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BERNSTEIN
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Global Automation

Humanoid Robotics: From autonomy to generalization - progress in brain model development (Figure AI Helix 2.5)



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When Figure AI launched the brain model Helix 02 in February and demonstrated autonomous multi-minute dishwasher unloading, we challenged it to the next level (here): "*How much training was done in that specific setting shown in the video? Can the robot perform this task with dishes and glasses different from training? What if the entire kitchen is different and Helix has only seen it for the first time? Can this robot, trained on dishwasher unloading, load and unload a washing machine?*" Last week, Helix 2.5 partly answered those questions by performing household chores in unseen homes (here). This marks a concrete step toward generalization and sheds light on the latest trends in robotic brain model development.

Generalized scenes, not yet generalized tasks. Previously, robotic tasks were demonstrated in environments where the robot had been trained. Helix 2.5 performed living-room tidying, towel folding, and bed making across 30 unseen homes, with no training data from those homes. Each task was in itself a nice demonstration of full-body loco-manipulation (Exhibit 1), and the robot achieved a 56% overall success rate. However, the Figure robot was specifically trained on the three tasks, and the objects and their arrangements showed limited variation across the 30 homes. We interpret the progress as "scene generalization" and see genuine zero-shot task generalization still a long way to go.

Important innovations in data paradigm and pretraining techniques. Helix 2.5 is pretrained on Index, Figure AI's proprietary dataset of egocentric human task videos. Index training lifted overall zero-shot success rate from 9% to 56%, holding other variables constant (Exhibit 2). It also enabled Helix 2.5 to halve the amount of data needed to match Helix 02's performance. Figure further reports early evidence of scaling effects, with action-prediction loss continuing to decline as human-to-robot pretraining data expands. As of August, Index contained 23mn videos, adding ~35 minutes of new human experience per second. Every 1k hours of collected data represented 373 tasks, 1146 manipulated objects, and 116 environments. Figure has been compounding its data engine and the investment on data collection (Exhibit 3).

In perspective: data-brain integration is becoming a critical moat. The positive results of Helix 2.5 support several key points in our recent note *The emperor's new brain and the AlphaGo moment*. First, the advance in robotic models has greatly expanded the scope of training data. In particular, egocentric human videos are becoming increasingly usable in pretraining, and there is increasing evidence of a scaling law ("the more, the better"). While real robot data remains valuable, teleoperation will likely be phased out due to its lack of scalability. Second, the integration of brain and data is going deeper. Inherited fixed-weight Vison-Language-Models (as was used by Helix 02) are replaced by models trained on proprietary data from scratch. Other recent progresses in the industry confirm these trends (Exhibit 4), including Agibot's recently released World Action Model, GE-ACT 2.0 (here), and Dyna 2.0 trained on 1 million hours of human videos (here).

Continue on the next page

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on 23-Sep-2026

... continued from the front page

What's next? We challenge Figure AI on two concrete progresses in the next release. First, we are keen to see evidence that a robot starts to show transferable skills, i.e. trained on one task and doing similar tasks without additional training. On this front, most notable recent progress was made by Physical Intelligence's π0.7, showing compositional task generalization, i.e. the emergence of untrained new skills composed of related skills (here). Second, a 56% overall success rate is far from ready for commercial deployment. "Practice makes perfect" is not yet true in robotics. We closely watch for the evidence of a true "data flywheel" in post training and deployment, which would mean *automatic* performance enhancement. Pretraining often brings success rate to 50-60%, from which point an efficient path to 99% will be the next major test.

Broadly speaking, the development by Figure, Agibot, Physical Intelligence, Dyna and others sends a consistent message: generalized tasks and large-scale deployment beyond a few applications (here) are not yet imminent, but humanoid robot technology, especially the brain models, is advancing quickly with tangible progresses every quarter. The worst of times is the best of times.

on 23-Sep-2026

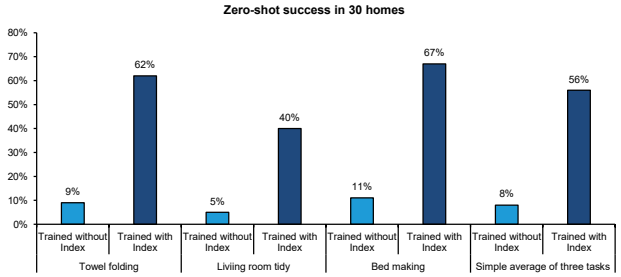
DETAILS

EXHIBIT 1: **Household task definitions and setup in Helix 2.5 demonstration**

Task	Living room tidy	Towel folding	Bed making
Objects	Toys and small handheld items, varying in shape, size, rigidity and material.	Towels of different sizes, colors, materials, thicknesses and textures.	Beds with different bedspreads and pillows, spanning different materials, weights, colors and textures.
Initial Configuration	A person tosses items across the floor, couch and tables. Placement and orientation are uncontrolled.	A person drops the towels onto the surface. Orientation and crumpling are uncontrolled.	A person messes up the comforter and pillows. Bedspread configuration and pillow placement are uncontrolled.
Task	Search the room, retrieve the items from different surfaces across the room and place them in a basket.	Fold each towel and place it in a basket.	Walk around the bed, place the pillows and arrange and tighten the bedspread.

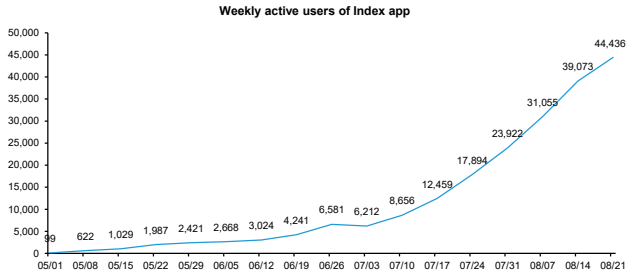
Source: Figure AI, Bernstein analysis

EXHIBIT 2: **Sucess rates improved by using models pretrained with Index, Figure's proprietary dataset**



Source: Figure AI, Bernstein analysis

EXHIBIT 3: **Since launching, active users contributing data to Index have increased quickly**



Source: Figure AI, Bernstein analysis

on 23-Sep-2026

EXHIBIT 4: **Recent development in robotic brain models highlights expansion of data modality, data-brain integration, scaling, and generalization**

	Figure AI's Helix 2.5	AgiBot's GE-ACT 2.0	Dyna Robotics' Dyna 2.0	Physical Intelligence's π0.7
Model architecture	Hierarchical VLA (S2-S1-S0 architecture)	World Action Model (WAM), modular	World Action Model (WAM)	VLA with a world model to generate subgoal images
Pretraining	From randomly initiated weights, pretrained on Index, Figure's large-scale proprietary dataset	Each module is separately trained. SVP: Trained on instruction-video pairs and manipulation recordings without action labels, including egocentric video IDM: Trained on action-labeled robot trajectories, including demonstrations, failures, and deployment data KASO co-training: Aligns SVP and IDM through instruction-video-action data while preserving their respective objectives	Pretrained on large-scale human manipulation videos	Pretrained using rich prompts that include task descriptions, detailed language instructions, generated subgoal images, and episode metadata
Data composition	Large-scale egocentric human task videos. 1mn hours of video comprising: • 373k unique tasks • 1.1mn unique objects (as of Aug 2026)	SVP: Robot data (71.8%), simulation (2.6%), open source (17.9%), ego/human video (7.7%) IDM: Robot data (87.5%), simulation (3.1%), open source (6.2%) Co-training: Robot data (93.4%), simulation (3.3%), open source (3.3%)	Primarily egocentric recordings of everyday activities. 1mn hours of video comprising: • 97k unique tasks • 10k distinct objects (as of Aug 2026) 3D hand-pose trajectories provide pseudo-action supervision	Diverse datasets with rich contextual information, including demonstrations across diverse tasks, robot embodiments, and environments; autonomous policy rollouts; human interventions; open-source robot datasets; egocentric human videos; and auxiliary web-scale data such as object localization, attribute prediction, VQA, and text-only corpora
Data scale	Index contains 23mn egoccentric videos, adding approximately 5.75 years of human experience per day. Weekly active contributors reached 44k (as of Aug 2026)	SVP: 39k hours IDM: 32k hours Co-training: 30k hours	More than 1mn hours of egocentric data, equivalent to 170 years of human experience (as of Aug 2026).	Not explicitly disclosed
Key findings	**Scene generalization**. **Scaling.** Three long-horizon behaviors across 30 unseen homes without environment-specific data collection, fine-tuning, or adaptation. Index pretraining alone improves zero-shot success from 9% to 56%. Evidence of a human-to-humanoid transfer scaling law.	**Scaling of zero-shot out-of-distribution (OOD) performance**. More manipulation data improves performance across 100 real-world robot tasks and two embodiments without task-specific fine-tuning. Scaling co-training data from 300 to 30k hours substantially improves performance.	Demonstrates a WAM **scaling law** up to 1mn hours of human data . Evidence supports a human-to-robot transfer scaling law, where larger human-video pretraining datasets improve robot-data prediction on unseen tasks.	Demonstrates strong out-of-the-box performance, instruction following, **cross-embodiment generalization**, and **compositional task generalization**. Results highlight the importance of combining diverse datasets with rich contextual information.

Source: Figure AI, AgiBot, Dyna Robotics, Physical Intelligence, Bernstein analysis

INVESTMENT IMPLICATIONS

We rate Keyence, Cognex, FANUC, Inovance, Harmonic Drive Outperform; Estun Market-Perform.

on 23-Sep-2026

BERNSTEIN TICKER TABLE

Ticker	Rating	Cur	18 Sep 2026 Closing Price	Price Target	TTM Rel. Perf.	Reported EPS Cur	2025A	2026E	2027E	Reported P/E (x) 2025A	2026E	2027E
6861.JP (Keyence)	O	JPY	76,580	95,000	5.5%	JPY	1,835.62	2,420.47	2,675.94	41.7	31.6	28.6
CGNX (Cognex)	O	USD	61.99	85.00	16.7%	USD	0.67	1.57	1.80	92.5	39.4	34.5
6954.JP (Fanuc)	O	JPY	5,852.00	7,200.00	3.2%	JPY	178.47	221.78	207.13	32.8	26.4	28.3
6324.JP (HDSI)	O	JPY	6,200.00	7,800.00	70.4%	JPY	16.99	57.37	79.51	364.9	108.1	78.0
300124.CH (Inovance)	O	CNY	54.05	82.00	(59.4)%	CNY	1.87	2.19	2.65	28.9	24.6	20.4
2715.HK (Estun)	M	HKD	14.80	17.12	NA	CNY	0.05	0.30	0.30	296.0	48.6	49.4
002747.CH (Estun)	M	CNY	29.68	31.60	(8.1)%	CNY	0.05	0.30	0.30	593.6	97.5	99.0
JPL			2,660.83									
SPX			7,764.70									
ASIAX			1,983.89									

O - Outperform, M - Market-Perform, U - Underperform, NR - Not Rated, CS - Coverage Suspended

6861.JP, 6954.JP base year is 2026;

Source: Bloomberg, Bernstein estimates and analysis.

on 23-Sep-2026

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VALUATION METHODOLOGY

Keyence Corp

We use EV/EBITDA multiple as the primary valuation method. We set a JPY95,000 target price using an EV/EBITDA multiple of 22x against our 1-year forward-looking EBITDA estimates (from the PT date) of JPY 913.2bn. We apply our target multiple on the upcoming cycle peak to get the enterprise value, and discount it back to derive our price target. We use DCF as reference for the company's long-term intrinsic value. As we move along the different stages of a cycle, the time-dependent target price may deviate from the DCF-implied value.

Cognex Corp

We use EV/EBITDA multiple as the primary valuation method. We set a USD85.00 price target using an EV/EBITDA multiple of 36.5x against our 1-year forward-looking EBITDA estimates (from the PT date) of USD 372.6 million. We set the multiple referencing previous cycles but adjust for secular or competitive trends that we believe are moving multiples higher or lower across multiple cycles. We use DCF as reference for the company's long-term intrinsic value. As we move along the different stages of a cycle, the time-dependent price target may deviate from the DCF-implied value.

FANUC Corp

We use EV/EBITDA multiple as the primary valuation method. We set a JPY7,200 target price using an EV/EBITDA multiple of 23.0x against our 1-year forward-looking EBITDA estimates (from the PT date) of JPY 255 bn. We set the target multiple referencing previous cycles but adjust for secular or competitive trends that we believe are moving multiples higher or lower across multiple cycles. We use DCF as reference for the company's long-term intrinsic value. As we move along the different stages of a cycle, the time-dependent target price may deviate from the DCF-implied value.

Harmonic Drive Systems Inc

We use EV/EBITDA multiple as the primary valuation method. We set a JPY 7,800 target price using an EV/EBITDA multiple of 45.5x against our 1-year forward-looking EBITDA estimates (from the PT date) of JPY16,194 mn. We set the target multiple referencing previous cycles but adjust for secular or competitive trends that we believe are moving multiples higher or lower across multiple cycles. We use DCF as reference for the company's long-term intrinsic value. As we move along the different stages of a cycle, the time-dependent target price may deviate from the DCF-implied value.

Shenzhen Inovance Technolo-A

We use EV/EBITDA multiple as the primary valuation method. We set a RMB82 target price using an EV/EBITDA multiple of 24.0x against our 1-year forward-looking EBITDA estimates (from the PT date) of RMB 8971.6 million. We set the multiple referencing previous cycles but adjust for secular or competitive trends that we believe are moving multiples higher or lower across multiple cycles. We use DCF as reference for the company's long-term intrinsic value. As we move along the different stages of a cycle, the time-dependent target price may deviate from the DCF-implied value.

on 23-Sep-2026

Estun Automation Co Ltd

We use EV/EBITDA multiple as the primary valuation method. Our price target of RMB31.6 (A-share) and HKD 17.1 (H-share) are based on an EV/EBITDA multiple of 45.5x against our 1-year forward EBITDA estimate of RMB681.4mn. We set the multiple referencing previous cycles but adjust for secular or competitive trends that we believe are moving multiples higher or lower across multiple cycles. We set Estun's H-share TP based on the average A/H share premium. We use DCF as reference for the company's long-term intrinsic value. As we move along the different stages of a cycle, the time-dependent target price may deviate from the DCF-implied value.

RISKS

Keyence Corp

The risks are mainly associated with the global macro economy. Our analysis shows that company's growth correlates with the overall utilization of manufacturing capacity in the major economies. Fluctuations in utilization may lead to unexpected near term fluctuations in growth rates. A global recession as severe as that of 2009 may even result in decline in Keyence's revenue. In addition, there is currency risk associated with the exchange rate of JPY. Therefore, the downside risks include: 1) weaker than expected overall utilization, 2) delayed or weaker than expected global automation demand, and 3) appreciation of JPY.

Cognex Corp

Similar to Keyence, the risks are mainly associated with the global macro economy and the overall utilization of manufacturing capacity in the major economies. The downside risks include: 1) delayed or weaker than expected global automation demands, 2) delayed or slower than expected progress in "emerging customer" program, 3) delayed or slower than expected in the integration of Moritex and realization of planned synergies.

FANUC Corp

FANUC's end user markets are cyclical in nature. The risks are mainly associated with the global macro economy and currency. The downside risks include 1) delayed or weaker than expected global automation demand, 2) losing market share to competitors, and 3) appreciation of JPY.

Harmonic Drive Systems Inc

The risks to our view on HDSI are mainly associated with the global macro economy, including industrial capex cycles, competition and currency. As HDSI has >50% of global share in strain wave reducer, potential change in competitive landscape would be a more relevant risk than to other companies. Therefore, the downside risks include: 1) weaker than expected global robot demand, 2) losing market share to competitors, and 3) appreciation of JPY.

Shenzhen Inovance Technolo-A

The risks to our view on Inovance are mainly associated with macro economy, including industrial capex cycles, trade frictions, and currency. The downside risks to our view on Inovance include 1) weaker than expected automation demands in China, 2) weaker or slower than expected share gain in China in segments besides servo motor and VFD, 3) weaker than expected EV demands.

Estun Automation Co Ltd

The risks to our view on Estun are mainly associated with China and global macro economy, including industrial capex cycles, trade frictions, and currency. In addition, the integration of Cloos and realization of planned synergies are important to our thesis and sources of additional risks. The upside risks include 1) faster than expected margin expansion; 2) faster than expected market share gain. The downside risks include 1) weaker than expected automation demands in China; 2) delayed or slower than expected in operating and net margin improvement; 3) delayed or slower than expected market share gain.

RATINGS DEFINITIONS, BENCHMARKS AND DISTRIBUTION

EQUITY RATINGS DEFINITIONS

Bernstein brand

on 23-Sep-2026

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The Bernstein brand has three categories of ratings:

- Outperform: Stock will outpace the market index by more than 15 pp
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Not Rated: A rating assigned when the stock cannot be accurately valued, or the performance of the company accurately predicted, at the present time. The covering analyst may continue to publish research reports on the company to update investors on events and developments.

Not Covered (NC) denotes companies that are not under coverage.

Bernstein brand stock ratings are based on a 12-month time horizon.

Autonomous brand – common stocks

The Autonomous brand rates common stocks as indicated below. As our benchmarks we use the Bloomberg Europe 600 Financials Price Return Index (E600BK) and Bloomberg Europe Dev Mkt Financials Large and Mid Cap Price Ret Index EUR (EDMFI) index for developed European banks and Payments, the Bloomberg Europe 600 Insurance Price Return Index (E600IN) for European insurers, the S&P 500 and S&P Financials for US banks and Payments coverage, S5LIFE for US Insurance, the S&P Insurance Select Industry (SPSIINS) for US Non-Life Insurers coverage, the Bloomberg Emerging Markets Financials Large, Mid and Small Cap Price Return Index (EMLSF) for emerging market banks and insurers and Payments, and the Bloomberg Japan Financials Large & Mid Cap Price Return Index (JPFILM) for Japanese Financials. Ratings are stated relative to the sector (not the market).

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Those denoted as 'Feature' (e.g., Feature Outperform FOP, Feature Under Outperform FUP) are our core ideas.

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on 23-Sep-2026

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Autonomous credit ratings are based on a 6-month time horizon.

A list of all investment recommendations produced by the author(s) of this report alongside credit ratings history are available upon request.

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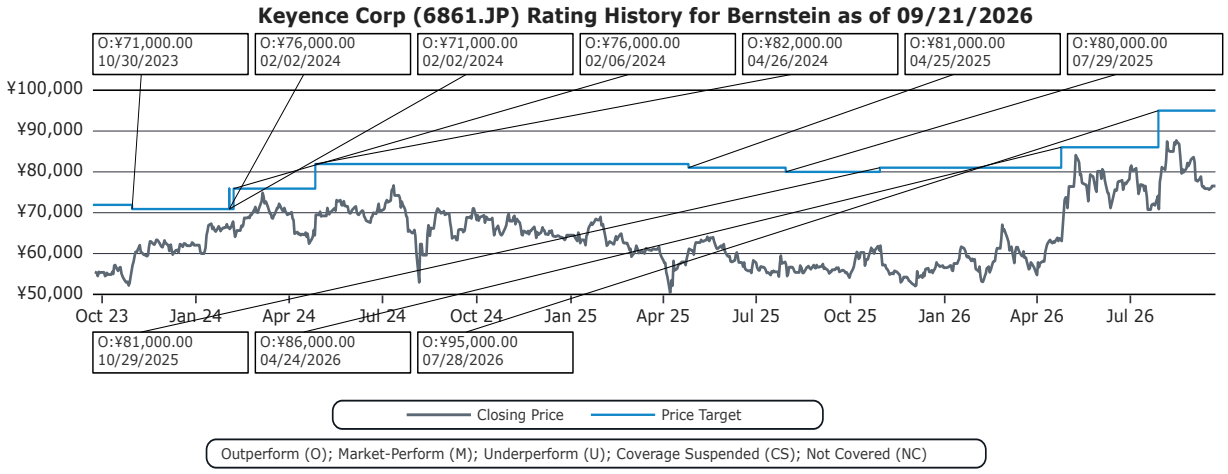
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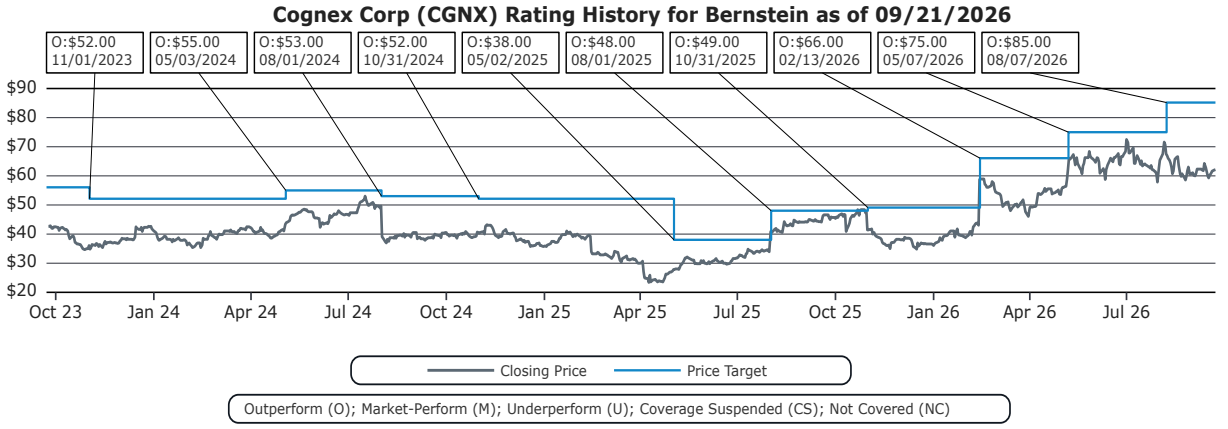
Equity Rating	Market Abuse Regulation (MAR) and FINRA Rating Category	Global Rating Distribution	Investment Banking Relationships*
Outperform	BUY	51.2%	15.3%
Market-Perform (Bernstein Brand) Neutral (Autonomous Brand)	HOLD	35.8%	16.2%
Underperform	SELL	13.1%	13.6%

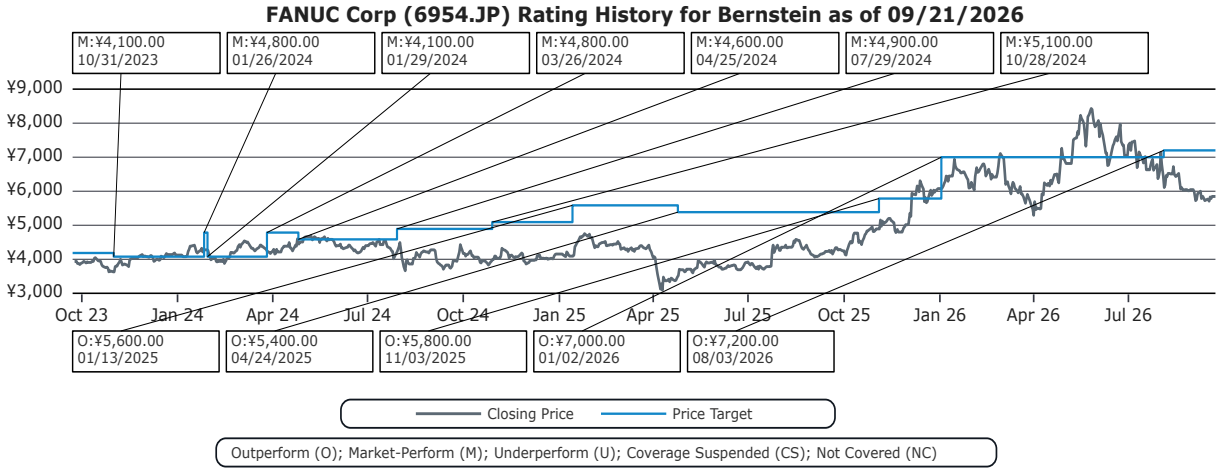
* These figures represent the percentage of companies within each equity rating category for which affiliates of Bernstein have provided investment banking services within the previous 12 months.
As of June 30, 2026. All figures are updated quarterly.

on 23-Sep-2026

PRICE CHARTS / RATINGS AND PRICE TARGET HISTORY

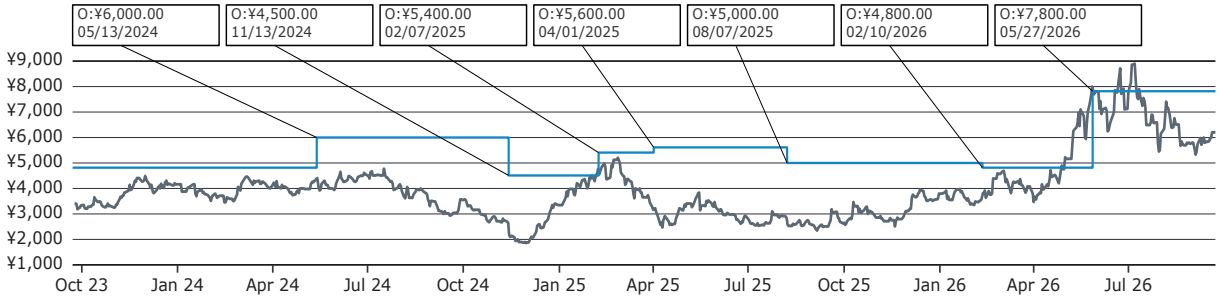






on 23-Sep-2026

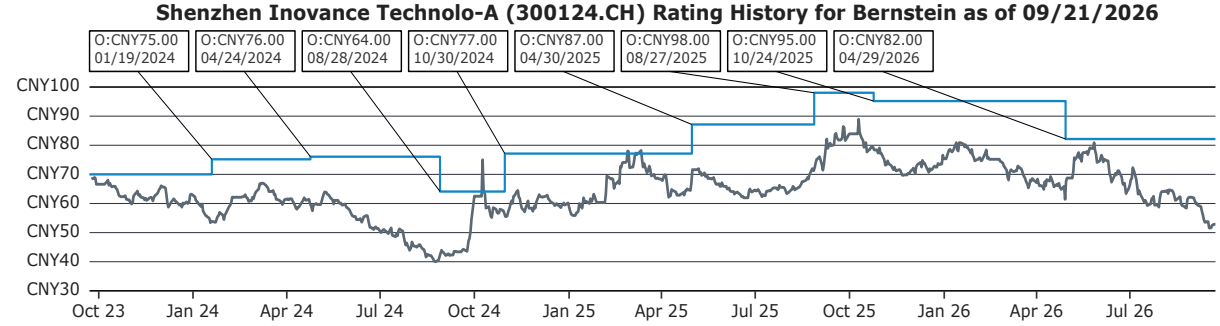
Harmonic Drive Systems Inc (6324.JP) Rating History for Bernstein as of 09/21/2026



Closing Price — Price Target

Outperform (O); Market-Perform (M); Underperform (U); Coverage Suspended (CS); Not Covered (NC)

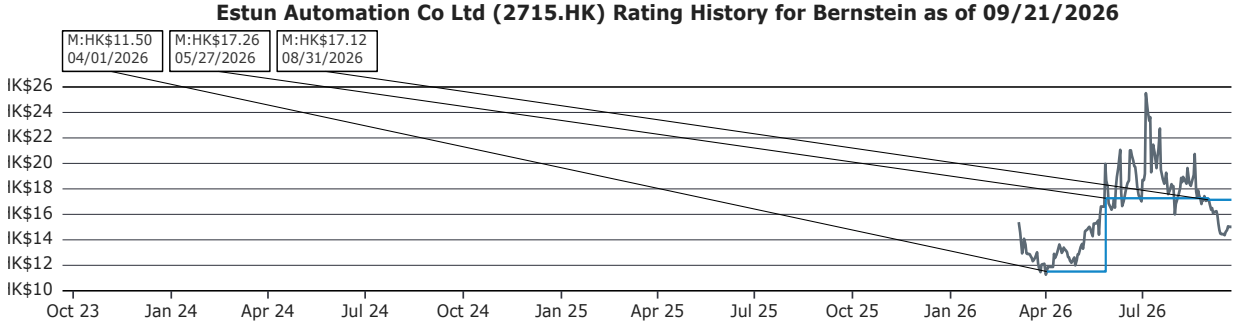
Shenzhen Inovance Technolo-A (300124.CH) Rating History for Bernstein as of 09/21/2026



Closing Price — Price Target

Outperform (O); Market-Perform (M); Underperform (U); Coverage Suspended (CS); Not Covered (NC)

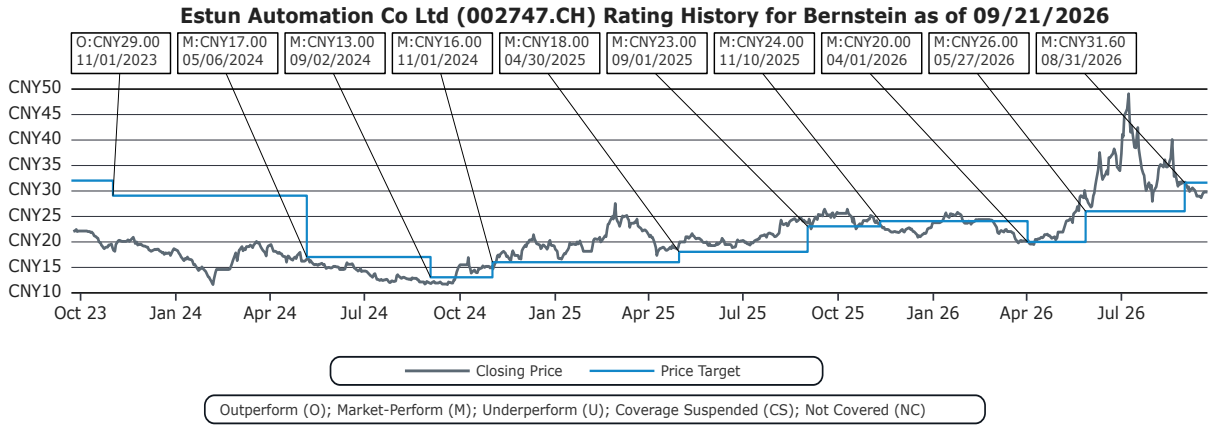
Estun Automation Co Ltd (2715.HK) Rating History for Bernstein as of 09/21/2026



Closing Price — Price Target

Outperform (O); Market-Perform (M); Underperform (U); Coverage Suspended (CS); Not Covered (NC)

on 23-Sep-2026



All price target and closing price data in the chart(s) above are denominated in the currency noted in the Ticker Table of this report.

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