NOVEMBER 2022 AUTOFORECAST MONTHLY REPORT

HIGHLIGHTS IN THIS ISSUE

BY SAM FIORANI

"We are living in most interesting times." With supply chain issues, the transition to electric vehicles, and global expansion, the automotive industry is currently moving through some of the most interesting times in history. Production is being interrupted and causing sales headaches for buyers everywhere. EVs are evolving the automobile ever closer to its new place as a mobile device. And Chinese brands including Polestar and BYD are expanding their reach and volume.

Interesting times, indeed.

Special reports: BYD's global expansion, plus Polestar's new Porsche rival. See p12

NEWS BY SAM FIORANI

Now it's tires?

Production of the Toyota Hilux and SW4 at Toyota's Zarate plant has run out of tires. In late September, the Argentinian plant halted output because they could not get enough tires for their vehicles. Two weeks was initially taken out of the schedule, but the company could not ensure a steady supply of tires going forward and may need to slow production further. Other manufacturers' operations in the country, including production of Fiat and Ford models, also find themselves short of tires and have reduced output in the short term.

Labor continues to be a problem

Even after COVID shutdowns ended in the US, factories are struggling to find enough workers to keep lines running. Rising wages have not lured enough people back into the workforce, especially for suppliers. This has caused a number of smaller suppliers to fall behind the demand for their products, which slows production of components and will ultimately hamper vehicle production.

Oil prices likely to rise

After oil prices soared in early 2022, oil-producing countries and companies enjoyed huge profits. In recent weeks, the price of oil has slipped back below US$100/barrel and that has been welcome news to consumers of petroleum and petroleum products.

The Organization of Petroleum Exporting

The fall in oil prices is expected to be reversed after OPEC announced plans to reduce global output by 2%

Countries (OPEC) has decided to target higher prices by lowering output. Led by member nations Saudi Arabia and Russia, the cartel moved to reduce global output by 2%, or about two million barrels per day. If accomplished and maintained, the resulting price rise will slow global markets well into 2023.

Russia's loss could be Kazakhstan's gain

Toyota ended production of the Camry and RAV4 at its plant in St. Petersburg early in 2022 and, due to the war with Ukraine, has no plans to return. To make up for the lost production, Toyota is looking to move its regional output to Kazakhstan. Negotiations are currently under way. If the plan comes to fruition, Toyota could quickly become the largest manufacturer in the country because light vehicle output in 2022 is not expected to top 20,000 units.

Toyota has quit its RAV4 and Camry plant in St Petersburg

'TOYOTA IS LOOKING TO MOVE ITS REGIONAL OUTPUT TO KAZAKHSTAN'

War brings more exits

In addition to Toyota, other automakers that ended local production were also given the ultimatum to continue output in Russia or potentially lose their investments. A growing list of automakers have decided to leave Russia. Nissan sold its holdings in St. Petersburg for a token €1 in October. Ford is parting ways with its local partner, Sollers, and so is Mazda. Volkswagen is also looking to sell its local plant in Kaluga. Losses in the hundreds of millions of euros will pale in comparison to the potential damage to reputations around the world if these companies continued supporting the Russian economy.

Stellantis looks to leave China

China has become the world's largest automobile market, but even with its massive size, some brands are finding it difficult to carve a niche there. Stellantis's Jeep was one of the first foreign brands to break into the market in the 1980s, but that joint venture disappeared after the demise of the DaimlerChrysler group.

After becoming part of the FCA family, Jeep found a new local manufacturer with GAC, but sales did not materialize to the level expected and the brand is abandoning the joint venture. Local troubles have the larger manufacturer re-examining its investments in China. Peugeot and Citroën have been producing locally for decades and may retreat as well. With the increased competition, sales of the two brands have not been as strong as they once were and China is no longer seen as necessary for the near-term plants of Stellantis.

California is building the EV wave...

With California's target to eliminate the sales of ICE vehicles by 2035, a substantial market for electric vehicles is being established. Automakers around the world are adjusting their portfolios to cater to this massive market, which they cannot ignore.

While some countries are also pushing for zero emissions from its new vehicles, California represents a huge number of buyers. For instance, Norway plans to ban ICE vehicles by 2025, but the population of California is nearly eight times larger than the Scandinavian country. California leads the charge and as many as a dozen other US states tend to follow that market when it comes to vehicle emissions. Washington state, Massachusetts and New York are expected to join the ZEV push.

...and Europe is doing its part

New emissions regulations are being imposed on vehicles sold in Europe under the new Euro 7 banner. Replacing the eight-year-old Euro 6

Euro 7 regulations set tighter limits on tailpipe emissions

regulations, the new emissions standards lower the limits for carbon monoxide, hydrocarbons and oxides of nitrogen and will encourage the transition to fully electric vehicles. It is expected that the Euro 7 standards will apply to all vehicles produced starting September 2025 and cover all vehicles registered starting September 2026.

US regulations pushing investment

With the recent Inflation Reduction Act (IRA), automakers around the world are re-assessing their investments for electric vehicle production. In order to take full advantage of the new incentives, EVs sold in the US must be assembled in North America with batteries assembled locally. High-end makers such as Porsche and Bentley are unable to qualify for the incentives based on their vehicles' pricing, but makers of lower-priced EVs can offer their buyers the incentive of up to US$7,500 only if the vehicles are not imported.

Hyundai has already announced that its new plant in Georgia will be opened as soon as possible. Audi, which currently imports all of its EVs from Europe, is looking to establish a North America-based plant to assemble future models. Expect more players to announce new plants in the USMCA region.

Aston Martin lures Geely

Geely has been building a global automotive empire over the past 12 years. After acquiring most of Volvo Cars in 2010, the Chinese manufacturer took a large stake in Malaysian automaker Proton, half of Lotus, all of British taxi maker formerly known as London Taxi and nearly 10% of Mercedes-Benz. Financially troubled Aston Martin could find added stability following Geely's recent purchase of a 7.6% stake. As Geely's corporate showroom grows to include entry-level models through mid-range Lynk & Co to entry-luxury Volvo and performance-oriented Polestar, Aston Martin could make a spectacular crowning jewel. A larger stake from Geely should be anticipated going forward.

Kia invests in Mexico

Kia's US$3 billion plant in Monterrey, Mexico, has been producing Kia and Hyundai models since 2016. Over the next two years, the manufacturer plans to invest another US$408 million in plant upgrades and expansions. Through August 2022, the Nuevo Leon facility has produced just over 1.5 million vehicles with the expectation of nearly a quarter million units coming from the plant in 2022. The new investment will add five new buildings and add as many as 800 new positions.

'ASTON MARTIN COULD MAKE A SPECTACULAR CROWNING JEWEL FOR GEELY'

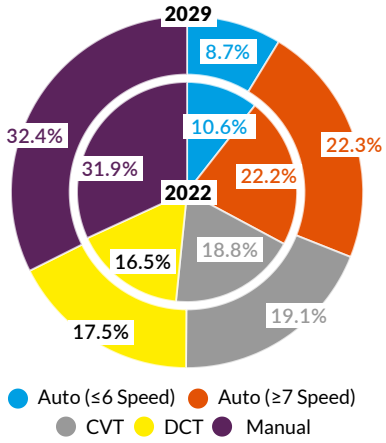
Geely has added a 7.6% stake in Aston Martin to its expanding global portfolio. A larger stake is likely in time

GM expands in South Korea

After years of labor issues in the country, General Motors will invest 900 billion won (US$627 million) in its Changwon plant. Currently scheduled for the new-generation Chevrolet Trax sub-compact crossover, the plant will be upgraded with a new press shop and paint facility. GM's South Korean operations have been financially troubled for most of the past decade, but the region has become more important in recent years as exports from China are less profitable due to US tariffs.

TRANSMISSION CONSUMPTION BY TYPE

Excludes BEVs



Source: AutoForecast Solutions

GLOBAL ELECTRIC VEHICLE INITIATIVES

BY CONRAD LAYSON

Software is the future at Volkswagen...

The Volkswagen Group's internal software development company, CARIAD SE, has signed a deal with China's Horizon Robotics, a leading developer of AI hardware and software. In addition to a US$1 billion investment into Horizon directly, CARIAD will invest an additional US$1.26 billion to take a 60% stake in a new joint venture with Horizon.

This joint venture plans full stack development of both advanced driver assistance systems (ADAS) and autonomous driving (AD) software that will integrate numerous vehicle functions onto one chip, a system-on-chip design (SoC). SoCs are cost savers. They require fewer semiconductors overall to drive the car yet increase operating system stability and reduce system energy consumption. Fulfilling Volkswagen's 'Made in China, For China' initiative, the joint venture represents an increasing split in the industry: one where two teams develop the same technology or software in parallel but deliver the results separately – one for China and the other for the rest of the world. This is true for Volkswagen, as CARIAD is also collaborating with the Bosch Group in Germany to deliver the same ADAS/AD software and system architecture for use there. The joint venture with Horizon is designed to stop Volkswagen's plunging EV sales in China. The ID.4 made its debut a year ago, with expectations of sales in excess of 150,000 units. Instead, Chinese buyers found the ID.4's lack of over-the-air updates and minimal digital offerings wanting and they purchased domestic new-energy vehicles with the more established digital ecosystems that appeal to them.

In September, CARIAD's failure to deliver a unified operating system for use across the group's EVs cost former CEO Herbert Diess his job. Regaining market share is critical for Volkswagen, in China and the rest of the world.

Volkswagen ID.4's software limitations are hurting its sales in China

...and at Hyundai

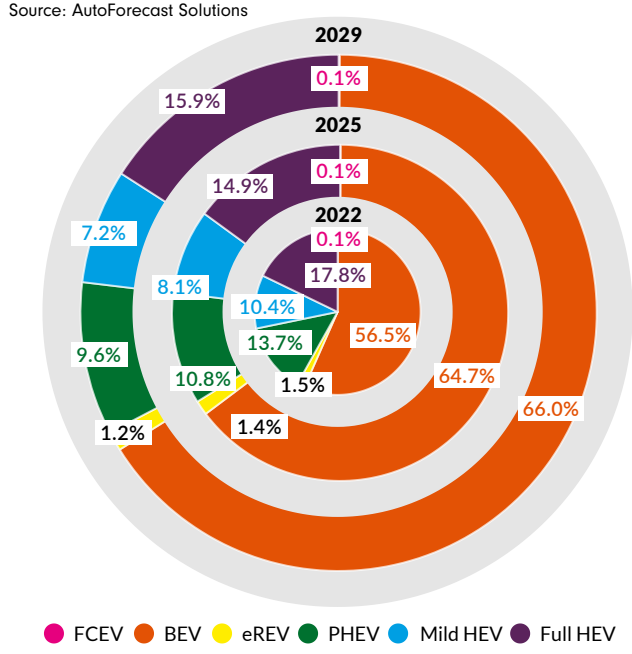
Hyundai Motor Company is committed to spending US$12.6 billion between now and 2030 to create its Global Software Center (GSC). The new entity will be tasked with creating and implementing the operating system and over-the-air upgrade capabilities needed to allow Hyundai to build software-defined vehicles with the launch of two new EV platforms in 2025: eM and eS.

"Creating visionary vehicles empowered with the ability to evolve through software will enable customers to keep their vehicles up to date with the latest features and technology long after they have left the factory." That is the Global Software Division's key mission, according to the President of Hyundai's R&D Division, Chung-Kook Park. All Hyundai Group vehicles, both

GLOBAL LIGHT VEHICLE ELECTRIFICATION

Percentages based on electrified vehicle market only

Source: AutoForecast Solutions



both EV and ICE, will be equipped with the internally developed Connected Car Operating System (ccOS), which will allow all Hyundai vehicles access to vehicle access to over-the-air upgrades, personalized services, and up to Level 3 autonomy using the eM platform. The eS platform will be developed as a skateboard underpinning purpose-built vehicles for B2B applications, such as delivery, logistics and even car-hailing services.

The group's ccOS will be loaded onto the NVIDIA DRIVE platform, designed for large-scale data processing needed by the lidar, cameras and radars for the Level 3 autonomy that will be deployed in future eM-based vehicles. The Global Software Center will create software-defined mobility devices and solutions that extend beyond the vehicle, entering the larger mobility ecosystem. Hyundai's Global Software Group is among the first legacy OEM software organizations to embrace and pursue this idea.

...and at Sony

Sony Honda Mobility is a joint venture with roots in both legacy OEM vehicle production, from Honda, and deep software development experience, from Sony. So it came as something of a surprise that in the press conference announcing the founding of Sony Honda Mobility, CEO Yasuhide Mizuno, the former automotive head at legacy automaker Honda, declared: "The mobility industry is reaching a time of transformation, with digital technology and software at the epicenter. Leading that transformation requires a completely different approach from the way that existing original equipment manufacturers do things." Perhaps it should not have been such a surprise, after all.

The Sony Honda Mobility focus on software-driven development has its foundations in Honda's establishment of a computer science research center in Silicon Valley in 2000. Five years later, Honda's research center

evolved to investing in start-ups that embraced open innovation in their software platforms. Meanwhile, Sony's 2016 revival of Aibo, the robot dog, led the company to concentrate on EVs as a way to bring about company success with software-defined vehicles. With that mutual interest in software-defined vehicles, Sony Honda Mobility plans to build smart vehicles that rely on open innovation software development to supply users with digital products and services that complement their lives outside the car, while over-the-air updates enhance their experience inside the car.

Open innovation software development allowed outside developers to create content for Sony's PlayStation, succeeding with the gaming community far beyond anything that Sony could have accomplished by itself. The joint venture will begin taking reservations in early 2025 and deliver technologically sophisticated and engaging customer vehicles towards the end of that year.

GLOBAL LIGHT VEHICLE PRODUCTION OUTLOOK

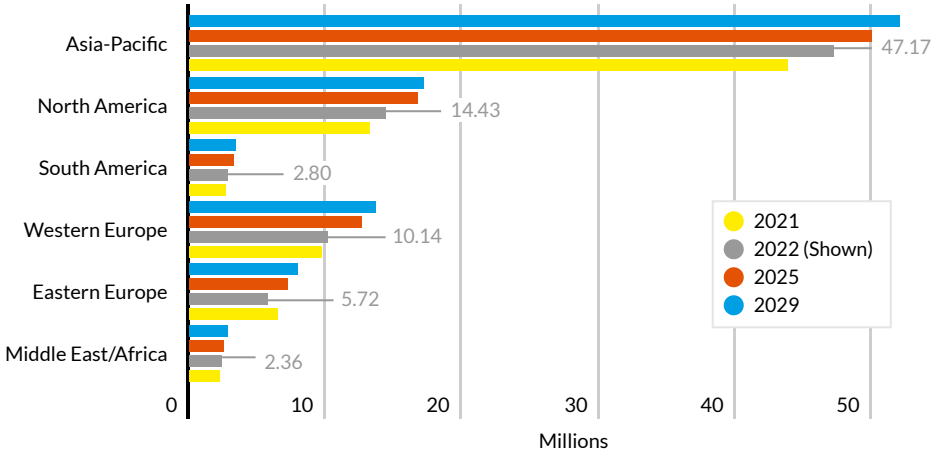
BY SAM FIORANI

SUPPLY CHAIN ISSUES will be with the industry for a while and automakers are beginning to come to terms with it. Recently, Volkswagen confirmed that it was looking at the parts supply issues, primarily the shortage of semiconductors, for all of 2023 and into 2024.

This may be looking at the issue with the most pessimistic eyes, but it is better than expecting the problems to be cleared up in the near term. As more and more companies and executives become aware of the acute nature of this problem, the focus on solving the shortage will be increased with the hopes of shortening the time needed to return to full production.

Volkswagen predicts the components supply issue will roll on through 2023 and into 2024, affecting deliveries

GLOBAL LIGHT VEHICLE PRODUCTION OUTLOOK



Source: AutoForecast Solutions

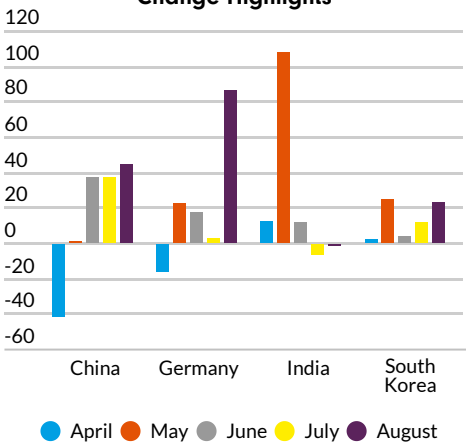
'SUPPLY CHAIN ISSUES WILL BE WITH THE INDUSTRY FOR A WHILE'

The exodus from Russia continues. Nissan sold its plant in St. Petersburg to the Russian government for €1, despite investing more than €700 million in the facility. Most recently, the plant built the Nissan X-Trail, Murano and Pathfinder utility vehicles. However, production stopped in spring 2022 and will not resume.

Japan continues to feel the effects of China's Zero COVID policy as a lack of parts is holding up production. Toyota and Honda slowed production in September and October as they struggle to find semiconductors and other components for their vehicles. Plants have been slowed by as much as 40% in this timeframe and more announcements of slowed production lines and closed plants are expected through the rest of the year. However, Toyota maintained that production in its fiscal year, which ends in March 2023, had been on target for about 9.7 million units but lowered its sights by late October.

Hurricane Ian hit Florida during the last week of September and moved northward along the US coast. Briefly, Volvo's Charlotte and Mercedes-Benz's Gaffney plants, both in South Carolina, were taken offline for the safety of their more than 3,000 workers. Although production of the Volvo S60 and Mercedes-Benz Sprinter was halted, the loss in output is expected to be recovered by the end of 2022.

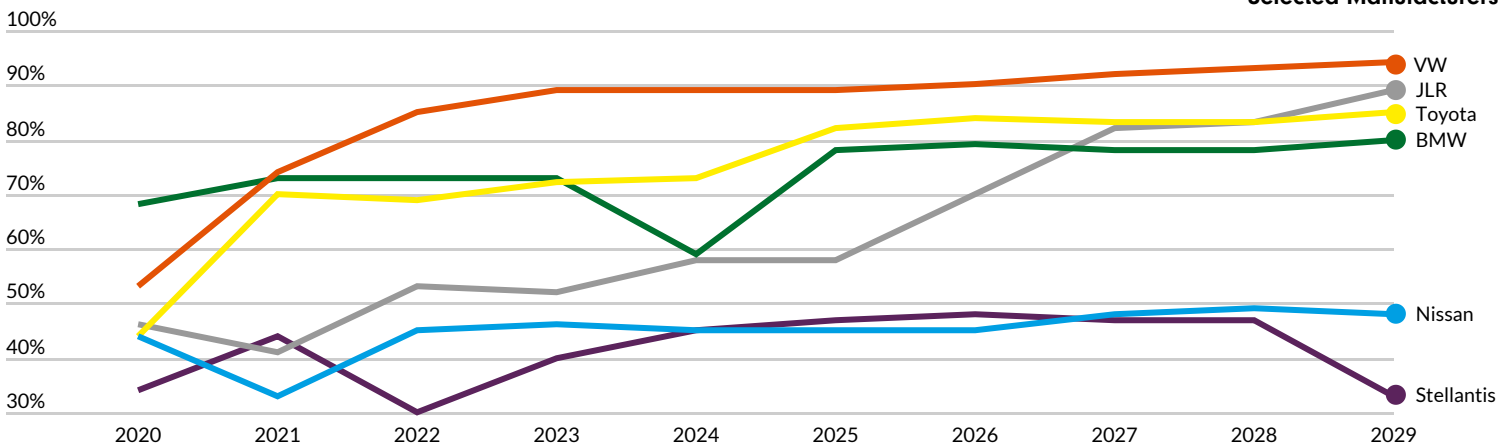
Year-Over-Year Production Change Highlights



The AFS Forecast covers 60 countries. Chart shows changes 2022 over 2021.

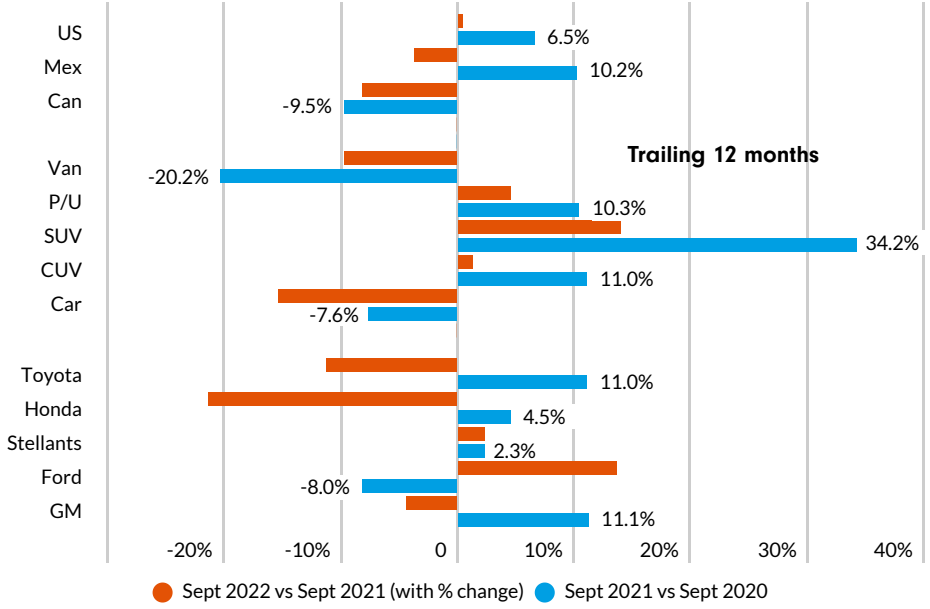
UNITED KINGDOM CAPACITY UTILIZATION BY VEHICLE MANUFACTURER

Source: AutoForecast Solutions

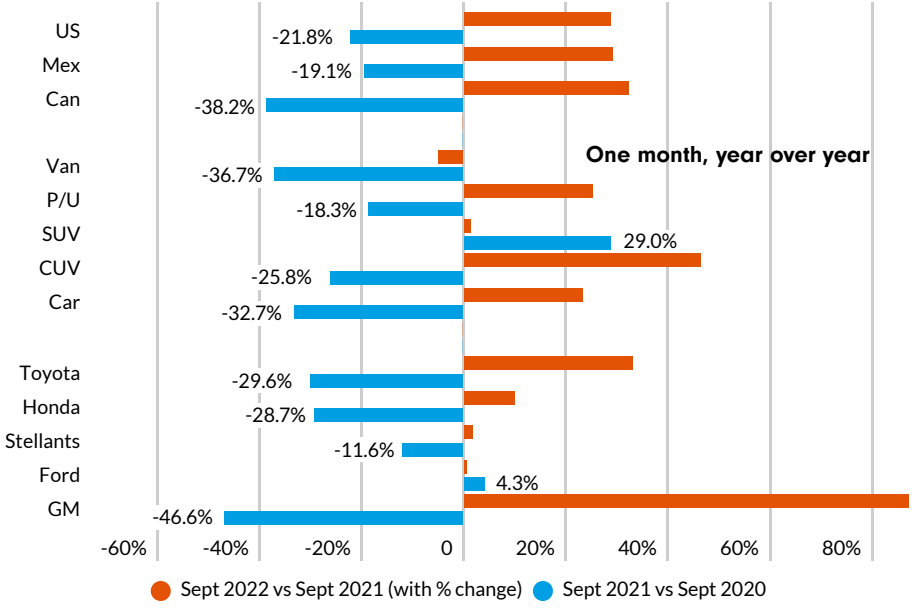


NORTH AMERICAN PRODUCTION CHANGES

Source: AutoForecast Solutions



Trailing 12 months represents 12-month period vs the year-prior period



One month represents single month over prior single-month change

GLOBAL LIGHT VEHICLE SALES OUTLOOK

BY SAM FIORANI

BUYERS ARE GETTING worried about the economy and where things will be as the holiday season begins and the new year approaches. Extended threats of a recession through price inflation and the constant barrage of talking heads warning of the "R" word may have generated the belief of its arrival with or without the actuality of it. Believing that a recession is near has the same result as the official announcement of the downturn: consumers decide to save money rather than spend it. And global national banks increasing interest rates have compounded the slowdown.

For years, the automotive industry has focused on the pent-up demand of buyers who did not buy a new vehicle during the COVID shutdown and could not find a vehicle in the post-shutdown inventory shortage. These buyers normally would have shifted to used vehicles but the shortage of pre-owned vehicles has raised prices to record levels. Combining high vehicle prices and short supply moved potential buyers out of the market. Maintaining old vehicles has become the norm, as can be measured by the continued rise in the average age of vehicles on the road. In the US, the average vehicle has been in use for well over 12 years.

To put that average age in perspective, more than 13 million vehicles will be sold in the US in 2022 on top of the 186 million vehicles sold in the prior 12 years. Today, there are about 280 million vehicles in use in the US, which means a substantial number of vehicles on the road today were produced more than two decades ago. The reliability of cars and trucks produced this century is so good that owners do not need to upgrade when these vehicles hit 100,000 miles, or even 200,000 miles. Knowledge of this has permeated the market, moving more buyers out of it and allowing them to save the average transaction price of nearly US$50,000 for a new vehicle or US$33,000 for a used one. Pent-up demand isn't satiated as much because these buyers simply walked away from the market.

Sales in China during September grew over the year prior, but not by as much as anticipated. Each of the past four months has surpassed 2021 numbers and September's 9.3% growth would be the envy of most markets around the world. Coming off the fourth straight year of reduced sales, positive signs of any kind are welcome. However, 2022 is still expected to be 3% below even the 2020 level and more than 21% below the peak year of 2017.

The United Kingdom is slowly recovering from the COVID-era downturn and this year won't demonstrate that recovery. August and September recorded gains, joining January and February as the only months not in the red. Even with an expected positive fourth quarter, this year will still lag behind 2021 by 6%. Economic troubles inside the United Kingdom and around the world will keep the region from growing too quickly and most of this year's losses will be recovered, but still well below pre-COVID levels.

Sales in the EU are doing no better. Last year, the EU slipped 2.4% from 2020's sub-10 million total, itself down 24.5% from 2019. This dismal track record continues in 2022. When all of the numbers are in, this year will fall below 8.7 million units of light vehicles, an additional 10.8% lower than last year's terrible showing. A slight recovery in 2023 won't push sales volumes back over nine million units and the region won't return to 10 million units before 2025.

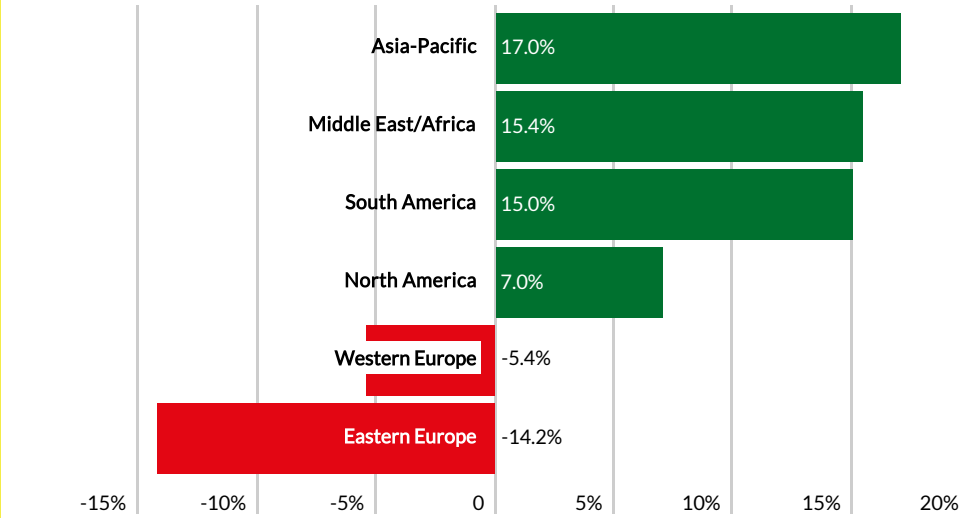
US light vehicle sales rose 9.5% in September, powered by a few major players. With slightly improving inventory levels, Toyota, Hyundai, Subaru and General Motors found more buyers last month than they had a year prior, while sales at Ford, Stellantis and Nissan fell. GM's improvement was thanks, in large part, to increased sales to fleets as retail sales lagged behind the overall market.

Sales in Canada were down 9.6% in September, which was as expected. Inventory shortages remain the biggest stumbling block to market growth and no remedy is on the immediate horizon. With just one quarter left in the year, the outlook for 2022 remains at 1.5 million units, followed next year by marginal growth of just 6%, taking the market above 1.6 million vehicles.

The 4.8% rise in sales in Mexico was right on forecast for September, following last month's sales growth. Again, two months do not make a trend, but this does follow the slowing inflation in the country as a positive sign for future growth. Light vehicle sales are still on pace for 1.05 million units this year.

South America got a boost, as usual, from Brazil. The region's largest market saw vehicle sales crater last September, setting the market for substantial growth last month. Rising nearly 27% looks great on paper, until it is pointed out that September 2021 was down over 28% from the prior year, which in turn was down nearly 11% from 2019. Third quarter economic growth in Brazil was very good just ahead of the presidential election and this is expected to continue for the rest of the year, paving the way for more year-over-year vehicle sales

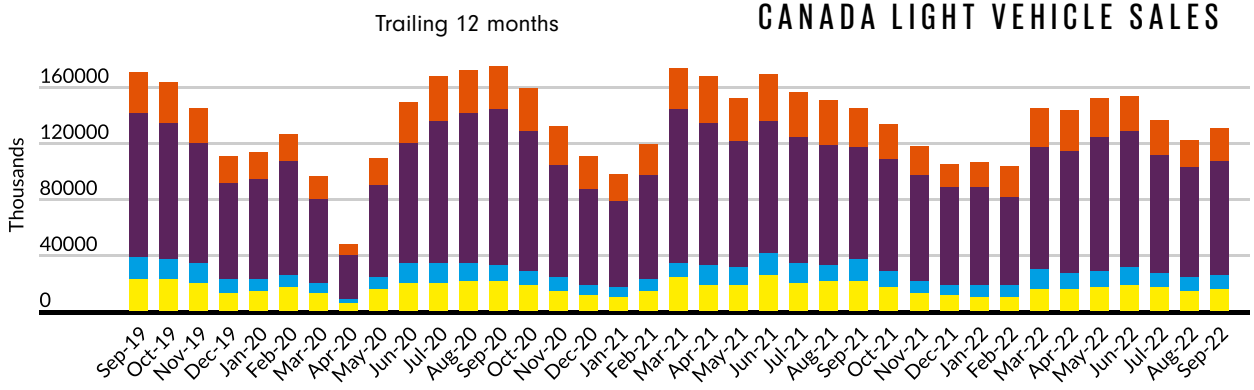
OCTOBER 2022 YOY LIGHT VEHICLE SALES CHANGE

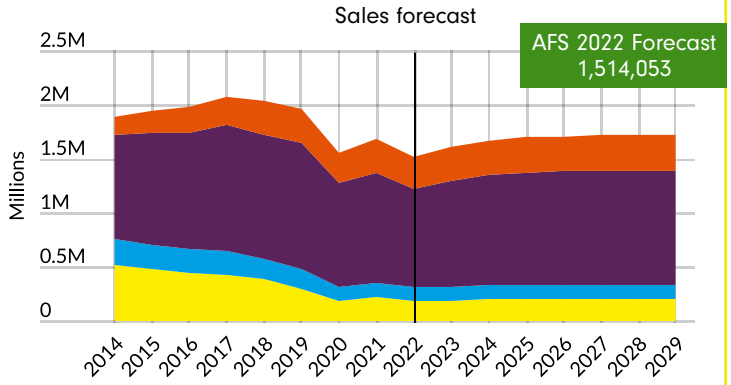


Source: AutoForecast Solutions

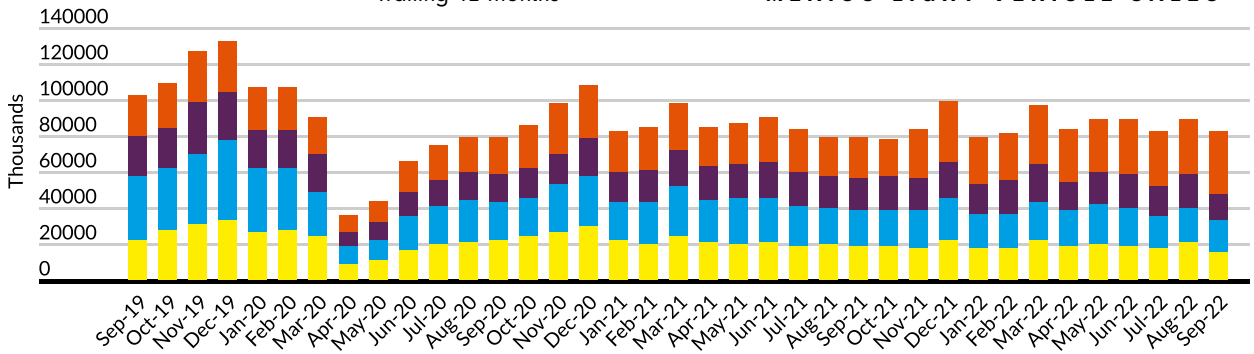
Source: AutoForecast Solutions

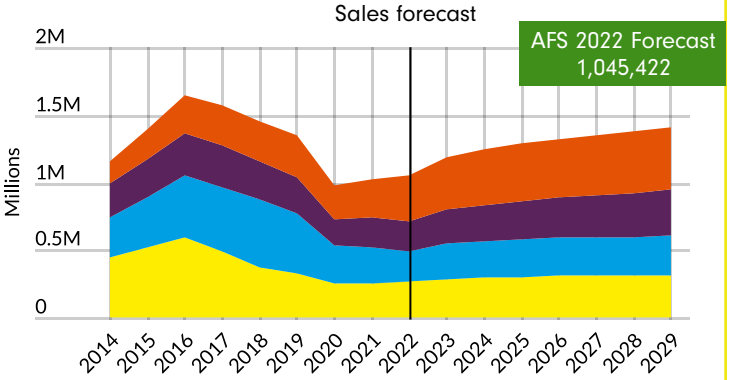
CANADA LIGHT VEHICLE SALES



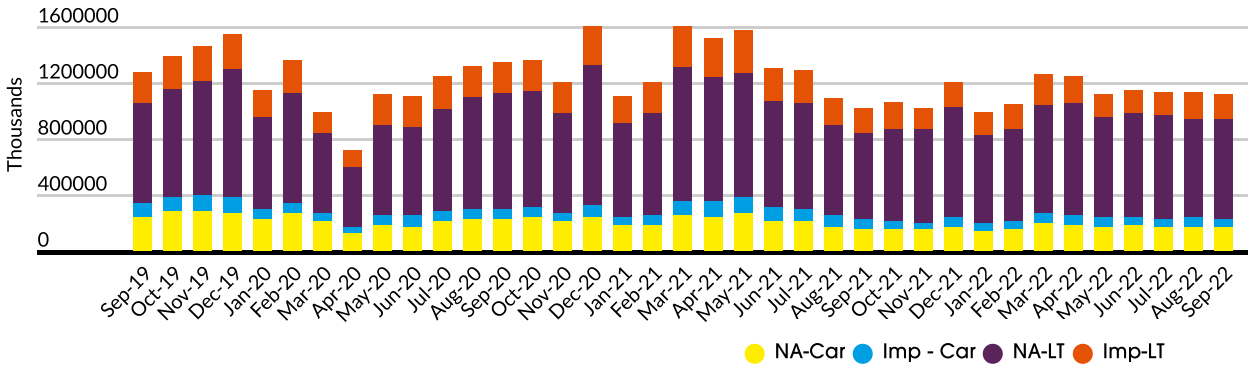


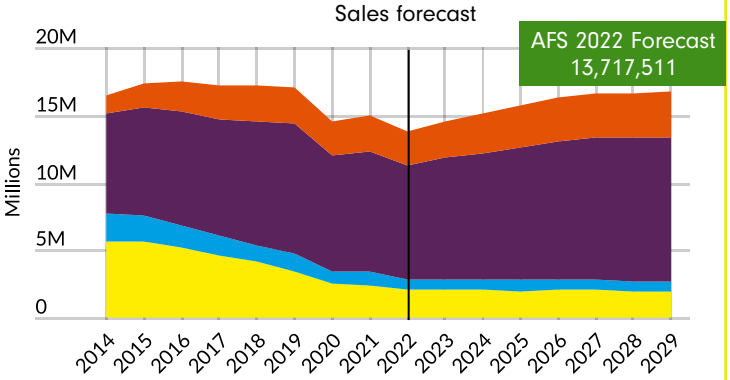
MEXICO LIGHT VEHICLE SALES





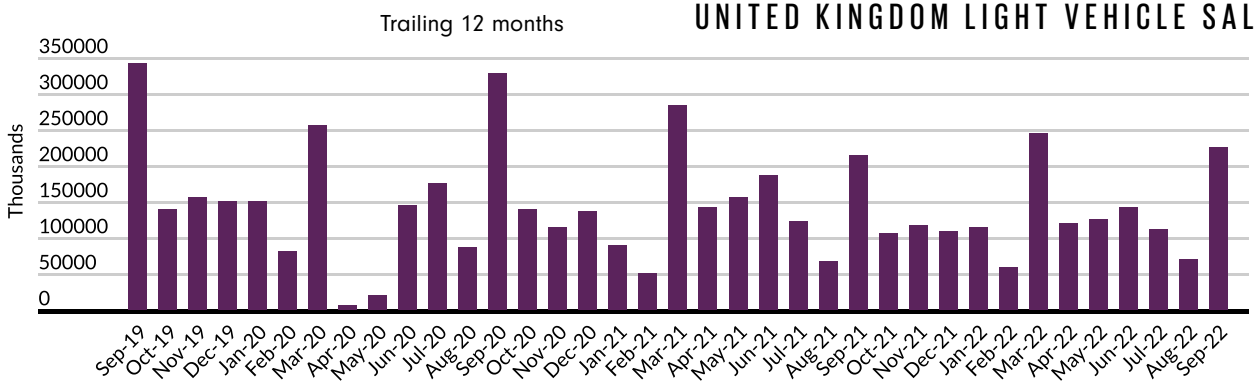
UNITED STATES LIGHT VEHICLE SALES

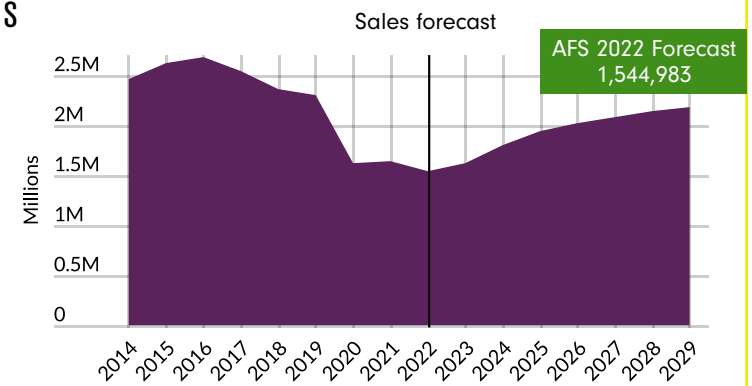




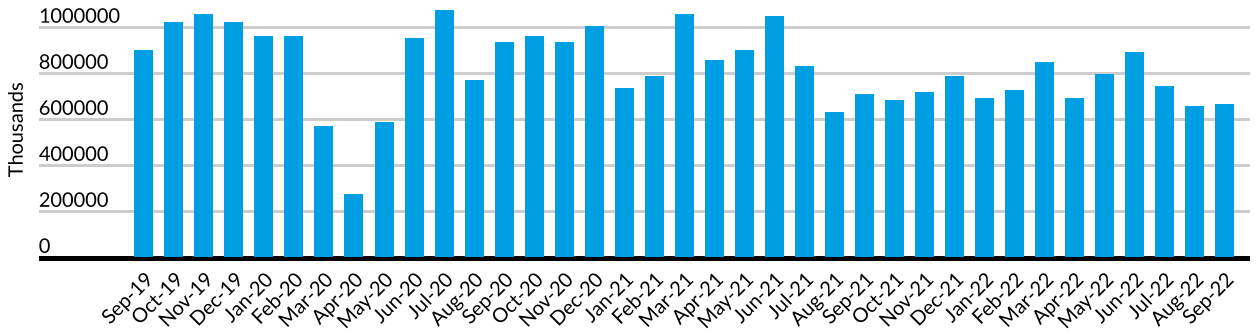
Source AutoForecast Solutions

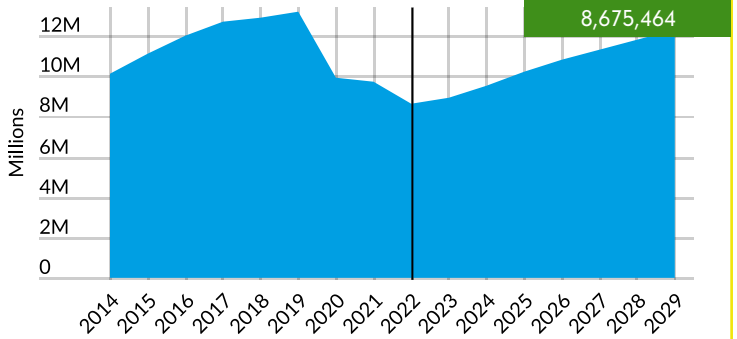
UNITED KINGDOM LIGHT VEHICLE SALES



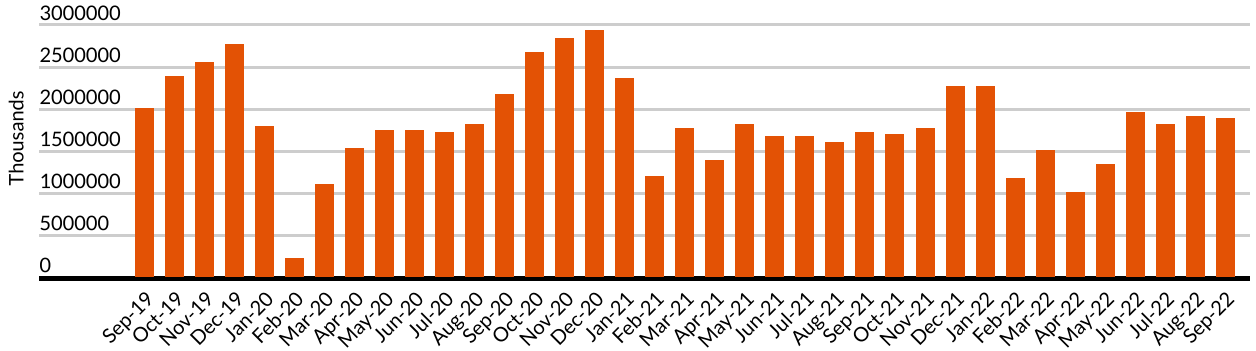


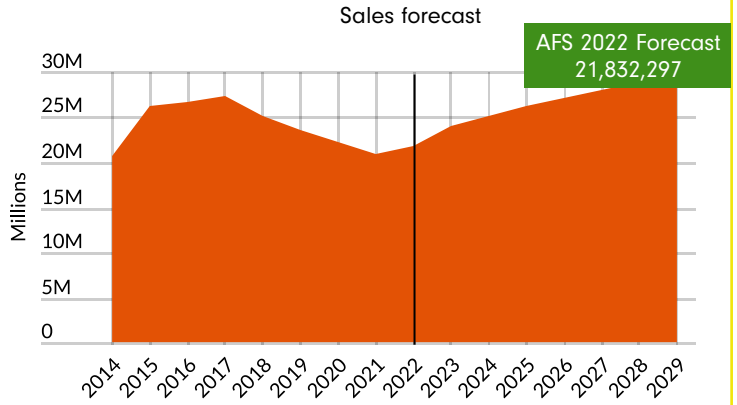
EUROPEAN UNION LIGHT VEHICLE SALES



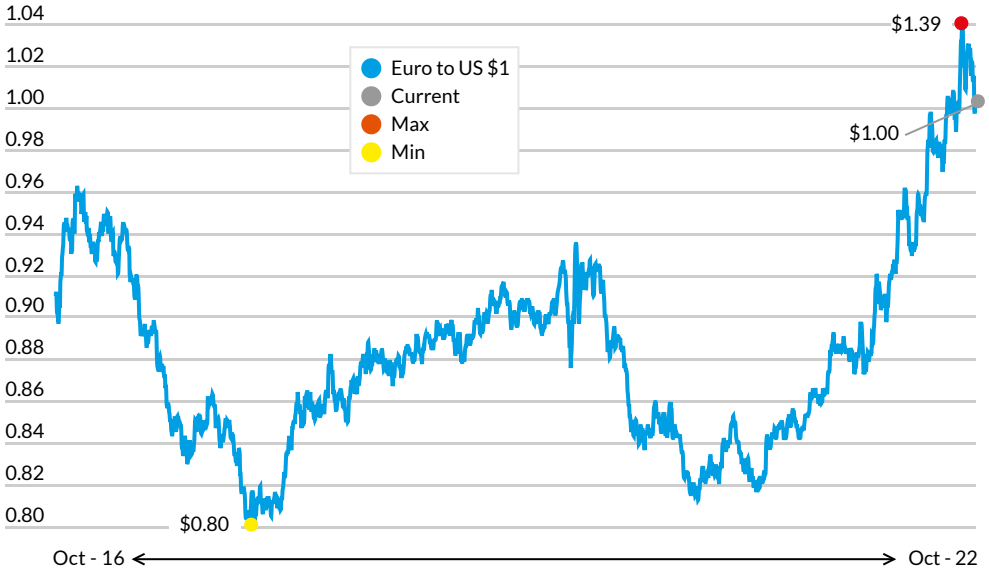


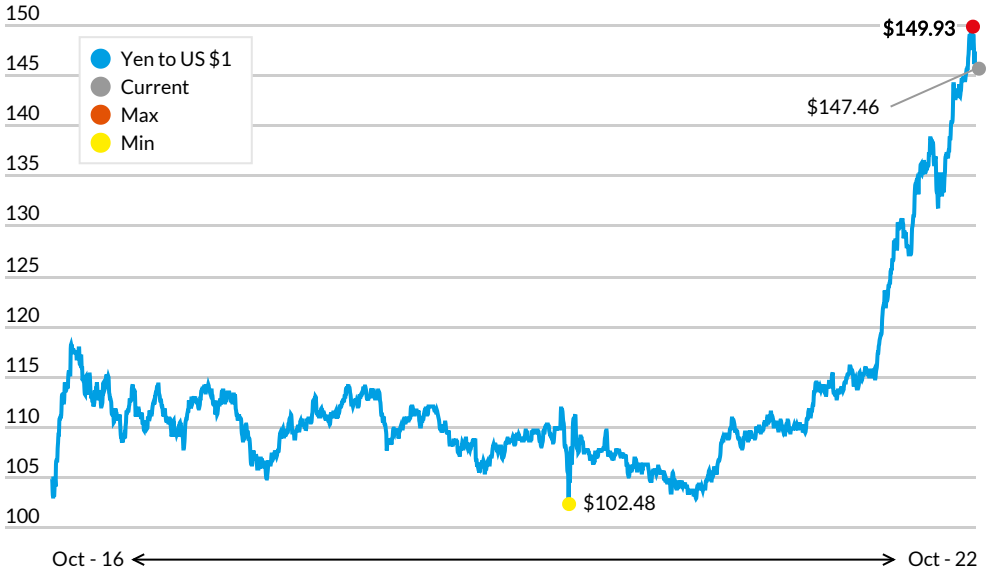
CHINA LIGHT VEHICLE SALES

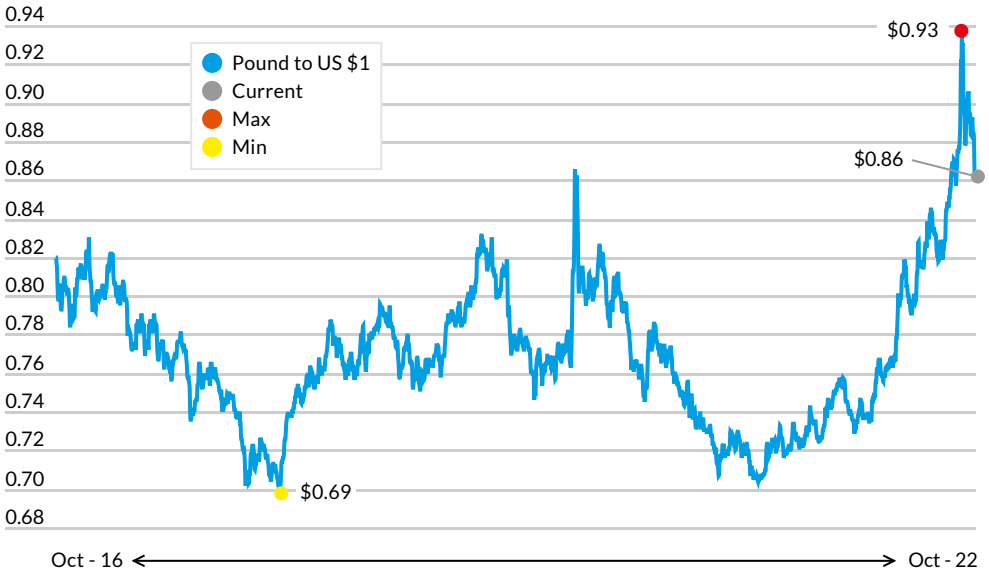




EXCHANGE RATES VS US DOLLAR



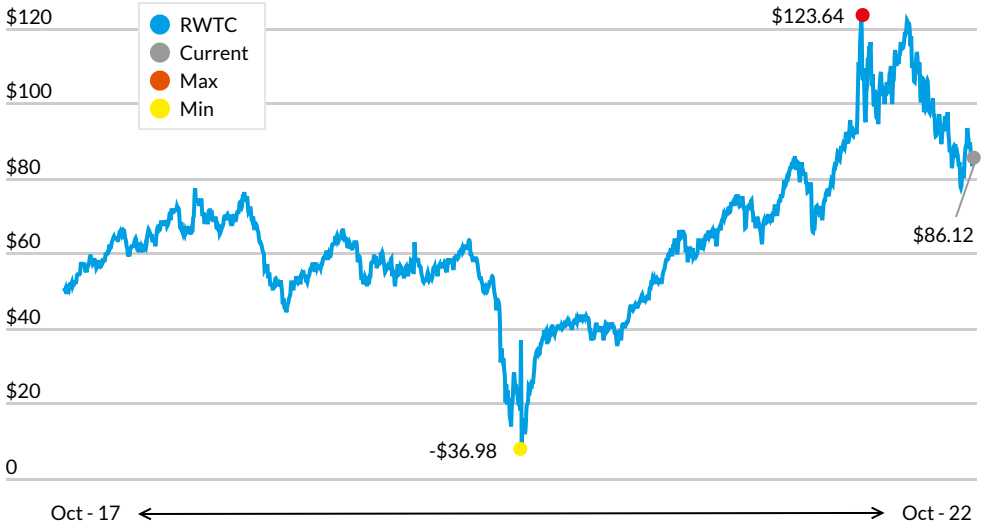




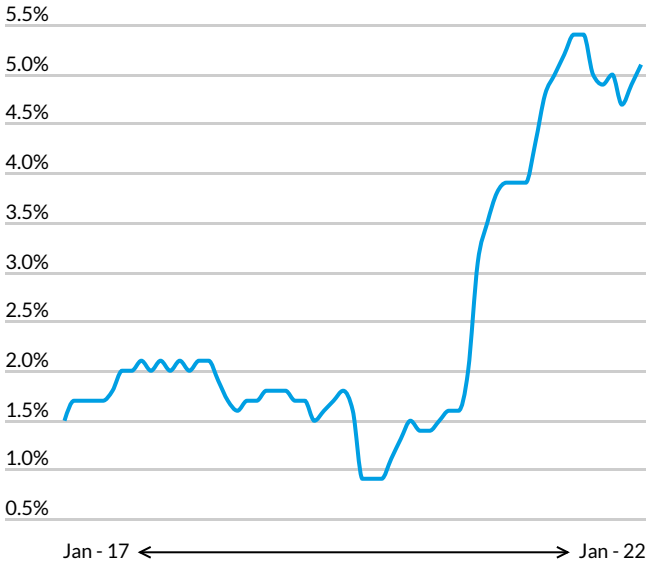
OIL PRICES

Europe Brent Crude

West Texas Intermediate

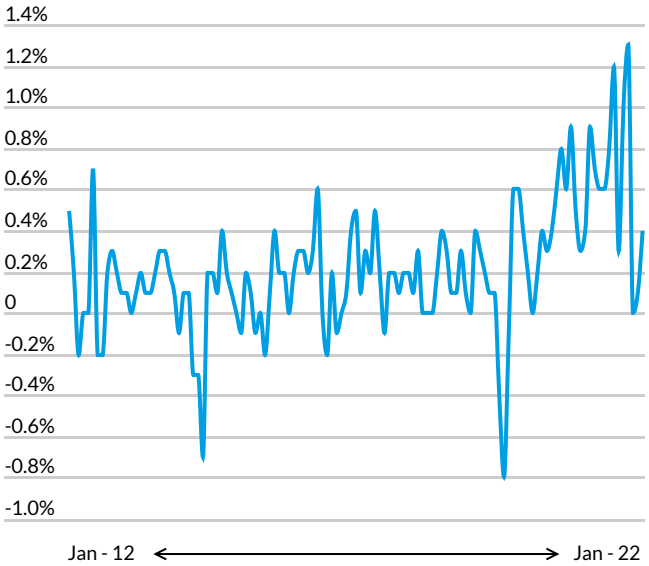


Change in Personal Consumption Expenditures



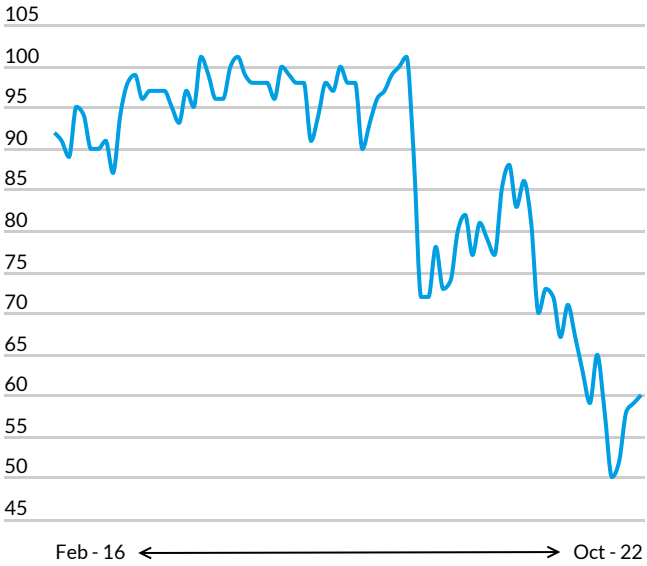
Federal Reserve Bank of St. Louis

United States Consumer Price Index



US Bureau of Labor Statistics

Consumer Confidence



University of Michigan

SPECIAL REPORT

BY SAM FIORANI

Polestar 3

Back in 1996, Polestar began modifying Volvo models for the street and track. After Volvo acquired the company in 2015, the division was groomed with the help of parent Geely to be a stand-alone brand. As Geely has looked to expand globally, brands such as Polestar have been designed to spearhead the move toward export markets. The move has been gradual, but Polestar is now ready to blossom.

Following the limited-production hybrid Polestar 1, the electric-only Polestar 2 was launched in 2020. Offered as a front-drive or all-wheel-drive hatchback, the Polestar 2 blurred the lines between a traditional sedan and a modern crossover, with its slightly raised ride height and taller body blended with its fastback body style. Sales have been good and opened the brand to many new customers.

In October, Polestar demonstrated its third production model, not unexpectedly named the Polestar 3. More obviously a crossover, the new model rides on the SEA2 platform, a new architecture for electric vehicles. Unlike the front-drive bias of the Polestar 2, the new Polestar 3 will feature a rear-drive bias to its all-wheel drive system for a more sporting demeanor.

'POLESTAR IS TARGETING ESTABLISHED PLAYERS SUCH AS PORSCHE'

Two motors provide the motivating power. With the Performance Pack, the combined output of the motors is 385kW, which should propel the crossover to 60mph (97km/h) in 4.7 seconds. Once certified, Polestar hopes to achieve an EPA rating of 300 miles on a single charge from its 107kWh battery pack, made up of CATL-supplied prismatic cells.

Technology throughout the Polestar 3 adds to the driver experience. Cameras, radar sensors and ultrasonic sensors keep track of the road and all passengers to help prevent accidents. The alertness of the driver is tracked as well as interior temperature for passenger health and vehicle occupancy to make sure children or pets are not left unattended. Active suspension continuously controls the four corners of the car for optimal ride and handling.

Production is scheduled to begin in China in August 2023, which will fill local orders as well as some export markets. Supplying demand in the US from this plant becomes less profitable because of the import tariffs and its ineligibility for EV incentives. Even before the Inflation Reduction Act, plans were in place for Volvo's Charleston plant to add the crossover alongside the S60 sedan and production will begin in June 2024. The South Carolina plant is expected to supply the Polestar 3 to Europe as well as North America.

Despite the model's US$85,300 starting price, the automaker expects global sales of the Polestar 3 to grow quickly. Only 24,000 are expected to find homes in 2023, but with the US plant coming online, planners are looking to sell as many as 77,000 in 2025. Targeting competition from established players such as Porsche and Audi, Polestar will find cracking this market to be extremely tough.

Twin-motor Polestar 3: up to 385kW and a 107kWh battery

Polestar 3 is a tech-rich electric crossover that will be priced from US$85,300 when it goes on sale next year

SPECIAL REPORT

BY SAM FIORANI

BYD's global expansion

It's been nearly two decades since automotive industry watchers started seriously discussing when Chinese automakers would make their move into Western markets. So many names have been mentioned as the "first" to break into European or North American markets, including Geely, Chery, Great Wall and any number of state-owned companies. Quietly, however, one other company has taken the lead.

When billionaire investor Warren Buffett's Berkshire Hathaway took a big stake in BYD in 2008, few outside of the industry had ever heard

of it. At the time, BYD was known more for its electronics division than its automotive branches but it didn't take long for that to change.

BYD was founded in 1995 and developed rechargeable batteries, especially for the booming mobile phone market. In 2002, the company acquired an automotive production license by absorbing Tsinchuan Automobile, which was renamed BYD. Starting in 2005, BYD launched a series of small cars designed to look like knock-offs of Japanese models.

The automaker made its desire to tap into the North American market known with a display at the 2008 North American International Auto Show. On the stand, in addition to the F3 compact and the F8 concept, was one of the company's first hybrid models, the BYD F6DM PHEV. The company's e6 electric vehicle made its debut at the show a year later.

Initial growth was slow. The legacy models barely made a dent in the local market, with no more than 20,000 units produced in a year. That started to change once BYD's own designs hit the street and production for 2006 rose to over 60,000 units. Growth was dramatic enough to lure Buffett over. Three years of nearly 100% growth brought BYD to half a million units of production in 2013, but volume remained fairly steady through the rest of the decade.

By 2021, BYD was poised to take advantage of the growth in electric vehicles. Launched in late 2020, the Qin Plus is offered with a plug-in hybrid drivetrain or as a fully electric model. With its 1.5L Atkinson-cycle four-cylinder, "blade" batteries, and continuously variable transmission (CVT), the fuel-efficient mid-sized Qin Plus can sprint to 100km/h (62mph) in about four seconds. Over 170,000 were produced in 2021 and that is likely to double in 2022.

Also achieving success in 2021 were the BYD Han sedan and Song Pro crossover models. The Song Pro is offered with a choice of pure ICE, PHEV, or pure electric drivetrains. The Han is BYD's second most popular model (behind the Qin Plus) and is available as a BEV or PHEV. The BEV has an NEDC (Chinese standard) range of up to 605km (376 miles) on a charge, accelerates to 100km/h in as little as 3.9 seconds and is priced from about US$34,000.

This lineup, along with new models such as the Tang, Dolphin/Haitun, Yuan Plus, and Song Plus, is a far cry from the cars demonstrated 15 years ago. Build quality today is on a par with that of many global nameplates, which was not the case for those early BYD F3 and F6 models. And while pricing is competitive, that will not be enough to break into export markets. BYD will need something special, like electrification.

With decades of battery development behind it, BYD is showcasing its pure electric vehicles to spearhead its export push. The company's move into Europe has already begun. The Dutch market has been very receptive to electric vehicles and BYD's debut this year, with the Atto 3 and Tang, has been modest but places the company ahead of established players such as Jaguar and it is moving up the ranks. In Norway, BYD is already a top-20 brand, tying with Opel and well ahead of Renault and Mini.

'BYD, THE TOP EV BRAND IN CHINA, OUTSOLD TESLA IN THE FIRST HALF OF 2022'

Just this month, BYD signed an agreement with car rental company Sixt to provide over 100,000 BEVs. Placing so many BEVs in the hands of German, French, and British renters over the next six years will provide the experience and familiarity needed for the automaker to become a retail player. German retail sales are planned to begin this month.

Cars like the Atto 3, also marketed as the Yuan Plus, are spearheading BYD's push into new global territories

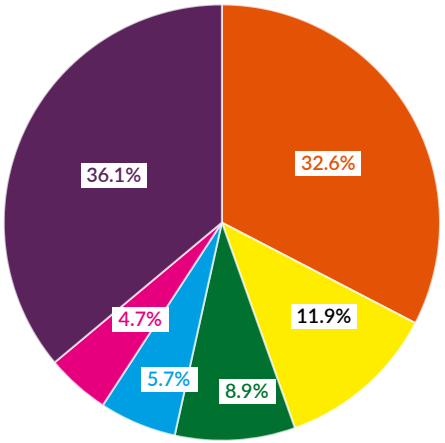
Notoriously tough on imports, the Japanese market is in the immediate future for BYD. Announced in June, BYD plans to launch local sales of the Dolphin sub-compact, Yuan Plus (marketed at the Atto 3) compact crossover and the Seal compact sedan. A small number of BYD vehicles have found their way to buyers and the company plans to have all three models on the market next year. Since pure electric vehicles have little in the way of domestic competition, last year more than 40% of electric vehicles sold in Japan were imported.

Already the top EV brand in China, BYD outsold Tesla in the first half of 2022. Despite quadrupling local sales of EVs, BYD still has to compete with the American brand. BYD's lineup is priced significantly lower than Tesla's and it plans to add more models than Tesla's two-car lineup. BYD has people waiting to buy its cars.

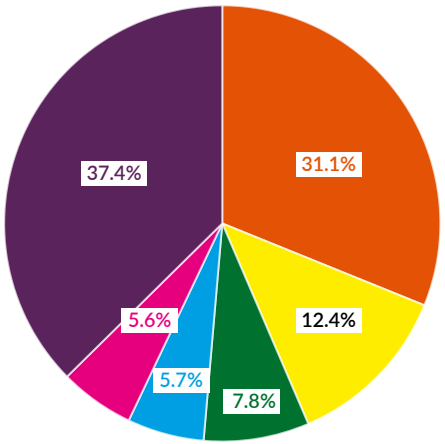
BYD's success has paid dividends for its investors, even with the recent drop in its stock price. Berkshire Hathaway reduced its holdings from roughly 20.5% of the company to less than 8%. The original investment of US$232 million grew to be valued at about US$7.5 billion. BYD places second or third, depending on how it is measured, among global electric vehicle battery manufacturers, competing with CATL and LG Energy Solutions.

BYD is not to be underestimated as it expands globally. While all of its current production is in China, success in other regions will be followed by local production of vehicles and batteries. Tesla may be taking up much of the news when it comes to electric vehicles, but that does not mean it is the future of the electric vehicle.

2022 TOP 5 GLOBAL COUNTRIES



2029 TOP 5 GLOBAL COUNTRIES



TOP 5 BRAND OWNERS

Brand Owner	2022 Production	Brand Owner	2029 Production
Toyota Motor	10,217,866	Toyota Motor	10,938,245
Volkswagen	8,062,073	Volkswagen	9,315,419
Hyundai Motor	6,971,479	Stellantis	8,371,461
Stellantis	6,876,501	Hyundai Motor	8,008,307
Renault-Nissan-Mitsubishi	6,778,919	Renault-Nissan-Mitsubishi	7,711,672

TOP 5 GLOBAL PLATFORMS

NGA-C	2,489,347	CMF-B HS	3,291,113
CMF-B HS	2,443,553	Gen III	2,359,675
MQB A1	2,132,431	KP2	2,352,854
NGA-K-SUV	1,942,533	NGA-C	2,338,617
N	1,808,457	NGA-K-SUV	2,155,548

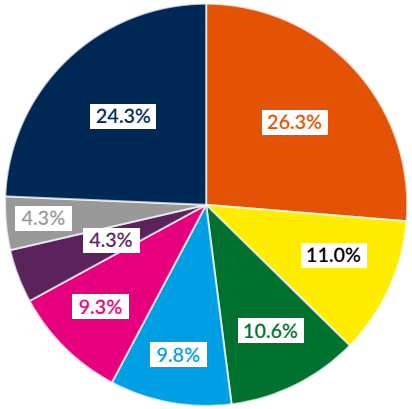
Renault-Nissan-Mitsubishi (CMF-B HS), **Toyota Motor** (NGA-C, NGA-K-SUV, NGA-C), **Tesla** (Gen III), **Volkswagen** (MQB A1), **Hyundai Motor** (KP2, N)

TOP 5 GLOBAL ASSEMBLY PLANTS

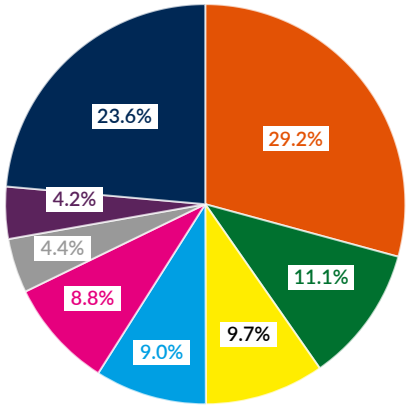
Manesar 1	1,064,893	Manesar 1	1,170,217
Chongqing Engine 1	1,051,644	Chongqing Engine 1	1,029,902
Liuzhou 2	780,991	Liuzhou 2	733,190
Xi`an 2	654,548	Beijing 1	675,306
Gigafactory 3	650,617	Gigafactory 3	629,524

Maruti Suzuki (Manesar 1) **Changan Auto** (Chongqing Engine 1) **SAIC-GM-Wuling** (Liuzhou 2) **BYD** (Xi`an 2) **Beijing Benz** (Beijing 1) **Tesla** (Gigafactory 3)

2022 TOP GLOBAL SEGMENTS



2029 TOP GLOBAL SEGMENTS



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