holds two classes of shares: ordinary, held by the family, and preferred, which are publicly traded and nonvoting. The dividend payment per share allocation is similar, with the 2016 preferred shares receiving a dividend payment at a 5% premium to the voting ordinary shares.

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Jungheinrich AG JUN3 (XDUS) | ★★★

Last Price	Fair Value	Uncertainty	Economic Moat™	Moat Trend™	Stewardship	Industry Group
37.08 EUR	36.00 EUR	Medium	Narrow	Stable	Standard	Industrial Products

Analyst Notes

Jungheinrich's Sales of Software on Its Connected Forklifts Is Encouraging for Other Industrials 27 Jun 2017
We have three takeaways from narrow-moat Jungheinrich's capital markets day: first, there was some evidence that the Internet of Things for capital goods companies is not purely hype; second, confirmation of our view that Jungheinrich lags Kion Group in warehouse automation equipment; and third, that Jungheinrich's forklift business has higher switching costs than we initially thought. We are making no changes to our EUR 36 fair value estimate.

We hear a lot of capital goods suppliers talking about connecting machines to the Internet for remote monitoring, with the hope of getting software revenue in exchange for enabling customers to do preventive maintenance and "optimise" the performance of the equipment. We have been fairly skeptical, not about the benefits, but about suppliers' ability to charge for software. We believe it will be included in the maintenance offering at no extra cost, and is commoditised by wide availability with little differentiation. So, we were pleasantly surprised to find out Jungheinrich's forklift customers are willing to pay for software.

We estimate the company generates less than 1% of revenue from software and expect that to rise no higher than the low-single digits, but were encouraged that customers are not only willing to share data but see value in the software. The software allows customers to monitor the service cost per truck and electric truck battery usage on a real time basis, making sure drivers don't stick to and wear out just their favourite trucks. This information can be used to tweak the usage of the trucks and lower costs.

Two thirds of the company's forklifts in circulation are under its maintenance contracts with most of those coming from customer leases through Jungheinrich's financing arm. Customers sign five-year leases and have been renewing at 99% rates since the company started leasing in the 1980s, indicating higher retention rates than we had previously thought.

Under its warehouse automation equipment offering, Jungheinrich's current portfolio contains a lot of equipment from third parties that it either resells under its own brand or the OEM's brand. This is in contrast to Kion Group, which produces nearly all of its own equipment. We believe Kion's breadth of product is much broader and its offering more sophisticated. Jungheinrich is just starting to offer some of the equipment that Kion has been offering for years.

At the capital markets day, we saw Jungheinrich's spare parts warehouse in Kaltenkirchen, Germany. This also serves as a testing centre for its warehouse equipment, much like Ocado's Andover warehouse. The warehouse came into operation in 2013 and has equipment from TGW, Kardex (rebranded as Jungheinrich), and Jungheinrich's 2015 acquisition of Mias. We think the fact that it uses so much equipment from third parties, or from its recent acquisition, is an indication that its own offering has been pretty narrow for sometime and is only recently broadening into automated picking solutions that can run large volumes and offer fast pick rates.

Even so, of the four warehouses that we have visited in the past four months, including Ocado's and an eighth-generation Amazon fulfilment centre, we think Jungheinrich's is the most automated, partly helped by the uniformity of the product in the warehouse, but still a credit to its own capabilities. We also think that it will benefit from strong relationships in its forklift business, where it has successfully cross-sold warehouse automation equipment.

Over time, the company expects warehouse equipment to contribute about 17% of revenue by 2020, up from 14.5% currently. This implies a 12% CAGR. To put this into

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perspective, we expect the industry to grow at 10%, as detailed in our Observer "Ready-to-Wearhouse: The Structural Shift Towards Automating Warehouses." So, we think the Jungheinrich's target is possible, but ambitious.

Ocado's Online Grocery Warehouse Equipment Solution Not a Meaningful Threat to Kion Group 07 Jun 2017

We recently visited Ocado's latest-generation warehouse in Andover, United Kingdom, and while impressed, we do not view the company's plans to offer warehouse automation equipment to international online grocers as a meaningful competitive threat to Kion Group. The warehouse is one of the distribution centres for the online grocer, but it is also the "showroom" from which Ocado will try to sell its system to other grocers and a testing centre for new technology. To date, it has signed one software agreement but no equipment deals. We are maintaining our narrow moat rating and EUR 75 fair value estimate for Kion Group.

We think the system's competitive threat is minimal because of its limited record and scope. It is a grocery-specific solution. Given that warehouse designs are highly customised by sector and even geography, it is unlikely to be transferrable to other sectors. Ocado could try to modify it, but the company has an information disadvantage to the incumbent equipment suppliers, which have a long list of reference projects using proven systems in other sectors.

Ocado's system is unproved on outside businesses, and even for its own, it is a relatively new system, still undergoing teething issues being tweaked by its engineers. Buyers of warehouse equipment prefer tried and tested systems to minimise the risk of system-failure related disruptions to warehouse operations. A track record is also important for servicing the equipment, as customers rely on their suppliers for maintenance over the 15- to 20-year lifespan of a warehouse.

Because Ocado has just entered this business with high up-front investments but no revenue yet, customers may question if it will still be in the business and offering maintenance support for the next 15-20 years. For these reasons, we think Ocado will be challenged to sign up a critical mass of customers that will enable it to have the strong reference book of projects usually necessary to secure new contracts.

Ocado seems to recognise this challenge by its willingness to absorb up-front financial risk normally taken on by customers. The planned business model more closely resembles a third-party logistics provider like Kuehne & Nagel than the traditional warehouse equipment suppliers like Kion Group and Jungheinrich. Ocado plans to lease the equipment to the customers, instead of an outright sale, and also provide maintenance. Traditional equipment suppliers sell the equipment outright but also provide the maintenance, which tends to be high margin.

On the other hand, 3PLs buy the equipment for customers whose warehouses they are running, then recoup the cost of this equipment through an amortisation schedule that matches the typical three- to five-year contract. Ocado's Andover system cost GBP 45 million to build, but can be scaled up or down, so the cost to build a system for a customer could be higher or lower. However, we question whether Ocado will be able to price the leasing contract without taking a loss simply because the equipment is unproved and so customers are likely to be more price-sensitive and unwilling to commit to a long-term leasing contract with full payback, in addition to maintenance and software fees.

That Ocado has engineered its own solution is impressive, even more so that the system is on the sophisticated end

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Analyst Notes

of the spectrum of automated picking solutions. Ocado is also using the system itself, so it may have unique insights into online grocery logistics that might provide greater efficiencies than traditional warehouse automation suppliers. Comparing this system with other goods-to-person automated picking solutions, we believe this falls in the middle on throughput capacity with our estimate of picking rates around 400-600 items per hour. The company did not disclose the exact pick rate but said that it was in between the pick-to-light system it uses in its Hatfield facility, which we believe is 200-300, and the 1,000 achieved by a multishuttle.

The system is centered on one enormous piece of equipment that bears similarities to Swisslog's AutoStore, which Ocado has used in its other warehouses. This main equipment consists of a massive cube made of steel beams holding 225,000 trays of inventory in 21,000 columns that are 4-17 tray layers deep. Robots travel around on the top level, taking trays from the top layer and transporting them to a lift system that feeds into picking stations. The capacity of the Andover system is 65,000-70,000 orders per week, but it's running at about a 25% utilisation currently, as it is a newly opened warehouse.

Ocado designed and engineered the hardware and software, including importantly the algorithms, and the robots. All of its hardware was manufactured by third parties, but not traditional warehouse equipment manufacturers. The cube is mainly steel and has few electronics and so did not require a specialist to build. The robots themselves are manufactured by an undisclosed U. K. company and currently cost a few thousand pounds each to manufacture, but the company expects cost to come down over time. Ocado has 40-50 patent families pending on the equipment.

Jungheinrich's Guidance for 2017 Looking Conservative Following 1Q 03 May 2017

Jungheinrich's guidance for 2017 looks conservative to us, as does consensus, following 19% sales and order-book growth in the first quarter. We are already slightly ahead of management's guidance and well above consensus for 2017 revenue and EBIT growth. Guidance for the full year implies 10% revenue and EBIT growth at the high end, falling between our forecast for 11% growth, and consensus of 9%. The first quarter was uncharacteristically strong for forklift sales for the industry and carried Jungheinrich with it. Orders from China were up 46%, boosted by easy comps and government subsidies. We do not expect the same level of growth for the rest of the year. However, with the order book up 19%, this implies at least another quarter of revenue growth well into the double digits, making guidance and consensus look cautious, in our view. We are maintaining our narrow moat rating and EUR 36 fair value estimate.

The warehouse automation business, or logistics systems solutions, in which we estimate Jungheinrich has 3% market share, grew by 50%. This business is contract-based, and so will likely introduce swings in quarterly growth. We expect warehouse automation equipment to grow at 10% annually for the next three years, spurred in part by e-commerce uptake. We believe Jungheinrich, as a top 15 player, should expand this part of its business at the 10% market rate, whereas we expect mid-single-digit growth for its forklift business. The division was helped by a EUR 5 million order from Ikea in Russia, which looks in line with what we believe is their average order size of EUR 3 million-EUR 5 million.

The firm improved its EBIT margin by 20 basis points year over year. For the medium term, we expect the EBIT margin to remain stable at just below 8%, below that of its closest peer, Kion Group. Management indicated that growth in absolute EBIT was the priority now and seems to have no plans to focus exclusively on margin improvement.

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Analyst Notes

Jungheinrich Outgrew the Market in 2016, but We Are Still Looking for Margin Gains 22 Mar 2017

Narrow-moat Jungheinrich outgrew the global market in 2016, helped by its disproportionate exposure to Europe and warehouse trucks--in particular, indoor narrow electric forklifts. Both factors helped it gain 10 basis points of market share in Europe and drive 8% organic revenue growth, but have done little to boost profitability, which still lags that of its closest peer, Kion Group. EBIT margin performance was unimpressive, with a slight 10-basis-point decline over 2015. The margin was at the bottom end of company guidance, while revenue was at the top end. Since 2013, revenue has grown 35%, but the EBIT margin has only managed a 10-basis-point improvement to 7.6%, well below Kion Group at 10%. We think the difference between the two companies is partly explained by Jungheinrich's high exposure to warehouse trucks and the retail food sector, which tends to order forklifts in large volumes, but with fewer premium features. For 2017, the company is guiding for 7%-10% revenue growth and a flat EBIT margin. Overall, the 2016 results and 2017 guidance were in line with our expectations. We expect to make less than a 5% increase to our EUR 31 per share fair value estimate, adjusting for the time value of money, and we view the shares as fairly valued.

Excluding the one-off boost from the MIAS acquisition, warehouse equipment sales grew by 8% on an organic basis to EUR 441 million in 2016, but remain a smaller part of group sales at 14% of the total. However, based on our calculations, Jungheinrich is a top-10 global supplier of warehouse equipment, where we expect a structural shift towards automation to drive long-term industry growth. The company's increased focus on this market is clear from its acquisitions over the past couple of years, in addition to its 2015 decision to create a separate board member role for the segment.

Forklift volume grew by 16%, well above the 7% global market growth and a little better than the 13% growth in Europe, explaining the company's slight market share gain in that region. Over the medium term, we would expect the forklift truck segment to grow by midsingle digits but warehouse equipment to grow by closer to double digits.

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Morningstar Analyst Forecasts

Financial Summary and Forecasts

Fiscal Year Ends in December

Growth (% YoY)	3-Year Hist. CAGR	2014	2015	2016	*Forecast* 2017	2018	5-Year Proj. CAGR
Revenue	*10.5*	9.1	10.3	12.0	*10.9*	*7.8*	*7.7*
EBIT	*10.9*	11.8	10.6	10.3	*10.9*	*9.9*	*9.4*
EBITDA	*11.9*	12.6	10.4	12.7	*10.2*	*8.8*	*8.6*
Net Income	*13.0*	17.6	9.4	12.2	*10.4*	*10.8*	*10.3*
Diluted EPS	*13.0*	17.6	9.4	12.2	*10.4*	*10.8*	*10.3*
Earnings Before Interest, after Tax	*12.4*	-3.1	38.5	5.6	*10.0*	*9.0*	*8.6*
Free Cash Flow	—	-266.5	-145.3	-518.4	*89.3*	*14.7*	*25.1*

Profitability	3-Year Hist. Avg	2014	2015	2016	2017	2018	5-Year Proj. Avg
Operating Margin %	*7.7*	7.7	7.7	7.6	*7.6*	*7.8*	*7.9*
EBITDA Margin %	*9.9*	9.9	9.9	9.9	*9.9*	*10.0*	*10.1*
Net Margin %	*5.0*	5.0	5.0	5.0	*5.0*	*5.1*	*5.3*
Free Cash Flow Margin %	*0.8*	1.2	-0.5	1.8	*3.1*	*3.3*	*3.5*
ROIC %	*17.9*	16.2	20.1	17.5	*17.9*	*18.2*	*18.5*
Adjusted ROIC %	*17.6*	16.1	19.7	16.9	*17.3*	*17.6*	*17.9*
Return on Assets %	*4.4*	4.3	4.3	4.4	*4.6*	*4.9*	*5.1*
Return on Equity %	*15.2*	15.4	15.0	15.1	*15.1*	*15.0*	*14.8*

Leverage	3-Year Hist. Avg	2014	2015	2016	2017	2018	5-Year Proj. Avg
Debt/Capital	*0.24*	0.27	0.24	0.22	*0.21*	*0.19*	*0.17*
Total Debt/EBITDA	*1.19*	1.32	1.20	1.04	*0.95*	*0.87*	*0.81*
EBITDA/Interest Expense	*14.72*	12.74	15.66	15.77	*17.39*	*18.93*	*20.55*

Valuation Summary and Forecasts

	2015	2016	2017(E)	2018(E)
Price/Fair Value	—	0.88	—	—
Price/Earnings	18.7	18.0	*22.2*	*20.0*
EV/EBITDA	9.2	14.1	*17.9*	*16.4*
EV/EBIT	11.8	18.4	*23.1*	*21.0*
Free Cash Flow Yield %	1.8	1.7	*1.6*	*2.1*
Dividend Yield %	1.3	0.9	*0.8*	*0.9*

Key Valuation Drivers

Cost of Equity %	9.0
Pre-Tax Cost of Debt %	5.3
Weighted Average Cost of Capital %	8.5
Long-Run Tax Rate %	30.0
Stage II EBI Growth Rate %	8.0
Stage II Investment Rate %	40.0
Perpetuity Year	15

Additional estimates and scenarios available for download at http://select.morningstar.com.

Discounted Cash Flow Valuation

	EUR Mil	Firm Value (%)	Per Share Value
Present Value Stage I	537	14.1	5.26
Present Value Stage II	1,070	28.1	10.49
Present Value Stage III	2,205	57.9	21.62
Total Firm Value	**3,812**	**100.0**	**37.37**
Cash and Equivalents	352	—	3.45
Debt	-319	—	-3.13
Preferred Stock	-48	—	-0.47
Other Adjustments	-190	—	-1.86
Equity Value	**3,606**	**—**	**35.36**
Projected Diluted Shares	102		
Fair Value per Share (EUR)	**36.00**		

The data in the table above represent base-case forecasts in the company's reporting currency as of the beginning of the current year. Our fair value estimate may differ from the equity value per share shown above due to our time value of money adjustment and in cases where probability-weighted scenario analysis is performed.

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Morningstar Analyst Forecasts

Income Statement (EUR Mil)

Fiscal Year Ends in December

	2014	2015	2016	*Forecast 2017*	*2018*
Revenue	**2,498**	**2,754**	**3,085**	***3,422***	***3,687***
Cost of Goods Sold	1,720	1,903	2,133	*2,366*	*2,549*
Gross Profit	**778**	**851**	**952**	***1,056***	***1,138***
Selling, General & Administrative Expenses	493	535	601	*669*	*718*
Research & Development	44	50	56	*68*	*74*
Other Operating Expense (Income)	-5	-6	-11	*-18*	*-21*
Depreciation & Amortization (if reported separately)	53	59	71	*77*	*81*
Operating Income (ex charges)	**193**	**213**	**235**	***261***	***286***
Restructuring & Other Cash Charges	—	—	—	—	—
Impairment Charges (if reported separately)	—	—	—	—	—
Other Non-Cash (Income)/Charges	—	—	—	—	—
Operating Income (incl charges)	**193**	**213**	**235**	***261***	***286***
Interest Expense	19	17	19	*19*	*19*
Interest Income	2	3	0	*2*	*3*
Pre-Tax Income	**175**	**198**	**216**	***243***	***269***
Income Tax Expense	49	61	61	*73*	*81*
Other After-Tax Cash Gains (Losses)	—	—	—	—	—
Other After-Tax Non-Cash Gains (Losses)	—	—	—	—	—
(Minority Interest)	—	—	—	—	—
(Preferred Dividends)	—	—	—	—	—
Net Income	**126**	**138**	**154**	***170***	***189***
Weighted Average Diluted Shares Outstanding	102	102	102	*102*	*102*
Diluted Earnings Per Share	**1.23**	**1.35**	**1.51**	***1.67***	***1.85***
Adjusted Net Income	126	138	154	*170*	*189*
Diluted Earnings Per Share (Adjusted)	**1.23**	**1.35**	**1.51**	***1.67***	***1.85***
Dividends Per Common Share	0.35	0.40	0.40	*0.44*	*0.50*
EBITDA	**246**	**272**	**306**	***337***	***367***
Adjusted EBITDA	**246**	**272**	**306**	***337***	***367***

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Morningstar Analyst Forecasts

Balance Sheet (EUR Mil)

Fiscal Year Ends in December	2014	2015	2016	*Forecast* 2017	*Forecast* 2018
Cash and Equivalents	301	210	214	*253*	*301*
Investments	125	172	138	*148*	*158*
Accounts Receivable	454	514	600	*666*	*717*
Inventory	299	317	396	*439*	*473*
Deferred Tax Assets (Current)	7	10	6	*6*	*6*
Other Short Term Assets	229	256	273	*273*	*273*
Current Assets	**1,415**	**1,479**	**1,627**	***1,784***	***1,928***
Net Property Plant, and Equipment	393	433	430	*448*	*475*
Goodwill	2	31	35	*35*	*40*
Other Intangibles	66	105	114	*95*	*82*
Deferred Tax Assets (Long-Term)	109	98	106	*106*	*106*
Other Long-Term Operating Assets	1,055	1,202	1,331	*1,331*	*1,331*
Long-Term Non-Operating Assets	—	—	—	—	—
Total Assets	**3,040**	**3,349**	**3,643**	***3,800***	***3,962***
Accounts Payable	188	241	287	*318*	*343*
Short-Term Debt	124	117	104	*104*	*104*
Deferred Tax Liabilities (Current)	8	12	16	*16*	*16*
Other Short-Term Liabilities	561	637	708	*708*	*708*
Current Liabilities	**881**	**1,007**	**1,116**	***1,147***	***1,172***
Long-Term Debt	200	210	216	*216*	*216*
Deferred Tax Liabilities (Long-Term)	9	20	19	*19*	*19*
Other Long-Term Operating Liabilities	1,049	1,085	1,178	*1,178*	*1,178*
Long-Term Non-Operating Liabilities	—	—	—	—	—
Total Liabilities	**2,140**	**2,323**	**2,529**	***2,560***	***2,585***
Preferred Stock	48	48	48	*48*	*48*
Common Stock	54	54	54	*54*	*54*
Additional Paid-in Capital	78	78	78	*78*	*78*
Retained Earnings (Deficit)	781	885	1,000	*1,125*	*1,263*
(Treasury Stock)	—	—	—	—	—
Other Equity	-62	-39	-66	*-66*	*-66*
Shareholder's Equity	**900**	**1,026**	**1,114**	***1,239***	***1,377***
Minority Interest	—	—	—	—	—
Total Equity	**900**	**1,026**	**1,114**	***1,239***	***1,377***

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Jungheinrich AG JUN3 (XDUS) | ★★★

Last Price	Fair Value	Uncertainty	Economic Moat™	Moat Trend™	Stewardship	Industry Group
37.08 EUR	36.00 EUR	Medium	Narrow	Stable	Standard	Industrial Products

Morningstar Analyst Forecasts

Cash Flow (EUR Mil)

Fiscal Year Ends in December				*Forecast*	
	2014	2015	2016	*2017*	*2018*
Net Income	126	138	154	*170*	*189*
Depreciation	43	46	53	*58*	*62*
Amortization	10	13	19	*19*	*19*
Stock-Based Compensation	—	—	—	—	—
Impairment of Goodwill	—	—	—	—	—
Impairment of Other Intangibles	—	—	—	—	—
Deferred Taxes	-24	12	-4	—	—
Other Non-Cash Adjustments	—	—	—	—	—
(Increase) Decrease in Accounts Receivable	-46	-60	-86	*-66*	*-52*
(Increase) Decrease in Inventory	-28	-17	-79	*-43*	*-34*
Change in Other Short-Term Assets	-34	-116	-31	—	*2*
Increase (Decrease) in Accounts Payable	28	53	46	*31*	*25*
Change in Other Short-Term Liabilities	34	77	71	—	—
Cash From Operations	**110**	**144**	**142**	***170***	***210***
(Capital Expenditures)	-96	-98	-72	*-76*	*-86*
Net (Acquisitions), Asset Sales, and Disposals	3	-70	-28	—	*-15*
Net Sales (Purchases) of Investments	59	-17	20	*-10*	*-10*
Other Investing Cash Flows	—	—	—	—	—
Cash From Investing	**-35**	**-185**	**-80**	***-86***	***-111***
Common Stock Issuance (or Repurchase)	—	—	—	—	—
Common Stock (Dividends)	-28	-34	-39	*-45*	*-51*
Short-Term Debt Issuance (or Retirement)	4	-16	-17	—	—
Long-Term Debt Issuance (or Retirement)	47	-1	-3	—	—
Other Financing Cash Flows	—	—	—	—	—
Cash From Financing	**23**	**-51**	**-59**	***-45***	***-51***
Exchange Rates, Discontinued Ops, etc. (net)	-1	0	154	—	—
Net Change in Cash	**98**	**-92**	**158**	***39***	***49***

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Jungheinrich AG JUN3 (XDUS) | ★★★

Last Price	Fair Value	Uncertainty	Economic Moat™	Moat Trend™	Stewardship	Industry Group
37.08 EUR	36.00 EUR	Medium	Narrow	Stable	Standard	Industrial Products

Comparable Company Analysis

These companies are chosen by the analyst and the data are shown by nearest calendar year in descending market capitalization order.

Valuation Analysis

Company/Ticker	Price/Fair Value	Price/Earnings 2016	Price/Earnings 2017(E)	Price/Earnings 2018(E)	EV/EBITDA 2016	EV/EBITDA 2017(E)	EV/EBITDA 2018(E)	Price/Free Cash Flow 2016	Price/Free Cash Flow 2017(E)	Price/Free Cash Flow 2018(E)	Price/Book 2016	Price/Book 2017(E)	Price/Book 2018(E)	Price/Sales 2016	Price/Sales 2017(E)	Price/Sales 2018(E)
KION GROUP AG KGX DEU	0.97	18.4	21.3	17.0	9.8	12.9	10.1	23.2	35.7	24.7	2.3	2.7	2.4	1.0	1.1	1.1
Average		18.4	21.3	17.0	9.8	12.9	10.1	23.2	35.7	24.7	2.3	2.7	2.4	1.0	1.1	1.1
Jungheinrich AG JUN3 DE	**1.03**	**18.0**	**22.2**	**20.0**	**14.1**	**17.9**	**16.4**	**60.3**	**63.9**	**48.1**	**3.8**	**4.8**	**4.3**	**1.4**	**1.7**	**1.6**

Returns Analysis

Company/Ticker	Last Historical Year Total Assets (Mil)	ROIC % 2016	ROIC % 2017(E)	ROIC % 2018(E)	Adjusted ROIC % 2016	Adjusted ROIC % 2017(E)	Adjusted ROIC % 2018(E)	Return on Equity % 2016	Return on Equity % 2017(E)	Return on Equity % 2018(E)	Return on Assets % 2016	Return on Assets % 2017(E)	Return on Assets % 2018(E)	Dividend Yield % 2016	Dividend Yield % 2017(E)	Dividend Yield % 2018(E)
KION GROUP AG KGX DEU	11,359 EUR	25.3	23.6	26.5	10.0	9.6	11.3	11.3	12.1	14.3	2.8	3.0	4.2	1.3	1.0	1.4
Average		25.3	23.6	26.5	10.0	9.6	11.3	11.3	12.1	14.3	2.8	3.0	4.2	1.3	1.0	1.4
Jungheinrich AG JUN3 DE	**3,643** EUR	**17.5**	**17.9**	**18.2**	**16.9**	**17.3**	**17.6**	**15.1**	**15.1**	**15.0**	**4.4**	**4.6**	**4.9**	**0.9**	**0.8**	**0.9**

Growth Analysis

Company/Ticker	Last Historical Year Revenue (Mil)	Revenue Growth % 2016	Revenue Growth % 2017(E)	Revenue Growth % 2018(E)	EBIT Growth % 2016	EBIT Growth % 2017(E)	EBIT Growth % 2018(E)	EPS Growth % 2016	EPS Growth % 2017(E)	EPS Growth % 2018(E)	Free Cash Flow Growth % 2016	Free Cash Flow Growth % 2017(E)	Free Cash Flow Growth % 2018(E)	Dividend/Share Growth % 2016	Dividend/Share Growth % 2017(E)	Dividend/Share Growth % 2018(E)
KION GROUP AG KGX DEU	5,587 EUR	9.6	44.2	7.0	4.4	43.2	20.9	10.2	26.8	25.4	-661.1	-119.6	11.3	—	3.9	42.5
Average		9.6	44.2	7.0	4.4	43.2	20.9	10.2	26.8	25.4	-661.1	-119.6	11.3	—	3.9	42.5
Jungheinrich AG JUN3 DE	**3,085** EUR	**12.0**	**10.9**	**7.8**	**10.3**	**10.9**	**9.9**	**12.2**	**10.4**	**10.8**	**-518.4**	**89.3**	**14.7**	**—**	**10.6**	**12.8**

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Jungheinrich AG JUN3 (XDUS) | ★★★

Last Price	Fair Value	Uncertainty	Economic Moat™	Moat Trend™	Stewardship	Industry Group
37.08 EUR	36.00 EUR	Medium	Narrow	Stable	Standard	Industrial Products

Comparable Company Analysis

These companies are chosen by the analyst and the data are shown by nearest calendar year in descending market capitalization order.

Profitability Analysis

Company/Ticker	Last Historical Year Net Income (Mil)	Gross Margin % 2016	2017(E)	2018(E)	EBITDA Margin % 2016	2017(E)	2018(E)	Operating Margin % 2016	2017(E)	2018(E)	Net Margin % 2016	2017(E)	2018(E)	Free Cash Flow Margin % 2016	2017(E)	2018(E)
KION GROUP AG KGX DEU	296 EUR	27.8	30.0	29.5	12.4	11.9	14.2	9.0	9.0	10.1	5.3	4.9	6.0	4.4	3.2	4.3
Average		27.8	30.0	29.5	12.4	11.9	14.2	9.0	9.0	10.1	5.3	4.9	6.0	4.4	3.2	4.3
Jungheinrich AG JUN3 DE	**154** EUR	**30.9**	**30.9**	**30.9**	**9.9**	**9.9**	**10.0**	**7.6**	**7.6**	**7.8**	**5.0**	**5.0**	**5.1**	**2.3**	**2.7**	**3.4**

Leverage Analysis

Company/Ticker	Last Historical Year Total Debt (Mil)	Debt/Equity % 2016	2017(E)	2018(E)	Debt/Total Cap % 2016	2017(E)	2018(E)	EBITDA/Interest Exp. 2016	2017(E)	2018(E)	Total Debt/EBITDA 2016	2017(E)	2018(E)	Assets/Equity 2016	2017(E)	2018(E)
KION GROUP AG KGX DEU	3,183 EUR	125.8	93.5	76.1	55.7	48.3	43.2	3.8	4.4	5.8	4.6	3.3	2.4	4.5	3.6	3.3
Average		125.8	93.5	76.1	55.7	48.3	43.2	3.8	4.4	5.8	4.6	3.3	2.4	4.5	3.6	3.3
Jungheinrich AG JUN3 DE	**319** EUR	**28.7**	**25.8**	**23.2**	**22.3**	**20.5**	**18.8**	**15.8**	**17.4**	**18.9**	**1.0**	**0.9**	**0.9**	**3.3**	**3.1**	**2.9**

Liquidity Analysis

Company/Ticker	Market Cap (Mil)	Cash per Share 2016	2017(E)	2018(E)	Current Ratio 2016	2017(E)	2018(E)	Quick Ratio 2016	2017(E)	2018(E)	Cash/Short-Term Debt 2016	2017(E)	2018(E)	Payout Ratio % 2016	2017(E)	2018(E)
KION GROUP AG KGX DEU	9,128 EUR	2.71	9.75	8.41	0.88	1.21	1.26	0.63	0.93	0.96	0.95	3.58	3.22	32.3	24.1	25.0
Average		2.71	9.75	8.41	0.88	1.21	1.26	0.63	0.93	0.96	0.95	3.58	3.22	32.3	24.1	25.0
Jungheinrich AG JUN3 DE	**5,986** EUR	**2.10**	**2.48**	**2.95**	**1.46**	**1.56**	**1.65**	**1.10**	**1.17**	**1.24**	**2.06**	**2.43**	**2.90**	**26.4**	**26.5**	**27.0**

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Research Methodology for Valuing Companies

Overview
At the heart of our valuation system is a detailed projection of a company's future cash flows, resulting from our analysts' research. Analysts create custom industry and company assumptions to feed income statement, balance sheet, and capital investment assumptions into our globally standardized, proprietary discounted cash flow, or DCF, modeling templates. We use scenario analysis, in-depth competitive advantage analysis, and a variety of other analytical tools to augment this process. Moreover, we think analyzing valuation through discounted cash flows presents a better lens for viewing cyclical companies, high-growth firms, businesses with finite lives (e.g., mines), or companies expected to generate negative earnings over the next few years. That said, we don't dismiss multiples altogether but rather use them as supporting cross-checks for our DCF-based fair value estimates. We also acknowledge that DCF models offer their own challenges (including a potential proliferation of estimated inputs and the possibility that the method may miss short-term market-price movements), but we believe these negatives are mitigated by deep analysis and our long-term approach.

Morningstar's equity research group ("we", "our") believes that a company's intrinsic worth results from the future cash flows it can generate. The Morningstar Rating for stocks identifies stocks trading at a discount or premium to their intrinsic worth—or fair value estimate, in Morningstar terminology. Five-star stocks sell for the biggest risk-adjusted discount to their fair values, whereas 1-star stocks trade at premiums to their intrinsic worth.

Four key components drive the Morningstar rating: (1) our assessment of the firm's economic moat, (2) our estimate of the stock's fair value, (3) our uncertainty around that fair value estimate and (4) the current market price. This process ultimately culminates in our single-point star rating.

1. Economic Moat
The concept of an economic moat plays a vital role not only in our qualitative assessment of a firm's long-term investment potential, but also in the actual calculation of our fair value estimates. An economic moat is a structural feature that allows a firm to sustain excess profits over a long period of time. We define economic profits as returns on invested capital (or ROIC) over and above our estimate of a firm's cost of capital, or weighted average cost of capital (or WACC). Without a moat, profits are more susceptible to competition. We have identified five sources of economic moats: intangible assets, switching costs, network effect, cost advantage, and efficient scale.

Companies with a narrow moat are those we believe are more likely than not to achieve normalized excess returns for at least the next 10 years. Wide-moat companies are those in which we have very high confidence that excess returns will remain for 10 years, with excess returns more likely than not to remain for at least 20 years. The longer a firm generates economic profits, the higher its intrinsic value. We believe low-quality, no-moat companies will see their normalized returns gravitate toward the firm's cost of capital more quickly than companies with moats.

To assess the sustainability of excess profits, analysts perform ongoing assessments of the moat trend. A firm's moat trend is positive in cases where we think its sources of competitive advantage are growing stronger; stable where we don't anticipate changes to competitive advantages over the next several years; or negative when we see signs of deterioration.

2. Estimated Fair Value
Combining our analysts' financial forecasts with the firm's economic moat helps us assess how long returns on invested capital are likely to exceed the firm's cost of capital. Returns of firms with a wide economic moat rating are assumed to fade to the perpetuity period over a longer period of time than the returns of narrow-moat firms, and both will fade slower than no-moat firms, increasing our estimate of their intrinsic value.

Our model is divided into three distinct stages:

Stage I: Explicit Forecast
In this stage, which can last five to 10 years, analysts make full financial statement forecasts, including items such as revenue, profit margins, tax rates, changes in working-capital accounts, and capital spending. Based on these projections, we calculate earnings before interest, after taxes (EBI) and the net new investment (NNI) to derive our annual free cash flow forecast.

Stage II: Fade
The second stage of our model is the period it will take the company's return on new invested capital—the return on capital of the next dollar invested ("RONIC")—to decline (or rise) to its cost of capital. During the Stage II period, we use a formula to approximate cash flows in lieu of explicitly modeling the income statement, balance sheet, and cash flow statement as we do in Stage I. The length of the second stage depends on the strength of the company's economic moat. We forecast this period to last anywhere from one year (for companies with no economic moat) to 10–15 years or more (for wide-moat companies). During this period, cash flows are forecast using four assumptions: an average growth rate for EBI over the period, a normalized investment rate, average return on new invested capital (RONIC), and the number of years until perpetuity, when excess returns cease. The investment rate and return on new invested capital decline until a perpetuity value is calculated. In the case of firms that do not earn their cost of capital, we assume marginal ROICs rise to the firm's cost of capital (usually attributable to less reinvestment), and we may truncate the second stage.

Stage III: Perpetuity
Once a company's marginal ROIC hits its cost of capital, we calculate a continuing value, using a standard perpetuity formula. At perpetuity, we assume that any growth or decline or investment in the business neither creates nor destroys value and that any new investment provides a return in line with estimated WACC.

Because a dollar earned today is worth more than a dollar earned tomorrow, we discount our projections of cash flows in stages I, II, and III to arrive at a total pres-

Morningstar Research Methodology for Valuing Companies

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ent value of expected future cash flows. Because we are modeling free cash flow to the firm—representing cash available to provide a return to all capital providers—we discount future cash flows using the WACC, which is a weighted average of the costs of equity, debt, and preferred stock (and any other funding sources), using expected future proportionate long-term, market-value weights.

3. Uncertainty around that fair value estimate
Morningstar's Uncertainty Rating captures a range of likely potential intrinsic values for a company and uses it to assign the margin of safety required before investing, which in turn explicitly drives our stock star rating system. The Uncertainty Rating represents the analysts' ability to bound the estimated value of the shares in a company around the Fair Value Estimate, based on the characteristics of the business underlying the stock, including operating and financial leverage, sales sensitivity to the overall economy, product concentration, pricing power, and other company-specific factors.

Analysts consider at least two scenarios in addition to their base case: a bull case and a bear case. Assumptions are chosen such that the analyst believes there is a 25% probability that the company will perform better than the bull case, and a 25% probability that the company will perform worse than the bear case. The distance between the bull and bear cases is an important indicator of the uncertainty underlying the fair value estimate.

Our recommended margin of safety widens as our uncertainty of the estimated value of the equity increases. The more uncertain we are about the estimated value of the equity, the greater the discount we require relative to our estimate of the value of the firm before we would recommend the purchase of the shares. In addition, the uncertainty rating provides guidance in portfolio construction based on risk tolerance.

Our uncertainty ratings for our qualitative analysis are low, medium, high, very high, and extreme.

- **Low:** margin of safety for 5-star rating is a 20% discount and for 1-star rating is 25% premium.
- **Medium:** margin of safety for 5-star rating is a 30% discount and for 1-star rating is 35% premium.
- **High:** margin of safety for 5-star rating is a 40% discount and for 1-star rating is 55% premium.
- **Very High:** margin of safety for 5-star rating is a 50% discount and for 1-star rating is 75% premium.
- **Extreme:** Stock's uncertainty exceeds the parameters we have set for assigning the appropriate margin of safety.

4. Market Price
The market prices used in this analysis and noted in the report come from exchange on which the stock is listed which we believe is a reliable source.

For more detail information about our methodology, please go to http://global.morningstar.com/equitydisclosures

Morningstar Star Rating for Stocks
Once we determine the fair value estimate of a stock, we compare it with the stock's current market price on a daily basis, and the star rating is automatically re-calculated at the market close on every day the market on which the stock is listed is open. Our analysts keep close tabs on the companies they follow, and, based on thorough and ongoing analysis, raise or lower their fair value estimates as warranted.

Please note, there is no predefined distribution of stars. That is, the percentage of stocks that earn 5 stars can fluctuate daily, so the star ratings, in the aggregate, can serve as a gauge of the broader market's valuation. When there are many 5-star stocks, the stock market as a whole is more undervalued, in our opinion, than when very few companies garner our highest rating.

We expect that if our base-case assumptions are true the market price will converge on our fair value estimate over time, generally within three years (although it is impossible to predict the exact time frame in which market prices may adjust).

Our star ratings are guideposts to a broad audience and individuals must consider their own specific investment goals, risk tolerance, tax situation, time horizon, income needs, and complete investment portfolio, among other factors.

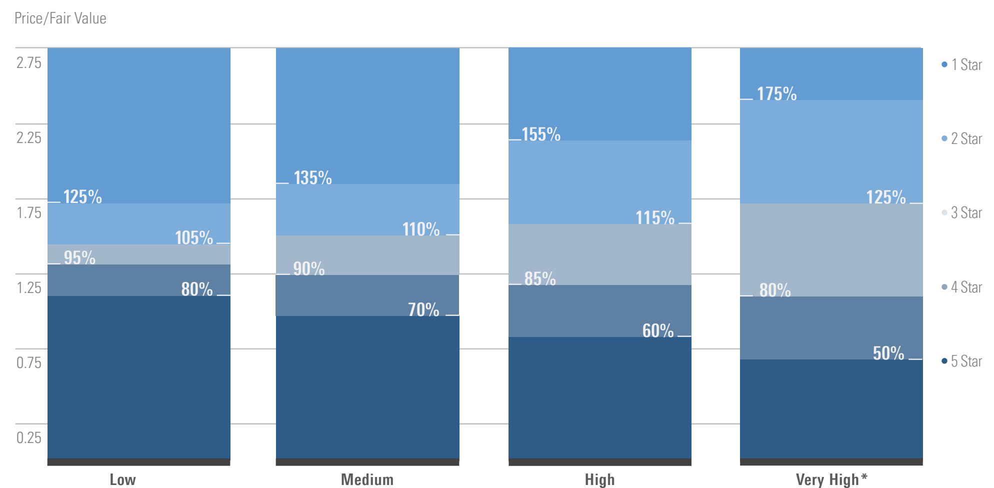
The Morningstar Star Ratings for stocks are defined below:

Five Stars ★★★★★
We believe appreciation beyond a fair risk-adjusted return is highly likely over a multiyear time frame. Scenario analysis developed by our analysts indicates that the current market price represents an excessively pessimistic outlook, limiting downside risk and maximizing upside potential.

Four Stars ★★★★
We believe appreciation beyond a fair risk-adjusted return is likely.

Three Stars ★★★
Indicates our belief that investors are likely to receive a fair risk-adjusted return (approximately cost of equity).

Morningstar Research Methodology for Valuing Companies



* Occasionally a stock's uncertainty will be too high for us to estimate, in which case we label it Extreme.

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Two Stars ★★
We believe investors are likely to receive a less than fair risk-adjusted return.

One Star ★
Indicates a high probability of undesirable risk-adjusted returns from the current market price over a multiyear time frame, based on our analysis. Scenario analysis by our analysts indicates that the market is pricing in an excessively optimistic outlook, limiting upside potential and leaving the investor exposed to Capital loss.

Other Definitions:

Last Price: Price of the stock as of the close of the market of the last trading day before date of the report.

Stewardship Rating: Represents our assessment of management's stewardship of shareholder capital, with particular emphasis on capital allocation decisions. Analysts consider companies' investment strategy and valuation, financial leverage, dividend and share buyback policies, execution, compensation, related party transactions, and accounting practices. Corporate governance practices are only considered if they've had a demonstrated impact on shareholder value. Analysts assign one of three ratings: "Exemplary," "Standard," and "Poor." Analysts judge stewardship from an equity holder's perspective. Ratings are determined on an absolute basis. Most companies will receive a Standard rating, and this is the default rating in the absence of evidence that managers have made exceptionally strong or poor capital allocation decisions.

Quantitative Valuation: Using the below terms, intended to denote the relationship between the security's Last Price and Morningstar's quantitative fair value estimate for that security.

- ►**Undervalued:** Last Price is below Morningstar's quantitative fair value estimate.
- ►**Farily Valued:** Last Price is in line with Morningstar's quantitative fair value estimate.
- ►**Overvalued:** Last Price is above Morningstar's quantitative fair value estimate.

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37.08 EUR	36.00 EUR	Medium	Narrow	Stable	Standard	Industrial Products

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KION GROUP AG KGX (XETR) | ★★★

Last Price	Fair Value	Uncertainty	Economic Moat™	Moat Trend™	Stewardship	Industry Group
77.51 EUR	80.00 EUR	Medium	Narrow	Stable	Standard	Truck Manufacturing

Kion's 2Q Shows Margin Improvement and a Pickup in Revenue on Dematic; Shares Still Attractive

See Page 2 for the full Analyst Note from 26 Jul 2017

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Research as of 26 Jul 2017
Estimates as of 03 Jul 2017
Pricing data through 07 Sep 2017
Rating updated as of 07 Sep 2017

Currency amounts expressed with "$" are in U.S. dollars (USD) unless otherwise denoted.

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Investment Thesis 18 Jan 2017

As a market leader in forklift manufacturing, Kion is already well positioned to benefit from growing e-commerce. Given this, combined with its recent Dematic acquisition, we think the company will offer attractive long-term revenue growth and increasing returns. Despite rapid growth, e-commerce still accounts for only a small portion of global retail sales, just 8% in the United States and near 14% in China. The low penetration levels suggest a long runway for growth, as we believe forklift sales will naturally follow the expansion of warehouses needed to support an e-commerce supply chain.

Kion and Dematic's respective leading market share positions in forklifts and warehouse automation secure dominance in a complementary product set that could increase the combined company's importance to customers over time. Eventually, we think Kion and Dematic will be able to offer a one-stop software-driven solution that combines the management of forklifts with automation systems. Given that warehouse automation is still in its early stages, we think Kion has an opportunity to gain critical early-mover ground with the addition of Dematic's solutions. This could offer upside to our current revenue growth outlook.

On its own, Kion has been consolidating plants and modernising its own manufacturing facilities, leading to near-term margin improvements and earnings growth acceleration. We think the company previously operated with a bloated cost structure, and current management has done a good job of streamlining the business. Robust volume growth over the longer term should also increase operating efficiencies, boosting the company's longer-term operating income margin and returns on invested capital.

Vital Statistics

Market Cap (EUR Mil)	9,128
52-Week High (EUR)	77.61
52-Week Low (EUR)	48.10
52-Week Total Return %	44.9
YTD Total Return %	48.2
Last Fiscal Year End	31 Dec 2016
5-Yr Forward Revenue CAGR %	13.9
5-Yr Forward EPS CAGR %	20.5
Price/Fair Value	0.97

Valuation Summary and Forecasts

Fiscal Year:	2015	2016	*2017(E)*	*2018(E)*
Price/Earnings	17.7	18.4	*21.3*	*17.0*
EV/EBITDA	11.1	9.8	*12.9*	*10.1*
EV/EBIT	14.7	13.5	*17.1*	*14.2*
Free Cash Flow Yield %	6.9	4.3	*2.8*	*4.1*
Dividend Yield %	1.2	1.3	*1.0*	*1.4*

Financial Summary and Forecasts (EUR Mil)

Fiscal Year:	2015	2016	*2017(E)*	*2018(E)*
Revenue	5,098	5,587	*8,057*	*8,624*
Revenue YoY %	9.0	9.6	*44.2*	*7.0*
EBIT	483	504	*722*	*872*
EBIT YoY %	9.0	4.4	*43.2*	*20.9*
Net Income, Adjusted	257	296	*392*	*513*
Net Income YoY %	5.9	15.1	*32.5*	*30.8*
Diluted EPS	2.60	2.87	*3.64*	*4.56*
Diluted EPS YoY %	6.1	10.2	*26.8*	*25.4*
Free Cash Flow	317	-1,780	*348*	*387*
Free Cash Flow YoY %	-12.5	-661.1	*-119.6*	*11.3*

Historical/forecast data sources are Morningstar Estimates and may reflect adjustments.

Profile

Kion Group is the number two forklift truck manufacturer globally, after Toyota, and a leading global warehouse automation equipment supplier. Headquartered in Germany, 60% of its revenue comes from the sale of new trucks and maintenance services. Another roughly 25%, and growing portion, comes from warehouse automation equipment under its Dematic division, which caters to sectors such as e-commerce, third-party logistics, and supermarkets. Its forklift trucks and warehouse equipment service the same end markets.

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Morningstar Analysis

Kion's 2Q Shows Margin Improvement and a Pickup in Revenue on Dematic; Shares Still Attractive 26 Jul 2017

Kion's second-quarter results surprised the more bearish side of consensus on revenue growth and EBIT margin expansion. This year has been tricky for the market to digest the company's quarterly results as it is the first full year of consolidation of Dematic (Kion's warehouse automation equipment business), which has a lumpier revenue flow compared with the forklift business. One generates single orders in the thousands, the other often in the millions. For the full year, we remain at the high end of consensus on group revenue and EBIT and expect further improvement in warehouse automation sales and EBIT margin expansion. We believe the shares are still attractive and maintain our EUR 80 fair value estimate.

Forklift sales benefited from double-digit global market demand with both Kion and the market growing 15% in the second quarter. This is an exceptionally strong year for forklift market growth, partially benefiting from demand for internal combustion engine forklifts in China, where demand is up 30% plus. We do not expect this level to hold, as we believe it is driven by short-term government subsidies. Forklift sales contribute 70% of Kion's group revenue, but we expect the contribution to shrink to 60% over the medium-term with higher growth at Dematic driven by the early stage of warehouse automation and our view that Dematic is the industry leader and will take share from competitors with less developed automation equipment.

Second-quarter sales of warehouse automation equipment picked up 23% sequentially (given the recent consolidation, year-over-year comparisons are not meaningful). We think third quarter will be even stronger, as most warehouses want equipment installations completed before the peak season--November through to the first quarter.

Group adjusted EBIT margin was up 30 basis points year-over-year in the first half with further expansion likely before year-end, as the Monterray plant comes fully on line.

The Dematic acquisition pulls together two business servicing the same customers, and the benefits from this overlap are starting to come through and will become key to the company increasing switching costs with customers. Kion has started to integrate sales of service contracts for both forklifts and warehouse equipment, enabling customers to simplify service administration. Next year, we expect the company to begin selling end-to-end warehouse systems with forklifts and warehouse equipment run under a single software layer, increasing traceability of products within the warehouse.

Valuation, Growth and Profitability 02 Jul 2017

We are increasing our fair value estimate for Kion Group to EUR 80 from EUR 75 per share, while retaining our narrow moat rating, and believe the shares are attractively valued. We recently attended the capital markets day of one of its competitors, Jungheinrich, where it was clear that Dematic's automation equipment offering has a much broader and more sophisticated range. We believe this will enable it to more aggressively take market share than our previous expectations. We believe Dematic is further along in its development of new products and has a larger library of project experience to sharpen its algorithms than most of its competitors. Prior experience and robust predictive algorithms are both key to being invited to tender for and win major warehouse automation projects.

Breaking down our forecast change, we previously forecast Dematic to grow medium-term revenue at a 11% CAGR, just above our 10% base case sector forecast for warehouse equipment (ex forklifts). This implied a market share gain of 70 basis points 15.7% by 2022 from 2017. We now forecast a 13.7% CAGR, implying a market share gain of 260 basis points to 17.6% by 2022. We note, market share figures are not disclosed by the company, but reflect our own analysis

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based on the financials of the top 18 suppliers.

While this promises to be strong year for forklift growth, we have slightly lowered our medium-term forklift revenue forecasts for Kion, as we believe a portion of the forklifts used inside warehouses will be replaced by conveyor belt systems over time. Given that most warehouses are still fully manually operated, we expect cannibalisation to be gradual. Our forklift medium term revenue forecast CAGR declines to 3.9% from 4.9%. The net effect is our medium-term group revenue CAGR increases to 7.3% from 6.9%.

We expect group operating income margins to increase from 9.0% in 2016 to 11.9% in 2022. Strong volume growth, an ongoing manufacturing footprint optimisation program, and an increasing portion of software-driven revenue should all improve the company's operating margins.

Given the strong expected growth in volumes, we also model in a capacity increase in 2021 and 2022, with capital expenditure/sales rising to 3.5% from 3.0%-3.3% in the previous years. Our capital expenditure and R&D assumptions both increase following the Dematic acquisition to accommodate new product development and manufacturing.

Scenario Analysis

Our bear- and bull-case scenarios for Kion Group contrast market environments where warehouse automation fails to take off and forklift growth stalls against one with rapid conversion of warehouse operations to include some automation equipment, but with little cannibalisation effect on forklifts. Global e-commerce and e-procurement trends will be a significant influence to the realisation of either scenario.

Our bull-case scenario reflects potential revenue synergies and suggests a fair value estimate of EUR 100 per share. Our long-term revenue growth forecast for the forklift business increases from lowsingle digits to mid single digits, and for the warehouse equipment (or supply chain solutions) the increase would be to high double digit growth from mid double digit growth. Our medium-term EBIT margins for both divisions would be 50 to 100 basis points higher than our base case.

In our bear-case scenario, we model in sluggish demand from a weaker global economic environment, with forklift truck sales growing at just 1% and warehouse equipment growing at midsingle digits. Group revenue growth would more than half to 3% from our base case scenario. Operating income margin 200-500 basis points lower than our base scenario due to lower volume expectations. Our fair value estimate in this scenario would be EUR 60 per share.

Economic Moat

We believe that switching costs underpin Kion Group's narrow economic moat, as a high level of reliance on customisation, financing, and service agreements supports customer stickiness. The Dematic acquisition will also bring similarly moaty qualities, as products tend to be tightly

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integrated with customer supply-chain processes and generate significant service revenue.

Kion also manufactures Linde forklifts, one of the oldest and arguably most premier brands, driven by a technology that its competitors have yet to perfectly copy. Excluding Dematic, we believe Linde Material Handling contributes two thirds of company revenue and 80% of operating income, while the Still brand and other businesses make up the remainder.

Of the more than 1 million forklifts sold in the world per year, 15% are sold by the Kion Group. Globally, the firm has held the number-two market share position since at least 2003. In Europe, the world's third-largest forklift market, it is the number-one manufacturer.

Market shares are remarkably stable at the higher end of the forklift market, with the number-one, number-two and number-three positions held respectively by Toyota, Kion, and Jungheinrich for more than a decade. We estimate that these three combined accounted for 45% of the industry's global unit sales in 2015. In Europe, Kion dominates with 35% market share, followed by Jungheinrich at 22%. Europe accounts for 83% of Kion on a stand-alone basis and 68% when combined with its recent acquisition of Dematic.

The market share stability stems primarily from two sources: maintenance contracts and customisation. Customers often take maintenance contracts and mainly purchase original spare parts. Service revenue (maintenance and spare parts) makes up around 25% of Kion Group's revenue. Service revenue yields high operating income margins of around 20%, or double the group level. Kion's business model creates a natural base of demand for service contracts, as it offers finance lease contracts that come with obligatory service contracts, both lasting five years on average. On a group level, about half of Kion Group's new trucks are sold with financing contracts. Although financing agreements do ensure a regular flow of service contracts, service agreements are not limited to finance customers. At least three fourths of the Kion's forklifts in Western Europe are serviced by the company itself.

Kion is able to achieve this high rate of service attachment because company software is needed to perform vehicle diagnostics, and many of Kion's forklift trucks contain a high proportion of proprietary spare parts. For example, its Linde brand manufactures a line of premium trucks that use hydrostatic drives. The drive eliminates the need for brakes, gear shifts, and a transmission, but all of the parts are proprietary. This drive was invented in 1960 and offers two key advantages. First, eliminating the brakes enables precision handling, allowing the truck operator to move in 1-millimetre increments. Depressing the truck's pedals compresses hydraulic fluid that, when forced through a closed loop in the drive, turns the wheels forward or backward, depending on which pedal is depressed. With no pressure on the pedals, the fluid and truck do not move.

Second, the elimination of the other traditional components, such as the gear shift and transmission, means fewer components wear or break down, enabling longer times in between servicing. Kion has used third-party testing to prove that its hydrostatic drive forklifts save operational time and energy. When unloading 15 road trucks, a Linde truck takes 1.7 hours less using the Linde hydrostatic drive than with a competitor's more conventional forklift truck. The total cost of ownership could be as much as 20% lower for the Linde trucks, owing to saved time and energy, as well as fewer spare parts.

Kion and other premium forklift manufacturers deliver new forklifts on a made-to-order basis from its customers. The choices to customise a Linde forklift to accommodate the variety of warehouse configurations and products, as well

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KION GROUP AG KGX (XETR) | ★★★

Last Price	Fair Value	Uncertainty	Economic Moat™	Moat Trend™	Stewardship	Industry Group
77.51 EUR	80.00 EUR	Medium	Narrow	Stable	Standard	Truck Manufacturing

Morningstar Analysis

as operator preferences, can include up to 6,000 different options, more than some of its competitors. For example, a wheelbase could be made lower or a standing platform made slightly shorter to accommodate tight spaces. Its customers are spread across multiple industries, with logistics as the largest (18% of 2015 revenue) followed by food (11%), metals (11%), automotive (9%), and chemicals (8%). This customisation increases customer stickiness, as replacement models would have to be tweaked and trialed to make sure that loading and unloading time efficiencies were not compromised by the switch to a new vendor. When existing customers are ready to replace or upgrade their forklifts, Kion already knows what specifications can offer the greatest efficiencies.

Driver preferences are also important. Drivers who spend hours a day in the trucks become accustomed to ergonomic and comfort features of certain brands, such as lower levels of noise or vibration, adjustable seats, lumbar cushions, or extra foot space, which minimise fatiguing effects and long-term discomfort.

Kion's key intangible asset is the Linde Material Handling brand. Linde and Jungheinrich started making forklifts in Europe around the same time, in the middle of the 20th century, but Linde managed to secure a 10%-plus market share lead over its closest competitor by offering better technology and a wider variety of trucks, as well as securing exclusive contracts with dealers in major markets. Jungheinrich focused primarily on indoor electric forklifts, which naturally limits its market share, as warehouses require both indoor and outdoor forklifts, not just for loading and unloading deliveries, but also for transport between buildings.

Kion spends about 2.5% of its revenue on research and development, about 50 basis points more than Jungheinrich. Close work with customers can have a multiplicative effect on R&D, giving the company greater insight into future needs that a competitor would struggle to attain. Aside from the hydrostatic drive, Linde has introduced other firsts in the industry, such as using fuel cells and lithium-ion batteries to power its forklifts.

To distribute its products, Kion uses a mix of third-party-dealer exclusive contracts, its own direct salesforce, and dealers who also offer competitor products. In its core market of Europe, it relies mainly on exclusive dealership arrangements and direct sales.

Kion's recent acquisition, Dematic, offers supply-chain automation: automated storage, conveyor, palletising, and picker systems. Its clients include Fedex, Amazon, Tesco, and Wal-Mart. Dematic has a number-one market share position in the U.S. and is number three in Europe and globally. Its products are integrated with its customers' warehouses, creating sticky relationships. It also derives around 25% of its sales from service revenue.

We think Kion also has a cost advantage in Europe, where its sales and service network cannot be easily replicated by a new entrant.

Moat Trend

We think Kion Group has a stable trend rating but see clear potential drivers for increasing switching costs strengthening Kion's moat. These are not yet material or visible; therefore, we have opted for a stable trend for the moment. In 2014, Kion Group introduced a new fleet-management software system. We do not think sales of the software or penetration of its customer base is material yet, but we will be looking for progress in this new product group.

Additionally, with the recent acquisition of Dematic, Kion has an opportunity to integrate its forklifts (likely favouring

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its driverless forklift line) with Dematic's systems to offer software-driven one-stop solutions. However, we would not expect these sales to become possible immediately, given the time necessary to integrate the products. We also think takeup would be very gradual, as switching to a new warehouse automation system is a large, expensive project that comes from new builds or major upgrades, and warehouse automation systems therefore enjoy much longer sales cycles than forklifts alone.

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Bulls Say/Bears Say

Bulls Say

- Kion and Dematic's respective leading market share positions and complementary products should increase both market share and the combined company's importance to customers.
- With Dematic, Kion is ideally positioned to benefit from a structural shift to greater warehouse automation, offering a mid-single-digit revenue growth rate opportunity for the next several years.
- On its own, Kion has been consolidating plants and modernising its own manufacturing facilities, leading to near-term margin improvements and earnings growth acceleration.

Bears Say

- Structural shifts toward greater automation in warehouse management open the door for possible market share shifts if competitors are able to come up with superior systems.
- Warehouse systems and forklifts are purchased at two different stages, making it more challenging to gain revenue synergies from offering both products.
- Differences in Kion and Dematic's products and geographic focus will make it difficult to extract significant cost synergies, particularly in its manufacturing footprint.

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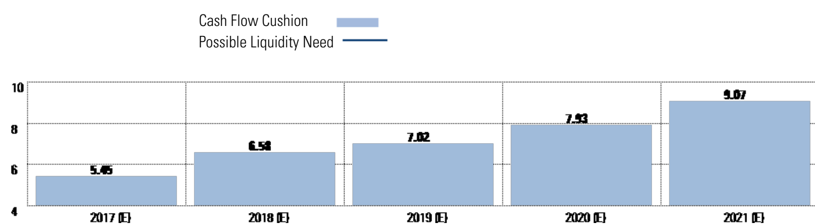
Five Year Adjusted Cash Flow Forecast (EUR Mil)

	2017(E)	2018(E)	2019(E)	2020(E)	2021(E)
Cash and Equivalents (beginning of period)	280	1,052	947	906	927
Adjusted Available Cash Flow	920	344	396	444	428
Total Cash Available before Debt Service	1,199	1,396	1,342	1,350	1,355
Principal Payments	—	—	—	—	—
Interest Payments	-220	-212	-191	-170	-149
Other Cash Obligations and Commitments	—	—	—	—	—
Total Cash Obligations and Commitments	-220	-212	-191	-170	-149

Cumulative Annual Cash Flow Cushion



Adjusted Cash Flow Summary

	EUR Millions	% of Commitments
Beginning Cash Balance	280	29.7
Sum of 5-Year Adjusted Free Cash Flow	2,531	268.4
Sum of Cash and 5-Year Cash Generation	2,811	298.0
Revolver Availability	—	—
Asset Adjusted Borrowings (Repayment)	—	—
Sum of Cash, 5-Year Cash Generation, Revolver and Adjustments	2,811	298.0
Sum of 5-Year Cash Commitments	-943	—

Financial Health

We think Kion's balance sheet leaves little room for further leverage, but expect the company's strong cash flow generation to lead to a less risky level of debt by 2018. In our model, the Dematic merger increases the company's net debt/EBITDA to 4 from below 1 in 2015. We forecast the metric to drop below 2 by the end of 2018. Interest coverage also deteriorates with the merger, declining from 3 in 2015 to 2 in 2016. We forecast an increase to 4 by 2018. During our explicit 10-year forecast period, we expect annual free cash flow of EUR 400 million-EUR 800 million. This should enable the company to quickly reduce some of the EUR 3 billion debt that it assumed for the acquisition.

Enterprise Risk

Kion Group's acquisition of Dematic presents operational risks that could diminish the expected future value of the acquisition. The Dematic takeover is a sizable one, adding 40% to Kion's revenue base. It also increases Kion's exposure to the Americas, in the U.S., from 5% to 20% and leads it down a new product path with the expansion into automated warehouse management systems. If executed well, the Dematic acquisition makes a lot of sense. The product portfolios and geographic exposure of the two companies complement each other and offer opportunity for increased growth. However, as with any acquisition, in order for Kion to reap the benefits, it will need to overcome cultural and operational differences and, importantly, foster cooperation on research and development. We have factored in an increase in research and development spend to support efforts to integrate and develop the two product lines.We expect Kion Group to continue to make small acquisitions to acquire developing warehouse automation technology, mostly from niche companies and startups. However, we cannot dismiss the temptation for the company to bite off more than it can chew with a large acquisition that is automation-related but not complementary to its core. This is not our base case as we believe the recent

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Dematic acquisition completes the company's medium-term strategy and offers plenty of growth opportunity.

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Management & Ownership

Management Activity

Name	Position	Shares Held	Report Date*	InsiderActivity
NA	NA	NA	NA	NA

*Represents the date on which the owner's name, position, and common shares held were reported by the holder or issuer.

Fund Ownership

Top Owners	% of Shares Held	% of Fund Assets	Change (k)	Portfolio Date
DWS Deutschland	0.83	0.96	—	30 Jun 2017
Lazard International Strategic Eq Port	0.82	1.09	618	30 Jun 2017
Oddo Avenir Europe	0.72	2.35	78	31 Jul 2017
DWS Investa	0.81	1.65	-50	30 Jun 2017
Fondak	0.80	2.66	—	31 May 2017
Concentrated Holders				
Multi Stars SICAV - Alexander	0.01	5.70	10	30 Jun 2017
Menara Capital SICAV	—	4.62	—	30 Jun 2017
First Trust Germany AlphaDEX® Fund	0.08	4.43	—	11 Aug 2017
Smith & Williamson European Equity Fund	0.02	4.14	—	30 Jun 2017
Putnam Global Industrial Fund	0.03	4.05	15	30 Jun 2017

Institutional Transactions

Top 5 Buyers	% of Shares Held	% of Fund Assets	Shares Bought/ Sold (k)	Portfolio Date
Lazard Asset Management LLC	0.82	1.09	618	30 Jun 2017
Principal Life Insurance Co	0.23	0.02	254	31 Dec 2016
Fundlogic SAS	0.27	3.27	233	31 Jan 2017
Deka Investment GmbH	0.24	0.33	230	31 Mar 2017
Crux Asset Management Limited	0.74	2.60	163	31 May 2017
Top 5 Sellers				
Invesco Asset Management Deutschland GmbH	0.01	0.47	-176	31 Mar 2017
Vanguard Investments Australia Ltd	—	0.08	-118	30 Jun 2017
Dimensional Fund Advisors LP	0.44	0.08	-85	30 Jun 2017
Lux-Investment Advisors SA	0.02	0.35	-76	31 Mar 2017
BlackRock Advisors LLC	—	0.66	-63	30 Jun 2017

Management 18 Jan 2017

Founded by Carl von Linde, the famous German scientist and entrepreneur, the company became officially part of the Linde Group (industrial gases) in 1929. The company was sold to a private equity consortium in 2006 and rebranded as Kion Group. The private equity owners sold a 25% stake to Weichai Power, a state-owned Chinese automotive and equipment manufacturer, in 2012 and then sold an additional stake with Kion's IPO in 2013. Under Chinese accounting rules, Weichai was able to consolidate Kion when it became its largest shareholder in 2014. Today, Weichai Power owns 40.2% of the company's shares, with nearly 60% of Kion shares held in free float. Weichai has signed an agreement not to increase its stake to 50% or more before June 2018. The benefits to further increasing its stake are not obvious, with Weichai already benefiting from consolidation and having no clear market overlap with Kion.

We do not view the Weichai ownership stake as a risk to the Kion Group from a corporate governance or capital-allocation standpoint. Weichai manufactures heavy-duty engines used in, for example, buses, trucks, and ships. The company's relationship with Kion has a modest influence on three areas. First, Weichai holds three of the 16 seats on the Kion supervisory board. Second, Kion pays an annual fee of EUR 125,000 to Weichai as a consulting fee. Weichai supports Kion in getting access to Chinese customers, such as ensuring that Kion is included as a bidder on major contracts. Third, Weichai manufactures heavy-duty engines, one of which Kion uses for its economy Baoli line of models. Weichai had to bid for this engine contract in a competitive process.

Kion's current CEO, Gordon Riske, has been with the company since 2007 and at the helm as CEO since 2008. His experience prior to that includes near 20 years at Kuka, a German robotics company. Under Riske's stewardship, the company has been consolidating and modernising its

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manufacturing footprint, improving gross margins by 400 basis points from 2010 to 2014. This also increased the company's returns on invested capital. We think the Dematic acquisition was a smart move to position the company for future growth and changing customer demand. Both companies service the same end markets and have complementary geographic leadership positions. Their products combined have the potential to offer customers end-to-end warehouse management systems.

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Analyst Notes

Increasing Kion Group FVE to EUR 80 from EUR 75; Shares Attractively Valued 02 Jul 2017

We are increasing our fair value estimate for Kion Group to EUR 80 from EUR 75 per share, while retaining our narrow moat rating, and believe the shares are attractively valued. We recently attended the capital markets day of one of its competitors, Jungheinrich, where it was clear that Dematic's automation equipment offering has a much broader and more sophisticated range. We believe this will enable it to more aggressively take market share than we had previously expected. We believe Dematic is further along in its development of new products and has a larger library of project experience to sharpen its algorithms than most of its competitors. Prior experience and robust predictive algorithms are both key to being invited to tender for and win major warehouse automation projects.

Breaking down our forecast change, we previously forecast Dematic to grow medium-term revenue at a 11% CAGR, just above our 10% base-case sector forecast for warehouse equipment (ex forklifts). This implied a market share gain of 70 basis points 15.7% by 2022 from 2017. We now forecast a 13.7% CAGR, implying a market share gain of 260 basis points to 17.6% by 2022. We note, market share figures are not disclosed by the company, but reflect our own analysis based on the financials of the top 18 suppliers.

While this promises to be strong year for forklift growth, we have slightly lowered our medium-term forklift revenue forecasts for Kion, as we believe a portion of the forklifts used inside warehouses will be replaced by conveyor belt systems over time. Given that most warehouses are still fully manually operated, we expect cannibalisation to be gradual. Our forklift medium-term revenue forecast CAGR declines to 3.9% from 4.9%.

The net effect is our medium-term group revenue CAGR increases to 7.3% from 6.9%, while our EBIT margins assumptions have not materially changed. The portion of warehouse equipment on our new forecast increases to 40% in 2022 from 30% in 2017.

Jungheinrich's Sales of Software on Its Connected Forklifts Is Encouraging for Other Industrials 27 Jun 2017

We have three takeaways from narrow-moat Jungheinrich's capital markets day: first, there was some evidence that the Internet of Things for capital goods companies is not purely hype; second, confirmation of our view that Jungheinrich lags Kion Group in warehouse automation equipment; and third, that Jungheinrich's forklift business has higher switching costs than we initially thought. We are making no changes to our EUR 36 fair value estimate.

We hear a lot of capital goods suppliers talking about connecting machines to the Internet for remote monitoring, with the hope of getting software revenue in exchange for enabling customers to do preventive maintenance and "optimise" the performance of the equipment. We have been fairly skeptical, not about the benefits, but about suppliers' ability to charge for software. We believe it will be included in the maintenance offering at no extra cost, and is commoditised by wide availability with little differentiation. So, we were pleasantly surprised to find out Jungheinrich's forklift customers are willing to pay for software.

We estimate the company generates less than 1% of revenue from software and expect that to rise no higher than the low-single digits, but were encouraged that customers are not only willing to share data but see value in the software. The software allows customers to monitor the service cost per truck and electric truck battery usage on a real time basis, making sure drivers don't stick to and wear out just their favourite trucks. This information can be used to tweak the usage of the trucks and lower costs.

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Analyst Notes

Two thirds of the company's forklifts in circulation are under its maintenance contracts with most of those coming from customer leases through Jungheinrich's financing arm. Customers sign five-year leases and have been renewing at 99% rates since the company started leasing in the 1980s, indicating higher retention rates than we had previously thought.

Under its warehouse automation equipment offering, Jungheinrich's current portfolio contains a lot of equipment from third parties that it either resells under its own brand or the OEM's brand. This is in contrast to Kion Group, which produces nearly all of its own equipment. We believe Kion's breadth of product is much broader and its offering more sophisticated. Jungheinrich is just starting to offer some of the equipment that Kion has been offering for years.

At the capital markets day, we saw Jungheinrich's spare parts warehouse in Kaltenkirchen, Germany. This also serves as a testing centre for its warehouse equipment, much like Ocado's Andover warehouse. The warehouse came into operation in 2013 and has equipment from TGW, Kardex (rebranded as Jungheinrich), and Jungheinrich's 2015 acquisition of Mias. We think the fact that it uses so much equipment from third parties, or from its recent acquisition, is an indication that its own offering has been pretty narrow for sometime and is only recently broadening into automated picking solutions that can run large volumes and offer fast pick rates.

Even so, of the four warehouses that we have visited in the past four months, including Ocado's and an eighth-generation Amazon fulfilment centre, we think Jungheinrich's is the most automated, partly helped by the uniformity of the product in the warehouse, but still a credit to its own capabilities. We also think that it will benefit from strong relationships in its forklift business, where it has successfully cross-sold warehouse automation equipment.

Over time, the company expects warehouse equipment to contribute about 17% of revenue by 2020, up from 14.5% currently. This implies a 12% CAGR. To put this into perspective, we expect the industry to grow at 10%, as detailed in our Observer "Ready-to-Wearhouse: The Structural Shift Towards Automating Warehouses." So, we think the Jungheinrich's target is possible, but ambitious.

Ocado's Online Grocery Warehouse Equipment Solution Not a Meaningful Threat to Kion Group 07 Jun 2017

We recently visited Ocado’s latest-generation warehouse in Andover, United Kingdom, and while impressed, we do not view the company’s plans to offer warehouse automation equipment to international online grocers as a meaningful competitive threat to Kion Group. The warehouse is one of the distribution centres for the online grocer, but it is also the "showroom" from which Ocado will try to sell its system to other grocers and a testing centre for new technology. To date, it has signed one software agreement but no equipment deals. We are maintaining our narrow moat rating and EUR 75 fair value estimate for Kion Group.

We think the system’s competitive threat is minimal because of its limited record and scope. It is a grocery-specific solution. Given that warehouse designs are highly customised by sector and even geography, it is unlikely to be transferrable to other sectors. Ocado could try to modify it, but the company has an information disadvantage to the incumbent equipment suppliers, which have a long list of reference projects using proven systems in other sectors.

Ocado’s system is unproved on outside businesses, and even for its own, it is a relatively new system, still undergoing teething issues being tweaked by its engineers. Buyers of

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warehouse equipment prefer tried and tested systems to minimise the risk of system-failure related disruptions to warehouse operations. A track record is also important for servicing the equipment, as customers rely on their suppliers for maintenance over the 15- to 20-year lifespan of a warehouse.

Because Ocado has just entered this business with high up-front investments but no revenue yet, customers may question if it will still be in the business and offering maintenance support for the next 15-20 years. For these reasons, we think Ocado will be challenged to sign up a critical mass of customers that will enable it to have the strong reference book of projects usually necessary to secure new contracts.

Ocado seems to recognise this challenge by its willingness to absorb up-front financial risk normally taken on by customers. The planned business model more closely resembles a third-party logistics provider like Kuehne & Nagel than the traditional warehouse equipment suppliers like Kion Group and Jungheinrich. Ocado plans to lease the equipment to the customers, instead of an outright sale, and also provide maintenance. Traditional equipment suppliers sell the equipment outright but also provide the maintenance, which tends to be high margin.

On the other hand, 3PLs buy the equipment for customers whose warehouses they are running, then recoup the cost of this equipment through an amortisation schedule that matches the typical three- to five-year contract. Ocado's Andover system cost GBP 45 million to build, but can be scaled up or down, so the cost to build a system for a customer could be higher or lower. However, we question whether Ocado will be able to price the leasing contract without taking a loss simply because the equipment is unproved and so customers are likely to be more price-sensitive and unwilling to commit to a long-term leasing contract with full payback, in addition to maintenance and software fees.

That Ocado has engineered its own solution is impressive, even more so that the system is on the sophisticated end of the spectrum of automated picking solutions. Ocado is also using the system itself, so it may have unique insights into online grocery logistics that might provide greater efficiencies than traditional warehouse automation suppliers. Comparing this system with other goods-to-person automated picking solutions, we believe this falls in the middle on throughput capacity with our estimate of picking rates around 400-600 items per hour. The company did not disclose the exact pick rate but said that it was in between the pick-to-light system it uses in its Hatfield facility, which we believe is 200-300, and the 1,000 achieved by a multishuttle.

The system is centered on one enormous piece of equipment that bears similarities to Swisslog's AutoStore, which Ocado has used in its other warehouses. This main equipment consists of a massive cube made of steel beams holding 225,000 trays of inventory in 21,000 columns that are 4-17 tray layers deep. Robots travel around on the top level, taking trays from the top layer and transporting them to a lift system that feeds into picking stations. The capacity of the Andover system is 65,000-70,000 orders per week, but it's running at about a 25% utilisation currently, as it is a newly opened warehouse.

Ocado designed and engineered the hardware and software, including importantly the algorithms, and the robots. All of its hardware was manufactured by third parties, but not traditional warehouse equipment manufacturers. The cube is mainly steel and has few electronics and so did not require a specialist to build. The robots themselves are manufactured by an undisclosed U. K. company and currently cost a few thousand pounds each

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Last Price	Fair Value	Uncertainty	Economic Moat™	Moat Trend™	Stewardship	Industry Group
77.51 EUR	80.00 EUR	Medium	Narrow	Stable	Standard	Truck Manufacturing

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to manufacture, but the company expects cost to come down over time. Ocado has 40-50 patent families pending on the equipment.

With Kion's Capital Increase Out of the Way, We Are Confident the Company Can Meet Its Targets 23 May 2017
Kion's 8.55% capital increase yesterday should bring its debt in line with the company's target medium-term levels, and we would not expect any further capital increases or large acquisitions in the near term. Given that warehouse automation technology is still evolving, especially on robotic hand-picking solutions, we expect the company to continue investing in small acquisitions funded through free cash flow. We don't expect another deal the size of Dematic, which pushed net debt/EBITDA to well over 4 times in 2016, as Dematic was transformative, enabling Kion to enter the warehouse automation equipment space. We are maintaining our EUR 75 fair value estimate and narrow moat rating.

The capital increase was expected, as management has been talking since the end of 2016 about a potential equity issuance to help reduce the Dematic-acquisition-related debt. The shares were placed at a tiny (0.2%) premium to Monday's close, but this is still about 1% dilutive, based on our fair value estimate. On our forecasts, this gets them to their medium-term 2 times net debt/EBITDA target by the end of the year. Management had board authorisation to issue 10% in total, so while they could place the rest, they are unlikely to do so, because last night's placing gets them to their target.

We remain confident that the company can meet its full-year guidance and will take market share over the long term. The logistics systems book/bill ratio in the first quarter was 0.96. However, guidance implies a pickup in orders, with a full-year book/bill of 1.06-1.07 for the segment.

In the past, about 60% of the revenue in this segment has come from service contract revenue (25%), where their attachment rates are close to 90%. Roughly another 35% of revenue comes from the previous year's order book (~35%). This is likely to remain the case, which means that about 60% of the order book each year is fairly secure from the start of the year.

Kion Group remains on our Best Ideas List. In our recent report "Ready to Wearhouse: The Structural Shift Towards Automating Warehouses," we discuss why Kion is likely to take share and how the logistic equipment business is a moaty space to be in. At the group level, we expect the ROICs to increase from 10% in 2016 to 14% in 2021. In the same time frame, we forecast EBIT margins going from 10% to 12.3% as the company's new logistics systems plants' utilisation rates pick up.

Kion's Warehouse Equipment Gets Off to Modest Start but Should Pick Up; Shares Undervalued 27 Apr 2017
Kion Group's first-quarter forklift sales grew strongly with a tailwind of a double-digit jump in industrywide orders, while logistics (warehouse) equipment orders got off to a more modest start with a book/bill below 1, at 0.96. Group reported revenue growth is rather meaningless, given its distortion by the Dematic warehouse equipment supplier acquisition at the end of 2016. We think the market is probably disappointed with the warehouse equipment order book, but we do not see it as an issue, given that warehouse equipment sales are based on long-term contracts and naturally lumpy. Guidance implies a pickup in logistics equipment book/bill to a range of 1.06-1.07, which we view as achievable. In terms of profit, the group-level EBIT margin improved 30 basis points year over year to 8.4%. We are maintaining our narrow moat rating and EUR 75 fair value estimate. We view the shares as trading at attractive levels.

Given its 15- to 20-year relationships with large global warehouse customers, we believe Dematic, which is also the leader in warehouse equipment, has a decent window

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on long-term equipment demand. Dematic has been adding production capacity for its equipment, which is almost purely focused on automation, with a new plant in Mexico, which should be fully operational this year, and more recently the announcement of new capacity in the Czech Republic. In the latter, the company will produce automatic storage and retrieval multi-shuttles. These are premium pieces of equipment that can cost tens of millions of euros and are used to improved speed and accuracy in storage and order picking, one of the most time-intensive and costly warehouse functions.

The capacity ramp-up has led to short-term margin dilution with current group EBIT margin at 8.4%, below the 9.5% achieved in 2015 before the Dematic acquisition. However, we expect margin expansion to just under 10% by year-end as the Mexico plant comes on line.

Kion remains on our Best Ideas list. We view Kion Group as one of the most attractive investment opportunities in the European industrials sector, as it is the largest supplier in warehouse equipment and will benefit from the structural shift towards automating warehouse equipment. E-commerce, same-day delivery demands, rising warehouse equipment rents, and skilled labour shortages are all long-term drivers that will create demand for the company's automation equipment. In the medium term, we expect 7% top-line growth and nearly 300 basis points in EBIT margin expansion, which should help the company's return on invested capital increase to 14% from 10% in 2016.

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Morningstar Analyst Forecasts

Financial Summary and Forecasts

Fiscal Year Ends in December

Growth (% YoY)	3-Year Hist. CAGR	2014	2015	2016	*Forecast* *2017*	*2018*	*5-Year Proj. CAGR*
Revenue	*7.5*	4.1	9.0	9.6	*44.2*	*7.0*	*13.9*
EBIT	*6.5*	6.3	9.0	4.4	*43.2*	*20.9*	*20.5*
EBITDA	*9.6*	4.9	15.5	8.6	*37.8*	*27.7*	*19.5*
Net Income	*18.9*	37.9	5.9	15.1	*32.5*	*30.8*	*22.6*
Diluted EPS	*10.1*	14.2	6.1	10.2	*26.8*	*25.4*	*20.5*
Earnings Before Interest, after Tax	*3.3*	-26.2	37.9	8.4	*25.4*	*26.0*	*17.2*
Free Cash Flow	*-264.5*	-9.2	-12.5	-661.1	*-119.6*	*11.3*	—

Profitability	3-Year Hist. Avg	2014	2015	2016	*2017*	*2018*	*5-Year Proj. Avg*
Operating Margin %	*9.3*	9.5	9.5	9.0	*9.0*	*10.1*	*10.8*
EBITDA Margin %	*12.3*	11.9	12.6	12.4	*11.9*	*14.2*	*14.6*
Net Margin %	*5.2*	5.2	5.1	5.3	*4.9*	*6.0*	*6.5*
Free Cash Flow Margin %	*-6.0*	7.8	6.2	-31.9	*4.3*	*4.5*	*4.9*
ROIC %	*34.2*	32.5	44.7	25.3	*23.6*	*26.5*	*27.8*
Adjusted ROIC %	*13.4*	13.0	17.1	10.0	*9.6*	*11.3*	*12.3*
Return on Assets %	*3.0*	2.9	3.5	2.8	*3.0*	*4.2*	*4.8*
Return on Equity %	*11.5*	10.9	12.5	11.3	*12.1*	*14.3*	*14.8*

Leverage	3-Year Hist. Avg	2014	2015	2016	*2017*	*2018*	*5-Year Proj. Avg*
Debt/Capital	*0.39*	0.36	0.27	0.56	*0.48*	*0.43*	*0.38*
Total Debt/EBITDA	*2.43*	1.64	1.06	4.58	*3.32*	*2.36*	*2.03*
EBITDA/Interest Expense	*3.81*	3.20	4.45	3.77	*4.35*	*5.76*	*7.60*

Valuation Summary and Forecasts

	2015	2016	*2017(E)*	*2018(E)*
Price/Fair Value	—	0.76	—	—
Price/Earnings	17.7	18.4	*21.3*	*17.0*
EV/EBITDA	11.1	9.8	*12.9*	*10.1*
EV/EBIT	14.7	13.5	*17.1*	*14.2*
Free Cash Flow Yield %	6.9	4.3	*2.8*	*4.1*
Dividend Yield %	1.2	1.3	*1.0*	*1.4*

Key Valuation Drivers

Cost of Equity %	9.0
Pre-Tax Cost of Debt %	6.5
Weighted Average Cost of Capital %	8.0
Long-Run Tax Rate %	30.0
Stage II EBI Growth Rate %	4.0
Stage II Investment Rate %	26.7
Perpetuity Year	15

Additional estimates and scenarios available for download at http://select.morningstar.com.

Discounted Cash Flow Valuation

	EUR Mil	Firm Value (%)	Per Share Value
Present Value Stage I	3,983	31.2	35.40
Present Value Stage II	2,057	16.1	18.28
Present Value Stage III	6,734	52.7	59.84
Total Firm Value	**12,775**	**100.0**	**113.51**
Cash and Equivalents	448	—	3.98
Debt	-3,183	—	-28.28
Preferred Stock	—	—	—
Other Adjustments	-1,295	—	-11.50
Equity Value	**8,745**	**—**	**77.70**
Projected Diluted Shares	113		
Fair Value per Share (EUR)	**80.00**		

The data in the table above represent base-case forecasts in the company's reporting currency as of the beginning of the current year. Our fair value estimate may differ from the equity value per share shown above due to our time value of money adjustment and in cases where probability-weighted scenario analysis is performed.

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Morningstar Analyst Forecasts

Income Statement (EUR Mil)
Fiscal Year Ends in December

	2014	2015	2016	*2017 (Forecast)*	*2018 (Forecast)*
Revenue	**4,678**	**5,098**	**5,587**	***8,057***	***8,624***
Cost of Goods Sold	3,337	3,655	4,035	*5,640*	*6,080*
Gross Profit	**1,341**	**1,443**	**1,553**	***2,417***	***2,544***
Selling, General & Administrative Expenses	687	757	813	*1,209*	*1,250*
Research & Development	126	90	97	*161*	*172*
Other Operating Expense (Income)	-26	-44	-52	*90*	*-102*
Depreciation & Amortization (if reported separately)	111	157	191	*236*	*351*
Operating Income (ex charges)	**443**	**483**	**504**	***722***	***872***
Restructuring & Other Cash Charges	57	33	42	*50*	—
Impairment Charges (if reported separately)	—	—	—	—	—
Other Non-Cash (Income)/Charges	39	27	27	—	—
Operating Income (incl charges)	**347**	**423**	**435**	***672***	***872***
Interest Expense	173	144	185	*220*	*212*
Interest Income	84	51	89	*83*	*117*
Pre-Tax Income	**258**	**330**	**339**	***535***	***777***
Income Tax Expense	80	109	93	*177*	*256*
Other After-Tax Cash Gains (Losses)	—	—	—	—	—
Other After-Tax Non-Cash Gains (Losses)	—	—	—	—	—
(Minority Interest)	-2	-4	1	*1*	*-7*
(Preferred Dividends)	—	—	-1	*-1*	*-1*
Net Income	**177**	**217**	**246**	***359***	***513***
Weighted Average Diluted Shares Outstanding	99	99	103	*108*	*113*
Diluted Earnings Per Share	**1.79**	**2.20**	**2.38**	***3.33***	***4.56***
Adjusted Net Income	243	257	296	*392*	*513*
Diluted Earnings Per Share (Adjusted)	**2.46**	**2.60**	**2.87**	***3.64***	***4.56***
Dividends Per Common Share	0.44	0.77	0.77	*0.80*	*1.14*
EBITDA	**458**	**580**	**626**	***908***	***1,223***
Adjusted EBITDA	**554**	**640**	**695**	***958***	***1,223***

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Morningstar Analyst Forecasts

Balance Sheet (EUR Mil)

Fiscal Year Ends in December				*Forecast*	
	2014	2015	2016	*2017*	*2018*
Cash and Equivalents	99	103	280	*1,052*	*947*
Investments	168	113	168	*168*	*168*
Accounts Receivable	598	671	999	*1,060*	*1,300*
Inventory	529	554	672	*757*	*833*
Deferred Tax Assets (Current)	7	8	35	*35*	*35*
Other Short Term Assets	203	182	200	*200*	*200*
Current Assets	**1,604**	**1,630**	**2,355**	***3,273***	***3,483***
Net Property Plant, and Equipment	494	509	679	*784*	*839*
Goodwill	1,497	1,548	3,606	*3,606*	*3,614*
Other Intangibles	916	904	2,631	*2,516*	*2,392*
Deferred Tax Assets (Long-Term)	358	349	420	*420*	*420*
Other Long-Term Operating Assets	1,111	1,350	1,536	*1,536*	*1,536*
Long-Term Non-Operating Assets	149	150	133	*133*	*133*
Total Assets	**6,128**	**6,440**	**11,359**	***12,267***	***12,417***
Accounts Payable	565	575	802	*834*	*900*
Short-Term Debt	263	119	294	*294*	*294*
Deferred Tax Liabilities (Current)	31	80	63	*63*	*63*
Other Short-Term Liabilities	934	958	1,513	*1,513*	*1,513*
Current Liabilities	**1,793**	**1,732**	**2,673**	***2,705***	***2,770***
Long-Term Debt	647	557	2,889	*2,889*	*2,589*
Deferred Tax Liabilities (Long-Term)	321	303	905	*905*	*905*
Other Long-Term Operating Liabilities	1,721	2,000	2,357	*2,357*	*2,357*
Long-Term Non-Operating Liabilities	—	—	—	—	—
Total Liabilities	**4,482**	**4,592**	**8,824**	***8,856***	***8,622***
Preferred Stock	—	—	—	—	—
Common Stock	99	99	109	*109*	*109*
Additional Paid-in Capital	1,996	1,997	2,444	*3,047*	*3,047*
Retained Earnings (Deficit)	-148	11	183	*456*	*841*
(Treasury Stock)	—	—	—	—	—
Other Equity	-305	-266	-207	*-207*	*-207*
Shareholder's Equity	**1,642**	**1,841**	**2,529**	***3,405***	***3,790***
Minority Interest	5	8	6	*6*	*6*
Total Equity	**1,647**	**1,849**	**2,535**	***3,410***	***3,795***

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Morningstar Analyst Forecasts

Cash Flow (EUR Mil)

Fiscal Year Ends in December				Forecast	
	2014	2015	2016	*2017*	*2018*
Net Income	177	217	246	*358*	*520*
Depreciation	70	71	76	*121*	*216*
Amortization	42	87	115	*115*	*135*
Stock-Based Compensation	—	—	—	—	—
Impairment of Goodwill	—	—	—	—	—
Impairment of Other Intangibles	—	—	—	—	—
Deferred Taxes	-17	23	-7	—	—
Other Non-Cash Adjustments	39	27	27	—	—
(Increase) Decrease in Accounts Receivable	-40	-72	-328	*-61*	*-240*
(Increase) Decrease in Inventory	-17	-24	-119	*-85*	*-76*
Change in Other Short-Term Assets	303	93	-379	—	*8*
Increase (Decrease) in Accounts Payable	14	10	228	*32*	*65*
Change in Other Short-Term Liabilities	33	24	556	—	—
Cash From Operations	**604**	**455**	**414**	***481***	***629***
(Capital Expenditures)	-133	-143	-167	*-226*	*-259*
Net (Acquisitions), Asset Sales, and Disposals	-176	-71	-2,107	—	*-40*
Net Sales (Purchases) of Investments	5	77	—	—	—
Other Investing Cash Flows	7	14	10	—	—
Cash From Investing	**-298**	**-122**	**-2,264**	***-226***	***-299***
Common Stock Issuance (or Repurchase)	1	0	457	*603*	—
Common Stock (Dividends)	-35	-54	-76	*-86*	*-128*
Short-Term Debt Issuance (or Retirement)	—	—	—	—	—
Long-Term Debt Issuance (or Retirement)	-301	-224	1,744	—	*-300*
Other Financing Cash Flows	-94	-51	-99	*0*	*-7*
Cash From Financing	**-428**	**-329**	**2,026**	***517***	***-435***
Exchange Rates, Discontinued Ops, etc. (net)	2	1	0	—	—
Net Change in Cash	**-120**	**4**	**176**	***773***	***-106***

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MORNINGSTAR®

KION GROUP AG KGX (XETR) | ★★★

Last Price	Fair Value	Uncertainty	Economic Moat™	Moat Trend™	Stewardship	Industry Group
77.51 EUR	80.00 EUR	Medium	Narrow	Stable	Standard	Truck Manufacturing

Comparable Company Analysis

These companies are chosen by the analyst and the data are shown by nearest calendar year in descending market capitalization order.

Valuation Analysis

		Price/Earnings			EV/EBITDA			Price/Free Cash Flow			Price/Book			Price/Sales		
Company/Ticker	Price/Fair Value	2016	*2017(E)*	*2018(E)*	2016	*2017(E)*	*2018(E)*	2016	*2017(E)*	*2018(E)*	2016	*2017(E)*	*2018(E)*	2016	*2017(E)*	*2018(E)*
Komatsu Ltd 6301 JPN	1.00	13.8	*24.5*	*17.5*	7.5	*11.7*	*11.9*	11.8	*25.9*	*36.4*	1.2	*1.7*	*1.8*	1.0	*1.5*	*1.3*
Caterpillar Inc CAT USA	1.23	NM	*25.2*	*20.1*	30.1	*16.6*	*15.3*	19.7	*24.2*	*19.7*	4.1	*5.1*	*4.9*	1.5	*1.7*	*1.6*
Average		13.8	*24.9*	*18.8*	18.8	*14.2*	*13.6*	15.8	*25.1*	*28.1*	2.7	*3.4*	*3.4*	1.3	*1.6*	*1.5*
KION GROUP AG KGX DE	**0.97**	**18.4**	***21.3***	***17.0***	**9.8**	***12.9***	***10.1***	**23.2**	***35.7***	***24.7***	**2.3**	***2.7***	***2.4***	**1.0**	***1.1***	***1.1***

Returns Analysis

		ROIC %			Adjusted ROIC %			Return on Equity %			Return on Assets %			Dividend Yield %		
Company/Ticker	Last Historical Year Total Assets (Mil)	2016	*2017(E)*	*2018(E)*	2016	*2017(E)*	*2018(E)*	2016	*2017(E)*	*2018(E)*	2016	*2017(E)*	*2018(E)*	2016	*2017(E)*	*2018(E)*
Komatsu Ltd 6301 JPN	— JPY	7.6	*6.9*	*7.5*	7.8	*7.1*	*7.8*	9.0	*7.3*	*8.4*	5.1	*4.3*	*4.6*	3.0	*2.0*	*1.9*
Caterpillar Inc CAT USA	45,863 USD	4.9	*13.6*	*15.4*	6.4	*17.8*	*20.3*	-3.8	*16.4*	*20.4*	-1.1	*4.8*	*6.1*	3.3	*2.6*	*2.7*
Average		6.3	*10.3*	*11.5*	7.1	*12.5*	*14.1*	2.6	*11.9*	*14.4*	2.0	*4.6*	*5.4*	3.2	*2.3*	*2.3*
KION GROUP AG KGX DE	**11,359** EUR	**25.3**	***23.6***	***26.5***	**10.0**	***9.6***	***11.3***	**11.3**	***12.1***	***14.3***	**2.8**	***3.0***	***4.2***	**1.3**	***1.0***	***1.4***

Growth Analysis

		Revenue Growth %			EBIT Growth %			EPS Growth %			Free Cash Flow Growth %			Dividend/Share Growth %		
Company/Ticker	Last Historical Year Revenue (Mil)	2016	*2017(E)*	*2018(E)*	2016	*2017(E)*	*2018(E)*	2016	*2017(E)*	*2018(E)*	2016	*2017(E)*	*2018(E)*	2016	*2017(E)*	*2018(E)*
Komatsu Ltd 6301 JPN	1,854,964 JPY	-6.3	*-2.8*	*30.0*	-16.2	*-12.6*	*48.3*	-11.6	*-14.7*	*50.4*	4.4	*-24.9*	*-315.9*	—	*—*	*3.5*
Caterpillar Inc CAT USA	35,773 USD	-19.0	*11.3*	*5.8*	-79.1	*434.9*	*12.1*	-102.7	*-4,149.6*	*25.2*	-10.7	*24.3*	*21.3*	5.4	*1.0*	*4.0*
Average		-12.7	*4.3*	*17.9*	-47.7	*211.2*	*30.2*	-57.2	*-2,082.2*	*37.8*	-3.2	*-0.3*	*-147.3*	5.4	*1.0*	*3.8*
KION GROUP AG KGX DE	**5,587** EUR	**9.6**	***44.2***	***7.0***	**4.4**	***43.2***	***20.9***	**10.2**	***26.8***	***25.4***	**-661.1**	***-119.6***	***11.3***	**—**	***3.9***	***42.5***

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Last Price	Fair Value	Uncertainty	Economic Moat™	Moat Trend™	Stewardship	Industry Group
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Comparable Company Analysis

These companies are chosen by the analyst and the data are shown by nearest calendar year in descending market capitalization order.

Profitability Analysis

Company/Ticker	Last Historical Year Net Income (Mil)	Gross Margin % 2016	2017(E)	2018(E)	EBITDA Margin % 2016	2017(E)	2018(E)	Operating Margin % 2016	2017(E)	2018(E)	Net Margin % 2016	2017(E)	2018(E)	Free Cash Flow Margin % 2016	2017(E)	2018(E)
Komatsu Ltd 6301 JPN	130,961 JPY	29.1	*28.7*	*30.3*	16.0	*14.7*	*13.0*	10.9	*9.8*	*11.2*	7.1	*6.2*	*7.2*	8.3	*5.9*	*3.4*
Caterpillar Inc CAT USA	-67 USD	26.9	*31.0*	*31.3*	7.9	*14.6*	*14.9*	1.9	*9.2*	*9.7*	-0.2	*6.8*	*8.0*	7.7	*7.2*	*8.3*
Average		28.0	*29.9*	*30.8*	12.0	*14.7*	*14.0*	6.4	*9.5*	*10.5*	3.5	*6.5*	*7.6*	8.0	*6.6*	*5.9*
KION GROUP AG KGX DE	**296** EUR	**27.8**	***30.0***	***29.5***	**12.4**	***11.9***	***14.2***	**9.0**	***9.0***	***10.1***	**5.3**	***4.9***	***6.0***	**4.4**	***3.2***	***4.3***

Leverage Analysis

Company/Ticker	Last Historical Year Total Debt (Mil)	Debt/Equity % 2016	2017(E)	2018(E)	Debt/Total Cap % 2016	2017(E)	2018(E)	EBITDA/Interest Exp. 2016	2017(E)	2018(E)	Total Debt/EBITDA 2016	2017(E)	2018(E)	Assets/Equity 2016	2017(E)	2018(E)
Komatsu Ltd 6301 JPN	457,552 JPY	30.2	*25.9*	*49.5*	23.2	*20.6*	*33.1*	33.9	*32.3*	*23.3*	1.5	*1.5*	*2.7*	1.7	*1.7*	*2.0*
Caterpillar Inc CAT USA	8,675 USD	65.7	*63.7*	*56.5*	39.6	*38.9*	*36.1*	5.1	*11.5*	*13.4*	3.1	*1.5*	*1.3*	3.5	*3.4*	*3.3*
Average		48.0	*44.8*	*53.0*	31.4	*29.8*	*34.6*	19.5	*21.9*	*18.4*	2.3	*1.5*	*2.0*	2.6	*2.6*	*2.7*
KION GROUP AG KGX DE	**3,183** EUR	**125.8**	***93.5***	***76.1***	**55.7**	***48.3***	***43.2***	**3.8**	***4.4***	***5.8***	**4.6**	***3.3***	***2.4***	**4.5**	***3.6***	***3.3***

Liquidity Analysis

Company/Ticker	Market Cap (Mil)	Cash per Share 2016	2017(E)	2018(E)	Current Ratio 2016	2017(E)	2018(E)	Quick Ratio 2016	2017(E)	2018(E)	Cash/Short-Term Debt 2016	2017(E)	2018(E)	Payout Ratio % 2016	2017(E)	2018(E)
Komatsu Ltd 6301 JPN	2,932,001 JPY	112.59	*127.01*	*212.13*	1.98	*2.03*	*2.20*	1.21	*1.26*	*1.39*	0.43	*0.55*	*0.90*	39.8	*48.3*	*41.5*
Caterpillar Inc CAT USA	69,132 USD	9.00	*10.57*	*11.42*	1.53	*1.64*	*1.68*	0.82	*0.91*	*0.93*	25.15	*29.45*	*31.61*	-335.0	*81.3*	*66.0*
Average		60.80	*68.79*	*111.78*	1.76	*1.84*	*1.94*	1.02	*1.09*	*1.16*	12.79	*15.00*	*16.26*	-147.6	*64.8*	*53.8*
KION GROUP AG KGX DE	**9,128** EUR	**2.71**	***9.75***	***8.41***	**0.88**	***1.21***	***1.26***	**0.63**	***0.93***	***0.96***	**0.95**	***3.58***	***3.22***	**32.3**	***24.1***	***25.0***

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Research Methodology for Valuing Companies

Overview

At the heart of our valuation system is a detailed projection of a company's future cash flows, resulting from our analysts' research. Analysts create custom industry and company assumptions to feed income statement, balance sheet, and capital investment assumptions into our globally standardized, proprietary discounted cash flow, or DCF, modeling templates. We use scenario analysis, in-depth competitive advantage analysis, and a variety of other analytical tools to augment this process. Moreover, we think analyzing valuation through discounted cash flows presents a better lens for viewing cyclical companies, high-growth firms, businesses with finite lives (e.g., mines), or companies expected to generate negative earnings over the next few years. That said, we don't dismiss multiples altogether but rather use them as supporting cross-checks for our DCF-based fair value estimates. We also acknowledge that DCF models offer their own challenges (including a potential proliferation of estimated inputs and the possibility that the method may miss short-term market-price movements), but we believe these negatives are mitigated by deep analysis and our long-term approach.

Morningstar's equity research group ("we", "our") believes that a company's intrinsic worth results from the future cash flows it can generate. The Morningstar Rating for stocks identifies stocks trading at a discount or premium to their intrinsic worth—or fair value estimate, in Morningstar terminology. Five-star stocks sell for the biggest risk-adjusted discount to their fair values, whereas 1-star stocks trade at premiums to their intrinsic worth.

Four key components drive the Morningstar rating: (1) our assessment of the firm's economic moat, (2) our estimate of the stock's fair value, (3) our uncertainty around that fair value estimate and (4) the current market price. This process ultimately culminates in our single-point star rating.

Morningstar Research Methodology for Valuing Companies

1. Economic Moat

The concept of an economic moat plays a vital role not only in our qualitative assessment of a firm's long-term investment potential, but also in the actual calculation of our fair value estimates. An economic moat is a structural feature that allows a firm to sustain excess profits over a long period of time. We define economic profits as returns on invested capital (or ROIC) over and above our estimate of a firm's cost of capital, or weighted average cost of capital (or WACC). Without a moat, profits are more susceptible to competition. We have identified five sources of economic moats: intangible assets, switching costs, network effect, cost advantage, and efficient scale.

Companies with a narrow moat are those we believe are more likely than not to achieve normalized excess returns for at least the next 10 years. Wide-moat companies are those in which we have very high confidence that excess returns will remain for 10 years, with excess returns more likely than not to remain for at least 20 years. The longer a firm generates economic profits, the higher its intrinsic value. We believe low-quality, no-moat companies will see their normalized returns gravitate toward the firm's cost of capital more quickly than companies with moats.

To assess the sustainability of excess profits, analysts perform ongoing assessments of the moat trend. A firm's moat trend is positive in cases where we think its sources of competitive advantage are growing stronger; stable where we don't anticipate changes to competitive advantages over the next several years; or negative when we see signs of deterioration.

2. Estimated Fair Value

Combining our analysts' financial forecasts with the firm's economic moat helps us assess how long returns on invested capital are likely to exceed the firm's cost of capital. Returns of firms with a wide economic moat rating are assumed to fade to the perpetuity period over a longer period of time than the returns of narrow-moat firms, and both will fade slower than no-moat firms, increasing our estimate of their intrinsic value.

Our model is divided into three distinct stages:

Stage I: Explicit Forecast

In this stage, which can last five to 10 years, analysts make full financial statement forecasts, including items such as revenue, profit margins, tax rates, changes in working-capital accounts, and capital spending. Based on these projections, we calculate earnings before interest, after taxes (EBI) and the net new investment (NNI) to derive our annual free cash flow forecast.

Stage II: Fade

The second stage of our model is the period it will take the company's return on new invested capital—the return on capital of the next dollar invested ("RONIC")—to decline (or rise) to its cost of capital. During the Stage II period, we use a formula to approximate cash flows in lieu of explicitly modeling the income statement, balance sheet, and cash flow statement as we do in Stage I. The length of the second stage depends on the strength of the company's economic moat. We forecast this period to last anywhere from one year (for companies with no economic moat) to 10–15 years or more (for wide-moat companies). During this period, cash flows are forecast using four assumptions: an average growth rate for EBI over the period, a normalized investment rate, average return on new invested capital (RONIC), and the number of years until perpetuity, when excess returns cease. The investment rate and return on new invested capital decline until a perpetuity value is calculated. In the case of firms that do not earn their cost of capital, we assume marginal ROICs rise to the firm's cost of capital (usually attributable to less reinvestment), and we may truncate the second stage.

Stage III: Perpetuity

Once a company's marginal ROIC hits its cost of capital, we calculate a continuing value, using a standard perpetuity formula. At perpetuity, we assume that any growth or decline or investment in the business neither creates nor destroys value and that any new investment provides a return in line with estimated WACC.

Because a dollar earned today is worth more than a dollar earned tomorrow, we discount our projections of cash flows in stages I, II, and III to arrive at a total pres-

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ent value of expected future cash flows. Because we are modeling free cash flow to the firm—representing cash available to provide a return to all capital providers—we discount future cash flows using the WACC, which is a weighted average of the costs of equity, debt, and preferred stock (and any other funding sources), using expected future proportionate long-term, market-value weights.

3. Uncertainty around that fair value estimate
Morningstar's Uncertainty Rating captures a range of likely potential intrinsic values for a company and uses it to assign the margin of safety required before investing, which in turn explicitly drives our stock star rating system. The Uncertainty Rating represents the analysts' ability to bound the estimated value of the shares in a company around the Fair Value Estimate, based on the characteristics of the business underlying the stock, including operating and financial leverage, sales sensitivity to the overall economy, product concentration, pricing power, and other company-specific factors.

Analysts consider at least two scenarios in addition to their base case: a bull case and a bear case. Assumptions are chosen such that the analyst believes there is a 25% probability that the company will perform better than the bull case, and a 25% probability that the company will perform worse than the bear case. The distance between the bull and bear cases is an important indicator of the uncertainty underlying the fair value estimate.

Our recommended margin of safety widens as our uncertainty of the estimated value of the equity increases. The more uncertain we are about the estimated value of the equity, the greater the discount we require relative to our estimate of the value of the firm before we would recommend the purchase of the shares. In addition, the uncertainty rating provides guidance in portfolio construction based on risk tolerance.

Our uncertainty ratings for our qualitative analysis are low, medium, high, very high, and extreme.

- **Low:** margin of safety for 5-star rating is a 20% discount and for 1-star rating is 25% premium.
- **Medium:** margin of safety for 5-star rating is a 30% discount and for 1-star rating is 35% premium.
- **High:** margin of safety for 5-star rating is a 40% discount and for 1-star rating is 55% premium.
- **Very High:** margin of safety for 5-star rating is a 50% discount and for 1-star rating is 75% premium.
- **Extreme:** Stock's uncertainty exceeds the parameters we have set for assigning the appropriate margin of safety.

4. Market Price
The market prices used in this analysis and noted in the report come from exchange on which the stock is listed which we believe is a reliable source.

For more detail information about our methodology, please go to http://global.morningstar.com/equitydisclosures

Morningstar Star Rating for Stocks
Once we determine the fair value estimate of a stock, we compare it with the stock's current market price on a daily basis, and the star rating is automatically re-calculated at the market close on every day the market on which the stock is listed is open. Our analysts keep close tabs on the companies they follow, and, based on thorough and ongoing analysis, raise or lower their fair value estimates as warranted.

Please note, there is no predefined distribution of stars. That is, the percentage of stocks that earn 5 stars can fluctuate daily, so the star ratings, in the aggregate, can serve as a gauge of the broader market's valuation. When there are many 5-star stocks, the stock market as a whole is more undervalued, in our opinion, than when very few companies garner our highest rating.

We expect that if our base-case assumptions are true the market price will converge on our fair value estimate over time, generally within three years (although it is impossible to predict the exact time frame in which market prices may adjust).

Our star ratings are guideposts to a broad audience and individuals must consider their own specific investment goals, risk tolerance, tax situation, time horizon, income needs, and complete investment portfolio, among other factors.

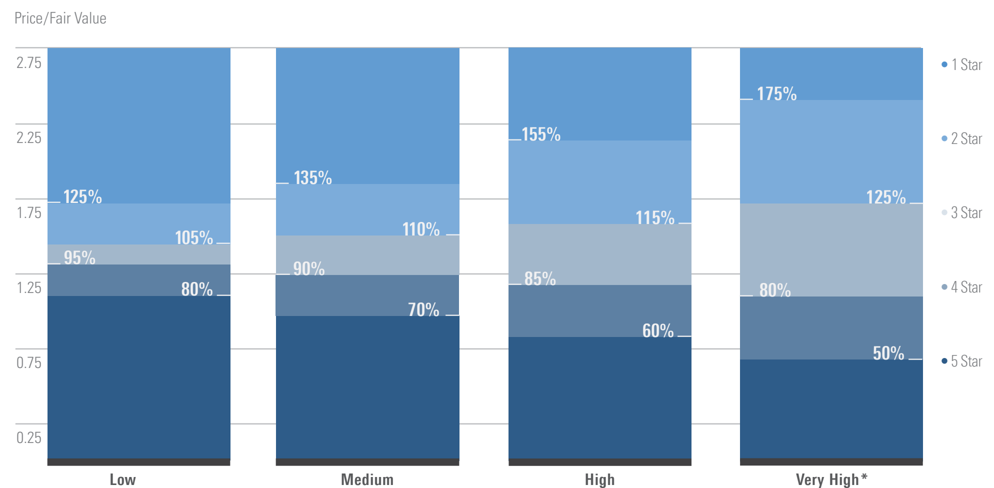
The Morningstar Star Ratings for stocks are defined below:

Five Stars ★★★★★
We believe appreciation beyond a fair risk-adjusted return is highly likely over a multiyear time frame. Scenario analysis developed by our analysts indicates that the current market price represents an excessively pessimistic outlook, limiting downside risk and maximizing upside potential.

Four Stars ★★★★
We believe appreciation beyond a fair risk-adjusted return is likely.

Three Stars ★★★
Indicates our belief that investors are likely to receive a fair risk-adjusted return (approximately cost of equity).

Morningstar Research Methodology for Valuing Companies



* Occasionally a stock's uncertainty will be too high for us to estimate, in which case we label it Extreme.

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Two Stars ★★
We believe investors are likely to receive a less than fair risk-adjusted return.

One Star ★
Indicates a high probability of undesirable risk-adjusted returns from the current market price over a multiyear time frame, based on our analysis. Scenario analysis by our analysts indicates that the market is pricing in an excessively optimistic outlook, limiting upside potential and leaving the investor exposed to Capital loss.

Other Definitions:

Last Price: Price of the stock as of the close of the market of the last trading day before date of the report.

Stewardship Rating: Represents our assessment of management's stewardship of shareholder capital, with particular emphasis on capital allocation decisions. Analysts consider companies' investment strategy and valuation, financial leverage, dividend and share buyback policies, execution, compensation, related party transactions, and accounting practices. Corporate governance practices are only considered if they've had a demonstrated impact on shareholder value. Analysts assign one of three ratings: "Exemplary," "Standard," and "Poor." Analysts judge stewardship from an equity holder's perspective. Ratings are determined on an absolute basis. Most companies will receive a Standard rating, and this is the default rating in the absence of evidence that managers have made exceptionally strong or poor capital allocation decisions.

Quantitative Valuation: Using the below terms, intended to denote the relationship between the security's Last Price and Morningstar's quantitative fair value estimate for that security.

- ►**Undervalued:** Last Price is below Morningstar's quantitative fair value estimate.
- ►**Farily Valued:** Last Price is in line with Morningstar's quantitative fair value estimate.
- ►**Overvalued:** Last Price is above Morningstar's quantitative fair value estimate.

Risk Warning
Please note that investments in securities are subject to market and other risks and there is no assurance or guarantee that the intended investment objectives will be achieved. Past performance of a security may or may not be sustained in future and is no indication of future performance. A security investment return and an investor's principal value will fluctuate so that, when redeemed, an investor's shares may be worth more or less than their original cost. A security's current investment performance may be lower or higher than the investment performance noted within the report. Morningstar's Uncertainty Rating serves as a useful data point with respect to sensitivity analysis of the assumptions used in our determining a fair value price.

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77.51 EUR	80.00 EUR	Medium	Narrow	Stable	Standard	Truck Manufacturing

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KION GROUP AG KGX (XETR) | ★★★

Last Price	Fair Value	Uncertainty	Economic Moat™	Moat Trend™	Stewardship	Industry Group
77.51 EUR	80.00 EUR	Medium	Narrow	Stable	Standard	Truck Manufacturing

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MORNINGSTAR®

Industrials Observer

May 2017

Ready-to-Wearhouse
The Structural Shift Towards Automating Warehouses

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Supplying Warehouse Automation Equipment Is a Moaty, Growing Business

Getting same-day delivery on a last-minute birthday gift or a critical spare part for an auto plant is becoming more commonplace but requires closer, more expensive warehouse proximity to customers. An obvious solution to rising costs is to optimise warehouse space utilisation with automation equipment. However, four fifths of warehouses globally still operate on a fully manual basis, a setup that is becoming increasingly inadequate as delivery standards shift towards next-day or same-day delivery. The multiple of warehouse space required to run an e-commerce fulfilment centre versus a brick-and-mortar distribution centre, combined with a growing shortage of cheap labour in Western markets, will add to the need to automate. We estimate the current market for warehouse equipment at around $15 billion. In our base case, we project the market to grow at a 10% CAGR over the next 10 years to reach $39 billion, with rising rents, labour shortages, contracted delivery times, and e-commerce as the main drivers.

We think the warehouse equipment market is not yet well understood by investors in general, as most of the suppliers are private and the sector niche. However, logistics systems suppliers enjoy wide moats. Based on our analysis, which includes interviews with large customers of logistics systems equipment suppliers, few companies meet the requirements for most major projects. We believe Kion Group will be one of the main beneficiaries of the structural shift to automation, and this firm represents one of our top ideas in the industrials sector.

Actionable Ideas in This Report

Name/Ticker	Economic Moat	Moat Trend	Currency	Fair Value Estimate	Current Price	Uncertainty Rating	Morningstar Rating	Market Cap (€ bil)
Kion Group KGX	Narrow	Stable	EUR	75	61.98	Medium	★★★★	6.6
Jungheinrich JUN3	Narrow	Stable	EUR	36	31.97	Medium	★★★★	3.2

Industrials
Observer

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Key Takeaways

Supplying Warehouse Equipment Is a Moat-Building Enterprise

- Warehouse equipment suppliers generally offer forklifts or logistics systems. Very few companies except Kion Group, Jungheinrich**,** and Toyota Industries have the potential to sell these two categories as an integrated solution.
- On a stand-alone basis, we think supplying forklifts is a narrow-moat business, while supplying logistics systems **could result in** a wide moat. But when these factors are combined, moats are reinforced.
- We think **narrow-moat** Kion Group, as the industry leader in logistics systems and number two in forklifts, is the best positioned to benefit from a strengthened moat, as well as the long runway of industry growth.

The Logistics Systems Sector Will Benefit for Years to Come From Ongoing Structural Changes

- We think warehouse equipment is under-researched, as most industry players have been privately held.
- A combination of factors, not least of which is growing e-commerce, should propel the growth of automation in warehouses for many years to come.
- Automation can solve several of the growing issues that warehouse operators are facing, including compressed shipping times, expanding space requirements and volumes, availability of labour, and increased complexity of warehouse processes.
- With e-commerce penetration levels below 20% in most major global markets and 80% of warehouses still operating using all-manual processes, we think there is a long runway of growth for the equipment suppliers.
- We estimate the current market for warehouse equipment at around $15 billion. In our base case, we project this to grow at a 10% CAGR over the next 10 years.

Best Idea: Kion Group

- Kion is the largest global logistics systems supplier, and has a narrow economic moat guarding economic returns for years to come, based on its close collaboration with customers and sector-specific expertise.
- As customers never really know whether new equipment will perform to expectations until the warehouse goes live, trust in suppliers is critical.
- Through its Dematic brand, Kion benefits from having a large reference book of proven projects across a broad range of sectors.
- As the second-largest global forklift supplier, Kion has an information advantage over many of its logistics systems competitors, most of which do not supply forklifts.
- We think the shares are undervalued due to the lack of market research on the company's newly acquired logistics systems exposure through the 2016 Dematic acquisition.

Moats: Each Warehouse Is Its Own Unique Beast

Specificity in Warehouse Equipment Creates Strong Moats

Switching costs and high barriers to entry create moats for warehouse equipment suppliers, as their customers demand a level of equipment customisation that requires close collaboration. They are also reluctant to switch out existing equipment in favour of equipment from unproven suppliers. A typical warehouse can perform 10-plus different functions (from receiving through to shipping), and there are a multitude of methods for performing each function, depending on the customer's preference. Throw into the mix variety in stock-keeping units, or SKUs, seasonality, and a long list of end customers, and one can easily envision many permutations of warehouse design and engineering. Put another way, if Lego, were to make a warehouse set (something we would immediately put on our Amazon wish list), it would contain thousands of pieces with endless possible combinations.

And for each warehouse, the right combination of equipment will be different. For example, a supermarket distribution centre will have multiple temperature zones for the equipment, ranging from ambient to freezing, while an apparel retailer will need a conveyor system with garment racks. A furniture manufacturer in North America may need extra capacity during the summer, which is apparently the season when many Americans order furniture, while other warehouses may not need the possibility of quickly adding capacity. Some of the parameters that equipment suppliers consider when delivering forklifts or logistics systems include: the range of sizes, weights, and materials of each of the products that the equipment will be handling; volumes; equipment usage intensity; ergonomics; temperature variations; chemical tolerances; seasonal peaks and valleys; the type of flooring in the warehouse; and the list of functions the warehouse performs. In other words, equipment is delivered on a highly customised basis.

In our research for this report, we interviewed major customers of equipment suppliers, toured some of their warehouses, spoke to several of the top equipment suppliers, and visited a logistics systems research and development centre. Based on our observations, we believe that the level of specificity required in designing warehouse equipment and processes is much deeper than most people would expect. The industry also has its own terminology for individual processes and elements within a warehouse. We provide a glossary of some of the most common terms in the appendix of this report.

Similar Drivers Create Moats in the Two Equipment Categories: Logistics Systems and Forklifts

Warehouse equipment is generally lumped into one of two categories: logistics systems and forklifts. "Logistics systems" equipment covers just about everything used to run a warehouse—including shelving racks, conveyor belts, sorting and picking equipment, and, of course, the software that orchestrates all the processes—but does not include forklifts. Forklift trucks are often referred to as "material-handling equipment". Historically, the two have had separate suppliers, as customers generally purchase forklift trucks at a later stage, only after a logistics system has been installed. In the

past, forklifts and logistics systems have not been integrated on a software level, which we expect to change.

Operating forklifts under the same software as the logistics systems equipment can create smoother and quicker goods processing, enabling software to track and time the movement of goods from one end of the warehouse to the other. Closer tracking increases throughput potential and helps with more efficient inventory management. Forklifts do not need to be driverless to be integrated through software, but driverless forklifts, which are a small but growing category, can increase efficiencies through labour savings. On a stand-alone basis, we think supplying forklifts is a narrow-moat business, while supplying logistics systems offers a wide moat. Both equipment categories require a high degree of specificity and customer knowledge, creating customer switching costs, but logistics systems equipment is longer-lived and more integral to a customer's operations, creating fewer opportunities for competitors to win over customers.

Logistics Systems Moats: The Strong Get Stronger

The First Step in the Tender Process for Major Project Bids Eliminates Most Competitors

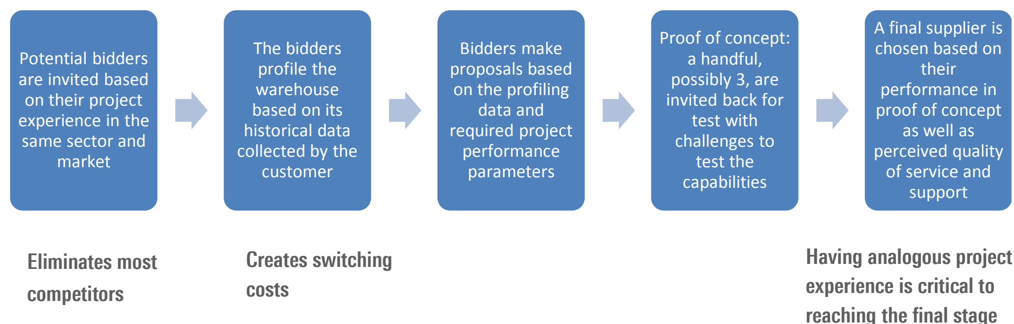
Based on our conversations with equipment buyers, we believe that for major logistics systems projects, particularly those requiring multiple pieces of equipment or large investments, customers are conservative in their supplier selection. Out of risk aversion to system failure, the first step in the purchasing process is to limit the companies invited to make proposals to just those with prior comparable project experience. For example, a customer looking for suppliers to kit out a fulfilment centre in Spain for an apparel retailer would likely invite only companies that had completed comparable projects for apparel retailers in Spain. Even though the systems are tested before they go live, the risk of system failure remains once the actual warehouse volume levels are put through the system.

A well-documented example of this was the U.K. grocer J. Sainsbury's 2004 attempt to launch a full automation project across four fulfilment centres simultaneously in a short period of time. The project, managed by Accenture and including multiple software vendors, ended in software-driven inventory shortages, loss of market share, and a multi-million-pound project write-off. The resulting risk aversion favours incumbents, especially those with deep project experience in a particular sector, because their systems take into account tail risk that less experienced suppliers might fail to work into their equipment and algorithm design.

Conversely, we think the shift towards automation will eliminate some of the major incumbents (listed in Exhibit 2) that have been slower in their expansion of automated equipment. Companies that sell manually operated equipment, such as Mecalux, will be challenged to build up a credible reference book of automation projects that can compete with the likes of Dematic (Kion) and Schaefer.

We think the tender process for major logistics systems immediately puts up barriers to entry for new entrants and increases customer switching costs, building moats for incumbents. The first step is to create a shortlist of suppliers that have successfully completed similar projects in the same sector and in comparable geographic markets.

Exhibit 1 Logistics Systems Tender Process on Major Projects: Step One Shuts Out Many Competitors



Source: Morningstar

The remainder of the tender process includes each bidder gathering detailed data on the warehouse's operations, also known as profiling, followed by an intensive period of design work and engineering of the proposed system to meet the project's required performance parameters. This period includes scenario simulations (for example, what happens when a supplier doesn't show up because of a snowstorm?) using the information from the profiling. The final decision is made based on the simulations' robustness in delivering on performance metrics, as well as the supplier's reputation for support and service. **Price is not the deciding factor, nor it is it even transparent, as project bids do not normally contain a breakdown of individual equipment prices.**

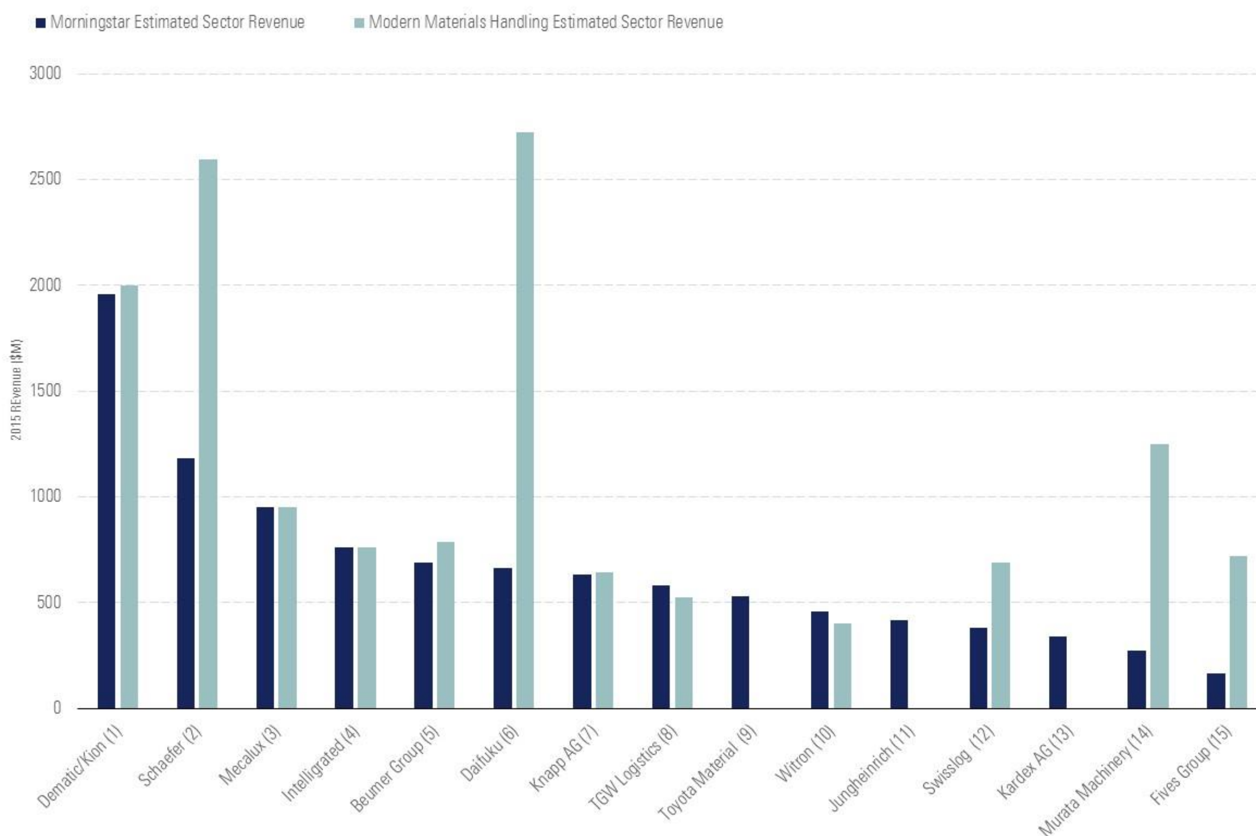
The decision-makers for equipment purchases could be the customers themselves if they have internal logistics experts, as is the case with third-party logistics providers, or 3PLs, such as Kuehne & Nagel and Deutsche Post DHL, or e-commerce companies such as Amazon or Ocado. Other companies may rely on some of the hundreds of available logistics consultants to help run the tender process and choose the equipment vendors, or "systems integrators" as they are commonly known. Whoever is running the tender process, the first step likely remains the same, creating a barrier to entry that over time enables the top existing players to maintain an oligopoly on large projects and shuts out new entrants. **In other words, we believe the strong will get stronger.**

Once a logistics systems supplier wins a contract, it can maintain a relationship with the client over the course of decades, using its informational advantage from close customer collaboration and ongoing service to upsell additional equipment for different functions in the warehouse over time. This model works especially well today, as most warehouses choose selective, rather than full, automation—one of the lessons learned from the Sainsbury example. They also tend to retain most of the service contracts over the 15- to 20-year lifespan of the warehouse equipment.

Who Are the Strong? We Respectfully Beg to Differ With "Modern Materials Handling" Rankings

Most industry participants cite the rankings for logistics systems suppliers as reported in *Modern Materials Handling*. But this ranking is based on group revenue, which often has nonrelated revenue and therefore is not a true representation. Our adjustments, based on cited sources, show a very different ranking, with Dematic, the logistics systems company acquired by Kion Group in 2016, as number one, instead of Daifuku, and Jungheinrich, which does not even appear in the magazine's ranking, as number 11.

Exhibit 2 Morningstar-Adjusted Global Ranking of Warehouse Equipment Suppliers

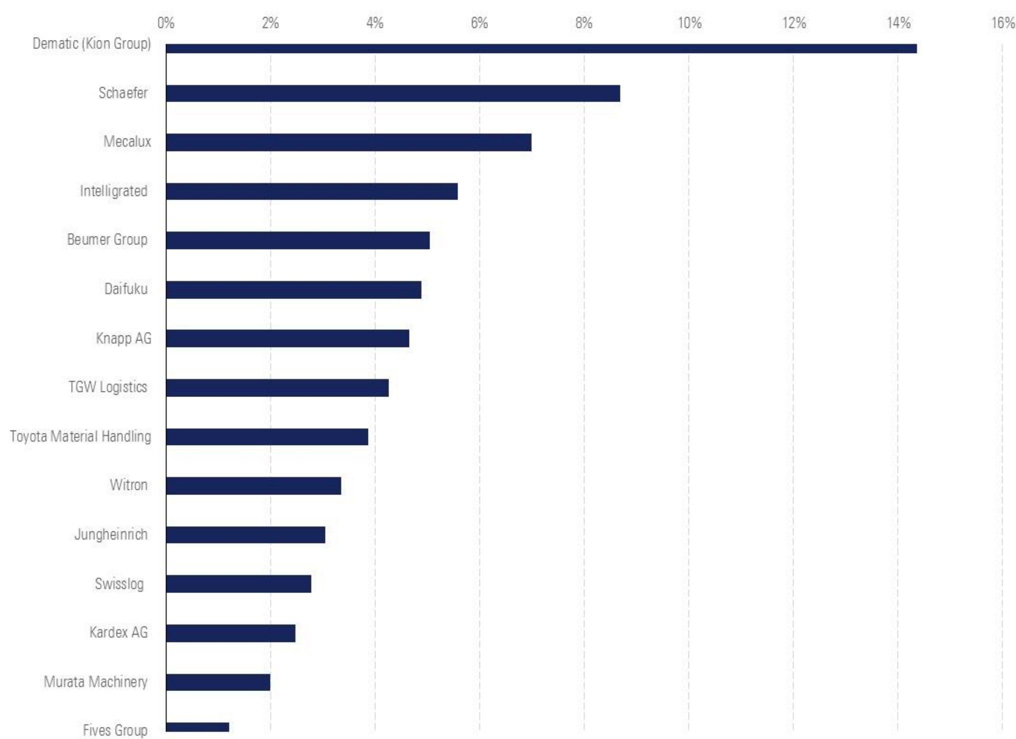


Notes:
(1) Reported at Kion Group's 2016 capital markets day
(2) Company filed 2014 accounts for logistics business. Assuming 10% growth rate to arrive at 2015 logistics revenue. Revenue may include some portion of office furniture revenue. (https://www.unternehmensregister.de)
(3) Assuming 100% of revenue from logistics systems (https://www.mecalux.com/company/introduction)
(4) Assuming 100% of revenue from logistics systems (https://www.honeywell.com/newsroom/pressreleases/?page=1)
(5) Based on EUR 750 million in reported revenue cited on company website (https://www.beumergroup.com/en/about-beumer-group/facts-figures)
(6) Daifuku
(7) Reported on company website: https://www.knapp.com/KNAPP_AG; focused on pharma; 6% owned by Daifuku
(8) Reported on company website: https://www.tgw-group.com/
(9) Toyota Material Handling. Combination of two 2017 acquisitions: Bastian Solutions (closed), Vanderlande (expected to close 2Q17). Sources for revenue estimate for Vanderlande: Estimating 50% of revenue from baggage handling systems, which is a market leading business deployed in 600 airports globally. (https://www.vanderlande.com/about-vanderlande/annual-report); for Bastian Solutions: MMH, company reports
(10) Reported on company website: http://www.witron.de/en/home.html
(11) Annual report (http://www.jungheinrich.com/en/investor-relations/reports-and-dates/financial-publications/)
(12) Excludes hospital logistics revenue. From Kuka annual report (https://www.kuka.com/en-de/investor-relations)
(13) Kardex 2015 annual report (publicly traded on Swiss exchange)
(14) Muratec fiscal 2016 CSR Report. Reported logistics and automation revenue portion (http://www.muratec.net/corp/csr/management/report.html)
(15) Annual Report (http://www.fivesgroup.com/about-fives/publications-videos/publications.html)

Source: Company documents, Morningstar

In our research into the top 15-plus logistics systems suppliers, most of which we list according to estimated market share in Exhibit 3 below, we found that few supplied to a broad group of sectors and many were specialised. Suppliers can get pigeonholed into one sector. This is particularly true of the smaller suppliers like Logistics Systems (number 18 on our ranking list), which focuses on the beverage industry and has a little more than 5% of the revenue of Dematic. However, we expect the larger suppliers with product portfolios geared towards manually operated warehouses to lose share over time as the switch towards automation accelerates. For example, Mecalux, the number-three supplier on our list, specialises in racking and shelving solutions, with only a few of its products offering some degree of automation. This strategy makes sense for the manual market, where racking comprises the majority of the equipment budget, but we expect the manual equipment market to stagnate over time. Gaining market share will be large suppliers like Dematic (Kion) and Schaefer, which have strong automation equipment portfolios with a broad library of prior projects in different sectors.

Exhibit 3 Estimated Market Share of Top 15 Companies



Source: Company documents, Morningstar

Logistics systems suppliers have wide moats because of the high barriers to entry described above, but also because of the long life of the equipment—generally 15-20 years—as well as the high, around 95%, retention on service contracts. The other 5% would likely be maintained by the customers themselves. For example, large 3PLs might have their own teams of technicians. This also leads customers to limit suppliers so technicians only need to learn maintenance on a few types of systems.

Stand-Alone Forklift Businesses Possess Narrow Moats

We view forklift suppliers on a stand-alone basis as narrow-moat businesses. The customer switching costs from the degree of customisation and high retention of service contracts, at 75% or more for the top companies, merit a moat. As the average life of a forklift is no more than 10 years, we do not grant a wide moat, as at the end of the life cycle, there is a risk of customers switching suppliers. However, the risk of this seems reasonably low for highly customised trucks, and the market shares of the top players, which supply mainly tailored trucks, have been remarkably stable, with the number-one, number-two, and number-three positions held by Toyota, Kion, and Jungheinrich, respectively, for more than a decade. We estimate that these three combined account for about 45% of the industry's global unit sales, the bulk of which goes to North America, Europe, or China (see Exhibit 5 below).

Exhibit 4 Examples of Customisable Forklift Truck Features

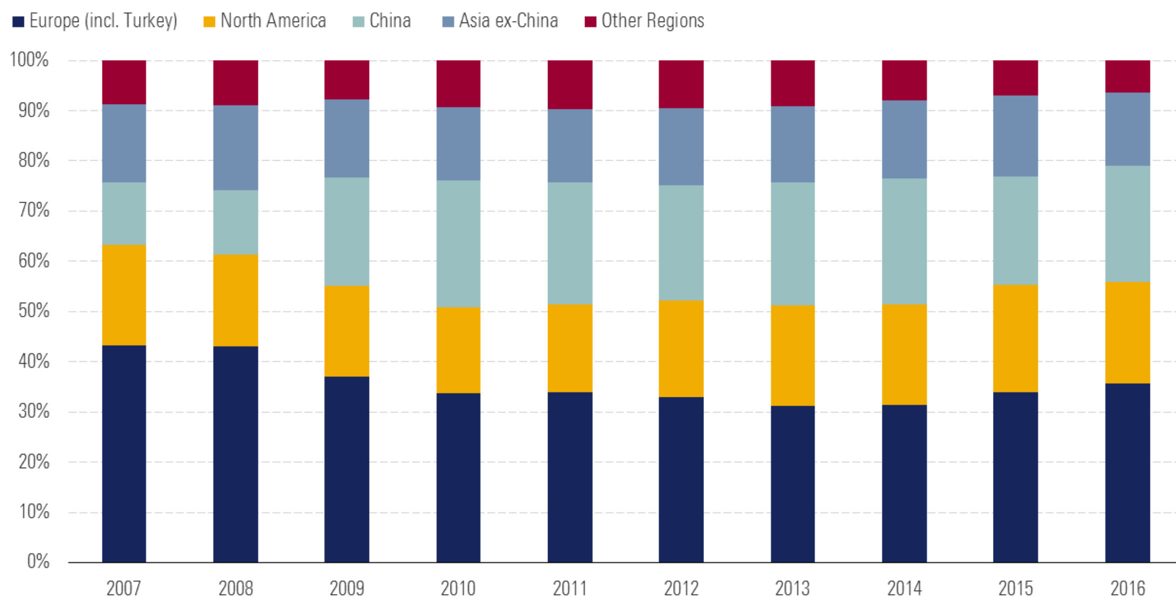
Source: Linde Material Handling, Morningstar

Kion, Jungheinrich, and other premium forklift manufacturers deliver new forklifts on a made-to-order basis. For example, the customisation choices for a Linde forklift (one of the Kion brands) to accommodate the variety of warehouse configurations and products, as well as operator preferences, can include up to 6,000 different options. For example, a wheelbase could be made lower or a standing platform made slightly shorter to accommodate tight spaces. This increases customer stickiness, as replacement models would have to be tweaked and trialled to ensure that loading and unloading time efficiencies are not compromised by the switch. When existing customers are ready to replace or

upgrade their forklifts, Kion, Jungheinrich, and Toyota already know what specifications can offer the greatest efficiencies.

Very few companies except Kion Group, Jungheinrich, and Toyota Material Handling (through its announced 2017 acquisitions of Bastian Solutions and Vanderlande) sell both kinds of equipment. **In 2018, we expect Kion to be the first to incorporate both under one software system, which is something that customers have started to request. Selling both kinds of equipment reinforces a moat, as the supplier is integrated with all virtually all areas of the warehouse, including at the software level.** Customers tend to be wary of changing out software once they have customised it and trained employees. Therefore, customers of suppliers like Kion Group that can put all the equipment under one software layer, like a warehouse execution software, or WES, will face higher switching costs.

Exhibit 5 Europe, North America, and China Accounted for Nearly 80% of Forklift Demand During the Past 10 Years

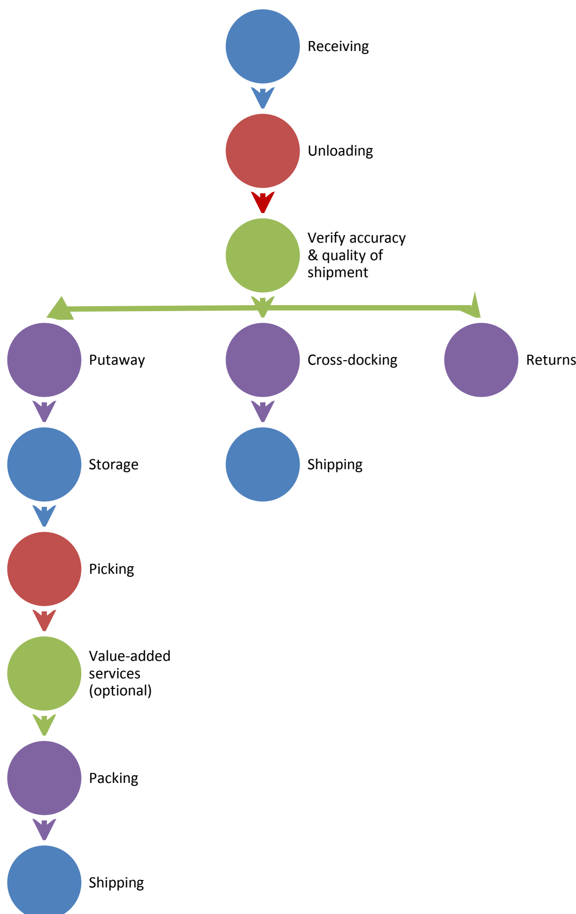


Source: Company documents, Morningstar

Warehouses Are Becoming More Complex

In most warehouses today, there are basically four elements: racks, papers, products, and people. The majority of warehouses around the world—80%, in fact[1]—are still run on a fully manual basis. For a warehouse with a small number of SKUs where the primary function is storage, as was the case for many warehouses in the past, manual is fine. However, across many industries, warehouses have come under pressure from handling e-commerce and online procurement. This has increased volumes, shortened delivery times, increased the complexity of traditional warehouse functions, and even added new ones like returns processing.

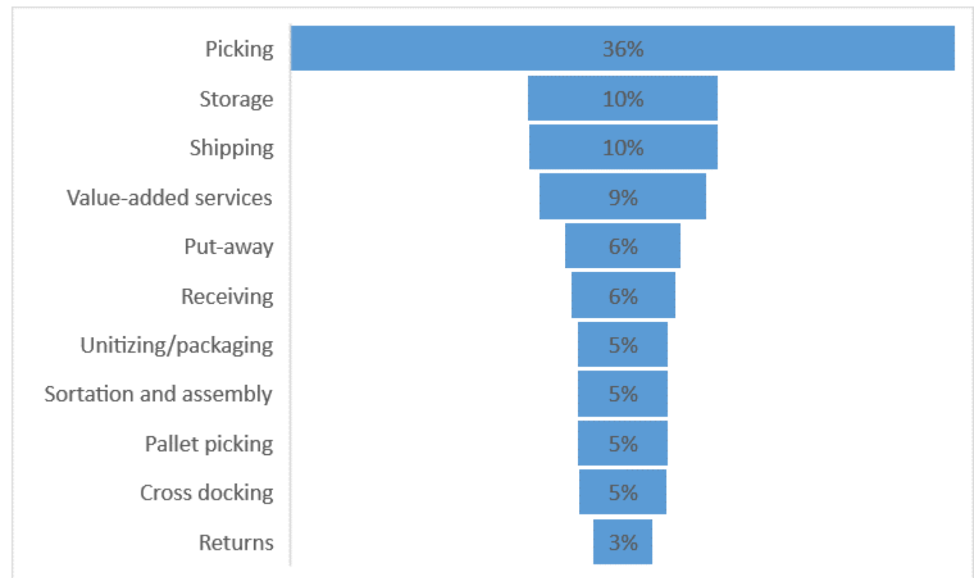
Exhibit 6 Basic Functions of an Omnichannel Distribution Warehouse



Source: Morningstar

1 St. Onge, Kardex

Exhibit 7 Typical Manual Warehouse Cost Breakdown by Function



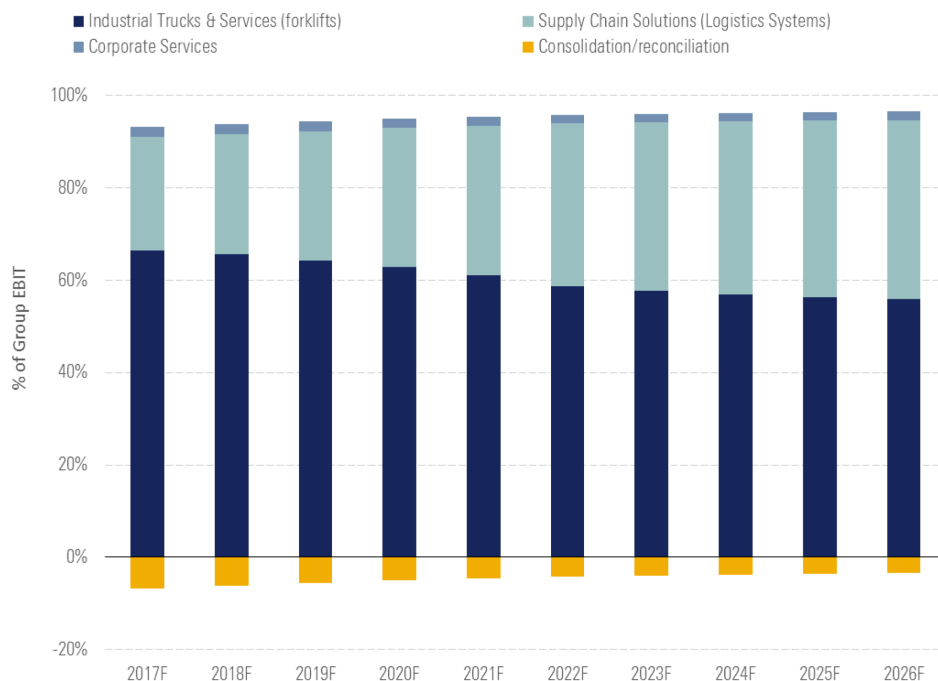
Source: Frazelle

Best Idea: Kion Group

Through its 2016 Dematic acquisition, Kion Group is the largest global logistics systems equipment company according to our analysis. It also the second-largest global forklift supplier, including the Linde line of premium forklifts. As it is at the very top of the competitive field for both categories, we think Kion faces few true competitors, given that only a handful have the same breadth of equipment applications and end-market project experience in each category. We estimate the company's 2015 logistics systems market share at 14% in 2015 and project it to grow to nearly 16% by 2022. By the end of our explicit forecast period in 2026, we expect logistics systems to contribute over 40% of group EBIT, up from just under 30% in 2017. We believe that its status as a top supplier in both markets reinforces Kion's narrow moat, and should strengthen it as the company becomes more successful in selling a software-driven system that integrates forklifts and logistics systems.

Both equipment categories serve the same end customers, giving Kion an information advantage over its closest peers, particularly when it comes to software design that will integrate forklifts into logistics systems. We believe Kion Group is the only supplier currently offering this solution. Kion's product offering is also more specialised in automation. Of the top companies, we view Schaefer, the number-two supplier, as its closest peer in terms of comparable product offerings and project experience. The number-three supplier, Mecalux, a privately held Spanish company, sells products that are more specialised in storage and specifically manual racking, which today makes up the majority of equipment costs in manual operation, but will likely shrink to one third or less of the value of a logistics equipment bid in the future as automation becomes more common.

Exhibit 8 We Expect Logistics to Contribute 40% of Kion Group EBIT by 2026



Source: Morningstar

Logistics systems have attracted an increase in investments. In the past 12 months, three of the top 15 logistics systems equipment suppliers have been acquired, including Kion's $3.25 billion acquisition of Dematic, Honeywell's $1.5 billion acquisition of Intelligrated, and Toyota Industries' announced acquisitions of Bastian Solutions for $260 million and Vanderlande for EUR 1.2 billion. Existing players are also trying to broaden product portfolios organically and through acquisitions. However, we think Kion Group's Dematic division has a head start and is likely to retain its lead position for years to come because of the high switching costs associated with logistics systems for its existing clients and the high barriers to entry on new large projects, which we discuss in the moat section above.

Through its Dematic division, Kion Group has deep experience across several sectors, including e-commerce, apparel, food and beverage, and parcel, which should help the firm continue making the initial cut to bid on projects in those sectors in the future. Dematic's customer base is impressive, with global companies in different end markets, including Amazon, Wal-Mart, Tesco, Gap, Unilever, and FedEx. In total, it has about 600 active customers, and is one of the few companies that can serve the high end of large-scale automation projects, with 20-40 projects per year over $10 million. To put this figure into perspective, basic unautomated storage racks would cost somewhere in thousands of dollars and a low-level picking automation solution like pick-to-light, where a lighting system guides the warehouse worker on which bin to pick items from, might cost $250,000, both depending on the size. Therefore, projects that run into the millions are reflective of larger scale or more sophisticated automation.

Exhibit 9 Examples of Kion's Impressive Customer List by Sector

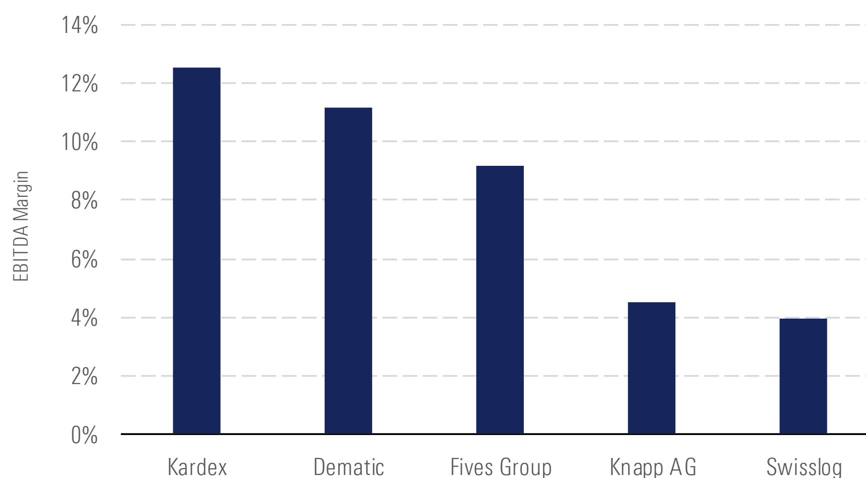
Sector	Dematic (Kion) Customer Examples
e-commerce	Amazon, Asos, JD.com
General merchandise	Wal-Mart, Tesco, JC Penney
Grocery	Delhaize, Migros, Rewe, Netto
Apparel	Adidas, Gap, Zara
Food & Beverage	Unilever, Coca-Cola, Nestle
Parcel	FedEx, Deutsche Post

Source: Morningstar, company documents

Large-scale projects come with more performance system requirements, which are difficult for smaller companies to meet, as they require larger support teams and greater risk. At the beginning of a tender process for a logistics systems bid, suppliers are given performance requirements for the new system—for example, certain throughput levels. In the three to six months after a system goes live, the winning supplier may have to remain on hand to guarantee delivery of those metrics.

Our EUR 75 fair value estimate for Kion is based on a 7% revenue CAGR over the medium term and an increasing EBIT margin from 9.6% in 2012 to 12.0% in 2022. For the next three years, our revenue forecasts are 2%-3% above consensus, while our EBIT forecast is 13%-23% above consensus. We see the recent margin weakness from delay in operations of the new Dematic Monterrey plant as temporary and believe margins will quickly rise back to historical levels. In 2015, the first year that Dematic took on more costs to support the new Monterrey plant, its EBITDA margin slipped by 170 basis points. Before that, its margin was nearly 13%, exceeding that of publicly traded peer Kardex, as seen in Exhibit 10 below.

Exhibit 10 Logistics Systems Suppliers' EBITDA Margin Comparisons (2015)



Source: Morningstar, company documents

We expect Kion Group's supply-chain solutions (logistics systems) division to contribute 31% and 28% of 2017 group revenue and EBIT, respectively. Its current 9% EBIT margin is temporarily depressed by extra operating costs from the delayed opening of a new plant in Monterrey, Mexico. We expect the margin to

recover beginning in 2018 and reach 12% by 2021 with help from higher plant utilisation as volume in its new plants ramps from our forecast 10% CAGR in divisional revenue through to 2026.

Exhibit 11 We Expect Logistics to Contribute 40% of Kion Group EBIT by 2026

Revenue Growth	2016	2017	2018	2019	2020	2021	2022
Industrial Trucks & Services	3%	4%	5%	5%	5%	5%	5%
Supply Chain Solutions	N/M	N/M	11%	11%	11%	11%	11%
Group	10%	41%	6%	7%	7%	7%	7%
% of Total Revenue							
Industrial Trucks & Services	93%	69%	67%	66%	65%	64%	62%
Supply Chain Solutions	0%	31%	32%	33%	35%	36%	37%
EBIT Margin							
Industrial Trucks & Services	11.3%	11.0%	11.5%	11.7%	12.1%	12.3%	12.3%
Supply Chain Solutions	1.6%	9.0%	9.5%	10.1%	10.8%	11.6%	12.3%
Group	9.6%	9.9%	10.4%	10.7%	11.2%	11.7%	12.0%
ROIC	**10.0%**	**10.2%**	**11.3%**	**12.2%**	**13.3%**	**14.4%**	**14.8%**
Kion/Dematic Logistics Systems Global Market Share	**2%**	**15.0%**	**15.0%**	**15.1%**	**15.3%**	**15.5%**	**15.7%**
Annual market share change	N/M	N/M	+7 basis points	+10 basis points	+20 basis points	+20 basis points	+13 basis points

Source: Morningstar

Exhibit 12 Our Kion Group Forecasts Are Higher Than Consensus

Group forecasts: Morningstar v. consensus	2017	2018	2019
Revenue vs. consensus	2%	2%	3%
Reported EBIT vs consensus	23%	15%	13%
Reported EBIT margin vs. consensus	+154 basis points	+121 basis points	+98 basis points

Source: Morningstar, company documents

Jungheinrich Is a Top 15 Logistics Systems Supplier

We have increased our fair value estimate for Jungheinrich to $36 from $31, owing to our expectations for higher medium-term revenue growth and adjusting for the time value of money. We project revenue to grow at a 7.7% CAGR, previously at 6.8%, during our explicit forecast period through to 2021. We expect logistics systems to be a more significant driver to revenue than we previously anticipated. Historically, the company has not reported separate financial data for logistics systems, which are lumped into "new truck sales" and contribute roughly 14% of group sales, compared with 86% from forklifts. However, we expect logistics systems to grow faster than forklifts, based on the sector drivers we discuss above. Logistics systems revenue started contributing 25% of new sales at the end of 2016, and should grow at close to double-digit rates, faster than our expectations for mid-single-digit growth for forklifts.

Narrow-moat Jungheinrich's logistics systems business is smaller than Kion's at just over $400 million, and we estimate that it had about 3% market share in 2015, versus 14% for Dematic. However, this still puts it in the top 10 list of global suppliers, by our calculations. Currently, the division's average order size is around EUR 3 million-EUR 5 million, but the company is attempting to expand the capabilities of the division in order to tackle bigger projects. In 2015, it acquired Mias Group, a specialist in stacker cranes used in warehouse storage, and also created a dedicated board position for the logistics systems business. Jungheinrich does not report the division's results separately, but we estimate it contributes just under 14% of revenue. However, we expect this to increase—first, because we expect the logistics systems market to grow at a 10% rate, faster than forklifts, which should grow closer to midsingle digits; and second, because the division is starting to contribute as much as one fourth of new business for the group.

We expect Jungheinrich, as the number-three forklift provider, to also benefit from an informational advantage over other similar-sized logistics systems companies, most of which do not have a forklift business. Given that forklifts and logistics systems serve the same customer base and require a high degree of specificity involving close collaboration with customers, we think Jungheinrich can use its forklift relationships to expand the logistics systems business.

Exhibit 13 Unlike Jungheinrich and Kion, Most Top Logistics Systems Suppliers Do Not Supply Forklifts

	2015 Logistic Systems Revenue				
	MMH ($m)	M* Estimated ($m)	Ranking MMH	Ranking M*	Also a forklift manufacturer?
Dematic (Kion Group)	2000	1956	3	1	Yes
Schaefer	2595	1182	2	2	No
Mecalux	952	952	6	3	No
Intelligrated	760	760	8	4	No
Beumer Group	788	688	7	5	No
Daifuku	2726	665	1	6	No
Knapp AG	640	634	11	7	No
TGW Logistics	525	580	12	8	No
Toyota Material Handling	195	528	N/A	9	Yes
Witron	400	458	14	10	No
Jungheinrich	N/A	415	N/A	11	Yes
Swisslog	688	380	10	12	No
Kardex AG	N/A	339	N/A	13	No
Murata Machinery	1250	271	4	14	No
Fives Group	721	164	9	15	No
Viastore Systems	130	130	19	16	No
System Logistics	155	109	17	17	No

Source: Morningstar, Modern Materials Handling, company documents

Exhibit 14 We Forecast Mid-Single-Digit Revenue Growth and 18% ROICs for Jungheinrich

	2016	2017	2018	2019	2020	2021
Revenue Growth						
New Truck Sales (includes logistics systems)	15%	11%	9%	8%	8%	8%
Services	7%	4%	4%	3%	3%	3%
Rental & Used Forklifts	15%	10%	8%	7%	7%	7%
Group	12%	11%	8%	7%	7%	7%
% of Total Revenue						
New Truck Sales (includes logistics systems)	56%	57%	57%	58%	59%	60%
Services	27%	26%	25%	24%	23%	22%
Rental & Used Forklifts	18%	18%	18%	18%	18%	18%
EBIT Margin	**8%**	**8%**	**8%**	**8%**	**8%**	**8%**
ROIC	**17%**	**17%**	**18%**	**18%**	**18%**	**18%**

Source: Morningstar, Modern Materials Handling, company documents

Pallets to Pieces: E-Commerce Upends the Traditional Warehouse

Order picking is likely to be the first warehouse process to be automated, as it is the most expensive due to its labour intensity and space requirements, when factoring in storage space. Most of the world's goods are still moved and stored by pallets that hold bulk quantities of a single item; these are convenient for moving goods to distribution channels like store fronts. Manufacturers ship containers containing pallets to a warehouse, then these pallets are typically stored in racks until they need to be shipped to individual store locations. Pallets are usually unpacked in the store and picked off the shelf by customers in the store. In warehouses serving e-commerce and shipping individual orders to consumers, the pallets need to be unpacked, with each piece or item in the pallet logged into the warehouse system and then stored to be later picked for an order. Breaking open the pallet and processing each item in the pallet multiplies the amount of work in a warehouse, not just because of the added functions, but because a full pallet is one item, whereas a "broken case" consists of many pieces.

Pallets come in standard sizes by region. Warehouses that deal only with full pallets or unbroken cases do not need sophisticated warehouse systems and therefore would not be first in line to buy equipment from the likes of Dematic or some of its close competitors, such as Vanderlande. Unbroken pallets are less complex to store, move, and pick. However, most warehouses are likely to do some degree of pallet-breaking. In a recent study conducted by Peerless Research for *Logistics Management* and *Modern Materials Handling* magazines, just 9%-13% of the participants represented warehouses that dealt only with full pallets.

One of the more sophisticated pieces of warehouse automation equipment is called a multishuttle (pictured in the following pages), which combines storage and picking in a single system and can provide picking rates of 8-10 times a manual picking process using paper. This is an important area for cost savings, as 50%-60% of the costs come from ordering picking[2]. Picking rates are a measure of productivity or volume throughput and generally discussed in terms of lines/hour or items/hour. A very basic manual picking method would be a warehouse worker walking to the storage racks (a "person-to-goods" method) and picking items from shelves while checking items from a paper order list. In this scenario, the worker might be able to pick 100 or so items per hour. The multishuttle (pictured in the following pages), which combines storage and picking in a single system, could enable picking rates of 800-1000 items per hour because the totes can move more quickly and more accurately than humans to take items from shelves and then bring them to the people in a packing area. Automation processes that bring items to people are known as "goods-to-person" systems.

2 Kardex AG 2015 Annual Report.

Exhibit 15 Multishuttle Fully Automated Storage (Left) Versus Traditional Racking With Aisle Space for People and/or Forklifts

Source: Kion Group (left), Jungheinrich (right)

The multishuttle also takes up less space for the equivalent volume of items, as there is no space needed for humans to walk the aisles, with all the items stored in floor-to-ceiling racks that are accessed by a tote train or shuttle grabbing totes of items from store locations within the system. The savings on space expense can come through in the initial construction cost of a greenfield warehouse and ongoing rental costs of a leased warehouse space. By some accounts, a multishuttle's footprint is almost 20% less than that of traditional storage racks.

For example, in our visit to Ocado's warehouse, we noticed that the company kept less popular longer-shelf-life products in an expensive multishuttle automated storage and retrieval system, or AS/RS, but more common items, such as bread, were kept right next to the order packers in the pick-to-light shelves. The multishuttle funnelled all the items in an order to a single location for the person packing to fill orders. This enabled the person to pick at a speed of 500-plus items per hour, twice the rate of the pick-to-light shelves for the more common items. The increased spending on the less popular items stemmed primarily from the storage space requirements associated with them. Popular perishable items like bread were not stored, but were received into the warehouse and immediately sent to the packing area, whereas wine was stored in the multishuttle.

The drawback is, of course, that a multishuttle can cost millions of dollars, versus thousands for basic racks, and if the shuttle fails, the whole warehouse operation is affected. However, traditionally rack systems not only need more space, but often require forklifts to access the higher shelves or take heavier items from the storage spots. Adding the forklifts to the cost analysis could make the manual option less attractive. The chart below shows the portion of space-related costs on a partially automated storage setup at 50%, much lower than the 90% that it would represent in manual setup with forklifts

and manual racking. The difference in the total costs will depend on the location but could as much as double the overall upfront warehouse investment.

The logistics systems suppliers also try to quantify general savings from automation. In one of its presentations, Vanderlande names the benefits as follows:

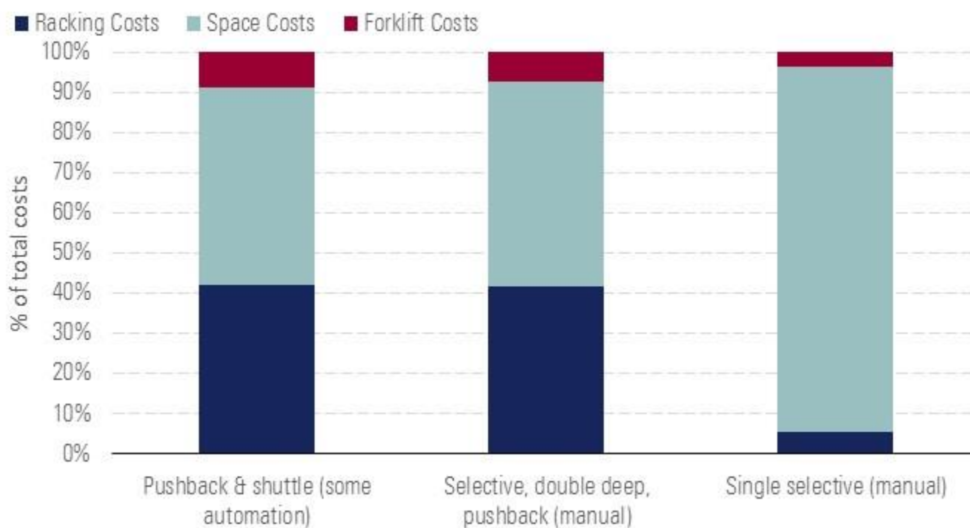
- 40% reduction in picking
- Picking up to 1000 lines/hour
- Up to 99.99% picking accuracy
- Triple throughput per square metre
- Order lead time of less than 1 hour

Retrotech, now part of Kion Group, claims automation can:

- Increase warehouse productivity by 80%
- Increase order accuracy to up to 99.9%
- Reduce cost per unit by 50%
- Reduce labour requirements by 70%

Bastian Solutions, a warehouse equipment supplier recently acquired by Toyota Industries, estimates that the average payback period for a goods-to-person automated solution is two to four years.

Exhibit 16 Comparison of Upfront Costs of Manual vs. Automated Storage, Including Land and Forklifts



Source: Cisco Eagle. Morningstar

Robot Arms Handle Uniformity More Easily Than Variety, but This Is Changing

The very last step in picking is to put individual items together into customer orders—in boxes, for example. This requires handling each item individually, something that robots still struggle with unless they are dealing with uniform items like pallets or pharmaceutical packaging (see Exhibit 17 below). Automated solutions like the multishuttle take items from the shelves in totes or boxes and then bring them to end picking/packing stations where humans pick up each item. Because many warehouses deal with thousands of different items of various weight, shape, size, and degree of fragility, robotic arms are

rarely used in picking solutions. However, established logistics systems companies and robotics companies such as Universal Robots (owned by Teradyne) and RightHand Robotics continue to work on solutions. RightHand Robotics, a startup that recently received $8 million in venture capital funding, has developed a robotic hand with a suction cup in its palm and three fingers that combined can adjust the grip to pick up an egg or soft packaging containing, for example, mozzarella cheese. Part of the ingenuity of this solution is that the suction cup enables the hand to latch on to objects with soft packaging (see Exhibit 18 below).

Exhibit 17 Robotic Arms Are Used for Picking Uniform Objects Like Pallets and Boxes

Source: Kuka, Dematic

Exhibit 18 Startup RightHand Robotics Uses a Combination of a Suction Cup and "Fingers" to Handle Diverse Item-Picking

Source: RightHand Robotics

Warehouse Automation Is Not New, so Why Now?

Technology in warehouse automation is still evolving but has come a long way. A logistics expert working at a 3PL described this as the fourth phase of warehouse automation, so it is not a new concept. In fact, the first completely dark warehouse—no lights, no people, only machines—was rolled out 20 years ago at a Black & Decker spare-parts warehouse in Belgium. However, warehouse automation did not take off then because fully automating a warehouse creates a lack of flexibility, and sometimes warehouses need to adjust processes to accommodate new SKUs or volume increases. The technology was also in the early stages and offered fewer efficiencies and functions. Today, it is more common for warehouses to automate individual warehouse functions than for them to go fully "dark", enabling them to avoid massive upfront costs and to cherry-pick the best technologies.

Warehouse automation systems are now more robust and offer better payback periods than the previous generations. Improvements in two of the key elements of general industrial automation—programmable logic controllers and sensors—are responsible for this. The PLC has been around since the 1960s but did not evolve in parallel with the personal computer. For years, the PLC lagged in memory and processing power, in part because it had a different programming language—ladder logic, instead of C/C ++ used for PCs—so the improvements to the PC did not transfer over to the PLC. The PLC was also specifically designed for industrial environments, and PCs are not sufficiently rugged substitutes. Today, there is less distinction between the two. The PLC has caught up in memory and processing power, aided by improvements in technology and declining costs of microprocessors and sensors. These developments have provided the necessary memory, data acquisition, and processing power for running more complex algorithms, which is essential to a good warehouse software program.

Sensors are an integral part of automation across all sectors, but in warehouses they measure important parameters that feed into the warehouse's software systems and aid the sequencing of SKU flow. Some of the data they measure include SKU dimensions, weight, volume, and proximity. For example, in one of our warehouse tours, we saw Sick's sensors on a conveyor belt, possibly measuring proximity to know when an item had reached a specific point on the belt so that it could then be diverted to a different part of the warehouse. Sick, a privately held German company, also provides dimension sensors for Dematic's equipment, which uses Sick's MLG-2 light grid sensor to determine the volume, weight, and dimensions of goods (even transparent ones) in a pallet so that they can be loaded onto a truck or stored in an optimal configuration. The sensors would send the data to the warehouse software system, which would then send commands back to the equipment or warehouse worker on how to treat the pallet.

Warehouse Automation Is 10-20 Times More Expensive Than Manual

Even though automated warehouse equipment costs 10-20 times more than manual equipment (think of the multishuttle versus a basic rack setup), it can still be essential for competitive reasons. This is put more succinctly by Jean Belanger, the founder of Reddwerks, now a software subsidiary of Kion Group:

> *The convenience that consumers enjoy from ordering online comes out of the hide of the retailer. Direct-to-consumer retailers have to react very fast, and minutes count where hours and days used to suffice.*

Based on our conversations with equipment buyers, the most expensive category of equipment in a fully manual warehouse is the racking, which could amount to 60%-80% of total equipment costs. However, in a warehouse with automated picking, racking could shrink to just one third of the total costs due to the additional costs of a goods-to-person setup, with conveyor belts and a multishuttle. The multishuttle would be the most expensive piece of equipment, costing as much as $10 million-$20 million, depending on the size, versus, say, $2 million for racking handling the equivalent volume, but of course taking up much more valuable floorspace. The overall cost breakdown would then be about one third each for racking, conveyors, and a multishuttle. The payback is project-specific but generally expected to be about 12-24 months for warehouses with sufficiently high labour or space costs to justify the investment. Therefore, warehouse customers must make a step change in capital expenditure budgets to accommodate the premium costs of automation. For others with competitive pressures for quicker delivery times, it will be more of a necessary investment without direct cost savings. **However, premiumisation, or price mix, is one of the reasons we are confident that the warehouse equipment market can grow 10% over the next 10 years.** Time is another reason, as warehouses generally do not go through big design overhauls before the end of their 15- to 20-year lifespan. This means automation will take a while to take hold on a widespread basis, but many companies are starting out with brownfield conversions, such as automating lines or other discrete functions.

For example, we recently toured Amazon's eighth-generation warehouse in Rugeley, England, where we most of the processes are handled manually, including person-to-goods picking, but there were two that were automated. The first was a 12-mile conveyor belt system from TGW (number-eight global logistics systems supplier in our ranking) in the middle of the warehouse that carried totes (plastic cartons) of order items to and from the various function areas (receiving, putaway, picking, and shipping) throughout the warehouse. The second was a piece of equipment from Dematic, known as a scan, label, attach, and manifest, or SLAM, whose primary function was to implement quality control and affix shipping labels on orders already in Amazon packaging. In what seemed like a second or two at most, the equipment would use an overhead scanner to read the barcode on the packaging, recalling the package's expected weight and delivery date from the central software system. At the same time, it would weigh the package, and if the weight was not in line with the expected one from the system, it would kick out the package to a side conveyor belt for a manual check. If the package wasn't kicked out, the system would then compare the delivery date given to the customer against the day the order was likely to arrive and dynamically change the label to a Prime (express shipping) label if it calculated that the actual delivery date would be late. For a description of our colleague's tour of the Jeffersonville Amazon facility in the U.S., please click here.

This is not Amazon's most automated warehouse, but it is generation eight out of nine. Generation nine has more sophisticated time-saving picking systems using Kiva robots, which are a goods-to-person system and can multiply picking rates. However, according to the Amazon employee who gave us the tour, the company does not retrofit existing warehouses for new systems. Amazon acquired Kiva in 2012, a year after the Rugeley warehouse was built. The Kiva robots, which are small autonomous platforms that can bring racks of goods to workers for order-packing, have inspired other companies,

including startups like Fetch Robots, to develop variations, especially as Kiva robots are now the exclusive domain of Amazon.

When Does Automation Not Make Sense?

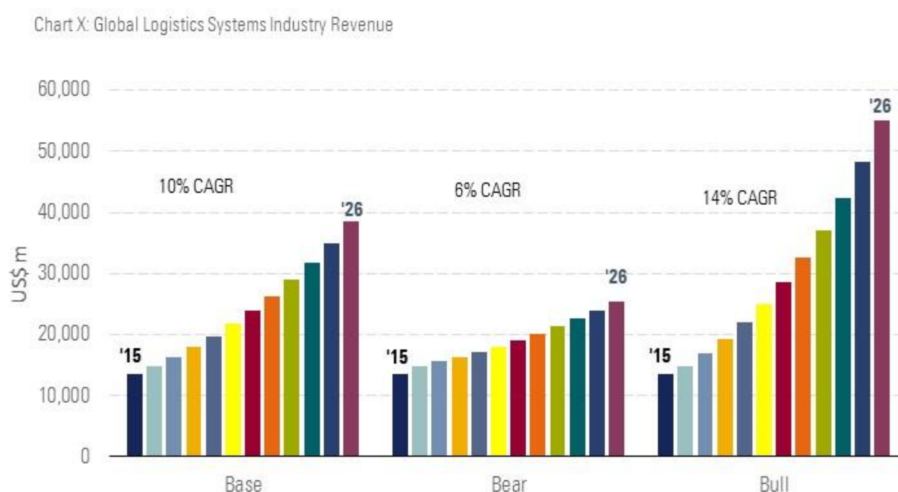
In processes that lack uniformity or require more customisation, automation is difficult to implement and unlikely to improve productivity. (This is also one of the reasons why we recommend plumbing as a trade to anyone who is worried about job security from automation.) For example, returns processing is a basic warehouse function, but returned items have to be inspected for damage and completeness—for example, to make sure all the Lego pieces are still in the kit. And of course, return on investment calculations for automation equipment usually don't make the cut in markets where labour and/or land is cheap.

Still in Its Infancy, the Warehouse Automation Equipment Market Has a Long Runway of Growth

In our base-case scenario, we forecast a 10% CAGR in the logistics equipment market through to 2026. This may seem like a long time to sustain double-digit growth levels, but we believe it is justified by several factors, including:

- The fact that most warehouses globally are fully manual, indicating the industry is in its infancy and that growth will be coming from a low base of penetration.
- The push from e-commerce, which is also in its early stages globally and which requires 2-3 times the warehouse space of traditional retail businesses.
- And finally, automated equipment commands a premium of as much as 20 times over manual equipment for the same function.

Exhibit 19 Our Base-, Bear-, and Bull-Case Scenarios for Industry Growth Range From 6% to 14% CAGRs



Source: Morningstar
Notes: Excludes forklift equipment

Our industry growth estimates are based on nominal GDP growth, particularly for Western Europe and the U.S., which should drive a large part of demand for automation equipment, as well as the structural shift demand drivers mentioned above. Our base case of 10% annual growth is based on roughly 4% nominal GDP annual growth (based on International Monetary Fund, or IMF, forecasts for North

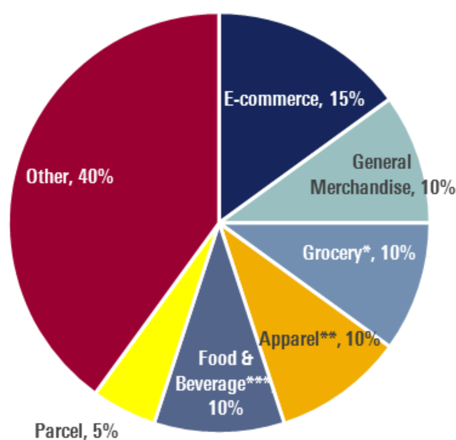
American and Europe) and 6% structurally driven growth. In our bear-case scenario, we assume no GDP growth for the first five years, and 5% structurally driven growth for a 6% CAGR over our forecast period. In our bull-case scenario, we assume the upside is on the structural shift and not on GDP growth. This scenario would envision faster conversion to automation from the current base of warehouses, 80% of which are all manually run, as well as greater demand from Asia, leading to a 14% CAGR.

Most industry estimates for material handling include a broad range of equipment. Here we focus on just the warehouse/distribution-centre-related equipment and exclude other items like forklifts and escalators. Our starting point is an estimate of just under $14 billion in 2015 and is based on our compilation of logistics systems revenue for the top 17 companies (detailed in Exhibit 2) in the sector, as well as the assumption that they generate 75% of industry revenue.

Prologis, a global logistics real estate company, expects 3 billion square feet of additional warehouse space to come to the market by 2025; impressively, this includes an expected doubling of space in Europe and Asia. Incremental to this demand would be additional space required in India and Australia, two markets where the company does not operate. One of the reasons for the expansion is e-commerce, which we expect to grow at a 10% CAGR over the next several years in the U.S. and Europe. Another factor is that warehouse buildings are getting higher to maximise square footage. New buildings can be at least 35 feet high, 30%-plus higher than the roughly 26-foot traditional warehouse. Higher ceilings will accommodate taller warehouse storage equipment.

However, the end markets for warehouse equipment extend well beyond e-commerce (see Exhibit 20), and include distribution centres for traditional retail, parcel, spare-parts distribution, and manufacturing. For example, Kardex, a small-cap Switzerland-based publicly traded logistics systems supplier, provided Alfa Laval's Frank Mohn subsidiary with a storage system for spare parts. Frank Mohn provides critical pump systems to the marine and energy industries, which run 24/7 operations and require spare-parts deliveries with minimal turnaround timee. This requires storing a large supply of diverse parts, which, with automation, can be done in tighter spaces and enable faster retrieval of the items for shipment.

Exhibit 20 End Markets for Logistics Systems Equipment Extend Beyond E-Commerce



Source: Kion Group. Morningstar; Notes: (*) 7%-10%. (**) 7%-10%. (***) 5%-10%

Labour and Space Costs: Key Automation Determinants

Of the 20% or so warehouses globally with some degree of automation, labour and space costs were likely key to the decision to automate. More than half of a warehouse's costs are from labour[3]. Reducing these costs can be an uphill battle, particularly for e-commerce businesses, as warehouses often need to be close to urban locations, where labour costs are high. Therefore, the decision to automate can originate from rising labour or warehouse space expenses. According to DHL, a warehouse worker might walk seven to 15 miles in a single shift, which, at the high end, is the equivalent of a half marathon. In the U.S., an unskilled warehouse worker can earn up to $19 per hour, and in the U.K., companies like Ocado pay GBP 12 per hour (including benefits and taxes). Both of these figures are well above local minimum-wage levels, and walking represents unproductive time that slows down order fulfilment times and decreases the number of items that can be picked per hour.

Automation increases space utilisation and reduces human tasks. Therefore, in markets where labour and space are at a premium, automation is higher. In its annual report, Kardex, a Switzerland-based equipment supplier, states that in Central Europe, about 30% of distribution centres and warehouses are automated. However, in India, where labour and land are inexpensive, automation is less common and in most cases likely uneconomical. In China, land and labour are generally still relatively inexpensive, but wages are increasing, and in port cities, which often have a concentration of warehouses, land is more expensive. As a general example of the increased automation from rising labour expenses, Kuka, one of the top five global robotics companies and owner of Swisslog (the number-12 global logistics systems company in our ranking), named Chinese wage increases as a driver for the growing portion of its revenue coming from the country (15% in 2016, nearly double 2014's 8% level).

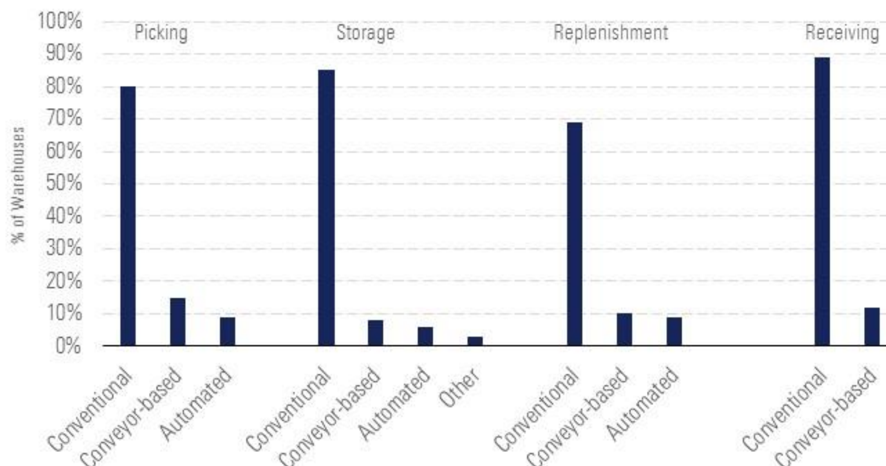
3 Argus I. http://www.argusi.org/en/european-warehousing-labor-cost/, Peerless Research "Labor Management Strategies in the Warehouse"

Exhibit 21 Rising Labour Costs in China (Average Annual Wage Growth)

Source: National Bureau of Statistics of China. Morningstar

We expect to see an increase in automation in North America, where only 10% of warehouses have automated picking, which is the most expensive and labour-intensive of all warehouse functions. The charts below show the high portion of manual operations for major warehouse functions. Exhibit 23 depicts the steady demand for warehouse workers, as reported by the U.S. Bureau of Labor Statistics. Following the financial crisis, the number of U.S. warehouse workers has grown annually by 6% on average, well above the roughly 2% in U.S. nonfarm payrolls coming out of the recession.

Exhibit 22 In North America, Only About 10% of Warehouses Have Automated Picking



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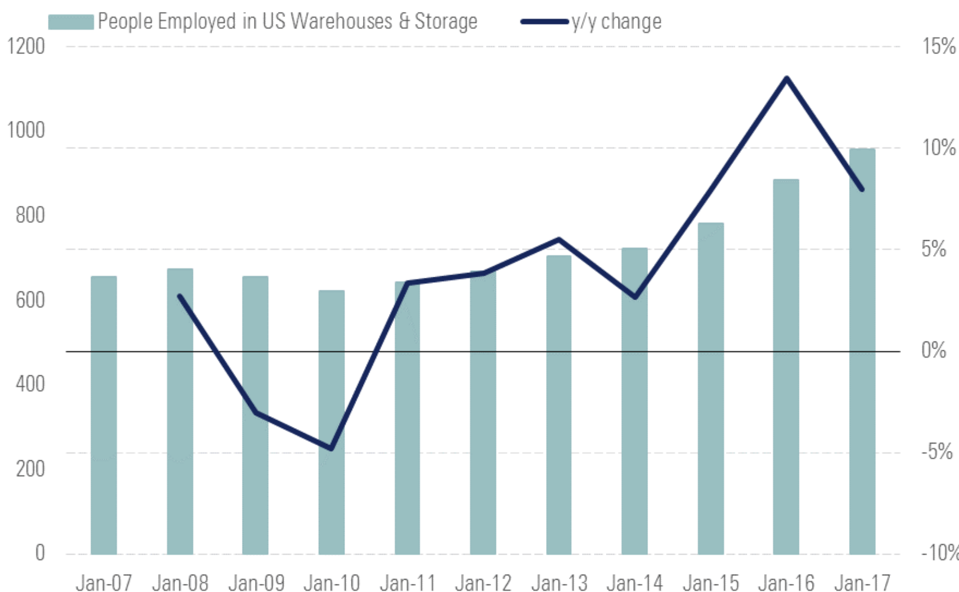
Source: 2011 Material Handling Industry of America.
Notes: Conventional=manual with some use of forklifts

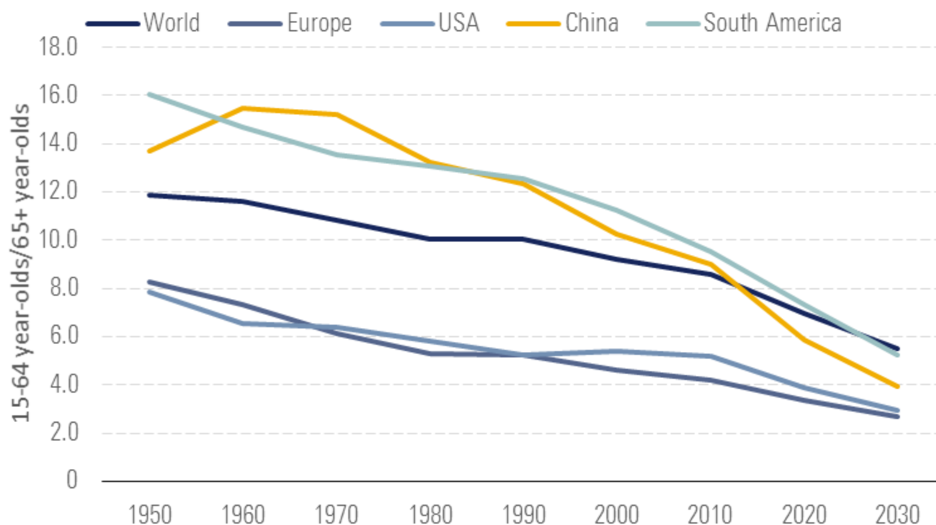
Exhibit 23 The Number of Warehouse Employees Has Grown by 6% on Average Since 2010 in the U.S.
Figures in thousands.



Source: U.S Bureau of Labor Statistics, Morningstar

Over the longer term, the ageing population will contribute to an already-tight market for warehouse workers. Deutsche Post DHL has referred to this as one of the greatest challenges in logistics today.[4] In the grocery sector, it can take twice as many people to fulfil an e-commerce order as a brick-and-mortar purchase, because in brick-and-mortar purchasing, the customer does the picking, whereas in e-commerce, the company does the picking. Exhibit 24 shows the United Nations forecast for a declining ratio of working-age to retirement-age population in all regions globally through to 2030, increasing the need for automation to make up for the coming labour shortage.

Exhibit 24 Declining Ratio of Working-Age/Retirement-Age Population



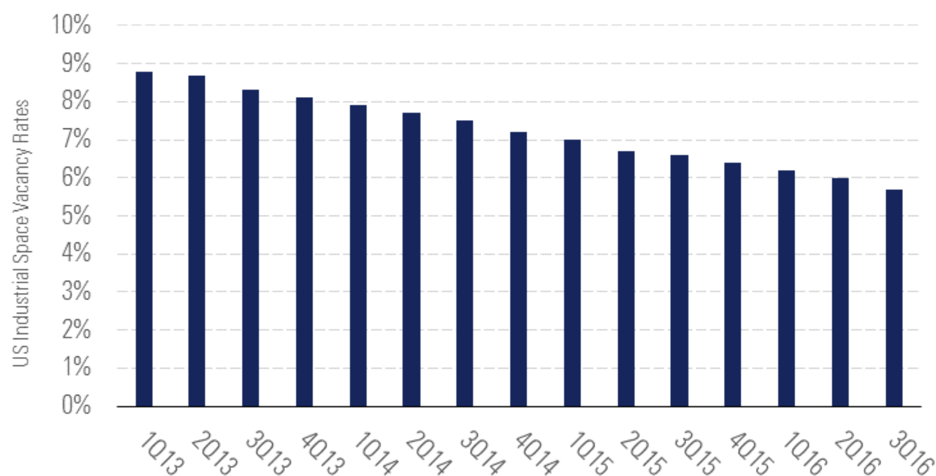
Source: United Nations, Morningstar

4 http://www.dhl.com/en/about_us/logistics_insights/dhl_trend_research/robotics_in_logistics.html#.WL8bZPKULVY

Prime Logistics Space in Demand

In the past two years, global logistics space rents have grown by 4%-6%, with the highest growth rates coming mainly from major global cities including New York, Barcelona, London, San Francisco, and Tokyo[5]. The U.S. has seen the highest growth rates, followed by Europe. Rent can be a significant portion of warehouse expenses, amounting to as much as 30% of the costs including labour. Rising demand has pushed global logistics space vacancy levels below 5%, meaning that the pressure on rental rates is unlikely to ease at least in the near term. In the U.S., industrial space vacancy rates dropped from nearly 9% in 2013 to below 6% in 2016.

Exhibit 25 U.S. Industrial Space Vacancy Rates



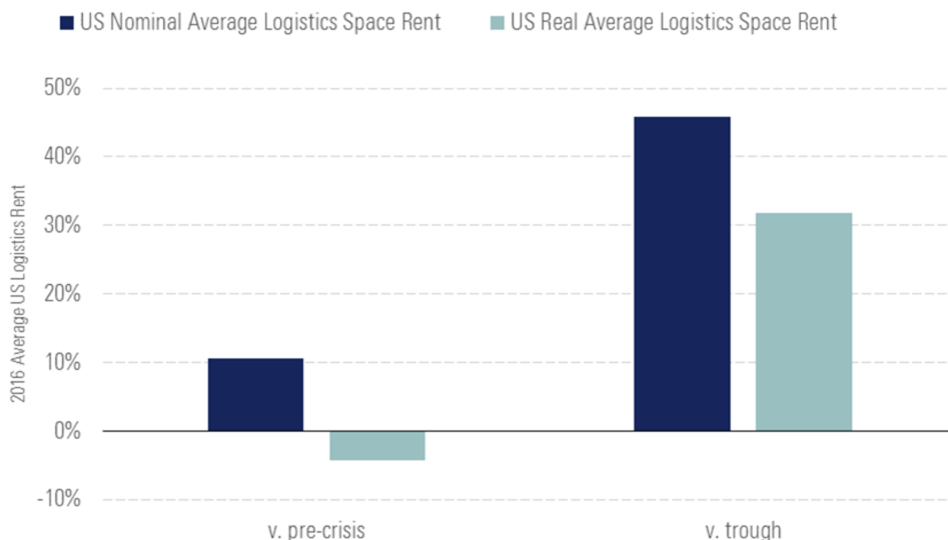
Source: Colliers International, Morningstar

According to Prologis, current global rent rates exceed rates on existing leases established a few years ago by 20%. During the financial crisis, warehouse rents fell sharply both in the U.S. and Europe. In the U.S., warehouse average rental rates are about 30% above the 2010 trough level (see Exhibit 26).

The rise in rental rates comes from a combination of pressures on both the supply and demand side of the market. On the supply side, the market experienced a dip in development during the financial crisis. And in the aftermath of the crisis, banks and investors became more cautious when financing new investments.

5 Prologis

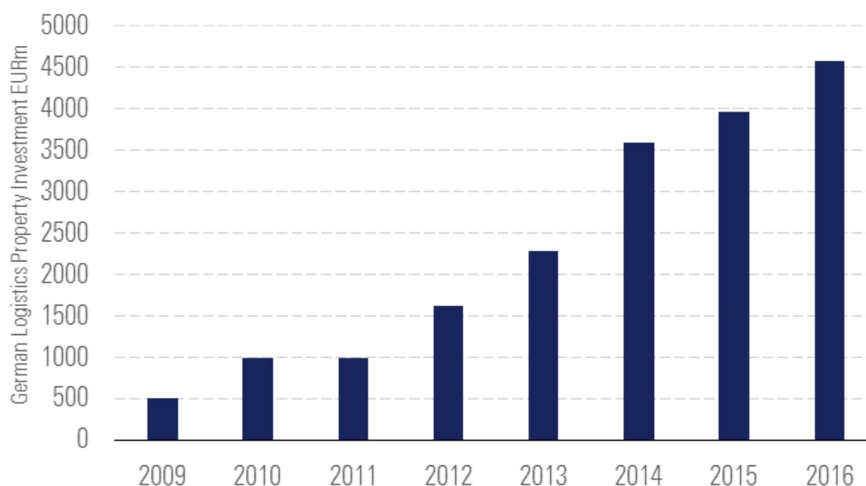
Exhibit 26 U.S. Industrial Space Rent Rates



Source: Colliers International, Morningstar

Growth in European rental rates has lagged the U.S. but is still above the 2011 trough levels by 7%-13% on a real and nominal basis. Low vacancy rates, expected economic growth, and growing e-commerce volumes should increase the stock of warehouse space (and hence warehouse equipment). Prologis expects European warehouse space to double from 2015 to 2025. In Germany, with important European logistics hubs like Hamburg, Frankfurt, and Munich, investment in the logistics space has picked up dramatically in the past few years (see Exhibit 27).

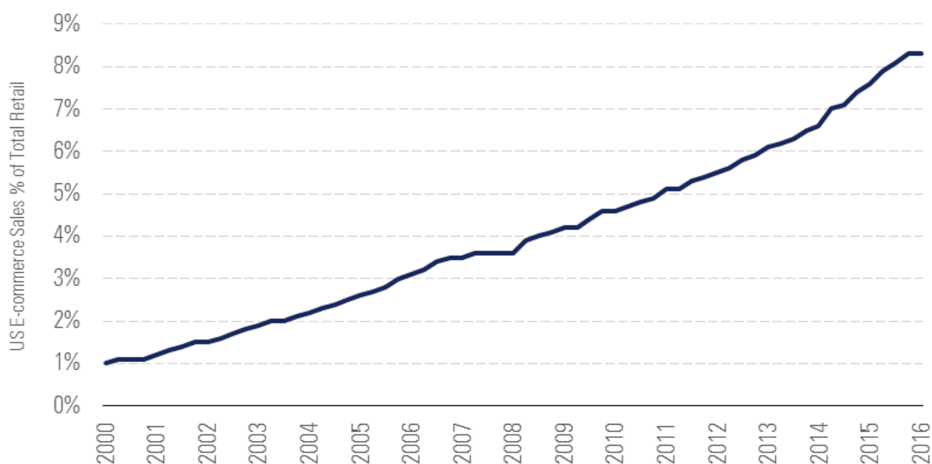
Exhibit 27 Rebound in Investments in German Logistics Space



Source: Colliers International, Morningstar

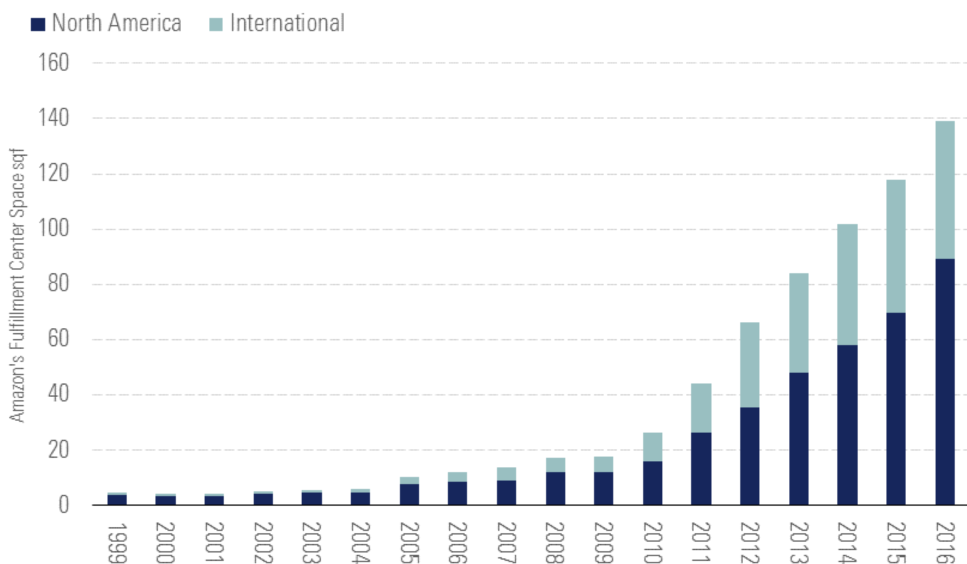
E-commerce and online-procurement-related warehouses require extra warehouse space due to their added functionality beyond basic storage, including, among other things, returns processing and cross-docking. With compressed shipping times, they also often need to be closer to urban areas. Amazon is a good example of the rising demand for warehouse space from online businesses. Exhibits 28 and 29 show e-commerce increasing as a portion of U.S. retail sales since the beginning of the decade, as well as Amazon's voracious appetite for space over the same period, with a marked acceleration since the end of the 2008-09 financial crisis. We expect Amazon to continue expanding its logistics space at a low-teens to midteens range over the next five years.

Exhibit 28 U.S. E-Commerce Retail Sales as Percentage of Total Sales



Source: St Louis Fed, Morningstar

Exhibit 29 Amazon's Voracious Appetite for Warehouse Space



Source: Company documents, Morningstar

In the United Kingdom, warehouse rental rates and wages have been growing above inflation (see Exhibit 30). U.K. labour costs may also be affected by the U.K. leaving the EU. According to the *Financial Times*, one fifth of all forklift drivers are from the EU, and the future status of their longer-term right to work in the U.K. is currently unclear.

Exhibit 30 U.K. Rents and Wages Have Been Growing Above Inflation

Source: Colliers International, Morningstar

Everyone Orders Bananas! The Importance of Warehouse Software

Algorithms run warehouses and are customised specifically for each warehouse, increasing customer switching costs and the moats of logistics systems suppliers that sell warehouse software. Most warehouse operations contain a degree of unpredictability, which only increases with the number of items and customers that a warehouse services. Automation algorithms manage this unpredictability in large part using historical data from the warehouses to calculate, for example, the probability of an item's popularity, but also prior project experience. Because warehouse patterns tend to be specific to the sector and local market level, prior experience with similar projects leads to more robust algorithms. The lines between the various layers of software in a warehouse are becoming blurred with more overlapping functions, and so we do not spend too much time here trying to delineate them. However, three layers are commonly discussed, albeit not always with uniform definitions. We provide basic definitions below:

- **Warehouse Management System:** Interfaces with the company's enterprise resource planning, or ERP, software and can help to manage inventory across several warehouses—if, for example, the customer is operating more than one distribution centre. Might also make decisions on sorting.

- **Warehouse Control System:** Controls the movements of all the equipment.

- **Warehouse Execution System:** Integrates some of the functions of the two above and sometimes cited as necessary for waveless (dynamic) order picking

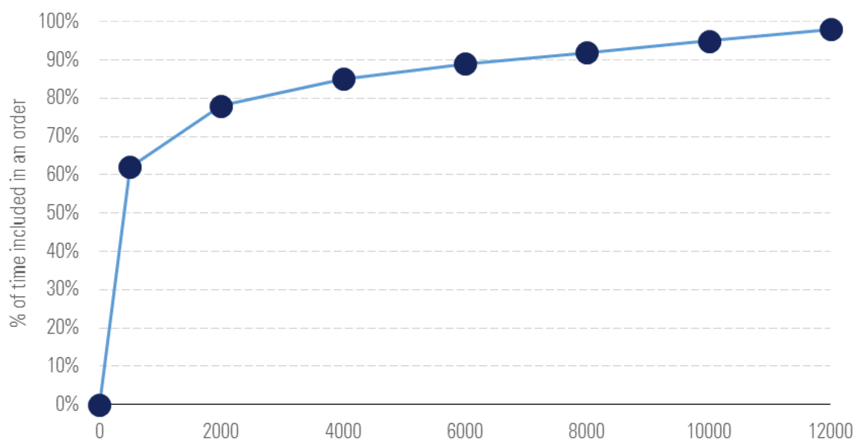
The automation software that directs warehouse storage and resource allocation are often based on probability-based algorithms, but the software can be based on more than one type of algorithm. The effectiveness of these algorithms can be measured on a real-time basis from performance metrics, which warehouse operators constantly track.

Some of these could include the number of items picked per person or the number of orders filled per hour. The other test of robustness is how the system performs when low-probability events happen somewhere along the process chain. For example, if there is a snowstorm during the Christmas period that delays product delivery into the warehouse, the warehouse software must be able to reallocate resources from within the warehouse or use external resources to find an alternative source to receive the product on time. High-probability events also require special treatment. For an online grocer like Ocado, bananas would be located next to the order packers, while less popular items would be kept in less accessible areas.

A key part of warehouse design is slotting—that is, planning where to store each item based on its popularity, size, and/or shelf life. The old Pareto rule of the 80/20 rules applies to warehouses as well, with a minority of either items or customers often generating the majority of activity in the warehouse.

However, designing based on Paretos alone can lead to issues, because every once in a while, Paretos no longer hold true. If an item has very low popularity for most days of the year but then becomes wildly popular for a brief period of time (for example, swimming goggles), detailed profiling and software development come into play. A well-planned and well-written warehouse software program will ensure that there is an increase of goggles in inventory just before summer and will also move the goggle slotting from somewhere deeper in the warehouses to a place that is easier to get to, or closer to the order-building area.

Exhibit 31 Warehouse Pareto Chart Example



Source: Morningstar

The performance of algorithms is one of the ways in which warehouse equipment suppliers differentiate themselves. One of the final stages that equipment suppliers go through to win major warehouse projects is to demonstrate how their systems would respond to a series of challenges given by the warehouse equipment customer. This is usually done through computer simulations. Owing to the many moving and unpredictable parameters in managing a warehouse, the various processes and pieces of equipment, along with the dynamic flow of incoming orders and inventory, mean that perfect optimisation is elusive, creating ongoing opportunities to improve processes, software, or hardware.

One of the latest trends in optimising warehouses through process is waveless order picking, with orders being picked on a continuous basis instead of in batches. This is a more unstructured, but done right, potentially more efficient way of operating a warehouse because it maximises resource utilisation by allowing the systems to take advantages of gaps in utilisation that batch-picking created. The algorithms that run this must deal with more complexities, and so are of a design that differs entirely from the traditional ones. In 2015, prior to being acquired by Kion Group, Dematic bought Reddwerks primarily for its waveless-specific algorithms.

Appendix: Glossary of Common Terms

Picking Processes	
Goods-to-Person (GTP)	Warehouse equipment carries stock from storage area to workers in packing area. GTP systems include carousels, AS/RS, automated shelving systems, and robots (like Amazon's Kiva).
Person-to-Goods (PTG)	Warehouse workers walk to storage area to take items from shelves.
Wave (or Batch) Picking	Orders are grouped together and gathered (picked) based on a common parameter—for example, destination, shipping scheduled, or shared items.
Waveless (or Batchless) Picking	Items are picked as needed and not based on any group sequencing, as in wave picking. This method is software-controlled and nearly impossible to do on a large-scale basis without automation, but can increase warehouse throughput.
Pick-to-Light	A lighting system coupled with storage bins, each holding a single SKU, directs the worker as to which item to take out of the bins next. Used in PTG and GTP picking.
Pick-to-Voice	A voice system coupled with storage bins, each holding a single SKU, directs the worker as to which item to take out of the bins next. Used in PTG or GTP picking.
Vision Picking	Relatively new technology used in PTG, with worker using smart glasses to walk through a storage area and pick items from shelves. In trial by DHL.
Pallet Pick	For orders shipped in pallets—for example, from a supermarket distribution centre to individual stores. Whole pallets are taken from shelves by workers, often using forklifts.
Broken Case	For orders that are shipped in pallets but with a mix of items or SKUs, often packed together with shrink wrap—for example, from a supermarket distribution centre to individual stores. Whole pallets are created from taking different items from various pallets.
Each Pick	For orders shipped in boxes instead of pallets. Items are picked on a single-unit basis.

Storage & Sorting Equipment	
AS/RS (Automated Storage and Retrieval System)	High-density storage rack system for pallets or totes, often floor-to-ceiling, with an automated retrieval system of totes or pallets moving between storage shelves to retrieve items for delivery to pickers.
Mini-load AS/RS	An AS/RS designed specifically for totes or smaller nonpallet loads. Typically uses stacker cranes to go from one level of racks to another.
Multishuttle AS/RS	The latest version of a mini-load, with more movement flexibility in vertical and horizontal movements of the retrieval system. Increases retrieval volumes/improves space utilisation. Movements usually run by software. Picking rates can be a multiple of a pick-to-light system, for example.
Vertical carousel	GTP unit with a high stack of shelves that rotate to bring items down to pickers, typically used for small items like tools or even small boxes in pharmaceutical storage. Kardex's Remstar is an example.

Warehouse Spaces	
Fulfilment Centre	Warehouse focused on fulfilling orders to individual customers.
Distribution Centre	Multifunctional warehouse redistributing goods to stores but also fulfilling orders to individual customers.

Warehouse Design	
Profiling	A detailed mapping of all historical unit/SKU movements in the warehouse by popularity, time, day, size, weight, material, shelf life, and so on.
Cube-Movement	Volume metric based on cubic feet used to determine storage placement, or slotting

Pareto distribution, or ABC Analysis	The old 80/20 rule applies to warehouses too, with a minority of items generating most of the warehouse activity.

Unit and Order Measurements

Order	Type and quantity of items required
SKU	Distinct type of item
Unit	An instance of an SKU
Line	SKU
Wave	Groups of orders

Processes

Cross-docking	Incoming product that doesn't need to be stored, but is immediately prepared for outgoing order fulfilment.
Kitting	Putting together one complete order from different items, possibly involving light assembly. Examples could be a first-aid kit or a computer with peripherals.
Value-added services	Various end-of-the-line adjustments to an order. Examples include customisation or special wrapping.

Warehouse Software Systems (Note: functions can overlap)

WMS	Software system managing flow of inventory in and out of a warehouse/distribution centre or even among several warehouses, usually integrated with the enterprise resource planning, or ERP.
WCS	Software interface between WMS and programmable logic controllers, or PLCs, directing warehouse equipment to manage the flow of items within a warehouse.
WES	Newer software interface combining WMS and WCS functions. Dematic's IQ is an example.

Kion Group (KGX)

Last Price	Fair Value	Uncertainty	Stewardship	Economic Moat	Moat Trend	Morningstar Credit Rating
61.98 EUR	75 EUR	Medium	Standard	Narrow	Stable	N/A

Analyst	Denise Molina, CFA	Five-Star Price	52.50	Estimated COE	9.0%	Adjusted P / E	22.2	26.8
Phone & Email	+31 20 797 0010	Fair Value Estimate	75.00	Pre-Tax Cost of Debt	10.0%	EV / Adjusted EBITDA	9.7	11.1
	denise.molina@morningstar.com	One-Star Price	101.25	Estimated WACC	8.4%	EV / Sales	1.2	1.4
Sector	Industrials	Market Price	61.98	ROIC *	28.6%	Price / Book	2.6	3.1
Industry	Farm & Construction	P / FVE	0.83	Adjusted ROIC *	12.3%	FCF Yield	2.1%	1.8%
				* 5-Yr Projected Average		Dividend Yield	1.2%	1.0%
						(2017 Estimates)	(Price)	(Fair Value)

All values (except per share amounts) in: EUR Millions	3-Yr CAGR/AVG	2016	Forecast 2017	2018	2019	2020	2021	5-Yr Projected CAGR/AVG
Income Statement								
Revenue		5,587	7,875	8,376	8,935	9,574	10,284	
Gross Profit		1,553	2,363	2,471	2,725	2,968	3,188	
Operating Income		504	776	868	958	1,076	1,199	
Net Income		246	283	464	533	624	713	
Adjusted Income		296	316	464	533	624	713	
Adjusted EPS		2.87	2.80	4.10	4.71	5.52	6.30	
Adjusted EBITDA		695	1,009	1,213	1,321	1,461	1,606	
Growth (% YoY)								
Revenue	7.5%	9.6%	41.0%	6.4%	6.7%	7.2%	7.4%	13.0%
Gross Profit	7.8%	7.6%	52.2%	4.6%	10.3%	8.9%	7.4%	15.5%
Operating Income	6.5%	4.3%	54.0%	11.9%	10.3%	12.4%	11.4%	18.9%
Net Income	21.2%	13.4%	14.9%	64.2%	14.8%	17.1%	14.2%	23.7%
Adjusted EPS	10.1%	10.1%	-2.5%	46.8%	14.8%	17.1%	14.2%	17.0%
Adjusted EBITDA	9.6%	8.6%	45.1%	20.2%	8.9%	10.6%	10.0%	18.2%
Profitability (%)								
Gross Margin	28.2%	27.8%	30.0%	29.5%	30.5%	31.0%	31.0%	30.4%
Operating Margin	9.3%	9.0%	9.9%	10.4%	10.7%	11.2%	11.7%	10.8%
Net Margin	4.1%	4.4%	3.6%	5.5%	6.0%	6.5%	6.9%	5.7%
Adjusted EBITDA Margin	12.3%	12.4%	12.8%	14.5%	14.8%	15.3%	15.6%	14.6%
Return on Equity	11.5%	11.3%	10.8%	16.1%	16.5%	17.4%	18.0%	15.7%
Adjusted ROIC	13.4%	10.0%	10.2%	11.3%	12.2%	13.3%	14.4%	12.3%
Adjusted RONIC	36.1%	0.1%	110.1%	119.2%	62.0%	109.0%	33.3%	86.7%
Leverage								
Debt / Capital	39.4%	55.7%	53.9%	46.8%	41.2%	35.6%	33.3%	42.2%
Debt / EBITDA	2.7	5.1	3.3	2.2	1.8	1.4	1.3	2.0
EBITDA / Interest Expense	3.4	3.4	2.7	5.9	7.5	9.3	11.0	7.3
FCFE / Total Debt	0.35	0.08	0.05	0.17	0.20	0.29	0.30	0.20
Cash Flow								
Dividends per Share		0.77	0.75	1.23	1.65	2.21	2.84	
Free Cash Flow to the Firm		(1,780)	354	520	540	646	540	
FCFE (CFO-Capex)		248	149	455	485	606	618	
Dividend Franking		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Dividend Payout Ratio		32.3%	30.0%	30.0%	35.0%	40.0%	45.0%	

Jungheinrich (JUN3)

Last Price	Fair Value	Uncertainty	Stewardship	Economic Moat	Moat Trend	Morningstar Credit Rating
31.97 EUR	36 EUR	Medium	Standard	Narrow	Stable	N/A

Analyst	Denise Molina, CFA	Five-Star Price	25.20	Estimated COE	9.0%	Adjusted P / E	19.1	21.6
Phone & Email	+31 20 797 0010	Fair Value Estimate	36.00	Pre-Tax Cost of Debt	5.3%	EV / Adjusted EBITDA	9.7	10.9
denise.molina@morningstar.com		One-Star Price	48.60	Estimated WACC	8.5%	EV / Sales	1.0	1.1
Sector	Industrials	Market Price	31.97	ROIC *	18.5%	Price / Book	2.6	3.0
Industry	Truck Manufacturing	P / FVE	0.89	Adjusted ROIC *	17.9%	FCF Yield	2.9%	2.6%
				* 5-Yr Projected Average		Dividend Yield	1.4%	1.2%
						(2017 Estimates)	(Price)	(Fair Value)

All values (except per share amounts) in: EUR Millions	3-Yr Historical CAGR/AV	2016	Forecast 2017	2018	2019	2020	2021	5-Yr Projected CAGR/AVG
Income Statement								
Revenue		3,085	3,422	3,687	3,943	4,201	4,477	
Gross Profit		952	1,056	1,138	1,217	1,297	1,382	
Operating Income		235	261	286	312	339	368	
Net Income		154	170	189	207	226	252	
Adjusted Income		154	170	189	207	226	252	
Adjusted EPS		1.51	1.67	1.85	2.03	2.22	2.47	
Adjusted EBITDA		306	337	367	398	429	462	
Growth (% YoY)								
Revenue	10.4%	12.0%	10.9%	7.7%	6.9%	6.5%	6.6%	7.7%
Gross Profit	10.6%	11.9%	10.9%	7.7%	6.9%	6.5%	6.6%	7.7%
Operating Income	10.9%	10.3%	10.9%	9.9%	9.0%	8.6%	8.6%	9.4%
Net Income	13.0%	12.2%	10.3%	10.8%	9.8%	9.2%	11.3%	10.3%
Adjusted EPS	13.0%	12.2%	10.3%	10.8%	9.8%	9.2%	11.3%	10.3%
Adjusted EBITDA	11.9%	12.7%	10.2%	8.8%	8.3%	7.8%	7.8%	8.6%
Profitability (%)								
Gross Margin		30.9%	30.9%	30.9%	30.9%	30.9%	30.9%	30.9%
Operating Margin		7.6%	7.6%	7.8%	7.9%	8.1%	8.2%	7.9%
Net Margin		5.0%	5.0%	5.1%	5.3%	5.4%	5.6%	5.3%
Adjusted EBITDA Margin	9.9%	9.9%	9.9%	10.0%	10.1%	10.2%	10.3%	10.1%
Return on Equity		15.1%	15.1%	15.0%	14.7%	14.5%	14.5%	14.8%
Adjusted ROIC		16.9%	17.3%	17.6%	17.8%	18.1%	18.4%	17.9%
Adjusted RONIC		2.4%	26.0%	21.2%	21.7%	21.9%	22.1%	22.6%
Leverage								
Debt / Capital		22.3%	20.5%	18.8%	17.3%	15.9%	14.5%	17.4%
Debt / EBITDA		1.0	0.9	0.9	0.8	0.7	0.7	0.8
EBITDA / Interest Expense		15.8	17.4	18.9	20.5	22.1	23.8	20.5
FCFE / Total Debt	0.13	0.22	0.29	0.39	0.45	0.50	0.56	0.44
Cash Flow								
Dividends per Share		0.40	0.44	0.50	0.55	0.60	0.67	
Free Cash Flow to the Firm		56	106	121	140	157	171	
FCFE (CFO-Capex)		71	94	125	144	161	180	
Dividend Franking		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	
Dividend Payout Ratio		26.4%	26.5%	27.0%	27.0%	27.0%	27.0%	

About Morningstar® Institutional Equity Research™

Morningstar Institutional Equity Research provides independent, fundamental equity research differentiated by a consistent focus on sustainable competitive advantages.

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