



## Futures Team

Sam Corey, Grant Drewyor, Eric Eickenhorst, Brayden Perry, Evan Sautters

# Security

**Palladium (\$XPD)**

# View

**Bearish**

# Investment

**Sell Palladium Futures  
Contract (\$PAZ5)  
Expires December 29<sup>th</sup>,  
2025**

Thesis Points  
and Risks



Supply



Demand



Position  
Overview

### Thesis

- About 85% of palladium is used in catalytic converters, which electric vehicles do not require
- Current market sentiment indicates a potential decrease of automobile demand
- Russia exports around 45% of palladium, so the easing of tensions could increase the supply
- Elevated interest rates reduce the demand for automobiles

### Thesis Risks

- The growth of hybrid vehicles could outpace the growth of electric vehicles
- President Trump ends the 25% tariff on automobile parts, decreasing the price of automobiles thus spurring demand
- Currency risk adds a risk of our contract price increasing due to strengthening currencies
- New use cases for palladium would increase demand

# Background Information

---

# What is Palladium

- Palladium is a precious grey white metal, that is often found as a byproduct of other metals
- It has many use cases like: catalytic converters, electronics, medicine, dentistry, etc.
  - However catalytic converters is the most common by far at 85% of palladium usage
- The production of this metal is heavily concentrated

# The Main Use of Palladium

- The main use of palladium is for catalytic converters
- This is the converter used to reduce harmful emissions from the car engine
- It is seen in hybrid & petroleum cars but not used in electric vehicles



# Supply

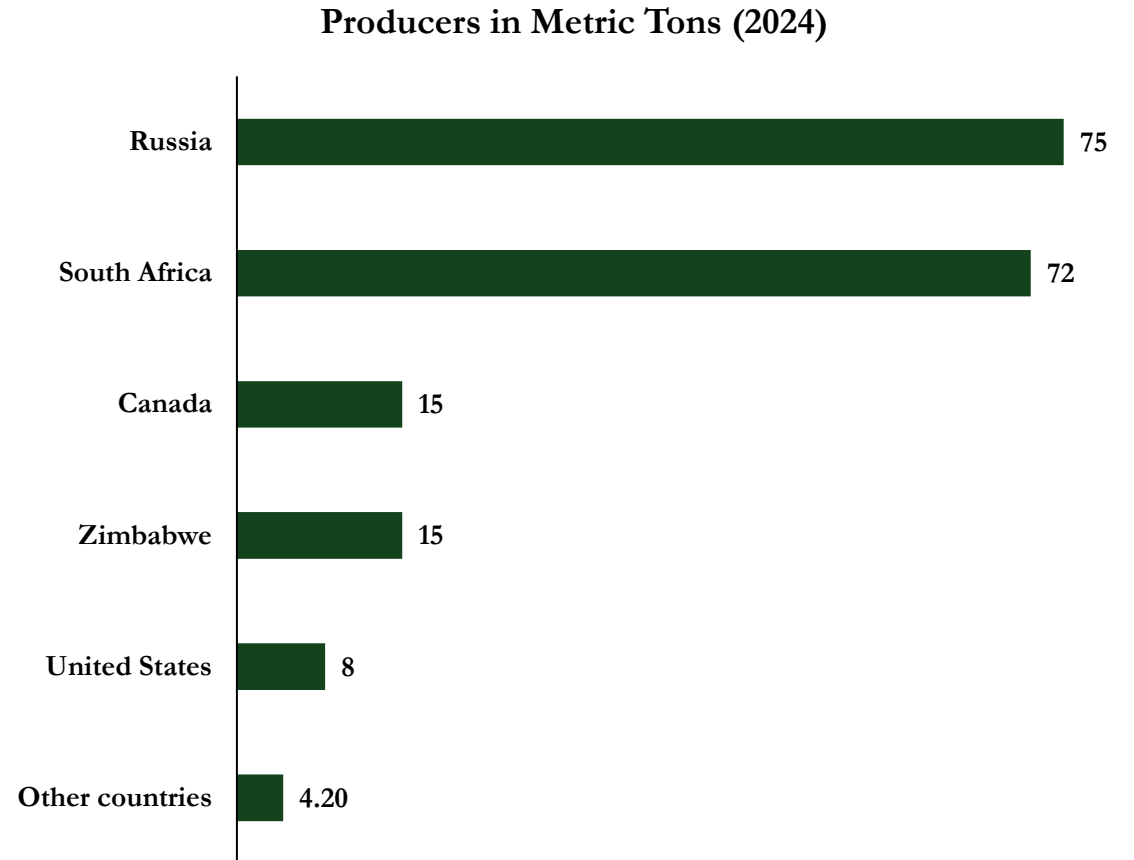
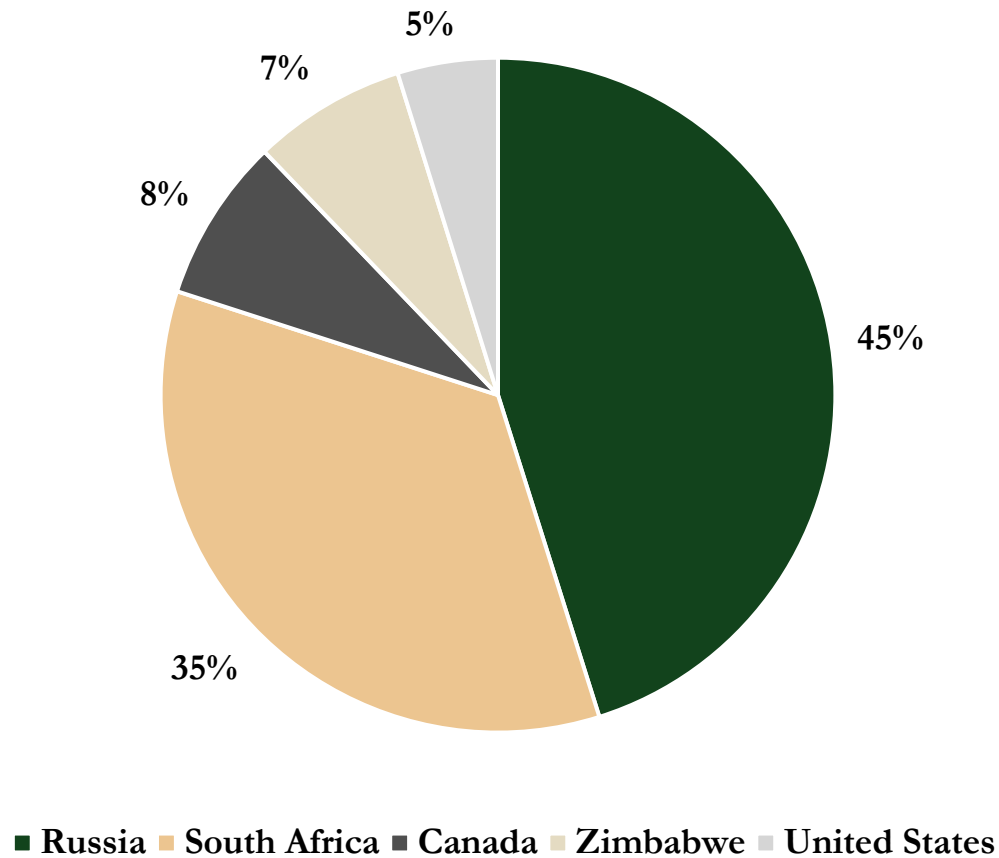
---



# Palladium Recycling

- Recent news about palladium involve a scientific discovery of palladium particles growing and contracting with an experiment
- The small group of palladium particles were able to be restructured into a larger nanoparticle structure
  - This potentially allows for the recycling of palladium particles
  - As palladium is around 30 times rarer than gold, this discovery can help boost the supply of palladium
- If scientists are able to control the stability of palladium nanoparticles, this could revolutionize the way palladium is used

# Top Producers of Palladium



# Russia and Ukraine Conflict

## Russia

- Stalling negotiations on peace talks
  - Trump has threatened “secondary tariffs” on buyers of Russian oil
- Putin proposed UN led temporary government
  - Challenged Zelenskiy’s legitimacy raising tensions
- 3/28 - sent a drone strike killing 4

## Ukraine

- Ukraine wants to change Trump’s aid proposal
  - This proposal would give U.S. control over mining, oil, gas, and minerals
  - Trump claims Zelenskiy is trying to back out of the deal
- Ukraine agreed to a ceasefire pending Russian agreement

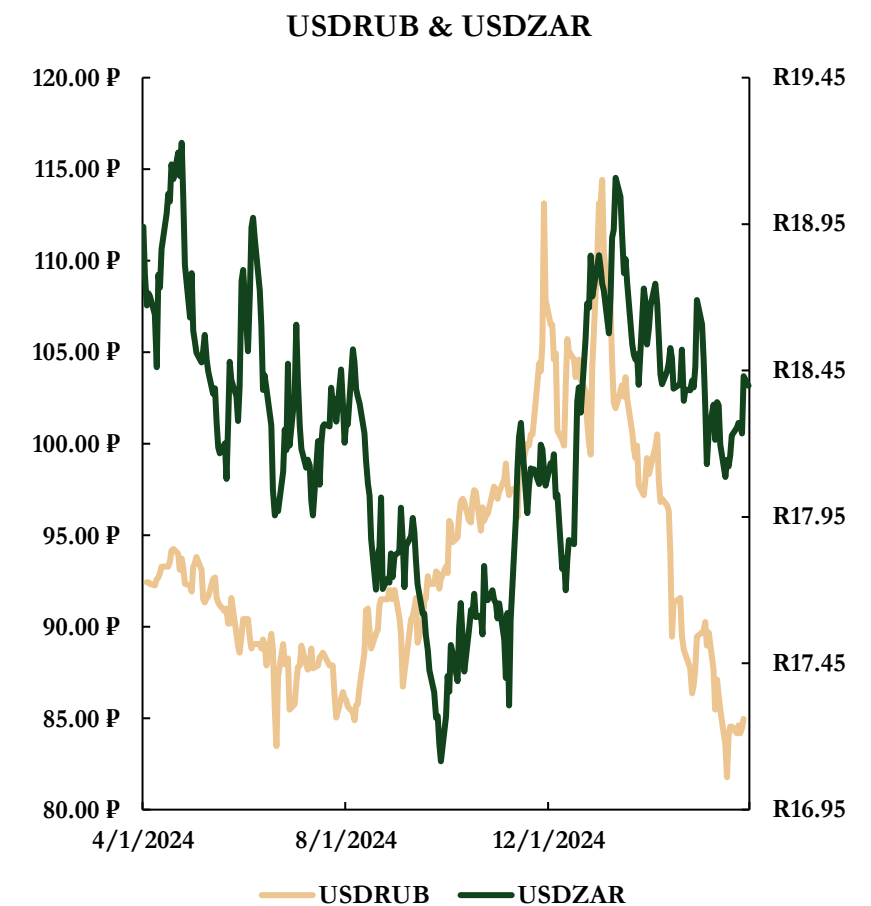
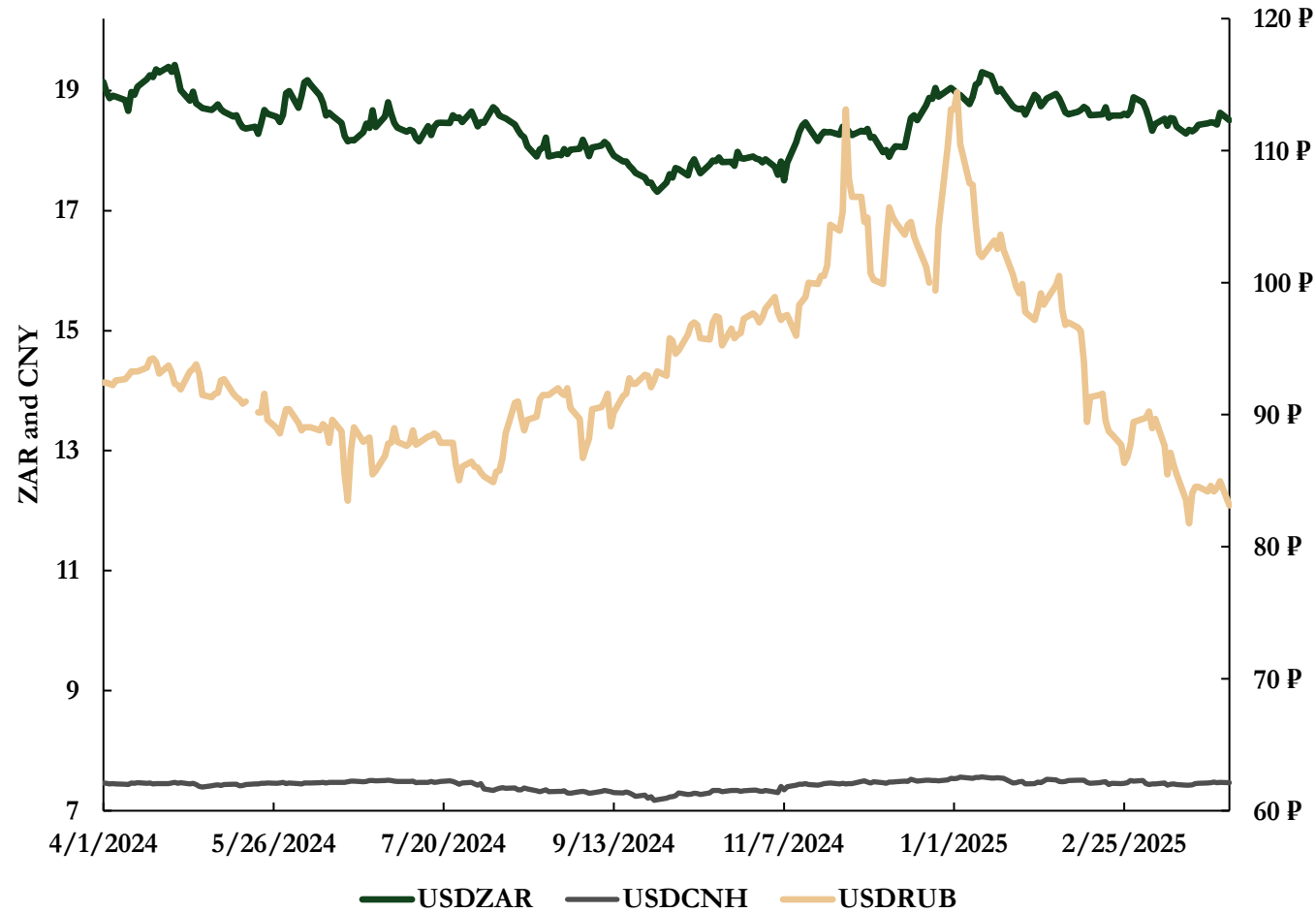
## Takeaway

- **Resolution would open up trade for Russia**
  - Filling the market with supply, decreasing price
- **Continuation of the conflict**
  - Keep supply/demand as it
- **Increase in restrictions**
  - Supply is restricted and price increases

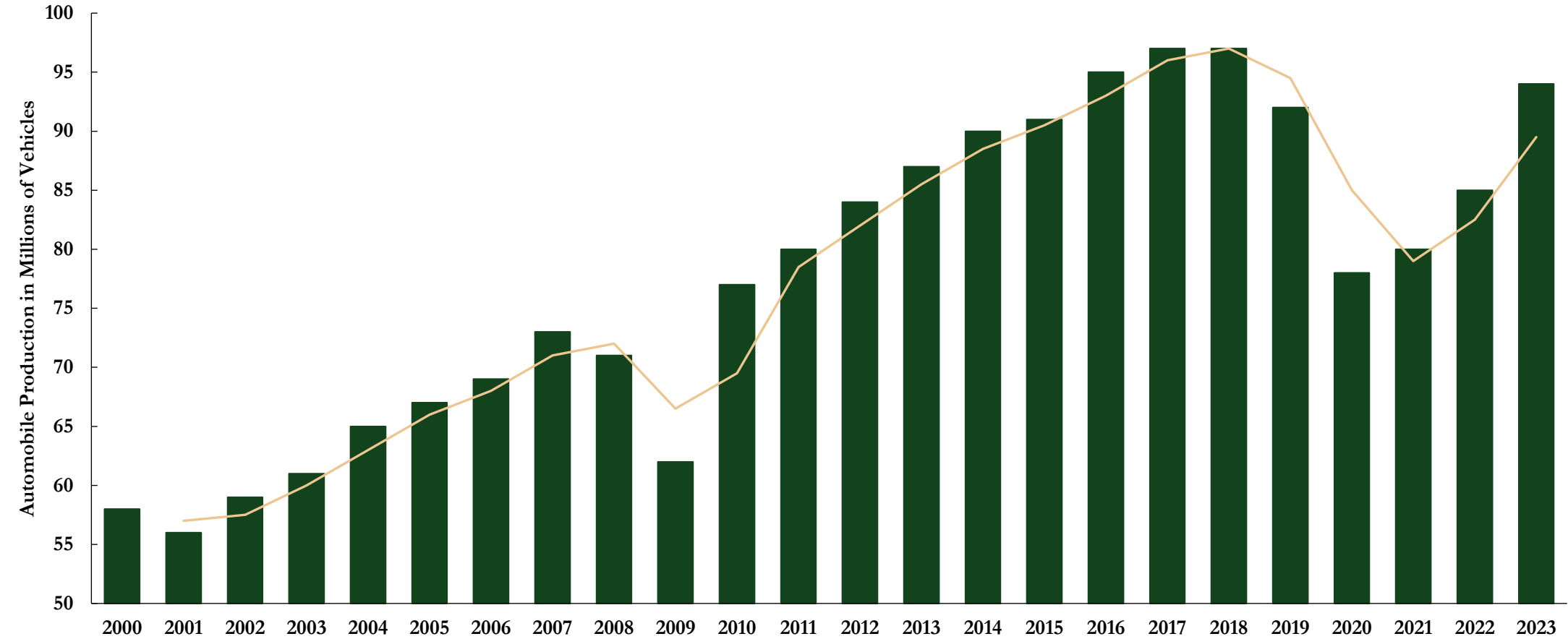
# South Africa Macro Overview

- Africa National Congress is in charge of economic policy
  - In a coalition with the Democratic Alliance, currently arguing over the budget
  - Talks of collapse of the coalition if there is no agreement – **ZAR weakened 1.1%**
- SA is looking to reset trade relations with the U.S.
  - Recently fired their ambassador last month
  - If relations do not improve, then we could see a weaker Rand
  - Trade proposal “AGOA” possibly being revoked - \$23.7b traded in 2023
- U.S. recently halted aid to SA
  - Trump also refuses to attend G20 meetings in SA

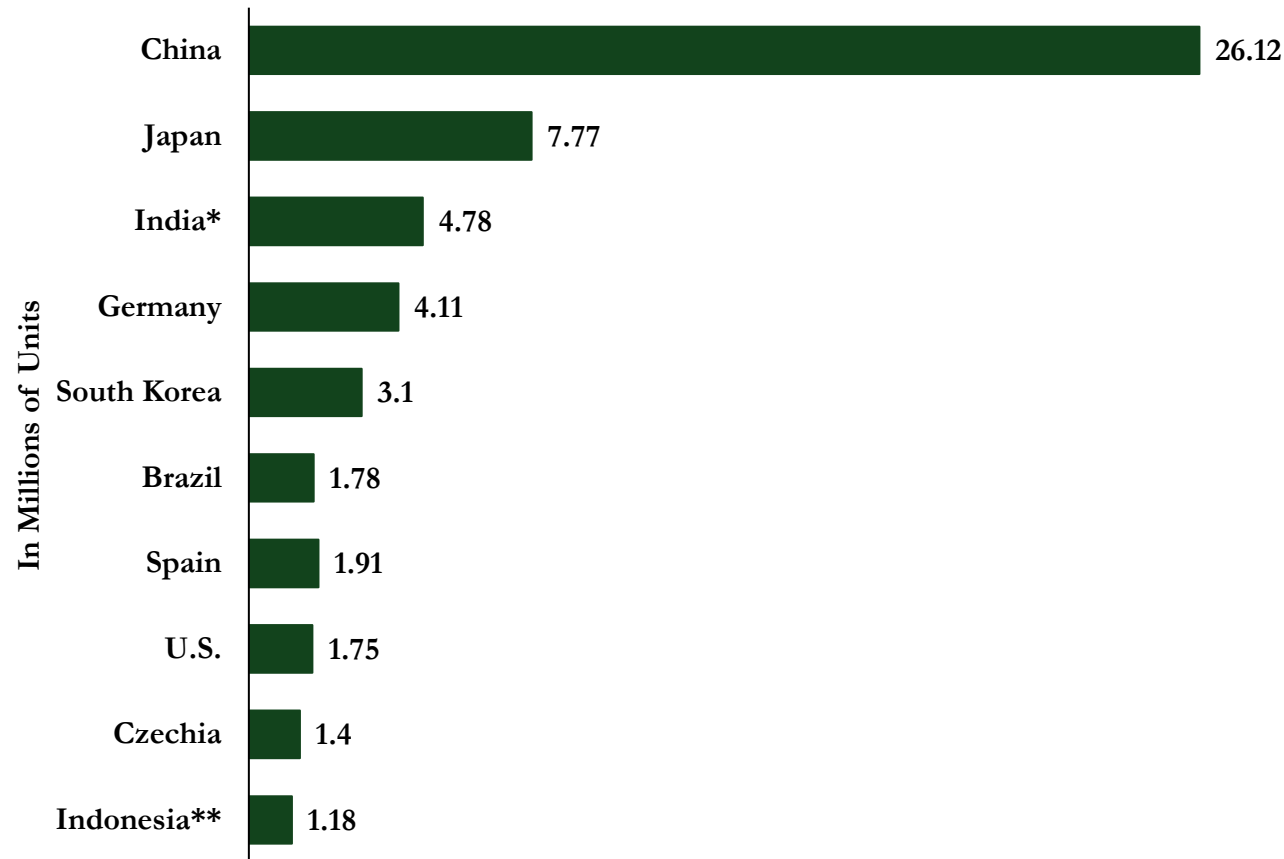
# Currency Markets



# Total Motor Vehicle Production

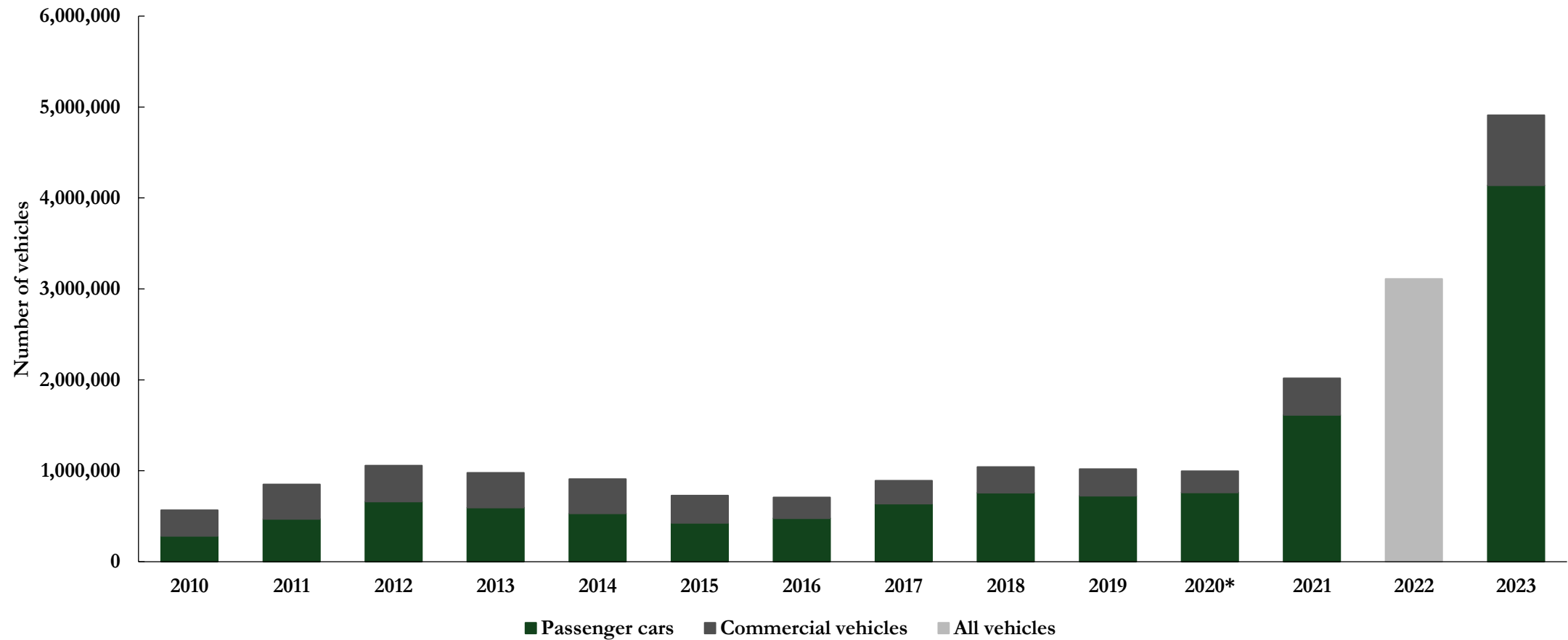


# Passenger Car Production by Country



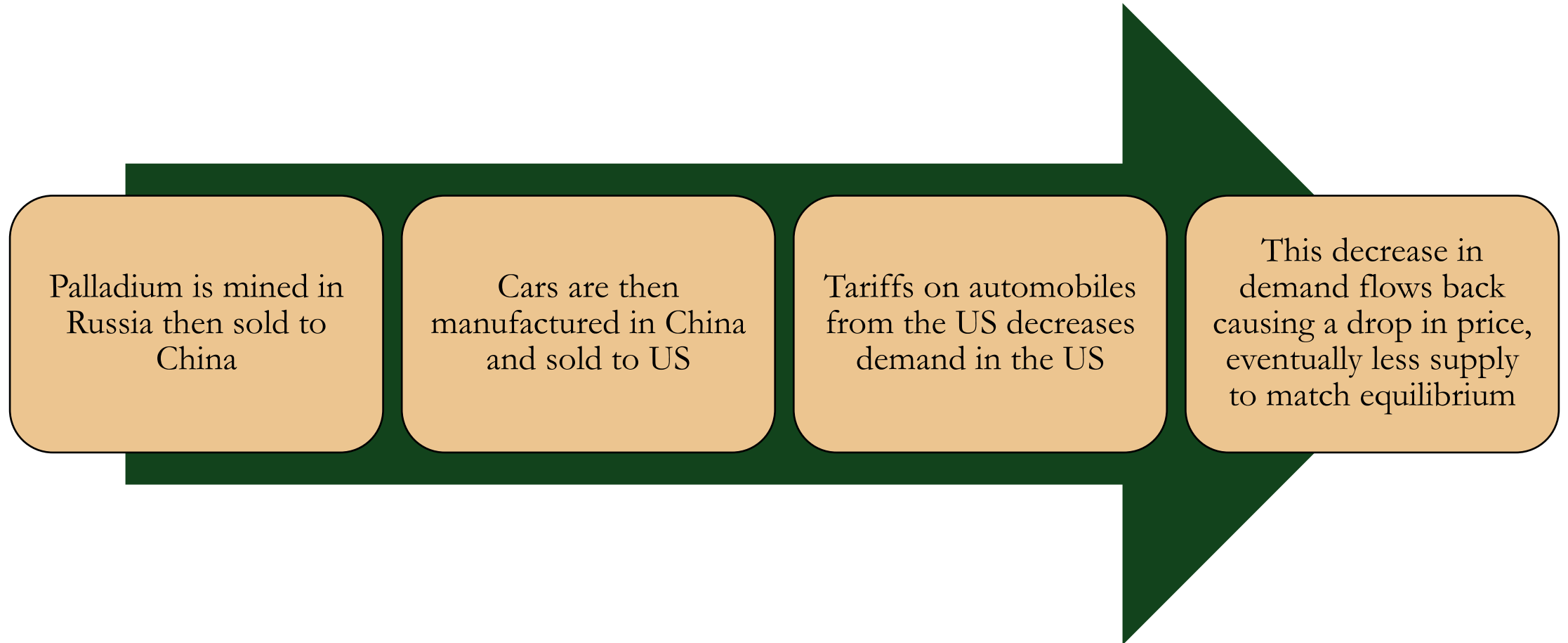
- China produces by far the most cars on a global basis
  - Led by SAIC, Changan, Dongfeng, Geely, and BAIC
- Worldwide, Volkswagen and Toyota lead the way

# China's Vehicles Exports





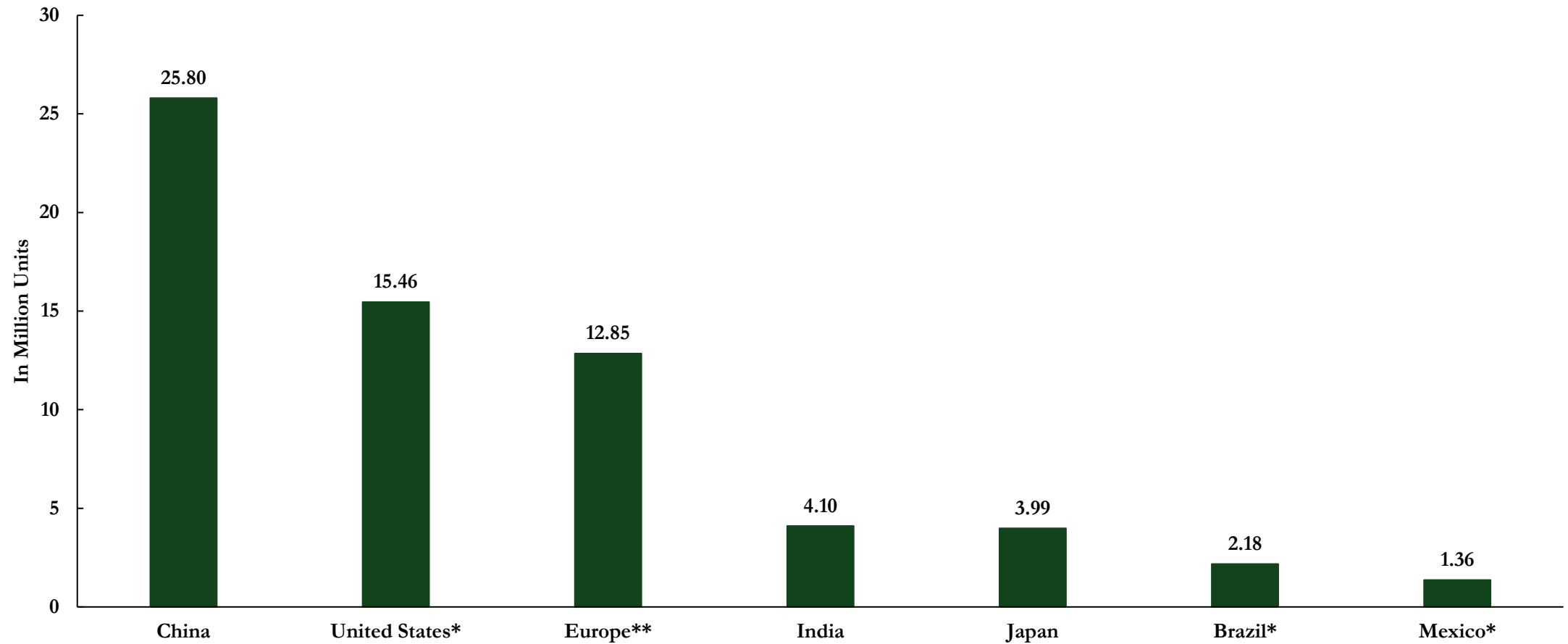
# Impacts on China Tariffs



# Demand

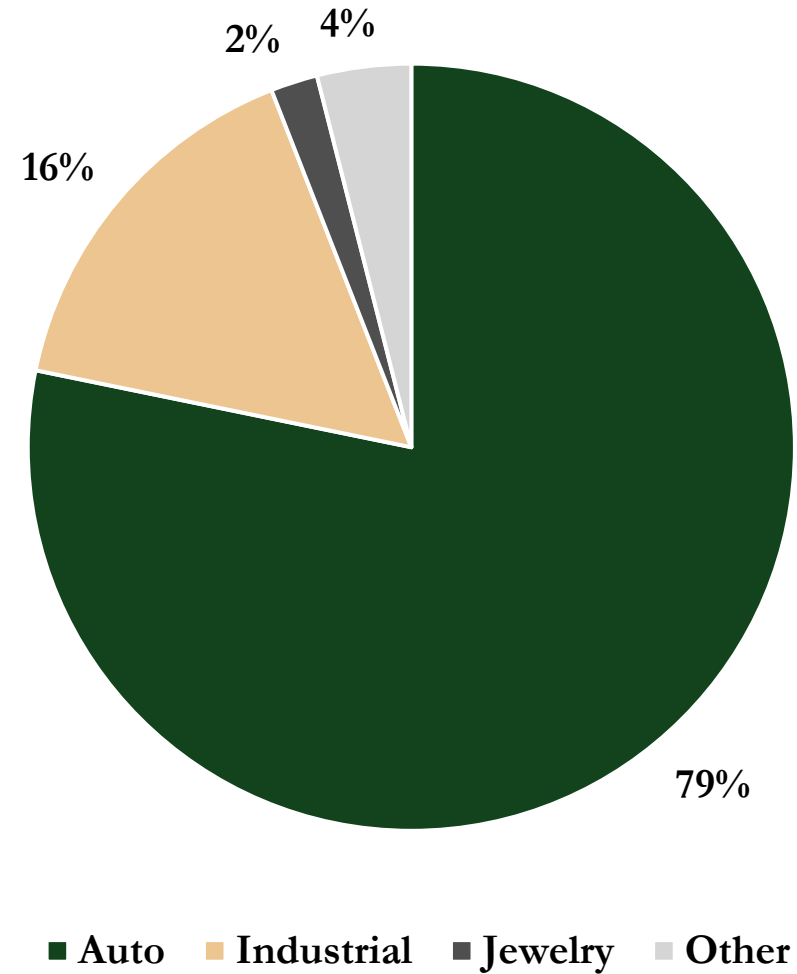
---

# Largest Auto Markets Worldwide

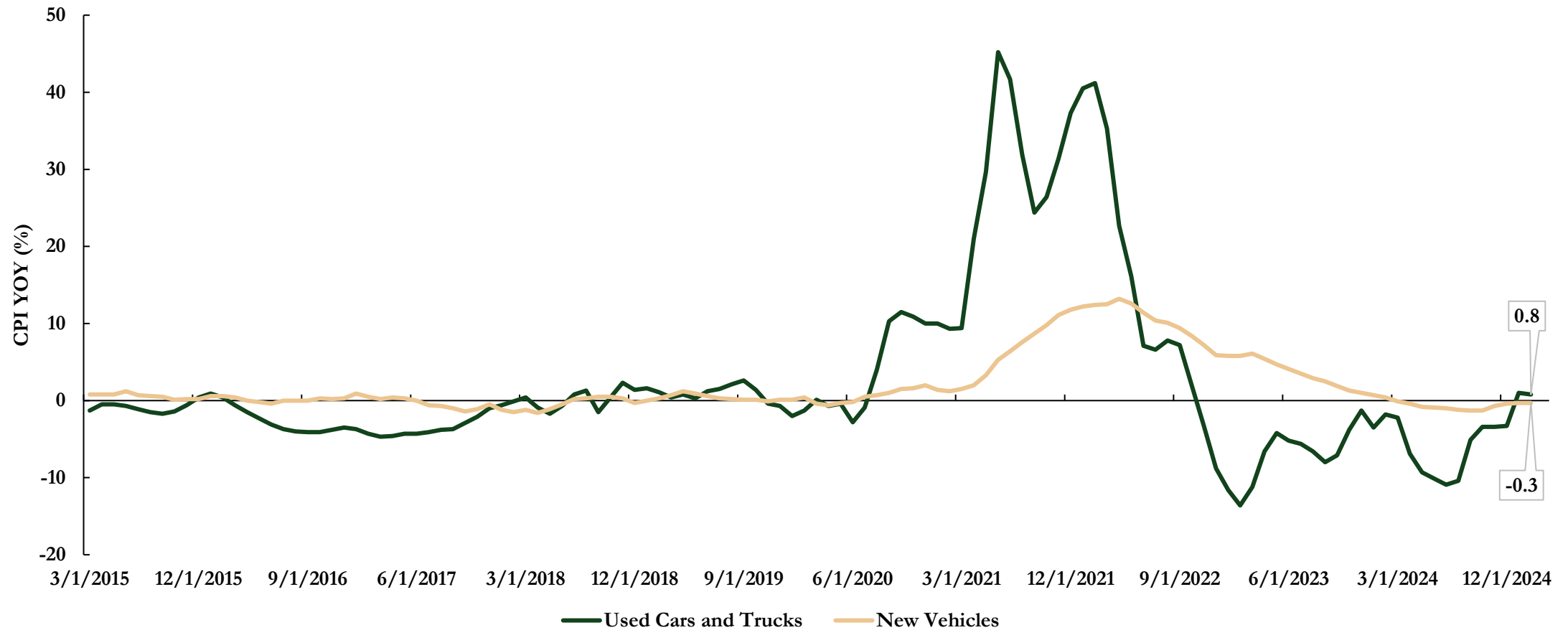


# Palladium Uses

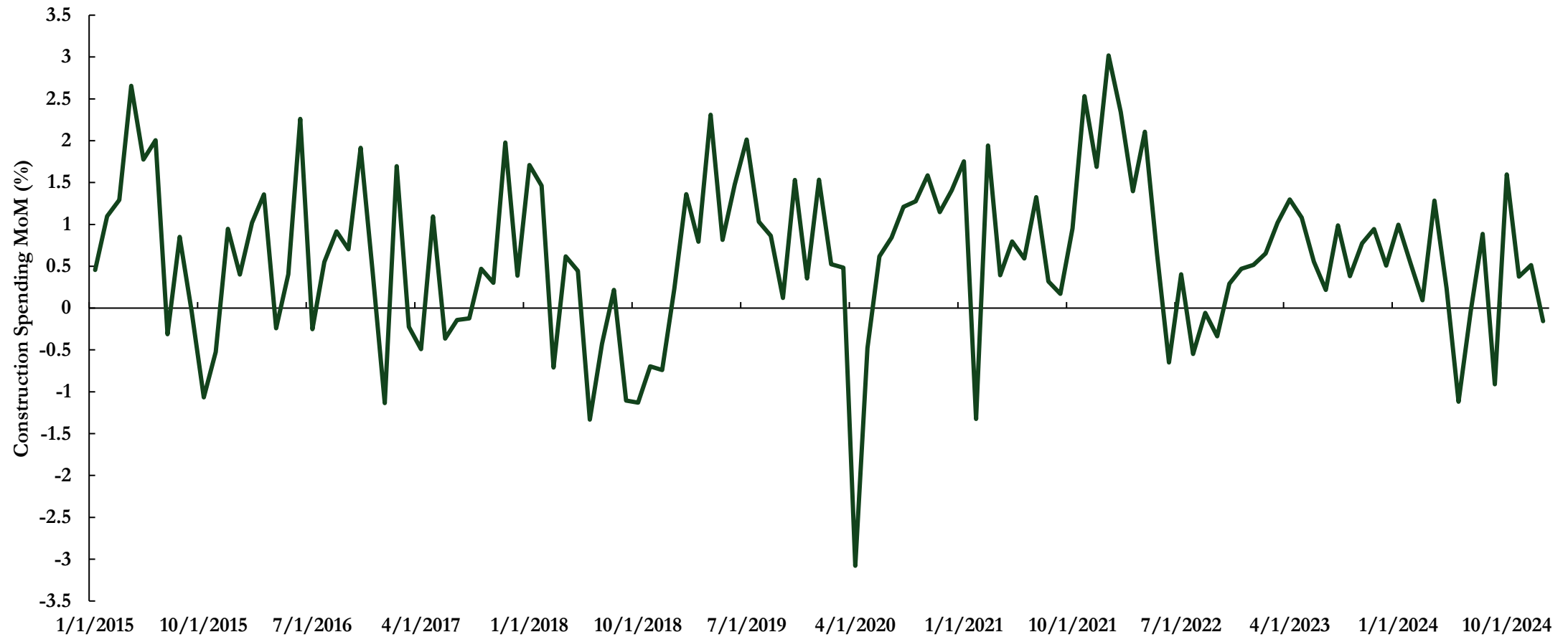
- Large majority is used for cars, trucks, and other vehicles
- Majority of uses are price **elastic**, **discretionary goods**
  - Meaning very sensitive to changes in price and less income leads to less purchases
  - ex. cars, jewelry, industrials



# Car Prices in the U.S.

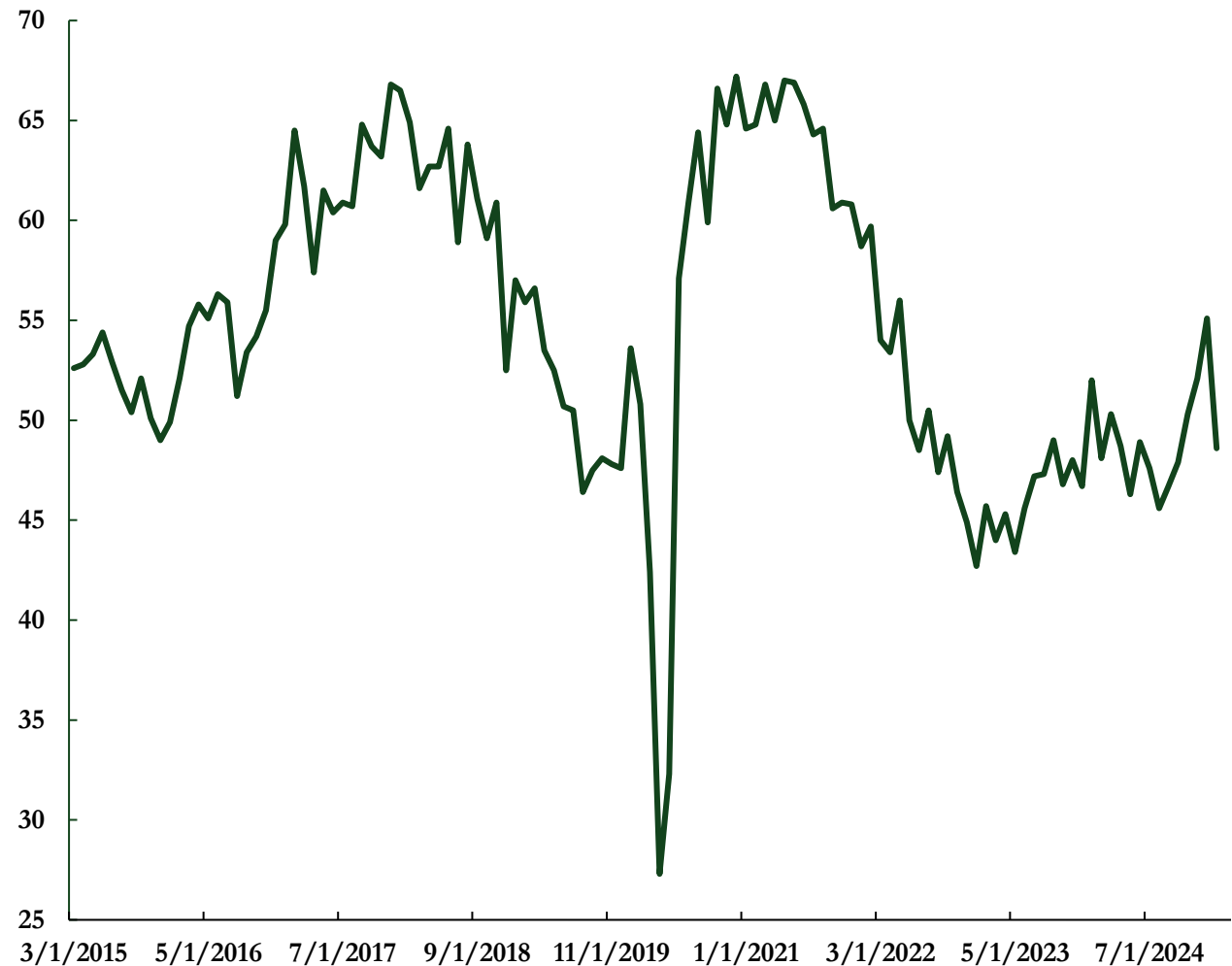


# Construction Spending



# ISM New Orders - Manufacturing

- Currently at 49.0 as of 4/1
- Showing slight market downturn with less investment in manufacturing
  - This means less orders for construction vehicles



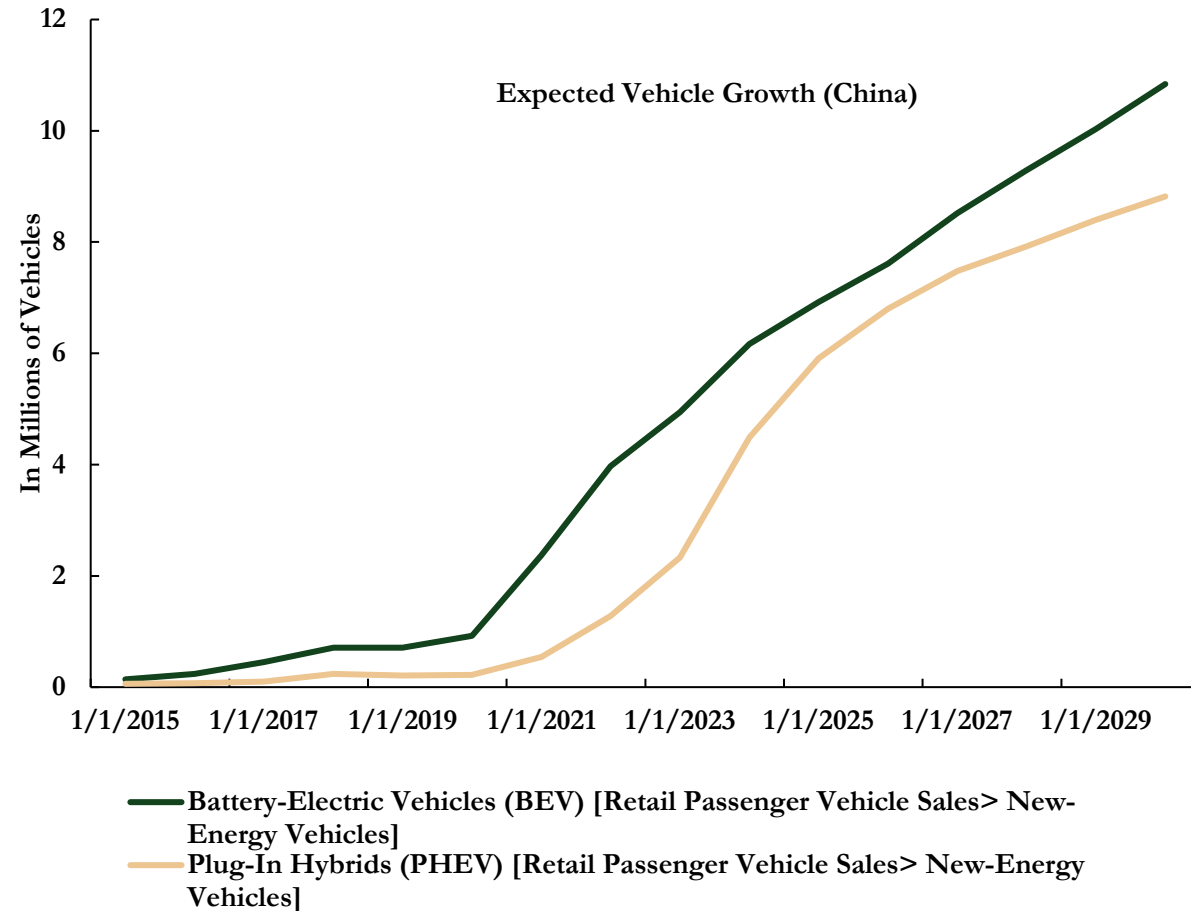
# EV Market Share Growth

- Electric vehicle growth continues to outpace gas powered vehicle growth
  - EV sales grew 9% in Q2 2024 compared to the previous year
  - Gas powered car sales decreased by 3.8% during the same timeframe
- The biggest reason against the purchase of an EV is the issues of traveling with a battery powered vehicle
  - EV chargers has doubled since 2022
  - Tesla has adaptable chargers for different EV brands
  - BYD's newest charger can charge 250 miles in five minutes (1,000 kilowatts)
  - ZEEKR is launching a charger station in Q2 2025 which is 1,200 kilowatts



# Palladium Use in Hybrid and EVs

- Electric vehicles do not require catalytic converters as fully-electric cars do not produce emissions
  - Catalytic converters are used to reduce harmful emissions being released
- There is no palladium used in the manufacturing of electric vehicles
- However, plug-in hybrid vehicles still require catalytic converters as they have internal combustion engines, which produce emissions



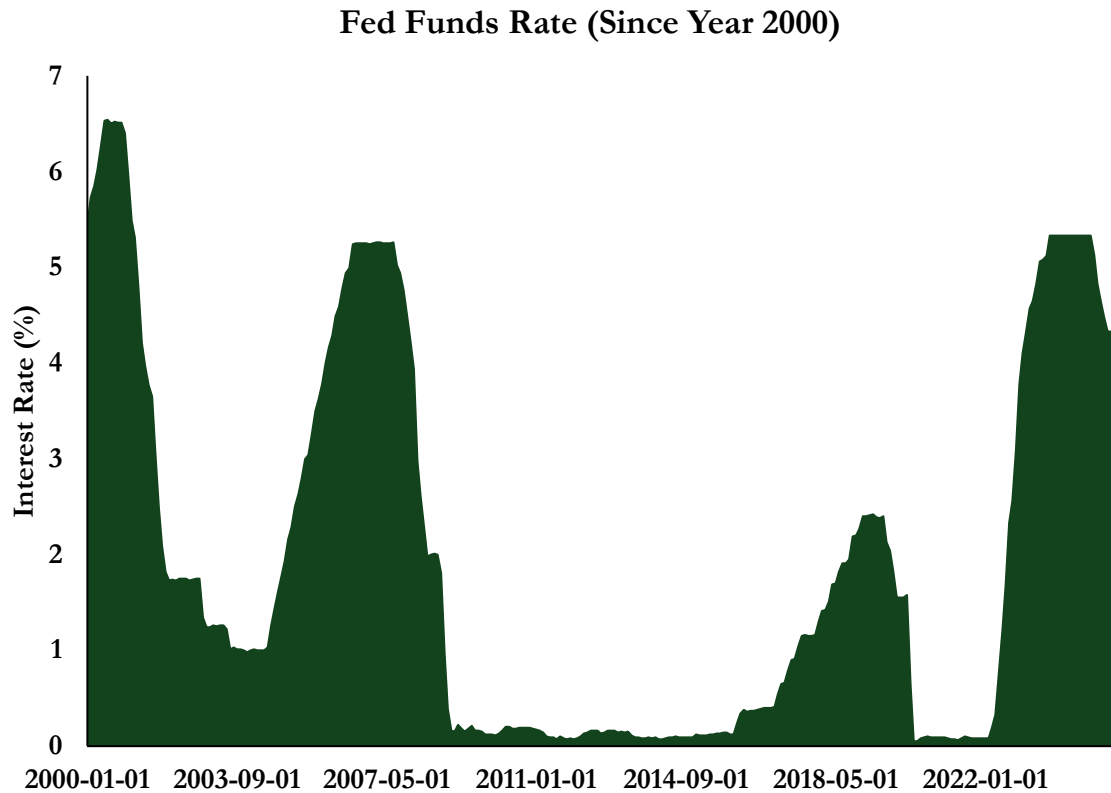
# Auto Tariff Impact on Demand

- President Trump recently announced a 25% tariff on imported cars, light trucks, and auto parts
- Of the US-made cars, **more than half were assembled with foreign parts**
  - Of the top ten manufacturers of catalytic converters, **only two are domestic** (Tenneco, Corning Inc.)
- Ford produces 1.8 million catalytic converters from their South Africa plants
- Experts expect about a \$3,000 increase of domestic car prices

# Emerging Use Cases

- Hydrogen energy, which typically uses platinum-based catalysts is adopting new electrocatalysts that make use of palladium
- Nornickel, the world's largest palladium miner expects hydrogen energy related uses of palladium to increase Chinese demand by 15% of current consumption by 2027
  - This is offset by an expected 29% fall in traditional demand during the same time frame in China
- Palladium finds use in electronics, being used in OLED display structures and printed circuit board coverings

# Interest Rates



- Current rate: 4.25 - 4.50
- The Federal Reserve is expecting 2 rate cuts by 2026
- Fed members have noted unusually high uncertainty in their forecasts
- Core PCE continues to stay higher than desired
- 2.8% vs. 2.7% expected YoY in February

# Economic Scenarios

## Scenario 1

- Inflation remains higher than expected
  - Tariffs increase cost of goods across the economy
- Labor market takes hit as firms try to compensate for rising costs
- Fed is forced to keep higher Fed Funds rate to avoid hyperinflation

## Scenario 2

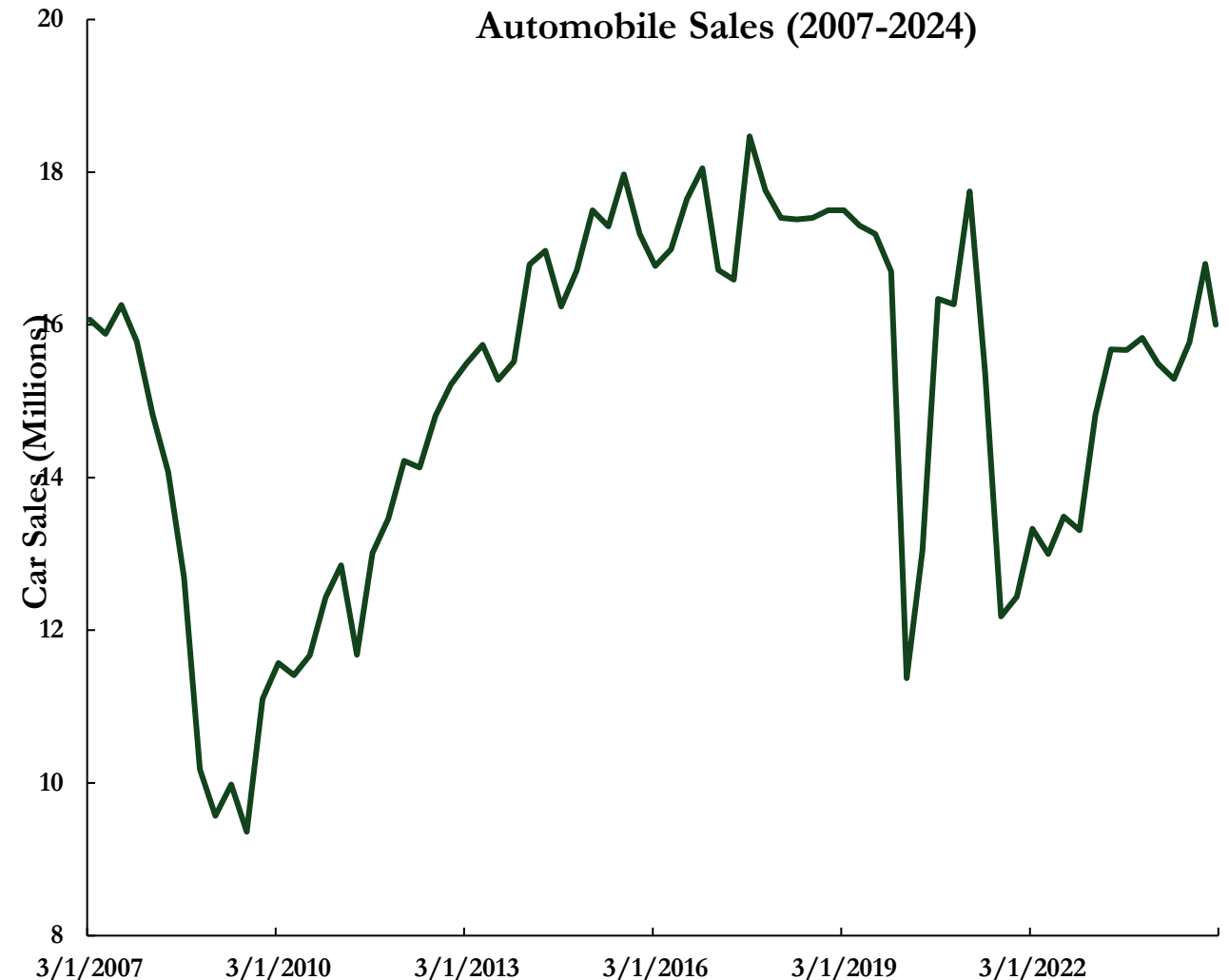
- Inflation remains in line with expectations
- Inflation caused by tariffs is strictly transitory
  - Jerome Powell has suggested this is his “baseline” expectation
- Fed gradually lowers rates while maintaining a healthy dual mandate

## Scenario 3

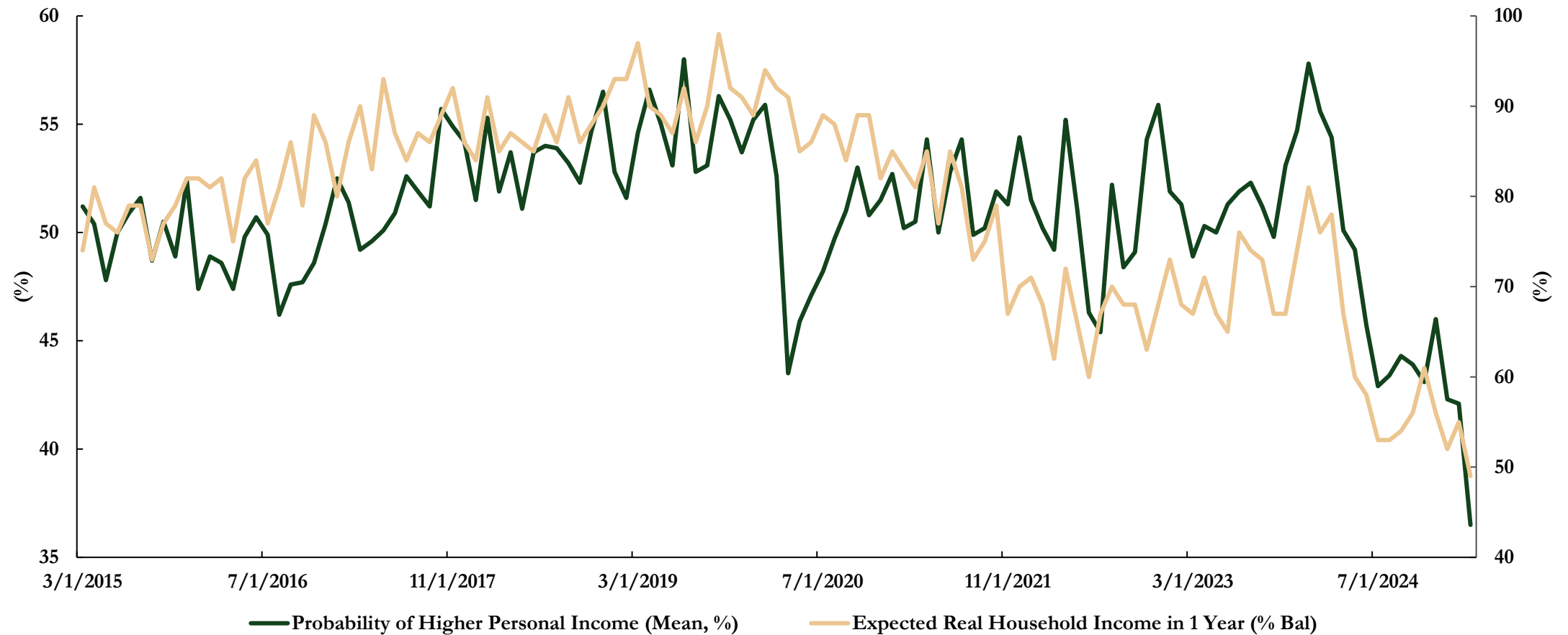
- Economy growth slows at an alarming rate
  - Driven by tariffs and reduced consumer spending
- Fed would be forced to cut rates faster than anticipated
- Goldman Sachs increased recession odds from 20% to 35%

# Buying Power

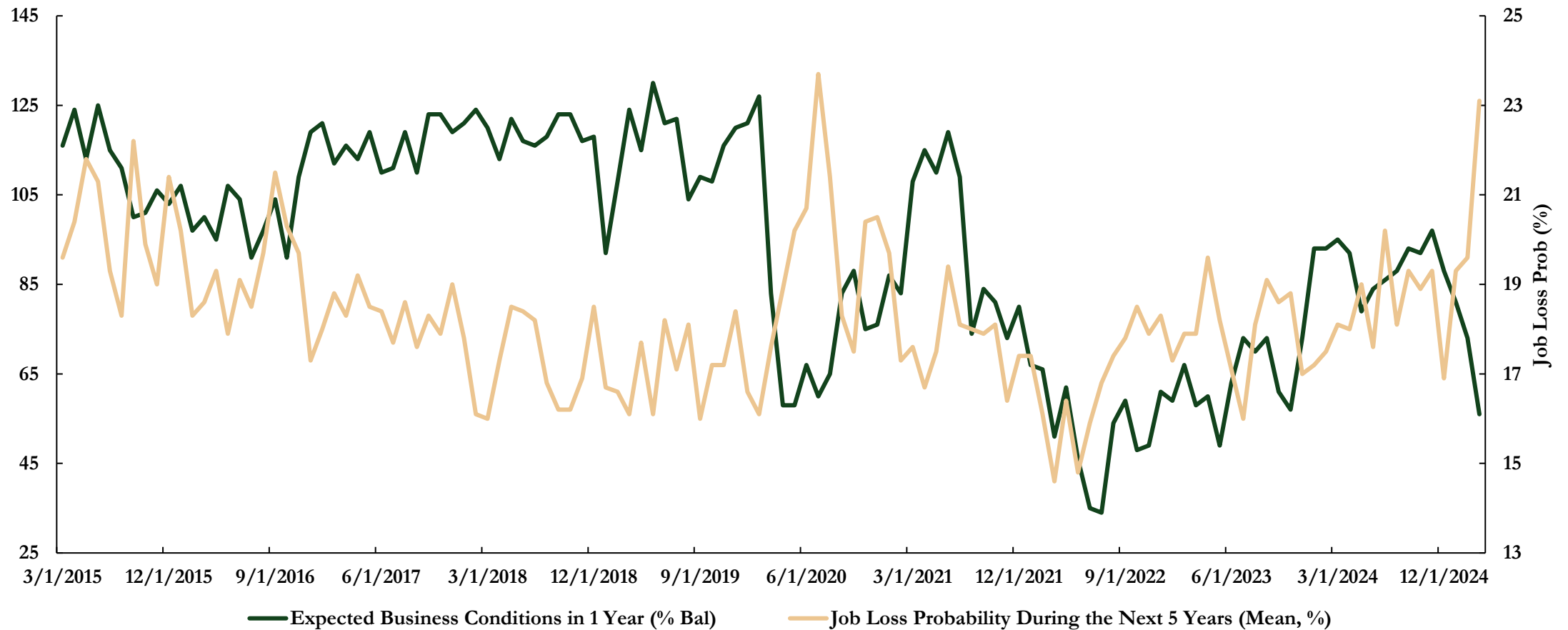
- **Scenario 1:** Inflation remains persistent, keeping rates higher for longer, decreasing incentive for consumers to make new auto purchases.
- **Scenario 2:** Lower rates and healthy economy increase buying power of average consumer.
- **Scenario 3:** Consumers halt spending as economy and labor market suffer. New car sales drop sharply.



# Consumer Confidence of Income



# Consumer Conditions Projections

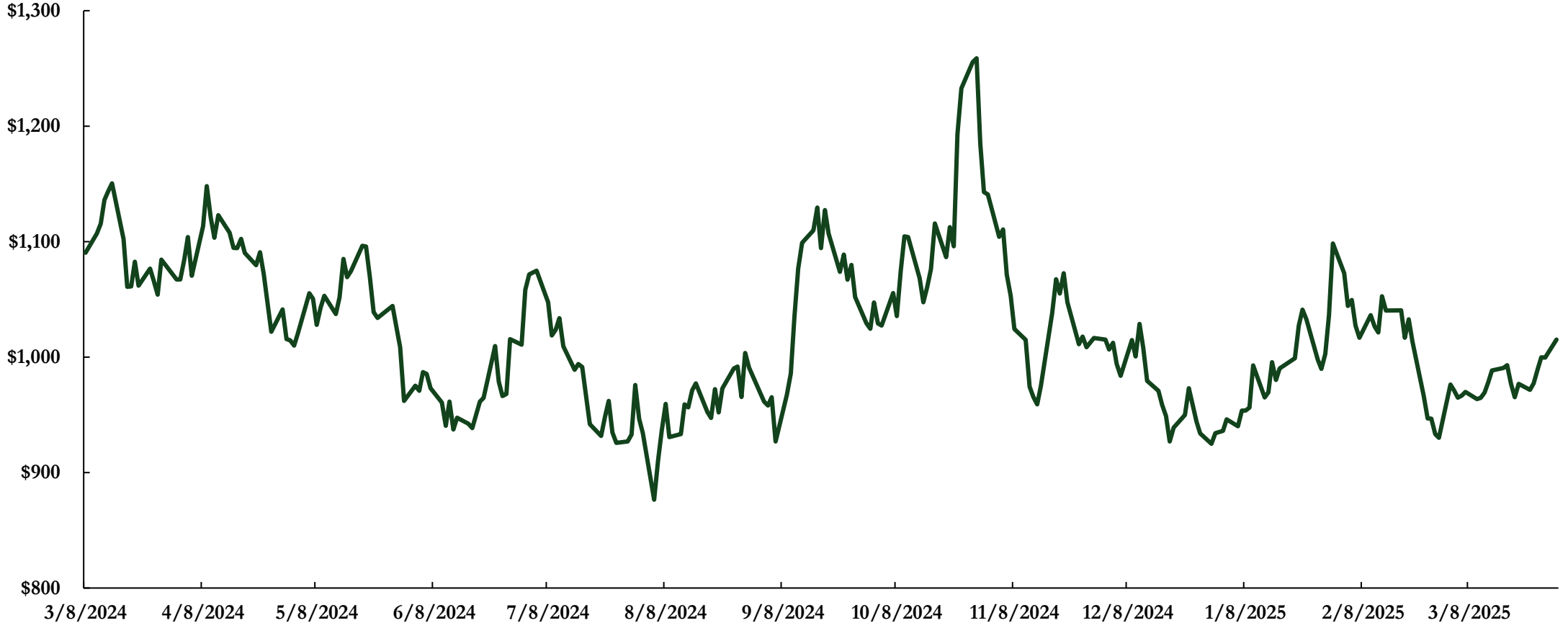




# Technical Analysis

---

# Price Chart



# Seasonality

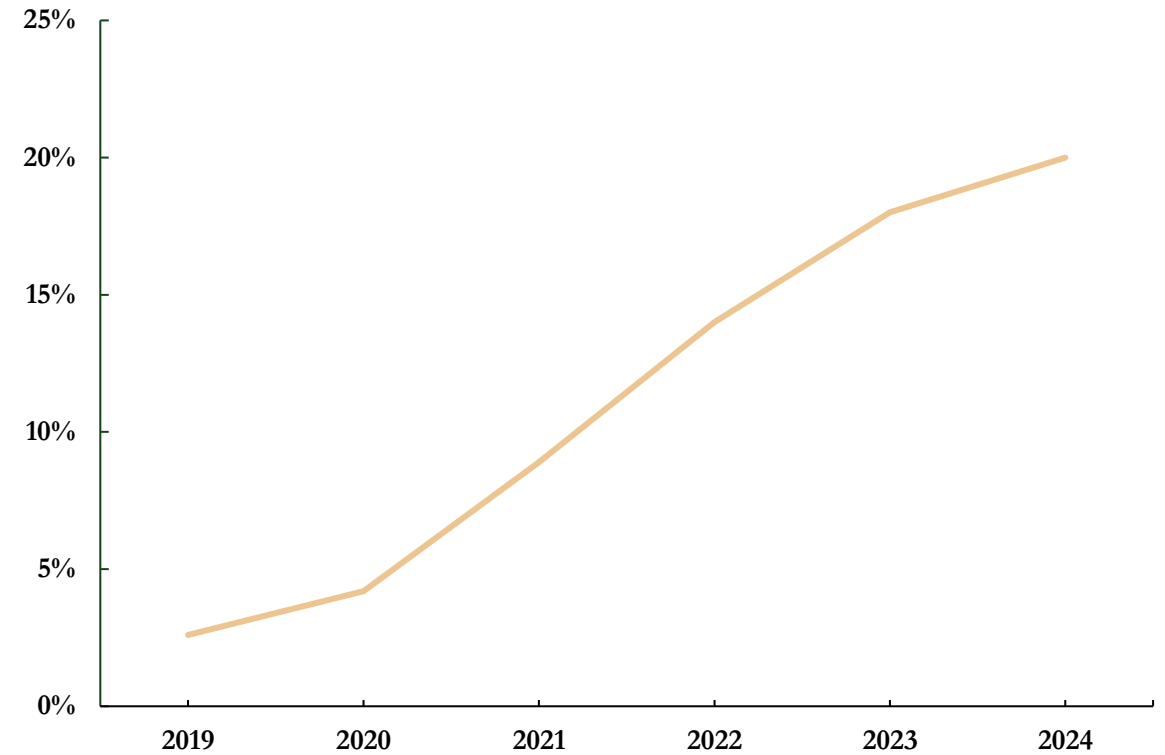
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
5 Year Average	2.79	1.31	0.96	-1.01	-6.52	-1.61	2.54	-0.37	-2.2	-2.5	-5.2	1.85
2025	11.36	-9.27	5.73	NA	NA	NA	NA	NA	NA	NA	NA	NA
2024	-10.75	-3.58	7.37	-5.96	-4.09	6.57	-4.95	4.4	3.47	11.62	-12.21	-7.17
2023	-7.77	-14.21	3.2	2.94	-9.19	-10.08	4.61	-4.46	1.51	-9.98	-10.16	8.99
2022	23.65	5.83	-9.01	2.6	-13.96	-3.09	9.84	-2.01	3.75	-14.79	1.98	-4.77
2021	-8.76	4.17	12.9	11.95	-3.74	-1.69	-4.34	-7.21	-22.58	4.76	-13.11	9.39

# Price Chart Vs. EV Population

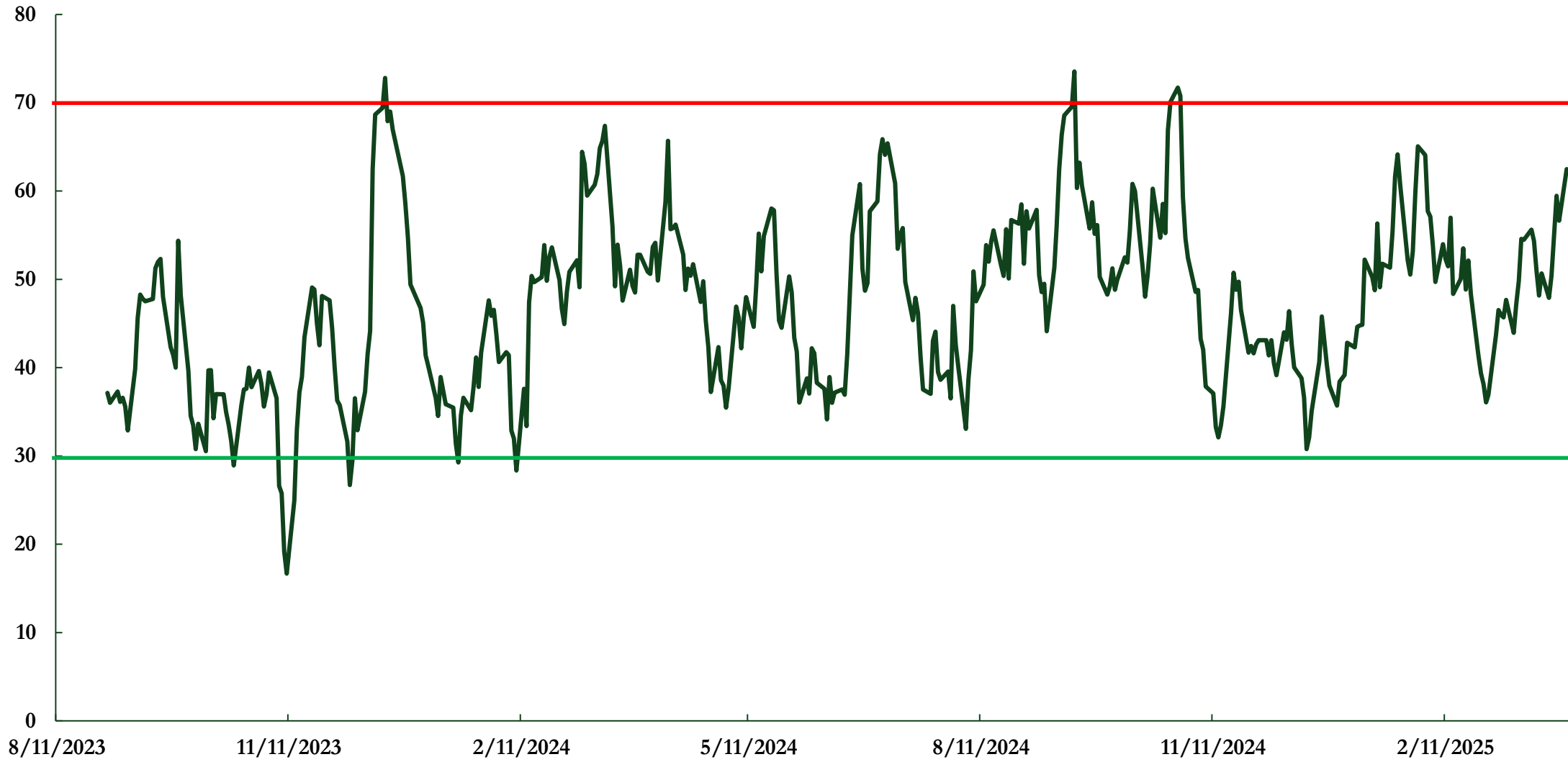
Price Chart



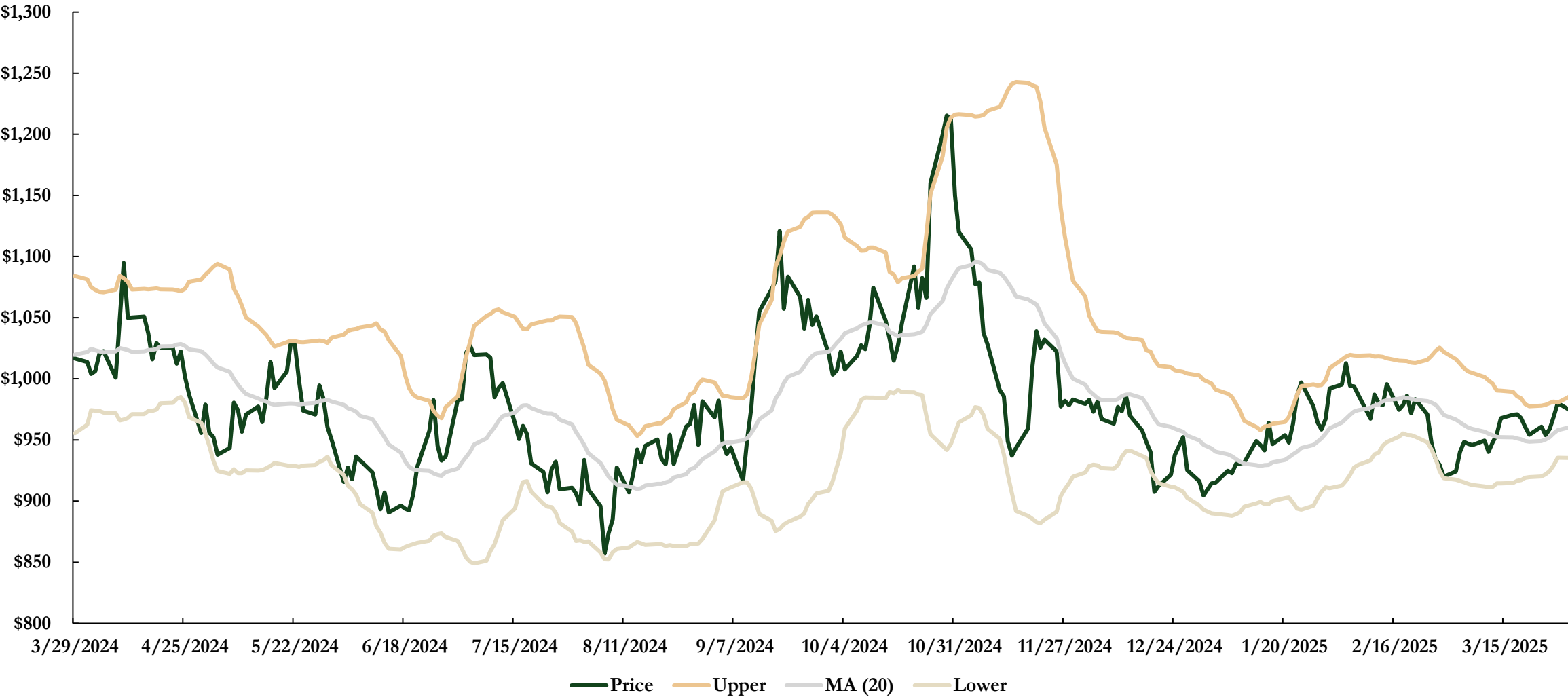
% of Cars sold that are EV



# Relative Strength Index (RSI)



# Bollinger Bands



# Position Overview

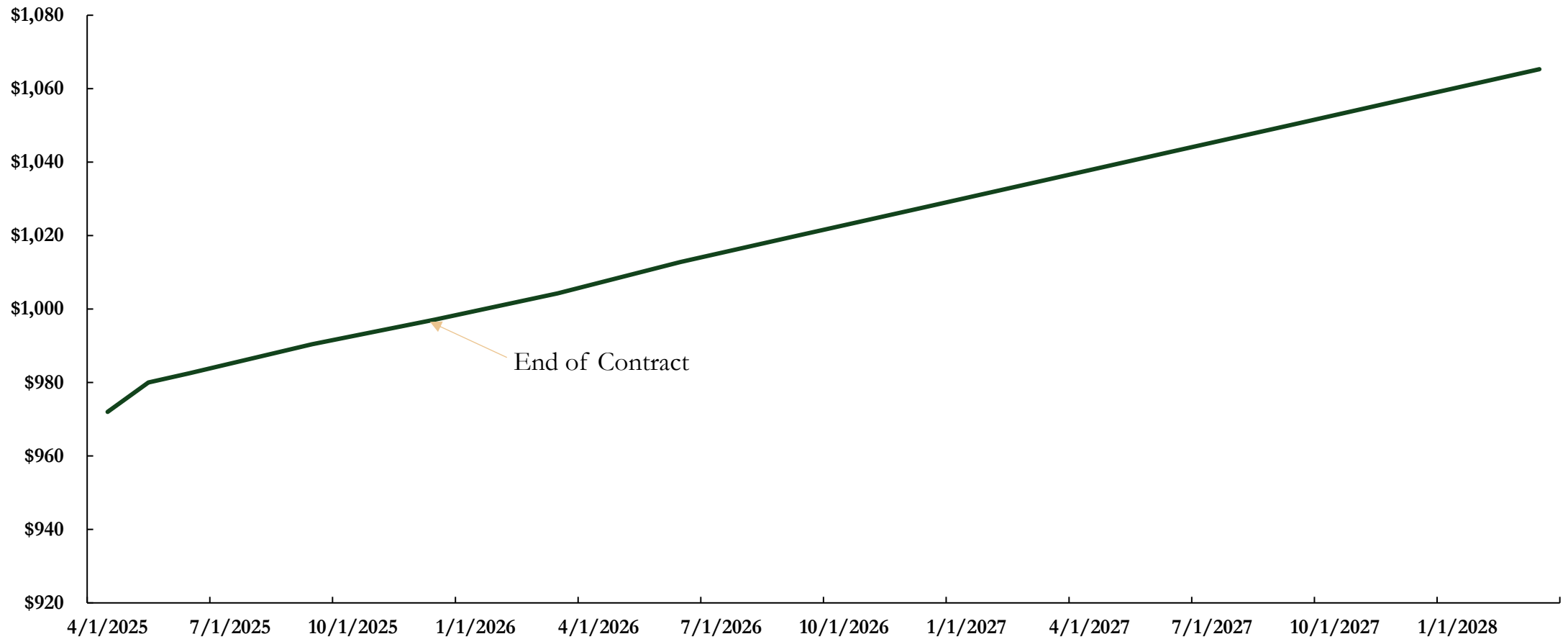
---

# Normal Backwardation VS Contango

- Normal backwardation occurs when the futures contract price is below the spot price
- This is a bearish indicator as the market is expecting a decrease in price over time
  - Example: Oil is trading around \$72 currently, while the April 2026 futures contract is trading around \$66.50
- Contango occurs when the futures contract price is above the spot price
- This is a bullish indicator as the market expects an increase in price
  - Example: Palladium is trading around \$972, and our contract is worth about \$1,000



# Commodities Curve

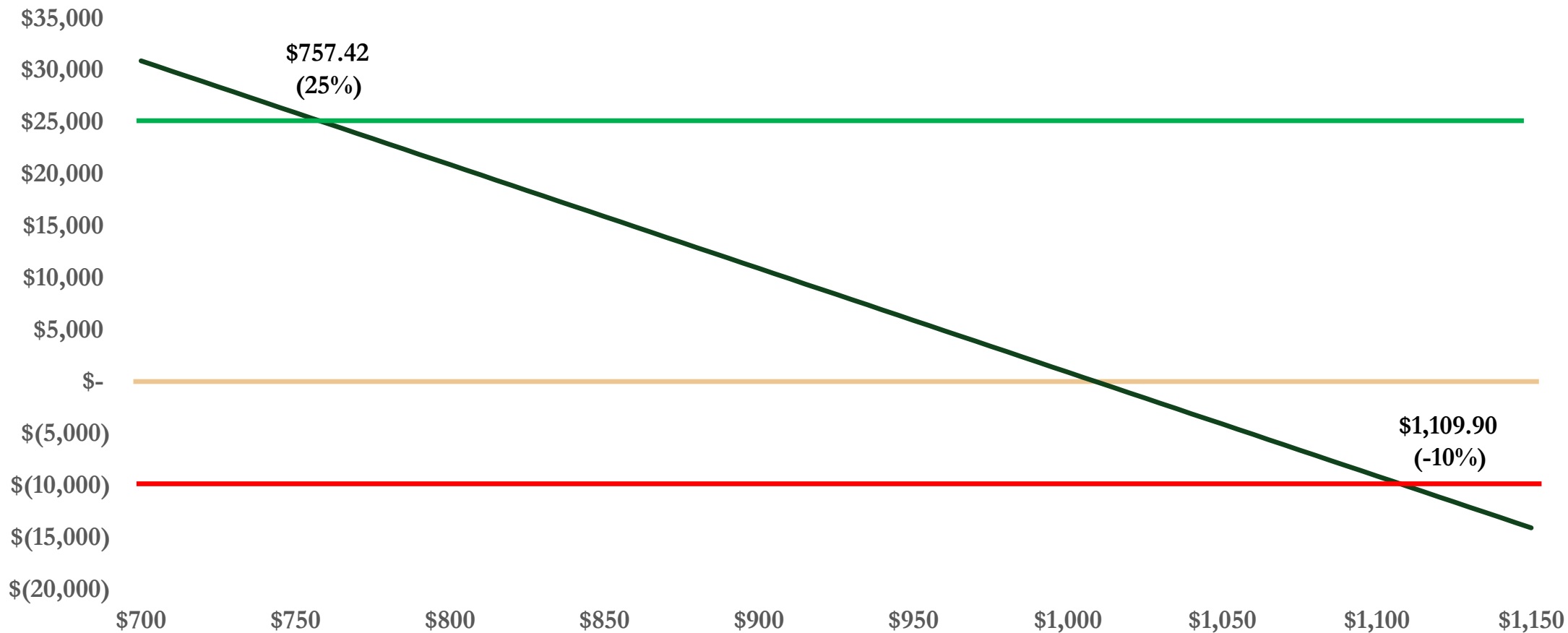


# Contract Specs

- The contract size is 100 troy ounces
- The last trade is **December 29th, 2025**
- Total cost is \$100,900
- This contract requires speculators to use at least \$13,200 in margin
- We would have \$13,200 in margin
- No risk for margin call as our stop loss is at 10%

Settle Price	\$996.50
Bid	\$1,006.50
Ask	\$1,009.00
Open Interest	18 contracts
Volume	3 contracts

# P/L



# Appendix

---

# Back testing Screenshot

BTST Palladium Spot \$/Oz Cu																												+ X																																															
Palladium Spot \$/Oz Curncy																												BTST		Related Functions Menu		Message		?																																									
XPD																												↓ 992.23		+1.53				BGN 988.73 / 995.72		BGN																																							
At 20:47 Op 990.70																												Hi 993.96		Lo 988.14		Close 990.70		Value 04/03/25																																									
XPD Curncy																												Add		Edit		Actions		Backtesting & Optimization: Multi-Strategy																																									
04/01/2024																												-		04/01/2025		Today		Daily																																									
Table																												Chart		Scatter Plot		Graphics Filter																																											
Worksheet Title																												BTST		Strategies		Columns		Settings																																									
Current Position																												Trades		Profit (Loss)		Statistics																																											
Strategy																												P&L		Age		Long		Sho...		Total		Total		↓ %Total		Long		Short		Avg Dura...		Profit Factor		Shar... Ratio		Sorti... Ratio		Total Return		% Max Return		% Min Return		Wins in %		Losses in %		% Max DD		Max DD Length		Recov... From Max DD		Max DD Recov... Period		% Max Increa...		Max Increa... Length	
Maximum																												8.50M		259		71		72		143		119.60M		119.60M		62.01M		57.60M		259.00		13.00		5.39		5.53		119.60		130.02		0.00		100.00		100.00		49.63		160		74		96		130.02		258	
Average																												1.82M		27		16		16		32.7		15.11M		15.11		6.70M		8.42M		29.59		1.62		0.74		0.76		15.11		34.66		-16.92		49.30		50.70		27.12		61.65		7.65		14.35		48.39		120.48	
Median																												1.69M		10		11		11		22		5.32M		5.32		0.00		6.35M		12.05		0.91		0.14		0.14		5.32		18.03		-13.67		44.00		56.00		25.16		64		N/A		N/A		34.67		96	
Minimum																												-4.32M		2		0		0		1		-44.77M		-44.77		-25.78M		-18.99M		2.80		0.00		-1.40		-1.40		-44.77		0.00		-49.63		0.00		0.00		13.11		9		N/A		N/A		22.13		7	
31) Rex Oscillator																												-3.62M		2		40		40		80		119.60M		119.60M		62.01M		57.60M		4.18		2.20		5.39		5.53		119.60		130.02		0.00		55.00		45.00		13.11		21		30		51		130.02		236	
32) Bollinger Bands																												8.50M		26		4		4		8		95.06M		95.06M		47.22M		47.84M		32.50		0.00		4.05		4.13		95.06		95.16		0.00		100.00		0.00		20.53		20		9		29		95.16		258	
33) Trading Envelopes																												8.50M		26		4		4		8		95.06M		95.06M		47.22M		47.84M		32.50		0.00		4.05		4.13		95.06		95.16		0.00		100.00		0.00		20.53		20		9		29		95.16		258	
34) KBand																												7.34M		26		8		8		16		68.48M		68.48M		33.72M		34.76M		16.81		13.00		2.84		2.90		68.48		68.57		-4.32		75.00		25.00		17.86		21		25		46		76.19		252	
35) MA Envelopes																												6.13M		26		7		7		14		40.70M		40.70M		17.78M		22.92M		19.07		4.55		1.65		1.68		40.70		45.31		-4.32		78.57		21.43		17.75		9		N/A		N/A		51.88		135	
36) Cmdty Channel Idx																												-4.32M		9		7		8		15		36.28M		36.28M		18.31M		17.97M		17.93		3.65		1.47		1.48		36.28		50.02		-9.38		60.00		40.00		20.95		12		10		22		65.54		160	
37) William's %R																												-2.70M		12		7		8		15		30.19M		30.19M		12.94M		17.26M		17.73		2.06		1.21		1.22		30.19		59.93		-0.26		60.00		40.00		21.23		74		N/A		N/A		60.35		153	
38) Stochastics (TAS)																												-2.94M		10		8		8		16		24.27M		24.27M		9.74M		14.54M		16.81		2.03		1.00		1.01		24.27		61.58		-0.24		68.75		31.25		25.16		74		N/A		N/A		61.97		153	
39) MA Oscillator																												-3.86M		7		11		11		22		22.04M		22.04M		12.43M		9.61M		12.68		1.46		0.94		0.97		22.04		58.86		-0.59		59.09		40.91		25.86		64		N/A		N/A		59.80		148	
40) Variable MA																												3.54M		5		17		17		34		12.39M		12.39M		5.71M		6.68M		8.26		1.43		0.49		0.50		12.39		18.03		-9.64		32.35		67.65		13.36		18		25		43		30.63		176	
41) RSI																												6.35M		137		0		1		1		6.35M		6.35		0.00		6.35M		137.00		0.00		0.14		0.14		6.35		14.46		-15.00		100.00		0.00		19.14		20		9		29		34.67		44	
42) Parabolic (PTPS)																												5.32M		16		12		11		23		5.32M		5.32		-1.41M		6.73M		11.96		1.10		0.25		0.25		5.32		19.59		-9.99		52.17		47.83		24.73		55		N/A		N/A		28.70		75	
43) Rate of Change																												-1.67M		2		68		68		136		1.51M		1.51		1.79M		-272.1		2.88		1.01		0.13		0.13		1.51		12.31		-27.06		37.50		62.50		35.06		68		N/A		N/A		43.53		74	
44) MACD																												3.57M		14		13		12		25		-1.12M		-1.12		-2.08M		960.35		11.12		0.97		0.03		0.03		-1.12		16.56		-13.67		44.00		56.00		25.93		88		N/A		N/A		22.29		96	
45) Buy & Hold																												-1.37M		259		1		0		1		-1.37M		-1.37		-1.37M		0.00		259.00		0.00		0.02		0.02		-1.37		21.11		-15.13		0.00		100.00		25.62		44		N/A		N/A		42.70		60	
46) Simple MA																												3.48M		14		16		15		31		-3.67M		-3.67		-1.94M		-1.73M		9.23		0.91		-0.08		-0.08		-3.67		5.43		-16.02		35.48		64.52		18.10		22		74		96		25.54		175	
47) Accum/Distrib Osc																												-1.29M		2		71		72		143		-21.59M		-21.59		-9.16M		-12.43M		2.80		0.84		-0.72		-0.72		-21.59		10.90		-34.75		37.76		62.24		41.16		68		N/A		N/A		29.76		43	
48) Fear & Greed																												1.69M		4		13		12		25		-21.95M		-21.95		-12.54M		-9.41M		11.12		0.51		-0.72		-0.74		-21.95		4.32		-38.34		36.00		64.00		40.90		139		N/A		N/A		33.52		91	
49) Weighted MA																												1.59M		4		17		17		34		-26.27M		-26.27		-14.20M		-12.07M		8.15		0.38		-0.81		-0.83		-26.27		3.26		-31.56		17.65		82.35		33.72		92		N/A		N/A		24.98		35	
50) Triangular MA																												1.59M		4		11		11		22		-26.32M		-26.32		-14.39M		-11.94M		12.05		0.35		-0.82		-0.84		-26.32		3.26		-33.58		18.18		81.82		35.68		92		N/A		N/A		28.03		35	
51) Exponential MA																												1.54M		4		19		19		38		-28.85M		-28.85		-15.60M		-13.25M		7.39		0.32		-0.89		-0.90		-28.85		3.26		-31.36		18.42		81.58		33.53		92		N/A		N/A		28.03		35	
52) DMI																												2.39M		14		16		16		32		-33.71M		-33.71		-16.39M		-17.32M		9.06		0.29		-1.16		-1.19		-33.71		0.00		-44.32		25.00		75.00		44.32		145		N/A		N/A		22.13		72	
53) Ichimoku (GOC)																												2.03M		6		7		6		13		-44.77M		-44.77		-25.78M		-18.99M		20.38		0.18		-1.40		-1.40		-44.77		0.00		-49.63		23.08		76.92		49.63		160		N/A		N/A		22.34		7	

# Contracts Table

CT PALLADIUM FUTURE Dec25 X CT Generic 1st 'CL' Future Com... PALLADIUM SPOT \$/OZ Comdty +

< > | PALLADIUM FUTURE Dec25 Comdty | CT | Related Functions Menu

PAZ5 s999.70 -15.30 i994.50 /996.50i 2x1 Prev 1015.00

At 13:00d Vol -- Op .00 Hi .00 Lo .00 OpenInt 18

PAZ5 COMB Comdty Export Settings

Palladium USD/t oz. Physical Future As of 04/02/25

Source New York Mercantile Exchange Session COMB Display Quoted Value Type Specific

Exchange Symbol PA Currency USD

Aggr Vol 3,174 Aggr Open Int 19,975

Futures Strategies

☒ Intraday ☐ Daily

PAZ5 COMB Comdty 1015.00

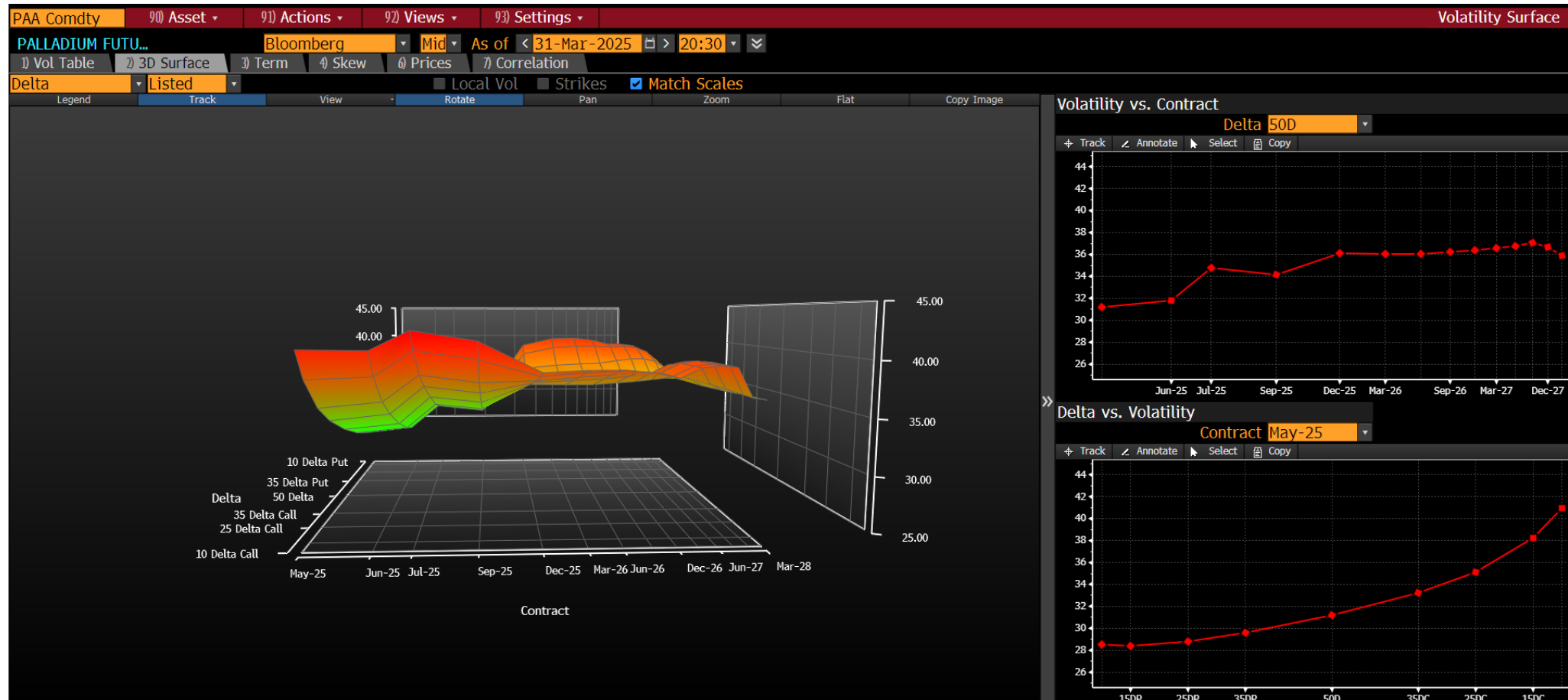
20:00 00:00 04:00 08:00 12:00 16:00 20:00 00:00 04:00 08:00 12:00 16:00

31 Mar 2025 01 Apr 2025

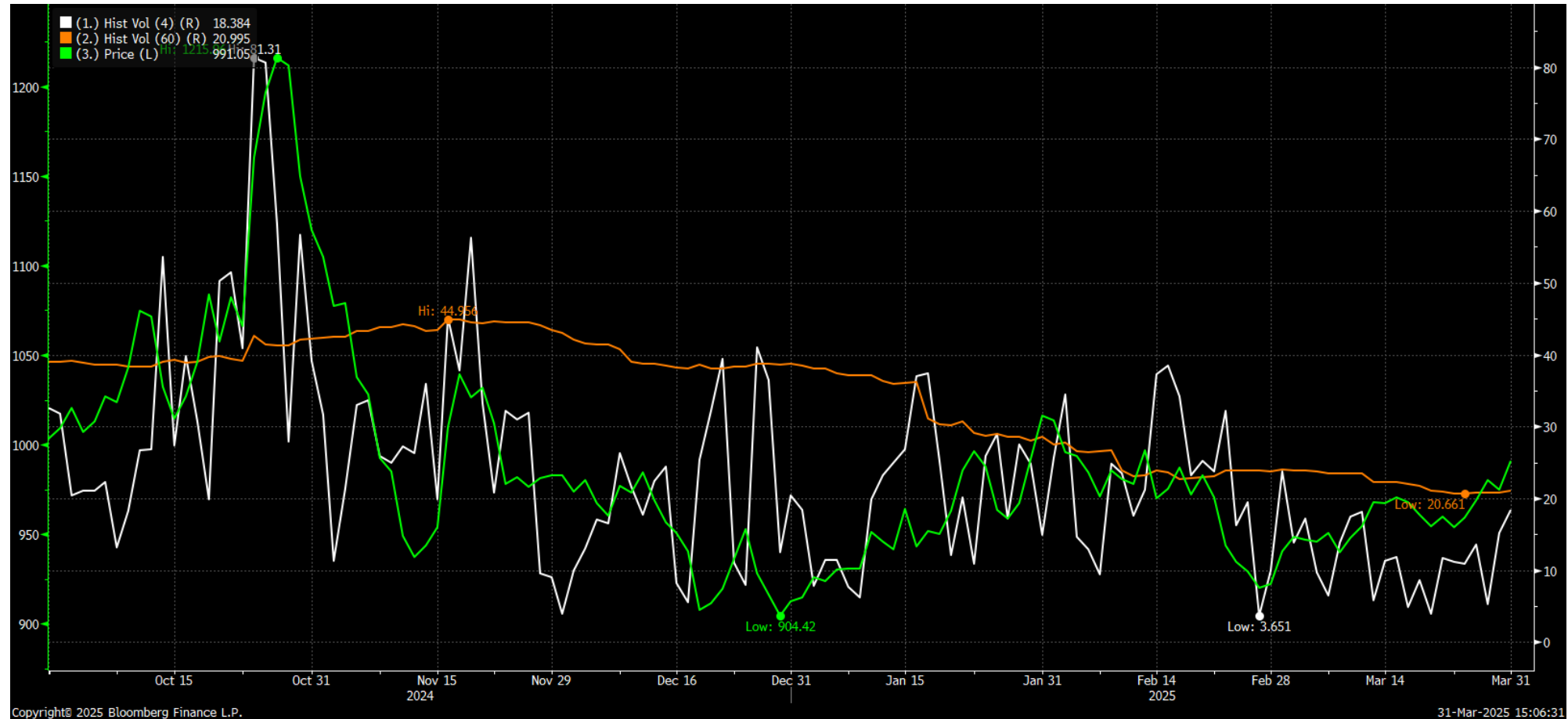
Description	Last	Chg	Settle	Time	Bid	Ask	Open Int	Volume	Yest Settle
1) Apr25	974.50s	-16.80	13:00	964.50	979.00				991.30
2) May25	982.50s	-16.80	13:00	976.00	981.00		10		999.30
3) Jun25	↑982.00	-18.80	14:42	981.00	981.50		19594	3122	1000.80
4) Sep25	992.50	-15.90	13:49	988.50	989.50		351	52	1008.40
5) Dec25	999.70s	-15.30	13:00	994.50	996.50		18		1015.00
6) Mar26	1007.00s	-15.20	13:00	1000.50	1006.00		1		1022.20
7) Jun26	1015.50s	-16.20	13:00	1010.50	1015.50		1		1031.70
8) Sep26	1023.00s	-16.10	13:00	1019.50	1024.50				1039.10
9) Dec26	1030.50s	-16.10	13:00	1028.50	1033.50				1046.60
10) Mar27	1038.00s	-16.10	13:00	1037.50	1042.50				1054.10
11) Jun27	1045.50s	-16.10	13:00	1046.50	1051.50				1061.60
12) Sep27	1053.00s	-16.10	13:00	1055.00	1060.50				1069.10
13) Dec27	1060.50s	-16.10	13:00	1065.00	1069.50				1076.60
14) Mar28	1068.00s	-16.10	13:00						1084.10



# Volatility Surface



# Graph Volatility

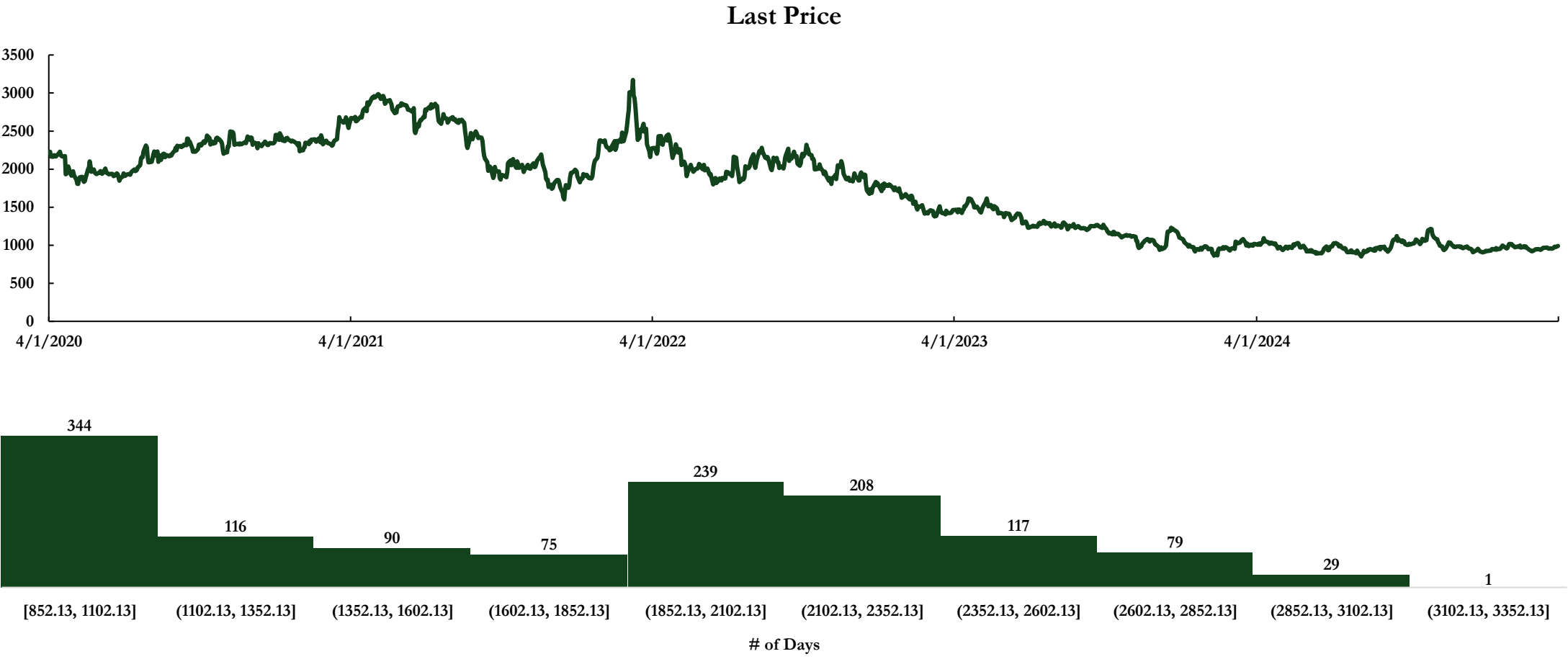




# Correlations

- Platinum: 0.6
- Aluminum: 0.27
- Steel: 0.12
- Copper: 0.36
- S&P: 0.25

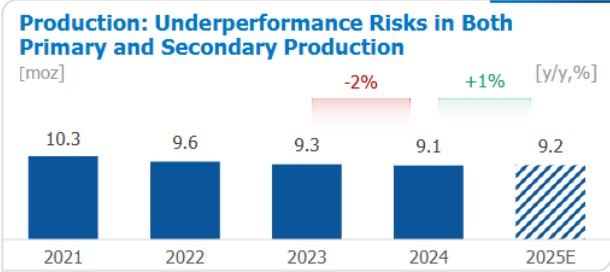
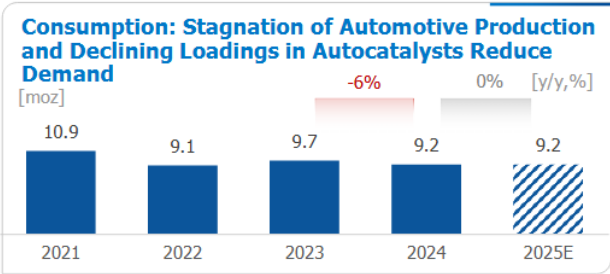
# Histogram (5y)



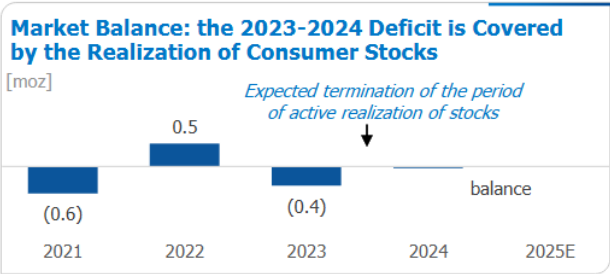
# Norvo Nickel Earnings Call

Norilsk Nickel 2024 Financial Results Presentation | Markets Update

## Palladium Market: Balanced State as Both Demand From the Automotive Industry and Recycling Volumes Contracted



Source: Company estimates  
Note: 1. Balance of production and consumption excluding investment demand and other stock movements



- In North America, production is expected to decline in 2025 (200 koz production cuts at the Stillwater mine) and additional optimization is possible at projects in South Africa
- Despite positive expectations in 2025, there is a risk that recycling will rise only slightly due to slower than expected monetary policy easing in developed economies
- Hybridization of vehicles will sustain palladium demand in the long term

Norilsk Nickel 2024 Financial Results | Operations and Strategy Update

## Innovative Applications of Palladium

**Green technology**

- Catalysts – to produce green hydrogen
- Tubular membranes – to obtain ultra-pure hydrogen
- Hydrogen-air fuel cell catalyst – extracting energy from hydrogen and converting it into electrical energy
- Photocell for solar panels – to convert solar radiation into electricity

**Hi-tech materials**

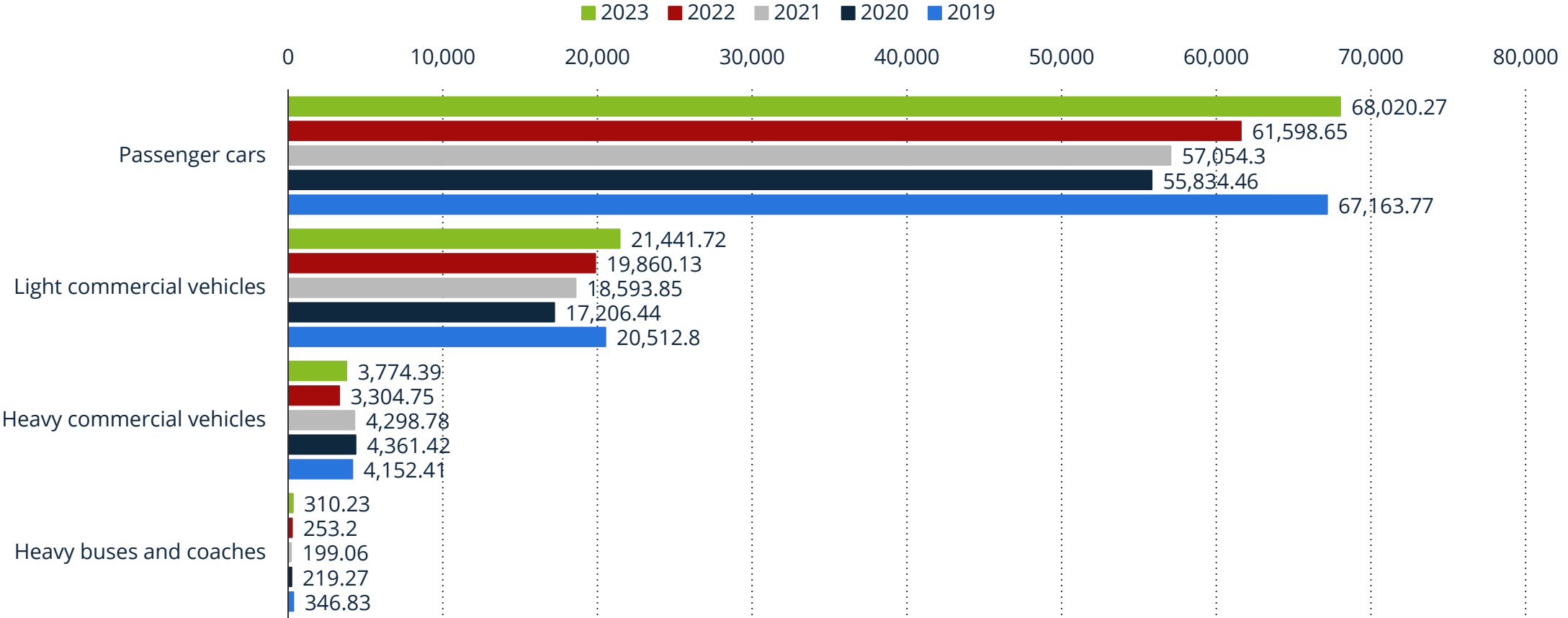
- OLED display structures
- Coverings in printed circuit boards, contacts and electronic components

**Traditional methods of use**

- Fiberglass spinneret
- Electrode for production of chloralkali, for nickel extraction, for copper extraction
- Catalyst for steam reforming of methane, autothermal reforming<sup>1</sup> of methane, for oil hardening

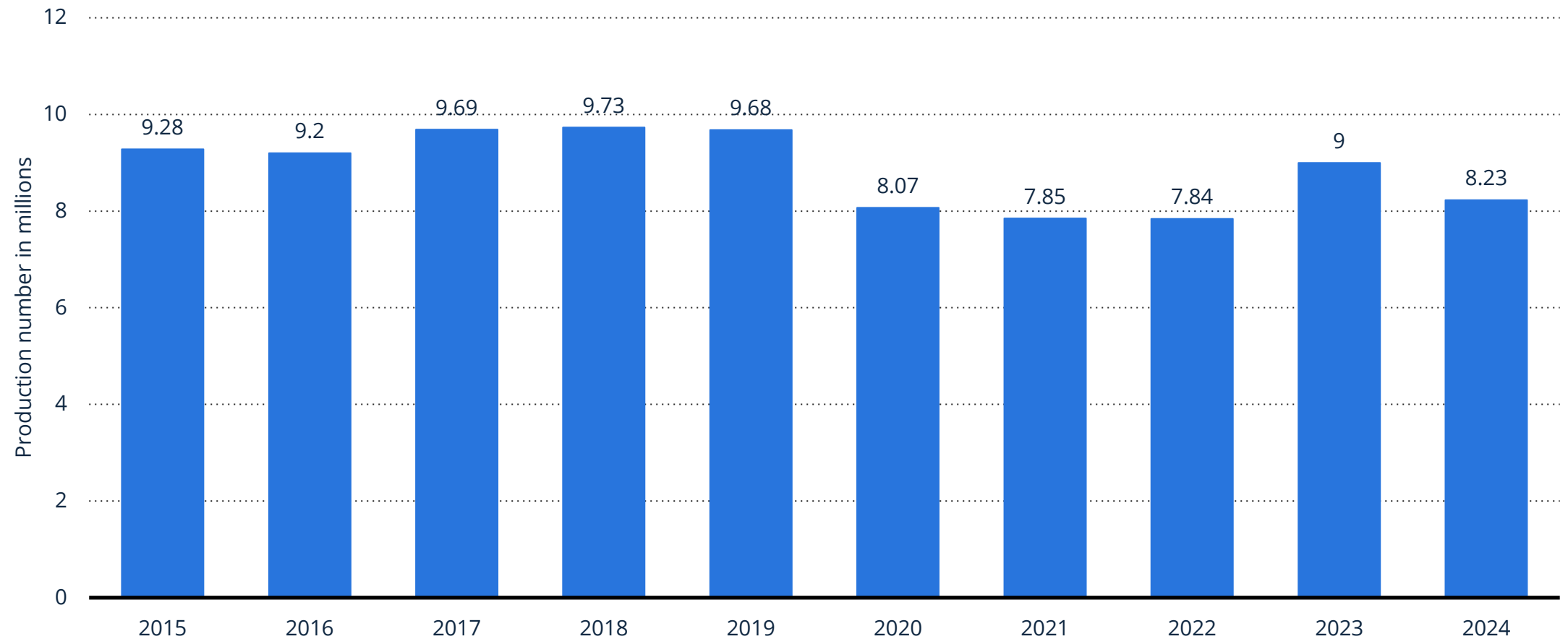
Source: Company data  
Note: 1. A process in which methane reacts with a mixture of oxygen and water, which does not require additional methane consumption to heat the reactor

# Motor Vehicle production by type (1000s)

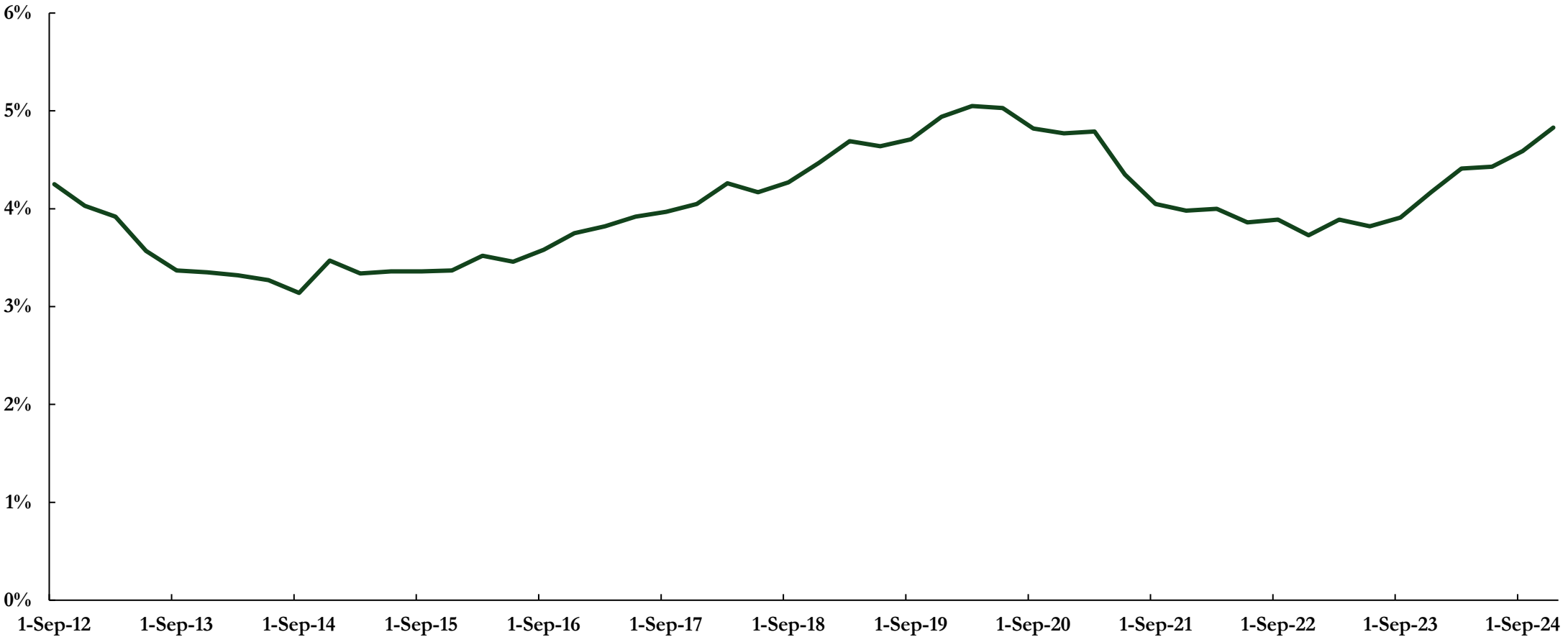


# U.S. Job Market

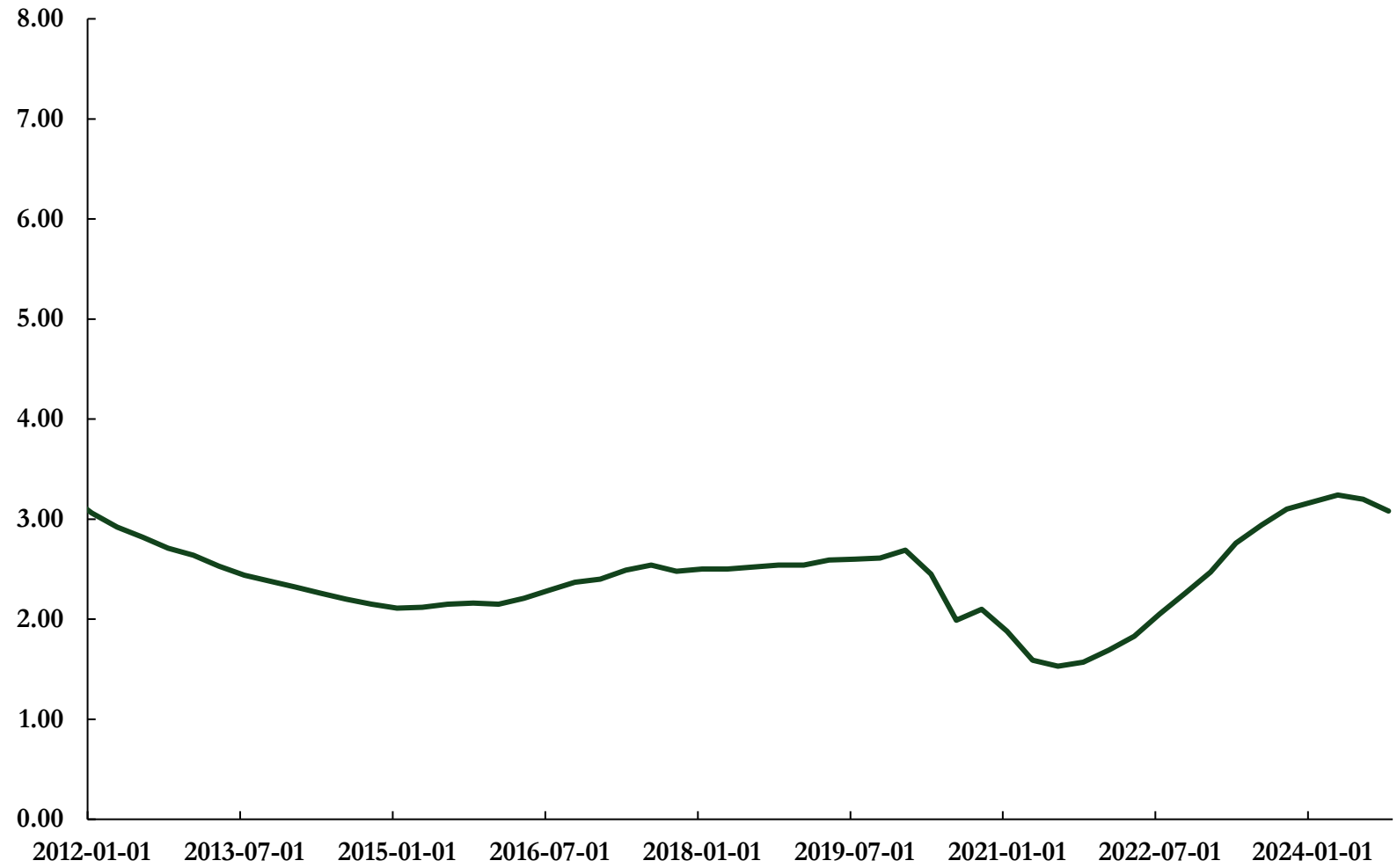
# Japan Motor Vehicle Production



# Auto Loans 90+ days delinquent



# US Credit Card Delinquency

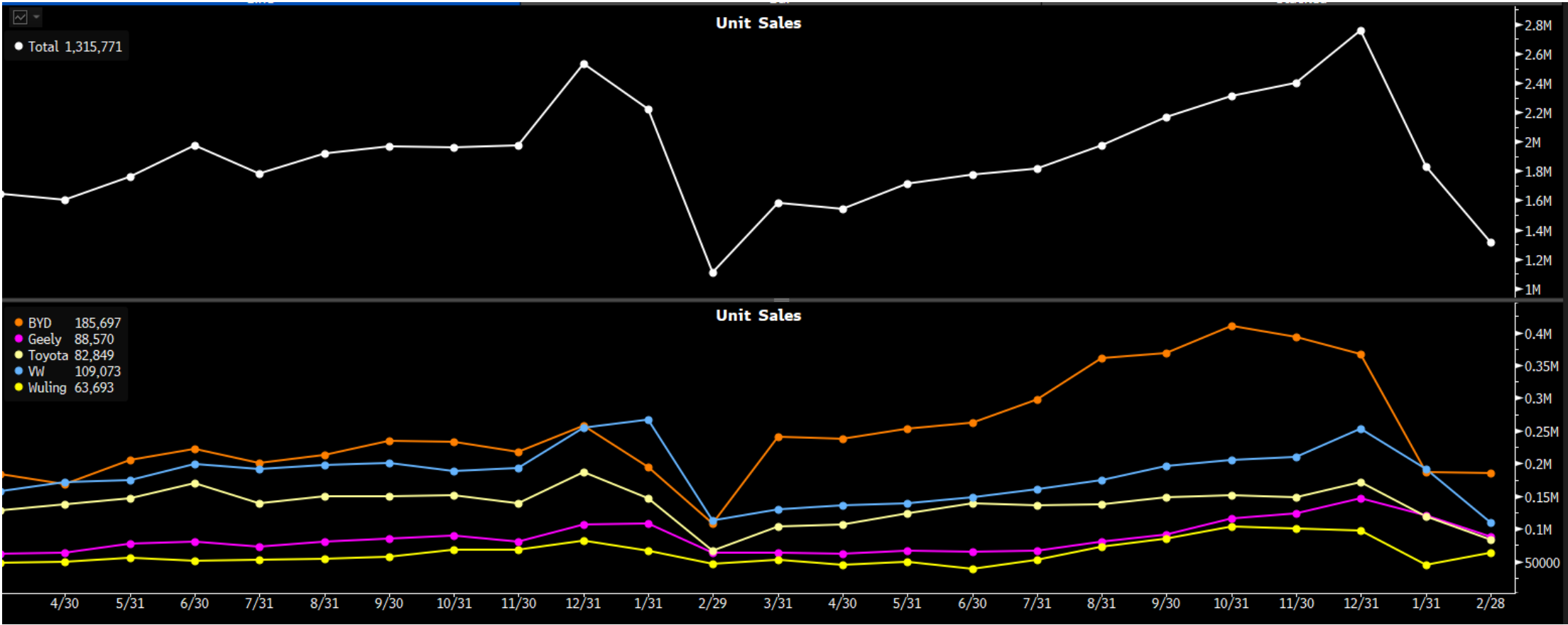




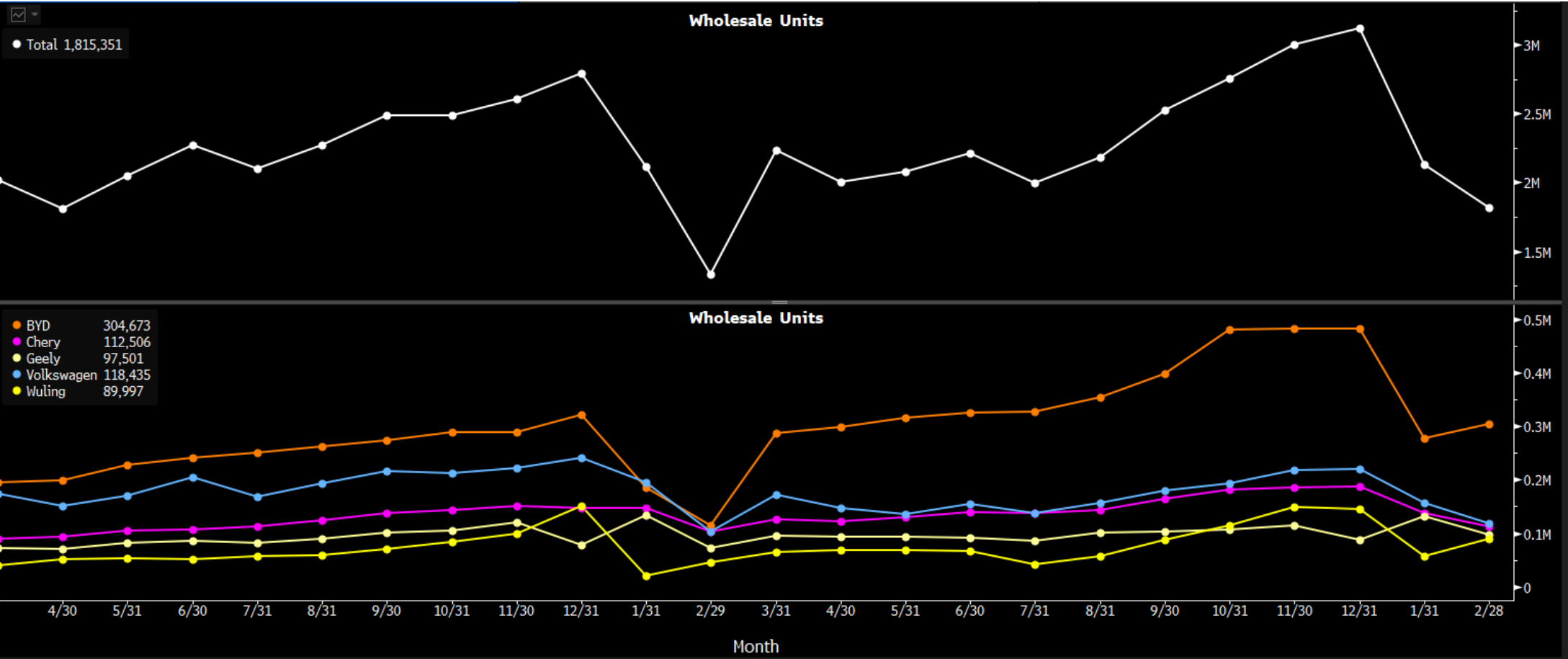
## Year-on-year percentage change of auto loans originated in the United States from 1st quarter 2005 to 3rd quarter 2024, by risk score

Characteristic	<620	620-659	660-719	720-759	760+
Q3 2024	11.18%	-2.97%	-3.82%	3.55%	4.33%
Q2 2024	0.55%	1.17%	-4.88%	-0.25%	2.76%
Q1 2024	12.04%	-2.72%	-1.88%	-7.03%	6.89%
Q4 2023	-10.38%	-18.03%	-22.01%	-16.37%	0.2%
Q3 2023	-7.47%	-11.7%	-4.92%	-9.95%	5.94%
Q2 2023	-15.82%	-21.76%	-13.98%	-4.72%	-2.26%
Q1 2023	-15.6%	-25.94%	-13.39%	1.76%	-0.05%
Q4 2022	-7.78%	-6.72%	8.95%	8.2%	6.18%
Q3 2022	-10.42%	-10.24%	-10.48%	-5.64%	-1.3%
Q2 2022	0.52%	1.6%	-0.83%	-4.33%	-2.78%
Q1 2022	18.93%	28.13%	22.77%	15.2%	6.44%
Q4 2021	10.13%	13.33%	29.63%	14.51%	1.1%
Q3 2021	19.29%	14.41%	26.88%	26.39%	9.8%

# Top 5 Chinese Companies Retail Unit Sales



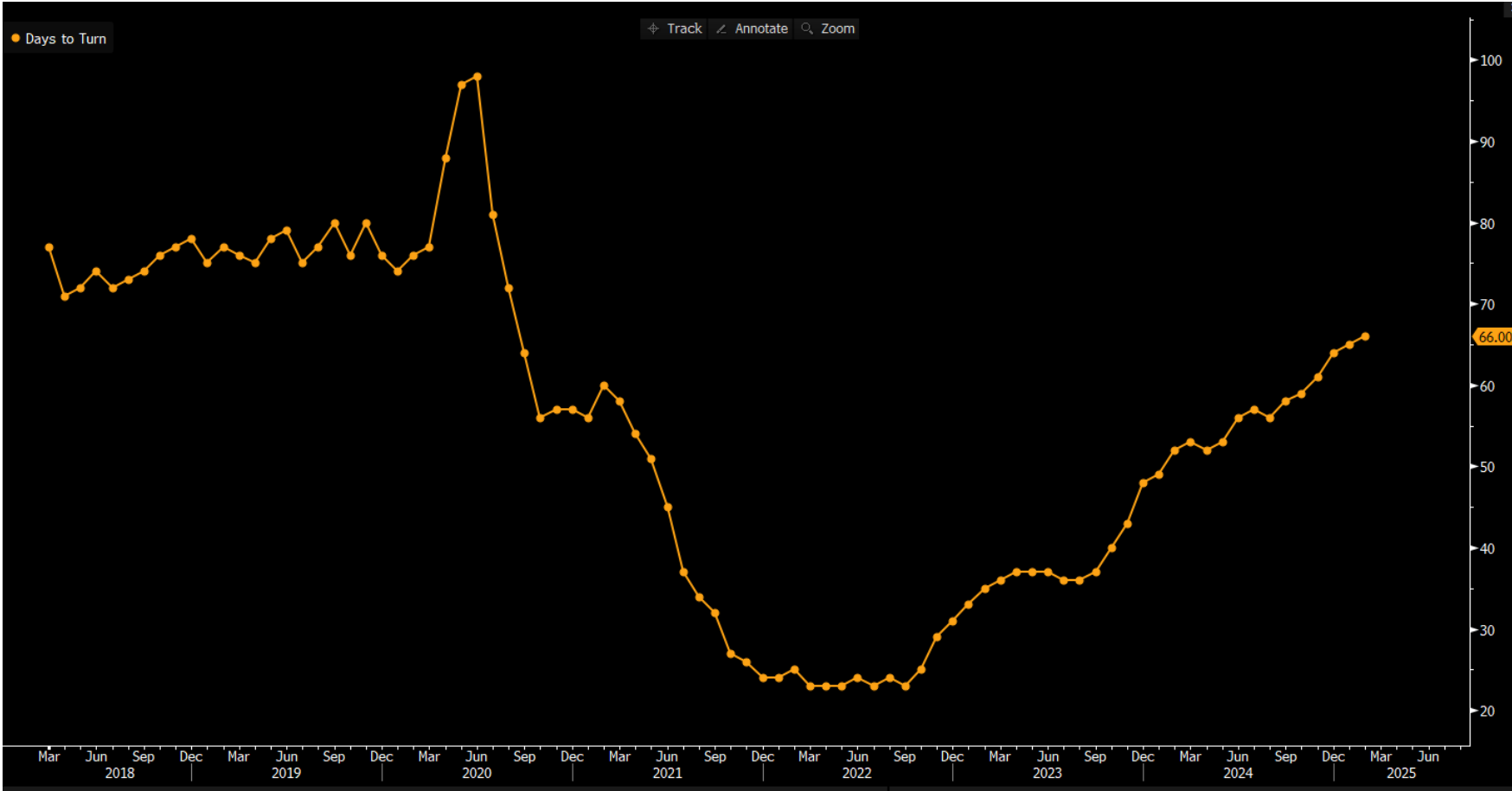
# Top 5 Chinese Companies Wholesale Sales



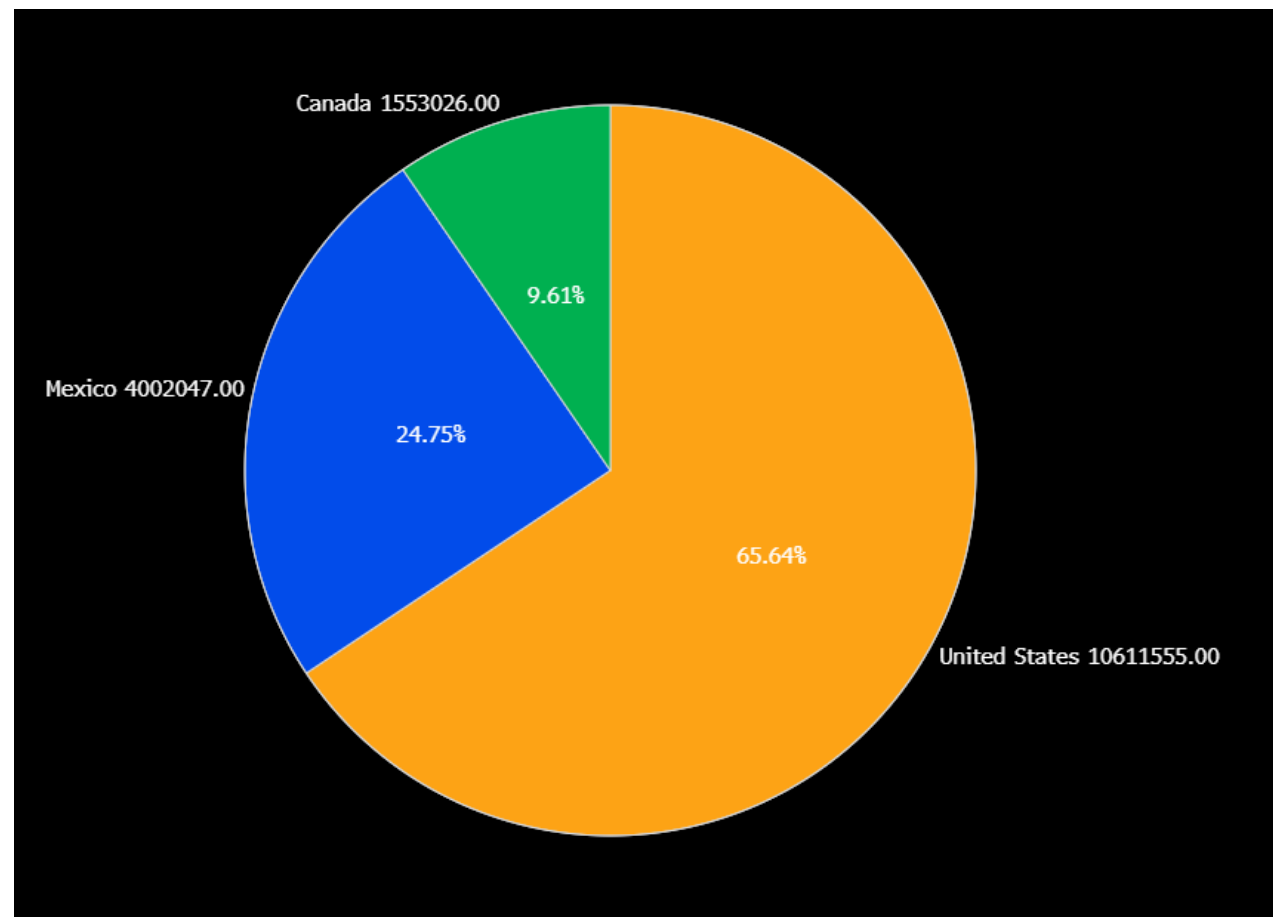
# North America Vehicle Sales



# North America Days to Turn

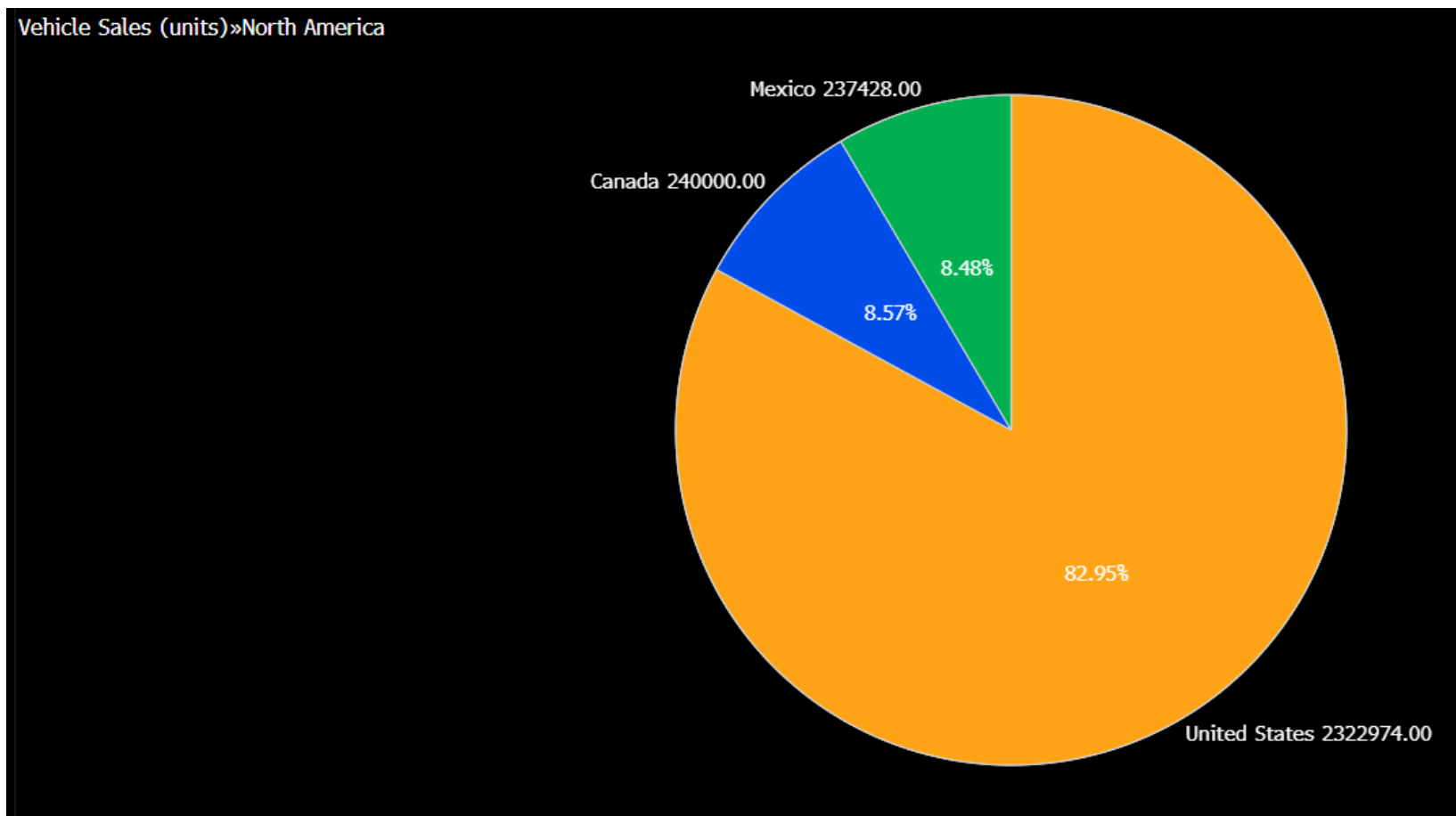


# Vehicle Production (North America)

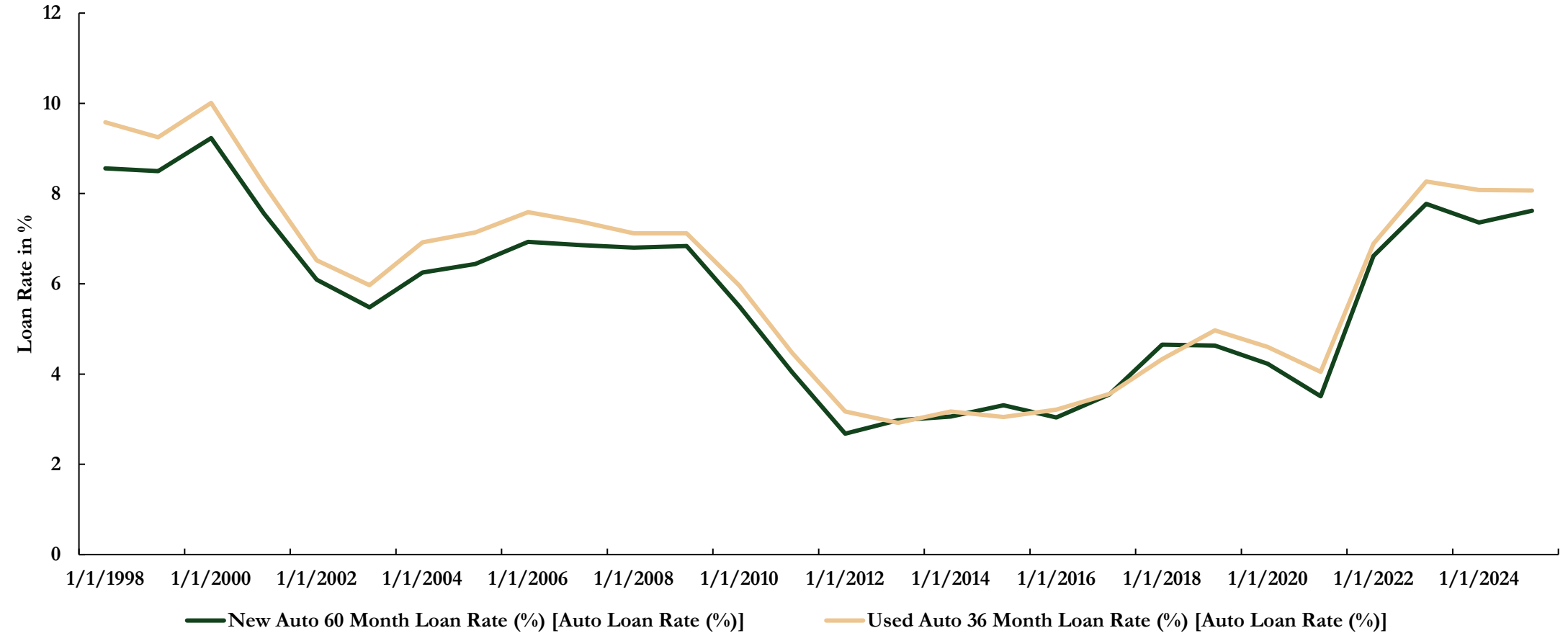


Values in units

# North America Vehicle Sales

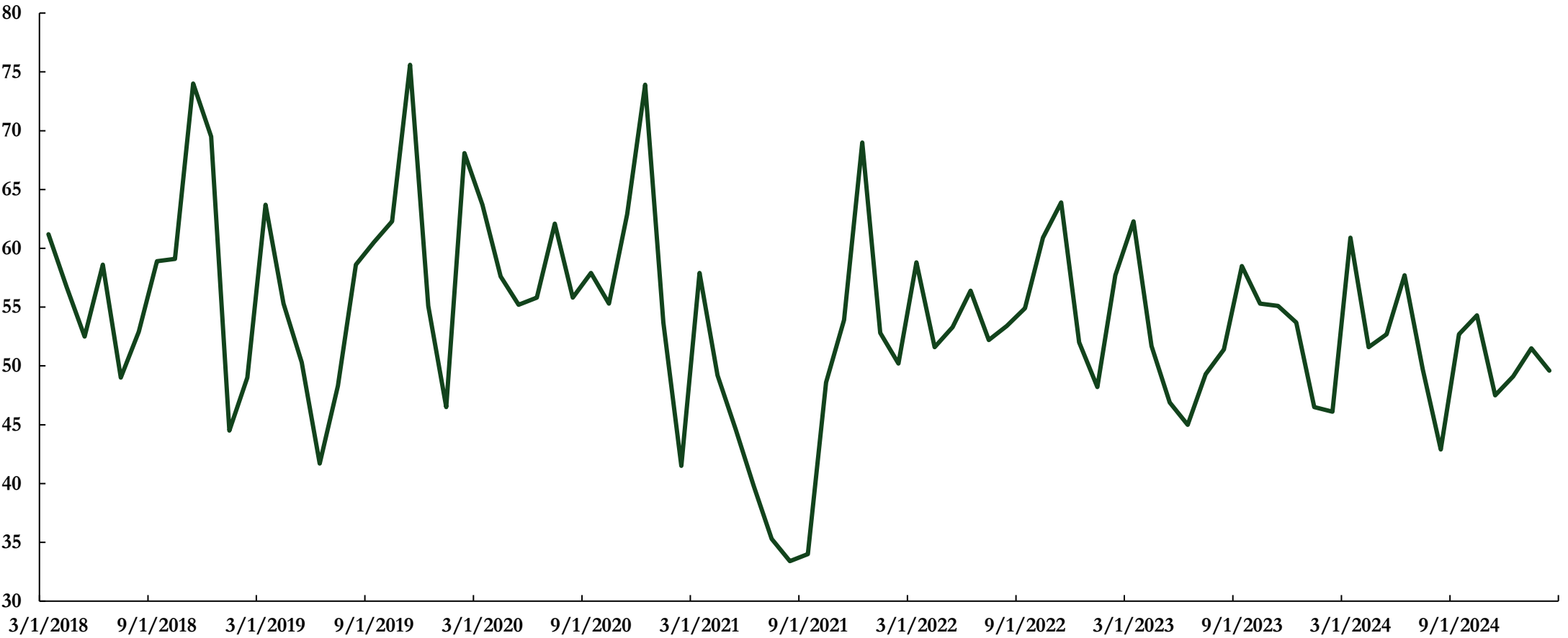


# North America New Car Auto Loan Rate

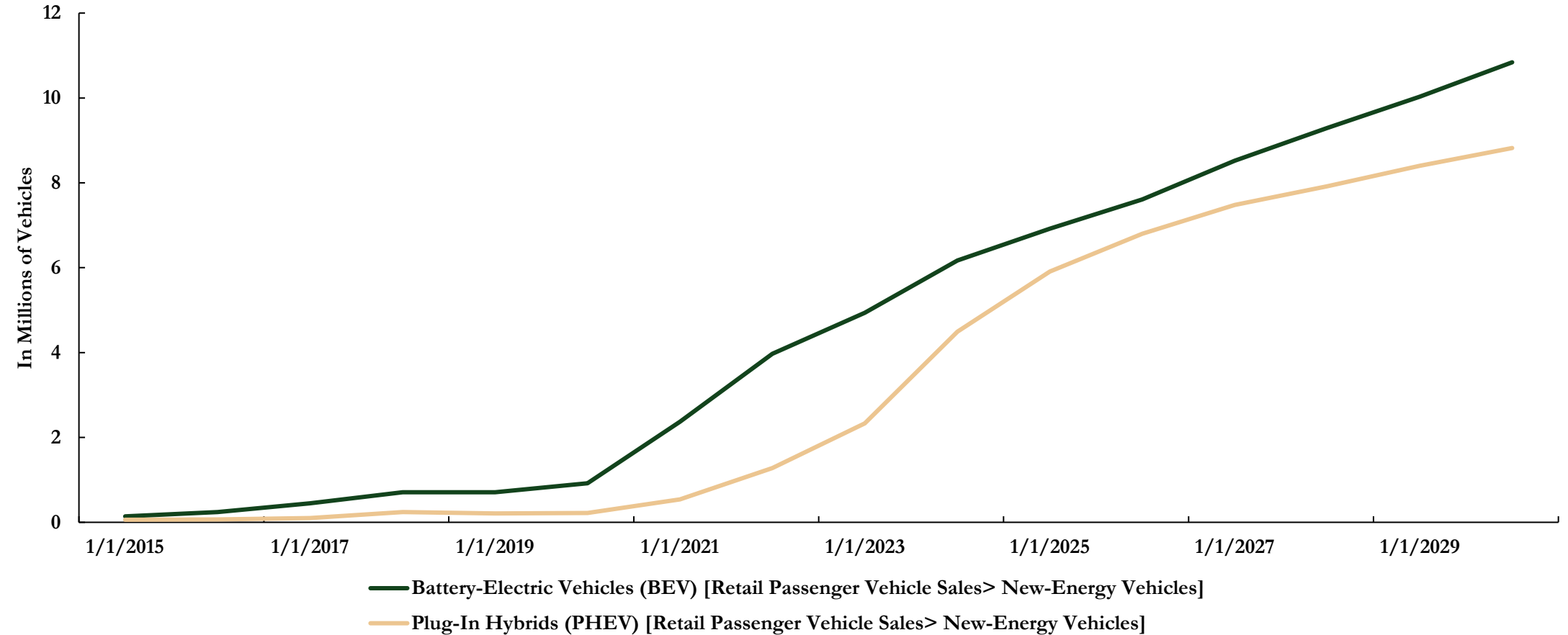




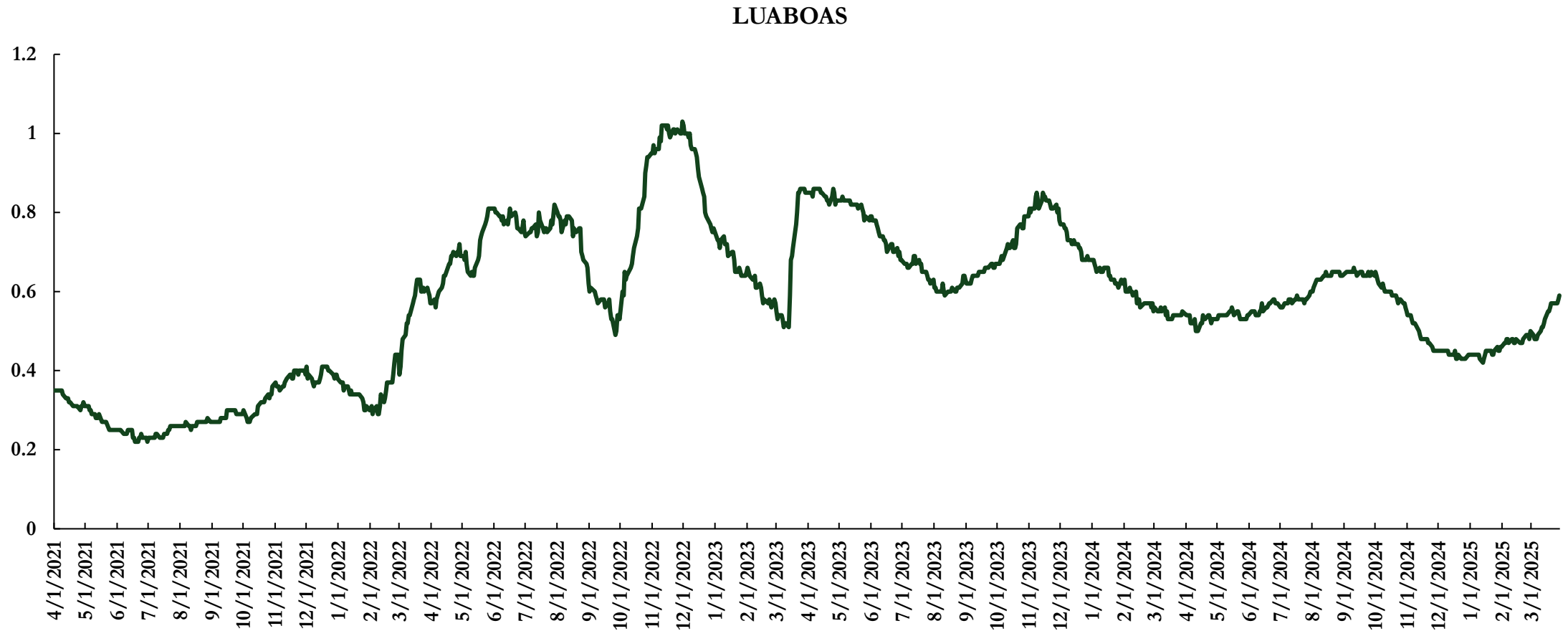
# China Vehicle Inventory Index (%)



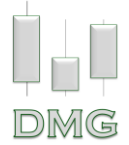
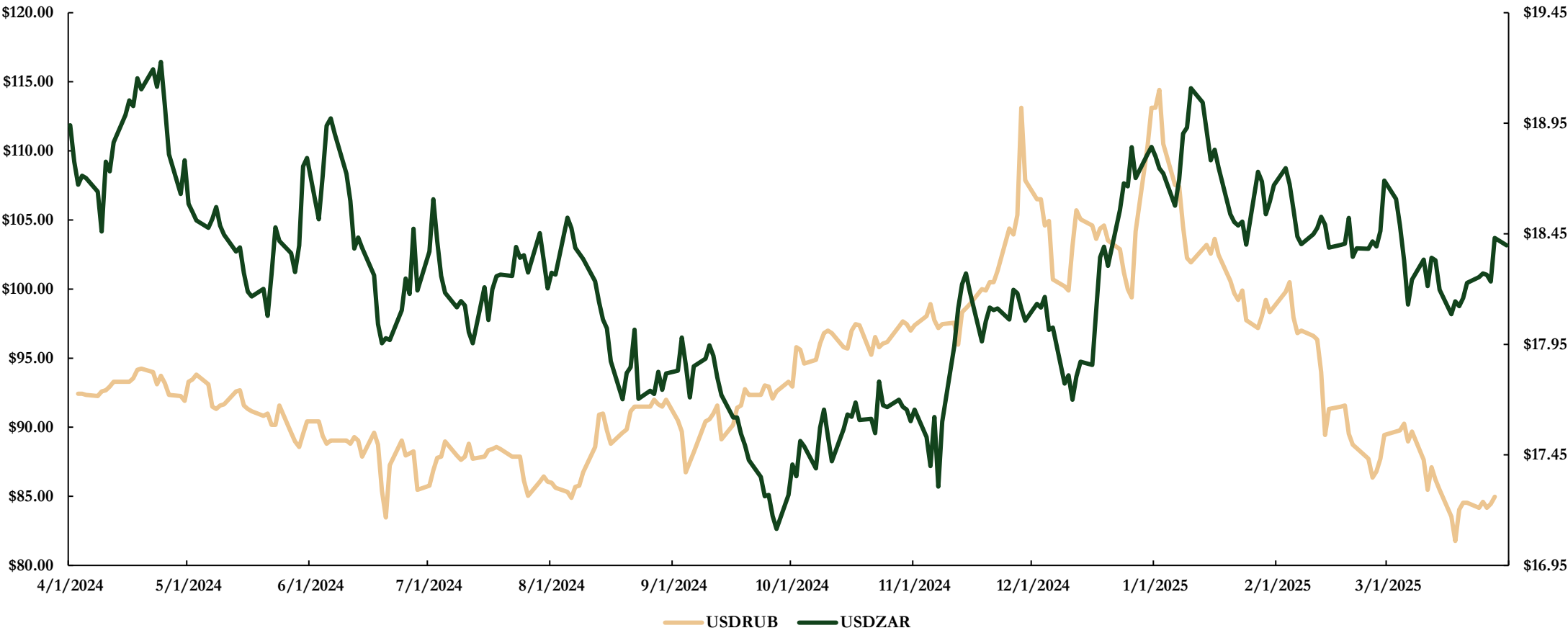
# Bloomberg Intelligence Forecast (China)



# Credit Spread on ABS



# RUB & ZAR Expanded



# America Tariff risk

## 5. Low US Production Capacity Exposes Tariff Risk

(03/25/25)

