

THIRD QUARTER IN REVIEW: ROBO GLOBAL'S INNOVATION INDICES

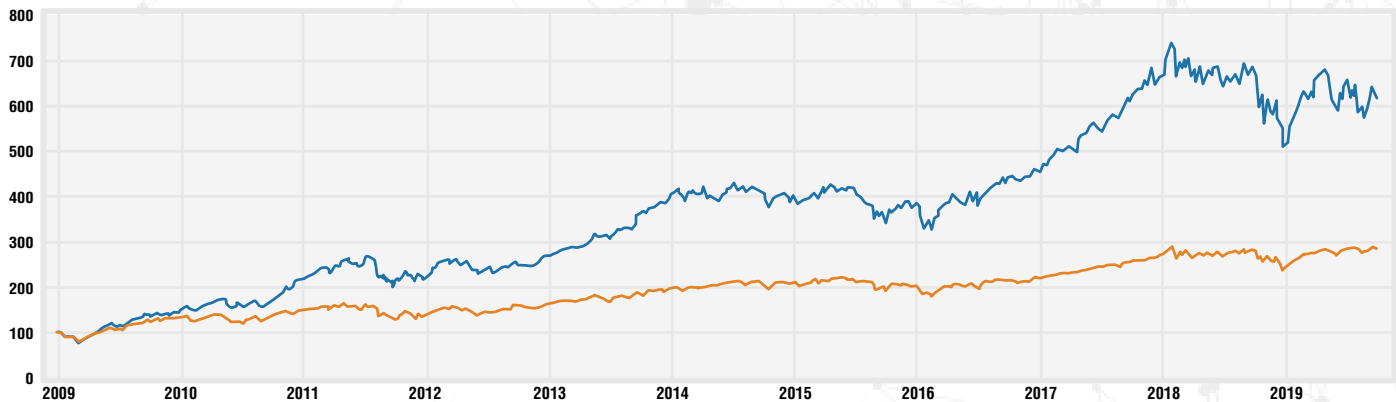
ROBO, HTEC, and THNQ

SUMMARY

Nine months into the year, the ROBO Global Robotics & Automation Index (ROBO) has returned more than 17%, the Artificial Intelligence Index (THNQ) has increased 23%, and the Healthcare Technology & Innovation Index (HTEC) is up 19%. After two consecutive quarters of earnings declines, ROBO's median EPS growth appears to have turned positive in 3Q19 and is set to return to double-digits in 2020. In this report, we discuss key trends and big movers.

Performance Chart

Rebased 100 = January 2009



	YTD	3 Year	5 Year	10 Year
ROBO GLOBAL ROBOTICS AND AUTOMATION INDEX	17.26%	11.56%	9.00%	16.03%
WORLD EQUITY INDEX	16.20%	9.71%	6.65%	8.34%

Periods greater than one year have been annualized

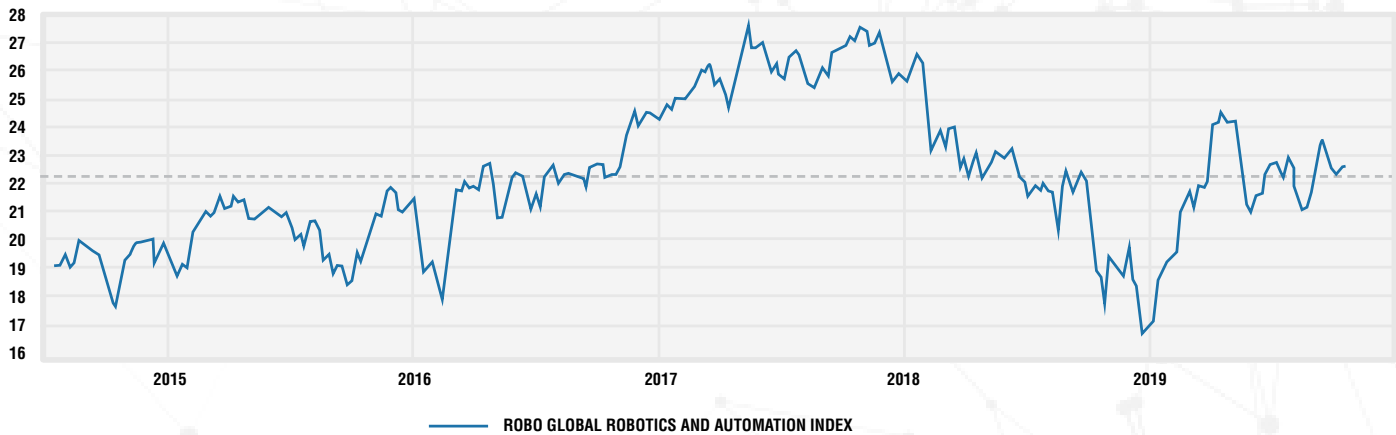
Global equities declined marginally in a volatile Q3 in the context of slowing capital investments, continued uncertainty around US trade policy, US dollar strength, and monetary easing around the world. Stocks edged up in the US and Japan but declined in much of the rest of the world. The MSCI AC World Index ended Q3 roughly where it began after dropping more than 2% in August and recouping its losses in September. Investors are growing increasingly concerned as manufacturing PMIs in advanced economies have dropped to the lowest levels since the global financial crisis.

However, upcycles don't die of old age. And consumer spending in the US and China remains strong, while the Fed just cut rates for the first time in more than ten years and returned to balance sheet expansion after a nearly 5-year hiatus. More importantly, manufacturing indicators have been declining for more than 18 months now and are already at levels where they have historically bottomed out. A resolution of the US-China trade negotiations would significantly improve business sentiment and corporate investment. Clearly, if there is one area where corporate investments are firmly set on a strong structural growth trajectory, it remains automation & AI—because productivity never goes out of style.

In fact, we believe the set-up may be particularly attractive for robotics, automation, and AI stocks at this juncture that, in many ways, appears to be comparable to early 2016. At that time, global manufacturing hit bottom following an energy bust that drove capital investments and manufacturing activity into a downward spiral in 2015. The equities of best-in-class robotics and automation companies from around the world are now trading on a forward P/E of 22x, in line with their five-year average, just as earnings and sales growth are inflecting. After two consecutive quarters of earnings declines, ROBO's median EPS growth appears to have turned positive in 3Q19 and is expected to accelerate to 15% in 2020. Meanwhile, it is increasingly clear that factory automation activity in China has stabilized and is about to enter a new upcycle.

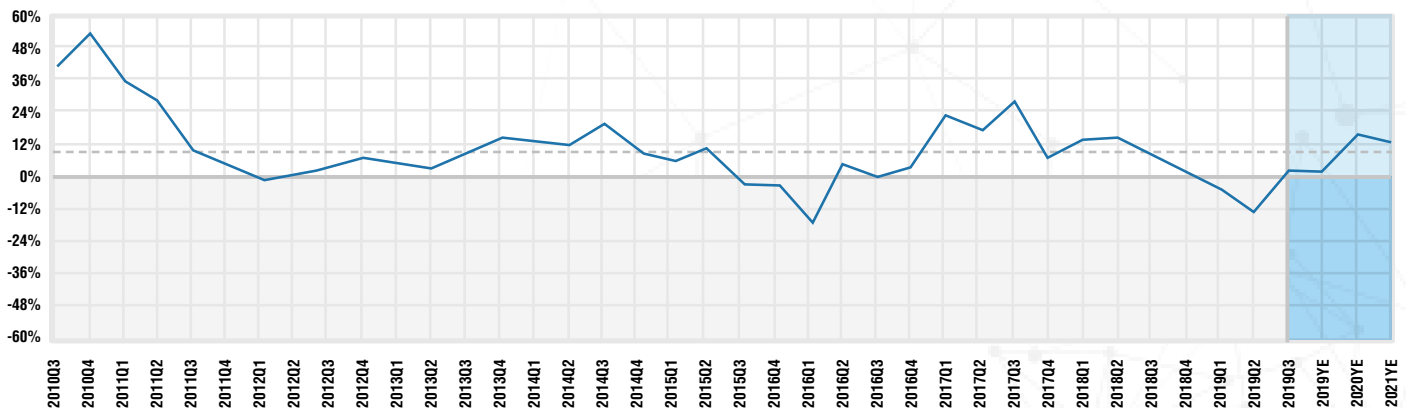
Median Forward Price/Earnings Ratio

Long Term Average = 22.37



Median EPS Growth - ROBO Index (ROBO)

Long Term Average = 11.4%



ROBO: ROBO GLOBAL ROBOTICS & AUTOMATION INDEX

Robotics and automation stocks underperformed global equities in Q3, with the **ROBO Global Robotics & Automation Index (ROBO)** declining 4.4%, including a 0.9% foreign currency headwind. This compares with a 0% return for the MSCI AC World Equities Index. Year-to-date, ROBO has returned a total 17.3%. While actuation, manufacturing & industrial automation, and sensing all delivered positive returns in the quarter, the other nine subsectors of the ROBO index declined, led by consumer products, energy, and 3D printing. By region, Asia outperformed, with Japan (+6%), Taiwan (+5%), and Korea (+3%) reflecting stabilization in order rates at several factory automation companies after five consecutive quarters of declines. Germany (-16%) and the rest of Europe were the largest detractors, reflecting the sharp deterioration in business conditions during the quarter. US holdings declined 5%.

ROBO SUBSECTOR PERFORMANCE

ROBO Index Attribution 2019-07-01 to 2019-09-30	TOTAL RETURN
3D Printing	-14.84
Actuation	2.40
Computing, Processing, & AI	-2.84
Consumer Products	-32.70
Energy	-32.37
Food & Agriculture	-12.01
Healthcare	-8.79
Integration	-6.13
Logistics Automation	-4.49
Manufacturing & Industrial Automation	1.55
Security	-1.71
Sensing	0.35
INDEX TOTAL	-4.18

MOVERS & SHAKERS

- One top contributor was **Ambarella** (+42%), which surged after announcing design wins for its computer vision chip. From its strong position in video processors, Ambarella is rapidly morphing into an AI company—a move that enlarges its addressable market from hundreds of millions of dollars to a multi-billion-dollar opportunity. Ambarella management expects five professional IP camera suppliers to ship product with its computer vision chip by the end of the fiscal year, with use cases in automotive driver assistance to follow.
- Another top contributor was **Teradyne** (+24%), which posted a surprisingly strong set of 2Q results on the back of strength in semiconductor test equipment, particularly for 5G infrastructure, networking and memory. While its collaborative robot business (Universal Robots) has slowed down from more than 50% annual growth in recent years to just 10% last quarter, it continues to largely outgrow the rest of the factory robot market, as does its Mobile Industrial Robots business.
- **Blue Prism** (-33%) was among the top detractors for the quarter. The UK-based provider of Robotic Process Automation (software robots) was hit by cautious analyst reports in August, arguing that after a few years of exceptional growth the outlook is becoming tougher as the RPA industry matures. We believe the RPA market remains in its infancy and see significant growth opportunities for the leading players, including UI Path and Automation Anywhere, which have recently

raised capital at much higher valuations. UI Path raised \$568M in April 2019 at a \$7B valuation, with \$200M in recurring revenue. Automation Anywhere raised \$300M in November from the SoftBank Vision Fund at a \$2.6B valuation, with \$110M in 2018 revenue. Meanwhile, Blue Prism ended 3Q with an enterprise value of just \$800M with ~\$120M in annual revenue.

- **iRobot** (-33%), the leading provider of robotic vacuum cleaners, reduced sales and earnings guidance due to the recently implemented 25% tariffs on certain Chinese goods. While sales grew 15% in 2Q, tariffs are likely to cost more than \$35M to the company this year and investors are concerned that the company may not be able to maintain its earnings power, leaving the stock trading on its lowest earnings multiple in 5 years.

HTEC: ROBO GLOBAL HEALTHCARE TECHNOLOGY & INNOVATION INDEX

The ROBO Global Healthcare Technology & Innovation Index (HTEC), which seeks to capture the growth and returns opportunity presented by the convergence of robotics, machine intelligence, and life sciences, declined 5.3% in 3Q19, underperforming global equities. Telehealth (+2%) was the only subsector seeing gains in the quarter, while the other eight subsectors declined, led by genomics and precision medicine. In the first nine months of the year, HTEC returned a total 19.4% compared to 16.2% for the MSCI AC World Index and 6.4% for the DJ Global Healthcare Index. More details are available on the [ROBO Global Healthcare & Technology Innovation Index Factsheet](#).

HTEC SUBSECTOR PERFORMANCE

HTEC Index Attribution 2019-07-01 to 2019-09-30	TOTAL RETURN
Data Analytics	-1.23
Genomics	-9.34
Lab Process Automation	-1.50
Medical Instruments	-3.82
Precision Medicine	-9.61
Regenerative Medicine	-18.62
Robotics	-1.18
Telehealth	1.58
INDEX TOTAL	-5.28

MOVERS & SHAKERS

- **Nevro** (+32%) is a medical instrument company that offers the only commercialized high frequency spinal cord stimulation device, which makes it a strong fit for HTEC. During the quarter the company reported strong earnings. Other positive catalysts were Omnia's preliminary FDA approval, and the injunction Nevro won on competitor Stimware for the duration of the two companies' legal battle. We believe the injunction indicates strong defensibility on Nevro's IP. With current market share of 15%, we believe Nevro will continue to take market share with the launch of Omnia (target Q4) and emerge as a market leader over the long run.
- **Medpace** (+28%) is a contract research organization (CRO) that provides a full suite of R&D outsourced services to life science companies. The company reported a strong earnings quarter, driven by strong win rates of 40-50% and improving cancellation rates. Medpace's focus on small biotech companies positions it well for specialization and scale as R&D investing remains strong, and we believe Medpace will emerge as a share leader for that end market, making it a strong fit for HTEC.

- **Fluidigm** (-62%) is a market and technology leader in mass cytometry, meeting the inclusion criteria for HTEC in its diagnostic subsector. Shares traded down after a disappointing earnings print, dragging microfluidics business, and increased competitive threat. Although the company missed estimates, it is still seeing high single-digit revenue growth. Mass cytometry was up 28% due to strong placement growth, which is a leading indicator for pull-through consumables over the long term.
- **Axogen** (-37%) reported disappointing earnings this quarter with a \$4M full year revenue guide down, and also suffered a sell-side downgrade. A technology leader in nerve repair, Axogen is an HTEC inclusion in our regenerative medicine subsector. The company is seeing delays in productivity growth, but is investing in sales force expansion, and is already seeing traction from these efforts, with a 20% increase in active accounts. We believe improved sales execution combined with success in the RECON and RANGER studies should drive share gain over the long term.

THNQ: ROBO GLOBAL ARTIFICIAL INTELLIGENCE INDEX

The ROBO Global Artificial Intelligence Index (THNQ) declined 4.9% in 3Q19. Semiconductor (+8%) and factory automation (+2%) delivered positive returns, while the other nine sectors of the index declined, led by consumer and e-commerce. In the first nine months of the year, THNQ returned a total 23.8%, compared to 16.2% for the MSCI AC World Index. More details are available on the [ROBO Global Artificial Intelligence Index Factsheet](#).

THNQ SUBSECTOR PERFORMANCE

THNQ Index Attribution 2019-07-01 to 2019-09-30	TOTAL RETURN
Big Data/Analytics	-3.29
Business Process	-8.03
Cloud Providers	-2.01
Cognitive Computing	-1.94
Consulting Services	-0.36
Consumer	-19.46
Ecommerce	-9.07
Factory Automation	2.48
Healthcare	-9.05
Network & Security	-3.87
Semiconductor	8.08
INDEX TOTAL	-5.28

Movers & Shakers

- **Cloudera** (+68%), the enterprise data cloud management company, reported better-than-expected 3Q results and raised guidance, which reassured investors following the resignation of its CEO and some difficulties integrating Hortonworks earlier in the year.
- **ASML** (+19%), the dominant provider of semiconductor manufacturing equipment, continued to hit new highs thanks to strong orders and sales of its long-awaited Extreme UltraViolet machines. ASML is the sole supplier of this next-generation lithography technology, which has been delayed for a decade and is now used for 7 nanometer chips, 5G, and AI.

- Top detractors included **iRobot** (-33%), which is detailed among the ROBO 'Movers & Shakers' above, and **New Relic** (-29%). The cloud-based analytics platform provider reduced its revenue growth outlook again, to 22-24%, and its CTO resigned, which further put pressure on the shares. While the company is seeing increased competition and is reorganizing its sales strategy around its New Relic One platform, we continue to see strong growth potential as it disrupts the market for application performance monitoring, particularly within the small- and medium-sized business segment.

Performance 3Q 2019 (%)

Robo Global Indices		3Q 2019	YTD	1-year	3-year	5-year
ROBO	Robotics & Automation	-4.18	17.26	-8.21	11.17	8.69
HTEC	Healthcare Technology & Innovation	-5.28	19.38	-1.14	24.9	23
THNQ	Artificial Intelligence	-4.91	23.84	2.06	27.03	24.27

Global Equities						
ACWI	AC World Equities	-0.03	16.2	1.38	9.38	6.41

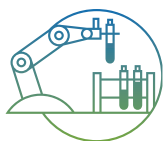


ROBO

ROBO Global Robotics & Automation Index

Roboglobal.com/ROBO

SUBSECTOR	EXPOSURE	TOP 10 HOLDINGS	WEIGHT
3D Printing	2.9%	FANUC CORP	1.7%
Actuation	11.5%	DAIFUKU CO LTD	1.7%
Computing, Processing, & AI	21.0%	INTUITIVE SURGICAL INC	1.7%
Consumer Products	1.5%	BROOKS AUTOMATION INC	1.6%
Food & Agriculture	5.6%	KRONES AG	1.6%
Healthcare	12.2%	KOH YOUNG TECHNOLOGY INC	1.6%
Integration	7.2%	COGNEX CORP	1.6%
Logistics Automation	9.7%	YASKAWA ELECTRIC CORP ORD	1.6%
Manufacturing & Industrial Automation	15.2%	OMRON CORP ORD	1.6%
		FLIR SYSTEMS INC	1.6%
Security	1.8%		
Sensing	11.3%		
			16.3%



HTEC

ROBO Global Healthcare Technology & Innovation Index

Roboglobal.com/HTEC

SUBSECTOR	EXPOSURE	TOP 10 HOLDINGS	WEIGHT
Data Analytics	6.5%	ILLUMINA INC	1.7%
Diagnostics	18.1%	TELADOC HEALTH INC	1.6%
Genomics	11.3%	INTUITIVE SURGICAL INC	1.6%
Lab Process Automation	10.5%	VOCERA COMMUNICATIONS INC	1.6%
Medical Instruments	27.5%	NATERA INC	1.5%
Precision Medicine	10.2%	INTEGRA LIFESCIENCES HOLDING	1.5%
Regenerative Medicine	4.3%	MYRIAD GENETICS INC	1.5%
Robotics	5.7%	THERMO FISHER SCIENTIFIC INC	1.5%
Telehealth	5.7%	CHARLES RIVER LABORATORIES	1.5%
		PENUMBRA INC	1.5%
			15.4%



THNQ

**ROBO Global Artificial
Intelligence Index**

Roboglobal.com/THNQ

SUBSECTOR	EXPOSURE	TOP 10 HOLDINGS	WEIGHT
Big Data/Analytics	12.2%	ILLUMINA INC	2.1%
Business Process	18.6%	SPLUNK INC	2.0%
Cloud Providers	6.9%	INTL BUSINESS MACHINES CORP	1.9%
Cognitive Computing	8.2%	ALPHABET INC-CL A	1.9%
Consulting Services	2.8%	BAIDU INC - SPON ADR	1.8%
Consumer	8.8%	MICROSOFT CORP	1.8%
Ecommerce	9.7%	IROBOT CORP	1.8%
Factory Automation	1.5%	SALESFORCE.COM INC	1.8%
Healthcare	4.5%	TENCENT HOLDINGS LTD	1.8%
Network & Security	13.9%	NEW RELIC INC	1.8%
Semiconductor	13.0%		18.6%

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