Executive Summary — Key Performance Indicators

TOTAL SALES 2008–2015	PEAK YEAR	TROUGH YEAR	FULL RECOVERY
$88.2B 8-Year Cumulative	**2015** $14.51B Annual Sales	**2009** $7.65B | -14.65% YoY	**+89.6%** From 2009 Low to 2015 Peak

The Colorado motor vehicle sales market demonstrated significant resilience over the 2008–2015 period, recording total cumulative sales of **$88.2 billion** across 17 counties and 32 quarters. Despite a sharp contraction of **14.65% in 2009** caused by the Global Financial Crisis, the market achieved a full and sustained recovery, reaching a record annual high of **$14.51 billion in 2015** — an increase of 89.6% from the post-crisis low.

1. Data Overview

Dataset characteristics and scope of analysis:

- **Time Frame:** Q1 2008 to Q4 2015 (8 fiscal years · 32 quarters)
- **Total Records:** 501 county-level quarterly observations
- **Geographic Coverage:** 17 counties across the State of Colorado
- **Data Fields:** Year, Quarter, County, Sales (USD)
- **Data Quality:** No missing values detected — dataset is complete and clean
- **Sales Range:** $6.27M (min, single county-quarter) to $916.91M (max)
- **Mean County Quarterly Sales:** $176.1M | **Median:** $138.6M

2. Exploratory Data Analysis (EDA)

a. Sales Distribution

The histogram of county-level quarterly sales revealed a right-skewed distribution, with over **65% of observations falling below $200 million** per quarter. This skew is driven by a small number of high-performing Metro Denver counties — primarily Arapahoe, El Paso, and Jefferson — which consistently record sales well above the statewide average, pulling the mean ($176.1M) above the median ($138.6M).

b. Quarterly Seasonality Pattern

Box plot analysis by quarter confirmed a statistically consistent seasonal pattern across all eight years. **Q2 (April–June)** and **Q3 (July–September)** outperformed Q1 and Q4 in every single year of the dataset, reflecting a well-established summer automotive buying cycle in Colorado. Q3 2015 recorded the highest single quarterly figure at **$3.92 billion**, while Q1 2009 was the weakest at **$1.66 billion**.

c. Geographic Concentration

County-level bar plot analysis confirmed **Arapahoe County** as the dominant market in every period. The top five counties (Arapahoe, El Paso, Jefferson, Adams, Denver) collectively accounted for approximately **64% of total statewide cumulative sales**, reflecting the concentration of population, purchasing power, and automotive retail infrastructure in the Denver Metropolitan Statistical Area.

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3. Statistical Analysis — Annual Sales & Year-over-Year Growth

Year	Total Sales	YoY Growth	Key Driver
2008	**$8.97B**	—	Pre-crisis baseline
2009	**$7.65B**	▼ -14.65%	Global Financial Crisis
2010	**$8.56B**	▲ +11.81%	Early economic recovery
2011	**$12.17B**	▲ +42.24%	Consumer confidence surge
2012	**$10.96B**	▼ -9.94%	Post-surge market correction
2013	**$12.00B**	▲ +9.49%	Sustained recovery resumes
2014	**$13.39B**	▲ +11.60%	Strong growth momentum
2015	**$14.51B**	▲ +8.32%	Record high — peak year

3.1 Key Statistical Observations

- **2009 Crisis:** Sharpest single-year decline at **-14.65%**, reflecting the Global Financial Crisis impact on consumer discretionary spending and automotive credit availability
- **2011 Inflection Point:** The **+42.24% YoY surge** was the strongest growth year on record — the clearest evidence of full consumer confidence recovery post-recession
- **2012 Correction:** A **-9.94% pullback** following the 2011 surge represents healthy market normalization, not structural deterioration
- **2013–2015 Sustained Growth:** Three consecutive years of positive growth **(9.49%, 11.60%, 8.32%)** confirm a stable, mature recovery trajectory
- **Peak Quarter:** Q3 2015 at $3.92B — the highest single quarter across the entire 8-year dataset
- **Worst Quarter:** Q1 2009 at $1.66B — reflecting the depth of recession-era consumer retrenchment

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4. County-Level Market Analysis

Rank	County	Total Sales	Share %	Notes
#1	Arapahoe	$20.14B	22.8%	Denver Metro — consistently #1 every year
#2	El Paso	$11.93B	13.5%	Colorado Springs — military & suburban growth
#3	Jefferson	$9.06B	10.3%	Lakewood / Jefferson County suburbs
#4	Adams	$8.90B	10.1%	North Denver suburban corridor
#5	Denver	$6.76B	7.7%	City & County of Denver proper
#6	Larimer	$5.34B	6.1%	Fort Collins — Northern Colorado hub
#7	Weld	$5.09B	5.8%	Greeley — energy sector driven
#8	Boulder	$4.74B	5.4%	Boulder County — tech & university market
#9	Rest of State	$3.58B	4.1%	All remaining rural counties combined
#10	Douglas	$3.24B	3.7%	South Denver suburban expansion

4.1 Metro vs. Rural Divide

The Denver Metropolitan Area (Arapahoe, Adams, Denver, Douglas, Jefferson) collectively accounted for over **54% of statewide cumulative sales**. This geographic concentration reflects population density, higher median household incomes, and a significantly greater density of automotive dealerships operating in the metro corridor.

4.2 Notable County Trends

- **Arapahoe County (#1):** Dominant market at **$20.14B cumulative** — #1 in every single year of the dataset with no exceptions
- **El Paso County (#2):** Colorado Springs-based market at **$11.93B**, underpinned by military presence (Fort Carson, Peterson AFB) and sustained suburban growth
- **Weld County (#7):** Notable outperformer relative to population size at **$5.09B** — likely driven by oil & gas sector prosperity in Greeley and the Northern Colorado energy corridor
- **Fremont County:** Smallest tracked market at **$316.9M cumulative**, reflecting rural population and limited dealership infrastructure

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5. Predictive Modelling & Sales Forecast

5.1 Model Methodology

An **ARIMA (Autoregressive Integrated Moving Average)** time series model was applied to quarterly statewide sales data. The model was trained on 32 quarters of historical data (2008–2015) and extended to project quarterly sales through **Q4 2021**. A supplementary **Random Forest Regressor** was used for feature-based modelling with year, quarter, and county as predictors — achieving an RMSE of approximately **$20.4M** on the held-out test set, with a tuned model improving this to **$19.98M**.

Metric	Value	Lower Bound (95% CI)	Upper Bound (95% CI)
Next Quarter Forecast	$4.95B	$4.32B	$5.57B
Latest YoY Growth Rate	+5.33%	—	—
Forecast Model Used	ARIMA Time Series	—	—
Forecast Horizon	2016 – 2021	—	—

5.2 Forecast Interpretation

- **Next quarter projected sales of $4.95B** sit within a 95% confidence interval of $4.32B to $5.57B, indicating reasonable model certainty
- The latest YoY growth rate of **+5.33%** suggests the market is in a steady-state growth phase — no boom or bust signals detected in the trajectory
- The **2016–2021 forecast trajectory** indicates continued expansion, with annual sales potentially reaching **$18–22B by 2020–2021**
- **Disclaimer:** Forecast accuracy is inherently limited by dataset scope (501 records, 3 features). Macroeconomic shocks, policy changes, and fuel price fluctuations are not captured in this model

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6. Conclusions & Business Implications

6.1 Summary of Key Findings

- Colorado's motor vehicle market is fundamentally healthy — the 2008–2015 period demonstrates a **complete V-shaped recovery** from crisis lows to record highs

- Seasonality is a reliable and consistent market driver — **Q2/Q3 outperform Q1/Q4 every single year** without exception
- Geographic concentration in the Denver metro creates both **opportunity** (scale, density) and **systemic risk** (dependence on one economic corridor)
- Weld County represents an **underappreciated growth market** tied to energy sector cycles and worth monitoring separately

6.2 Business & Policy Implications

- **Inventory Planning:** Dealerships should increase vehicle stock entering Q1 to capitalize on the predictable Q2/Q3 demand surge
- **Regional Strategy:** Priority investment in Arapahoe, El Paso, and Jefferson counties yields the highest revenue exposure and lowest geographic risk
- **Economic Sensitivity:** The 2009 data confirm the Colorado auto market is sensitive to macroeconomic conditions — stress-testing against a **15% demand shock** is prudent for financial planning
- **Growth Outlook:** With a current growth rate of +5.33% and $4.95B next-quarter forecast, near-term market conditions appear **stable and favourable for expansion**.