

BofA Global EV Battery Value Chain Indicator

Downtrend to continue on softer EV demand outlook and lower metal prices

Industry Overview

BofA Global EV Battery Value Chain Indicator – Dec update

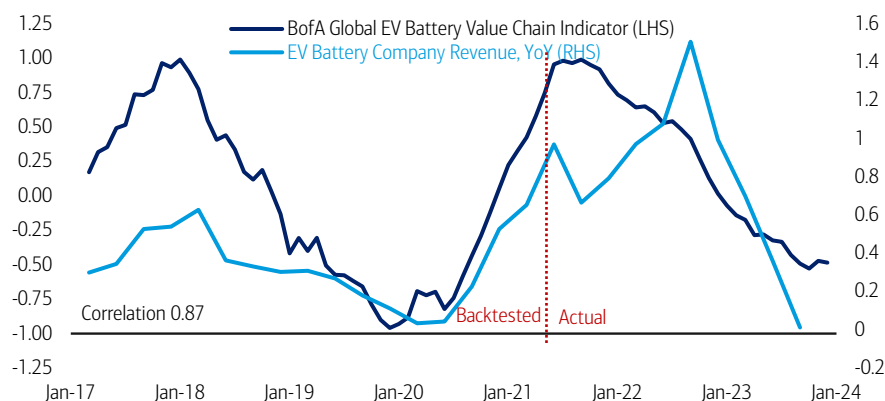
We update the indicator with the latest EV battery industry data. Our latest reading shows a continued decline in Dec, suggesting a sustained drop in the YoY revenue growth rate, largely in line with what we highlighted in our [Global EV Battery YA report](#). The indicator tracks the trends in EV-battery-related revenues of 26 major value-chain names with a focus on identifying the turning points. It provides visibility on revenue growth for the next quarter with a back-tested correlation of 0.87 from March 2017 to June 2021. Constructed using 20 industry-specific factors that broadly fall under the categories of car sales, battery demand/supply, raw material prices, and analyst opinions, this directional indicator also moves in tandem with the EV Battery Value Chain share prices (see Exhibit 2 and Exhibit 3).

Indicator heads downward on softer EV demand outlook

The indicator declined MoM in December, primarily due to lower metal prices amid slowing EV demand. We expect the industry-wide slowdown to continue in 1H24, especially on weakening EV demand in the EU, given the phase-out of subsidies, per the BofA Global Auto team (see [Sudden stop of German subsidies](#) for more details), and slower-than-expected battery energy density gain, while PHEV outpaces BEV sales in China (see [China EV and battery Year Ahead](#)); at the same time, the upcoming presidential election in the US adds uncertainties to policies, such as the Inflation Reduction Act, which have been supportive of the EV demand, especially in North America (see [US Auto Year Ahead](#)).

Exhibit 1: BofA Global EV Battery Value Chain Indicator vs revenue growth YoY

Provides visibility into revenue growth for the next quarter with a back-tested correlation of 0.87



Source: BofA Global Research, company data. **Note:** Back-tested data from March 2017 to June 2021. This performance is back-tested and does not represent the actual performance of any account or fund. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein. **Disclaimer:** The indicator identified above as the BofA Global EV Battery Value Chain Indicator is intended to be an indicative metric only and may not be used for reference purposes or as a measure of performance for any financial instrument or contract, or otherwise relied upon by third parties for any other purpose, without the prior written consent of BofA Global Research. This indicator was not created to act as a benchmark.

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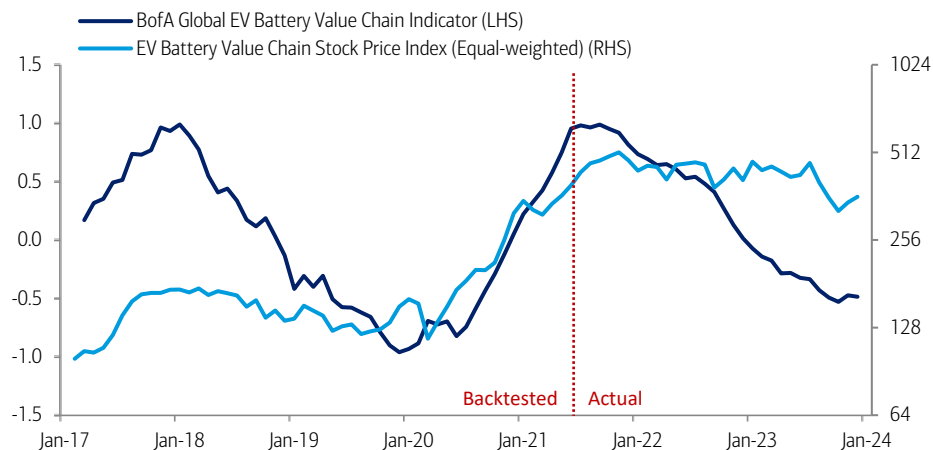
BofA Global EV Battery Value Chain Indicator

Indicator in brief

- **Target Variable:** EV-battery-related revenue growth of 26 major global listed EV battery value chain companies
- **Input Variables:** 20 industry-specific factors that broadly fall under the categories of car sales, battery demand and supply, raw material prices, and analyst opinion
- **Revenue Growth Correlation / Visibility:** 0.87 / 1 quarter

Exhibit 2: BofA Global EV Battery Value Chain Indicator vs share price changes

Our indicator moves in tandem with EV Battery Value Chain stock prices

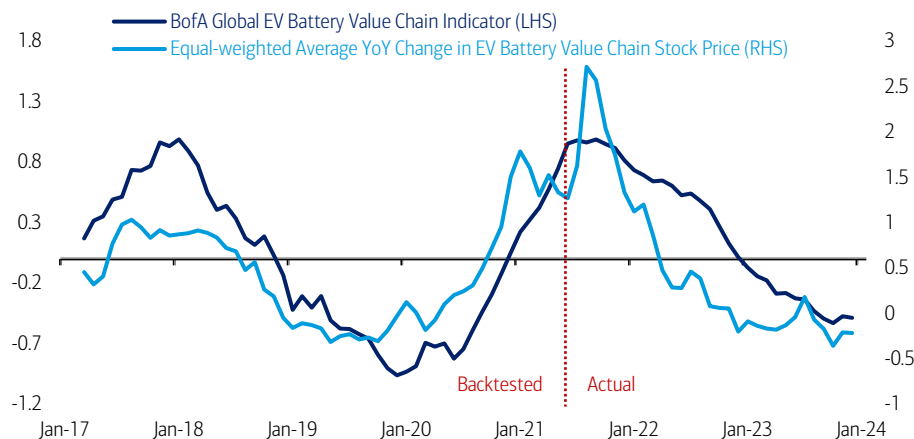


Source: BofA Global Research, company data. **Note:** Back-tested data from March 2017 to June 2021. This performance is back-tested and does not represent the actual performance of any account or fund. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein.

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Exhibit 3: BofA Global EV Battery Value Chain Indicator vs Equal Weighted share price index

Our indicator moves in tandem with EV Battery Value Chain stock price index



Source: BofA Global Research, company data. **Note:** Back-tested data from March 2017 to June 2021. This performance is back-tested and does not represent the actual performance of any account or fund. Back-tested performance depicts the theoretical (not actual) performance of a particular strategy over the time period indicated. No representation is being made that any actual portfolio is likely to have achieved returns similar to those shown herein.

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Methodology for the indicator

The BofA Global EV Battery Value Chain Indicator is a proprietary tool that tracks the EV battery revenues of major value chain companies globally. The 26 companies selected are the major listed producers of cathode, anode, separator, binder, lithium, cobalt and EV battery cell, with an average revenue exposure of 79% to EV-battery-related businesses as of 3Q23.

Exhibit 4: EV battery value chain companies

We try to gauge the EV battery-related revenue growth trends of 26 value chain companies using the BofA Global EV Battery Value Chain Indicator

Company Name	Product	Ticker	EV battery related revenue contribution (3Q23)
Shanghai Putailai	Anode	603659 CH	100%
CATL	Battery	300750 CH	100%
Ecopro BM	Cathode	247540 KS	100%
L&F	Cathode	066970 KS	100%
Beijing Easpring	Cathode	300073 CH	100%
Huayou Cobalt	Cobalt	603799 CH	100%
Lotte Energy Materials	Copper Foil	020150 KS	100%
Livent	Lithium	LTHM US	100%
Tianqi Li.	Lithium	002466 CH	100%
Ganfeng Li.	Lithium	002460 CH	100%
SQM	Lithium	SQM US	100%
Yunnan Energy	Separator	002812 CH	100%
Shenzhen Senior	Separator	300568 CH	100%
W-Scope	Separator	6619 JP	100%
Albemarle	Lithium	ALB US	74%
POSCO Future M	Cathode / Anode	003670 KS	74%
Toda Kogyo	Cathode	4100 JP	68%
LG Chem	Battery	051910 KS	61%
Umicore SA	Zinc	UMI BB	57%
Samsung SDI	Battery	006400 KS	49%
Kureha	Binder	4023 JP	12%
SK Innovation	Battery	096770 KS	16%
Sumitomo MM	Cathode	5713 JP	16%
BYD	Battery	002594 CH	14%
Zeon	Binder	4205 JP	13%
Panasonic	Battery	6752 JP	8%
Average			69%
Revenue-weighted average			79%

Source: Company data

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The steps taken to construct the indicator are briefly laid out below.

Inputs. Given the EV battery industry is still in the nascent stage, it is relatively less impacted by macro factors, leading us to focus on industry-specific factors only. We started out with an exhaustive list (100+) and filtered down to 20 leading components that have historically influenced EV battery revenues. These components can be broadly categorized into three groups: (1) EV sales and battery shipment volume, (2) raw materials consumption volume and pricing, and (3) chemical components pricing.

Special attention was paid to the timing aspect of input variables, selecting only those data series that are leading in nature considering their release times as well - e.g., if a data series leads the target variable by one month but is released with a delay of two months, it would not be considered as a leading indicator.

Exhibit 5 details the list of the inputs along with their start dates and correlation with the target variable.

Exhibit 5: BofA Global EV Battery Value Chain Indicator input details

We have taken 20 industry-specific input variables that have historically led the revenue growth of the 26 EV battery value chain companies under consideration

S/I Input	Source	Description	Start Date	Back-tested Correlation
EV sales & battery volume				
1 Global total BEV+FCEV+PHEV sales	EV-Volumes	Global EV sales growth YoY	Jan-14	0.81
2 Japan battery supply	SNE Research	Japan battery supply growth YoY	Jan-15	0.76
3 Global pouch battery supply	SNE Research	Global pouch battery supply growth YoY	Jan-15	0.68
Raw material consumption & pricing				
4 Japan lithium consumption	SNE Research	Japan lithium consumption growth YoY	Jan-15	0.75
5 Global cobalt consumption	SNE Research	Global cobalt consumption growth YoY	Jan-15	0.79
6 Asia manganese consumption	SNE Research	Asia manganese consumption growth YoY	Jan-15	0.73
7 Japan cobalt consumption	SNE Research	Japan cobalt consumption growth YoY	Jan-15	0.79
8 China nickel consumption	SNE Research	China nickel consumption growth YoY	Oct-15	0.67
9 Japan nickel consumption	SNE Research	Japan nickel consumption growth YoY	Oct-15	0.62
10 Lithium price	Bloomberg	Lithium price change YoY	Jan-15	0.79
11 Manganese price	Bloomberg	Manganese price change YoY	Jan-15	0.70
Chemical component pricing				
12 China cobalt sulfate 20.5% DEL price	Bloomberg	China cobalt sulfate 20.5% DEL price change YoY	Jan-16	0.98
13 China manganese sulfate Mn 32% price	Bloomberg	China manganese sulfate Mn 32% price change YoY	Nov-18	0.56
14 China aluminum hydroxide 64.5% price	Bloomberg	China aluminum hydroxide 64.5% price change YoY	Jan-15	0.58
15 China dry type separator (16µm) price	Baiinfo	China dry type separator (16µm) price change YoY	Jul-17	0.60
16 China AG anode (high-end) price	Baiinfo	China AG anode (high-end) price change YoY	Jun-18	0.65
17 China NG anode (high-end) price	Baiinfo	China NG anode (high-end) price change YoY	Jan-18	0.43
18 China NG anode (mid-end) price	Baiinfo	China NG anode (mid-end) price change YoY	Jan-18	0.59
19 China NCM 523 delivered precursor price	Bloomberg	China NCM 523 delivered precursor price change YoY	Apr-17	0.69
Consensus revisions				
20 Sales revisions	BofA Global Quantitative Strategy	3-Month Sales Revision Ratio	Jan-13	0.59

Source: BofA Global Research

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Construction. The indicator is constructed using an equal-weighted average of the YoY growth in the input variables in standardized form. Our preference for a simplistic approach over more sophisticated approaches stems from the fact that the increased complexity does not justify the marginal increase in accuracy, while helping to avoid over-fitting issues at the same time.

It is to be noted that not all variables are available from the starting date of the analysis - data for 14 variables were available at the start of our analysis in 2017, with full availability starting only in November 2018. We believe the period since 2017 is comprehensive enough to support the robustness of the indicator.

Current reading. Since peaking in July 2021, the indicator has been in a consistent downtrend, with the latest reading suggesting moderation in revenue growth of EV battery businesses of our selected companies in 4Q23.

Exhibit 6 below shows the current trend for data inputs used in our indicator. Note that green arrows denote an improvement in the input compared with the 3-month ago reading, while the red arrows indicate a deterioration and yellow arrows denote no significant change.

Exhibit 6: BofA Global EV Battery Value Chain Indicator inputs

Overall, the input variables largely continued to decline MoM in Dec 2023

#	Component	Jan-23	Feb-23	Mar-23	Apr-23	May-23	Jun-23	Jul-23	Aug-23	Sep-23	Oct-23	Nov-23	Dec-23
EV sales & battery volume													
1.	Global total BEV+FCEV+PHEV sales	↓	↓	↔	↓	↑	↔	↑	↓	↓	↓	↔	↓
2.	Japan battery supply	↓	↑	↑	↓	↓	↓	↔	↓	↓	↓	↑	↔
3.	Global pouch battery supply	↑	↔	↑	↔	↑	↔	↔	↓	↑	↓	↔	↓
Raw material consumption & pricing													
4.	Japan lithium consumption	↔	↑	↑	↓	↑	↓	↓	↓	↓	↓	↑	↔
5.	Global cobalt consumption	↓	↓	↑	↑	↑	↓	↓	↓	↓	↓	↔	↓
6.	Asia manganese consumption	↓	↓	↔	↑	↑	↓	↓	↓	↓	↓	↔	↔
7.	Japan cobalt consumption	↑	↓	↑	↑	↑	↓	↓	↓	↓	↓	↑	↑
8.	China nickel consumption	↓	↓	↔	↓	↓	↓	↓	↓	↓	↓	↔	↑
9.	Japan nickel consumption	↑	↑	↔	↓	↓	↓	↓	↓	↓	↓	↑	↑
10.	Lithium price	↓	↓	↓	↓	↓	↓	↔	↓	↓	↓	↓	↔
11.	Manganese price	↔	↑	↔	↓	↓	↓	↔	↑	↑	↑	↑	↔
Chemical component pricing													
12.	China cobalt sulfate 20.5% DEL price	↓	↓	↓	↓	↔	↑	↑	↑	↑	↔	↔	↔
13.	China manganese sulfate Mn 32% price	↓	↔	↓	↓	↑	↑	↑	↑	↑	↔	↔	↓
14.	China aluminum hydroxide 64.5% price	↑	↑	↑	↔	↑	↔	↔	↓	↓	↓	↓	↓
15.	China dry type separator (16μm) price	↔	↔	↔	↔	↑	↔	↔	↔	↔	↓	↓	↓
16.	China AG anode (high-end) price	↓	↓	↓	↓	↓	↓	↓	↔	↔	↑	↑	↑
17.	China NG anode (high-end) price	↓	↓	↓	↓	↓	↓	↓	↔	↔	↓	↓	↓
18.	China NG anode (mid-end) price	↓	↓	↓	↓	↓	↓	↓	↔	↔	↓	↓	↓
19.	China NCM 523 delivered precursor price	↓	↓	↓	↓	↔	↑	↑	↑	↑	↓	↓	↔
Consensus revisions													
20.	Earnings revisions	↓	↓	↓	↓	↓	↓	↔	↔	↑	↔	↔	↓
% of indicators contributing positively		25%	30%	30%	10%	40%	15%	20%	30%	35%	30%	35%	15%

Source: BofA Global Research. **Notes:** Green arrows denote an improvement in the input compared with the 3-month ago reading, while the red arrows denote a deterioration and yellow arrows denote no significant change

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