

Storytelling with Shiny

Taylor Kirk

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Part I — Links and Description

- Deployed Shiny App URL: <https://019ab7f1-2a81-e275-5edd-087b0d3fde19.share.connect.posit.cloud/>
- Code URL:
 - GitHub repository: <https://github.com/tkbarb10/aus-wine-sales.git>

App Description:

This Shiny application facilitates the exploration, modeling, and forecasting of Australian wine sales from 1980 through 1994. It enables users to visualize time series decompositions, compare automated versus custom parameter models (ETS, ARIMA, TSLM), and validate accuracy using hold-out sets. These models can then be used to project and compare future sales trends for up to 24 months.

App Features:

- Visualize sales trends across custom date ranges for single or multiple varietals
- Inspect STL decompositions to isolate trend and seasonal components
- Set variable forecast horizons (1-5 years) to define training and validation splits
- Build ETS, ARIMA, or TSLM models using either auto-selection or manual parameter tuning
- Compare training and validation metrics across all models to assess performance
- Generate detailed specification reports for individual models
- Visualize validation performance for up to 4 models against held-out data
- Forecast future sales for up to 2 years using models refitted to the full data set

Part II — Data Story

Sales of Fortified wine in Australia declined through the entire time period of the available. This is accompanied by an increase of Dry White and Red varietal. This trend can be explained largely by an increase in the popularity of easier to produce table wines and in part due to increased competition from other alcoholic beverages (“The Rise and Fall of Fortified Wine Popularity” 2025). This decrease is best modeled by a SARIMA model, specifications listed below.

Model Structure

$\text{ARIMA}(0,0,1)(1,1,1)[12]$ w/ drift

(a) ARIMA Structure

Model Coefficients				
Term	Estimate	Std.error	Statistic	P.value
ma1	0.14	0.09	1.56	0.12
sar1	0.33	0.17	2.00	0.05
sma1	-0.84	0.15	-5.54	0.00
constant	-80.19	7.48	-10.73	0.00

(a) Model Coefficients

The chosen SARIMA model has one non-seasonal moving average (MA) term, and a seasonal term for autoregressive (AR) and MA. The model also includes a drift term of -80.19, highlighting the decreasing trend in sales.

Time Series & Decomposition

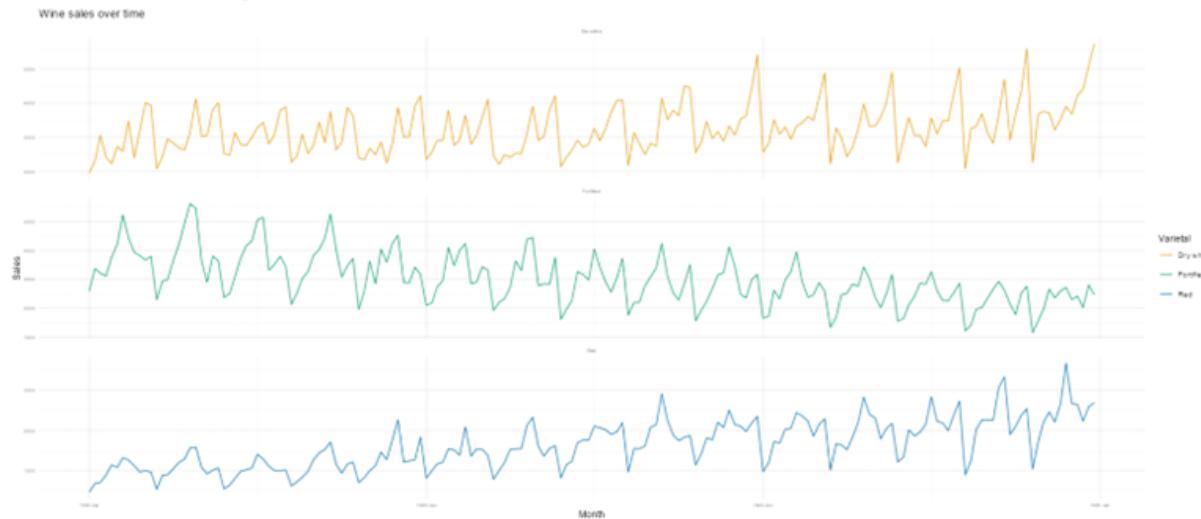


Figure 3: Fortified Wine (middle) Compared to Dry White (top) and Red (bottom)

In this time series comparison, we can see the declining trend of Fortified wine sales is mirrored by an increasing trend for White and Red varietals.

Validation metrics over forecast period

Up to 10 selected models shown

ModelName	Varietal	RMSE	ME	MAE	MPE	MAPE
Fortified - ARIMA	Fortified	284.15	-2.84	218.20	-0.03	9.48
Fortified - ETS	Fortified	291.02	-125.20	238.65	-6.88	11.16
Fortified - TSLM	Fortified	358.38	28.28	283.98	2.26	12.53

Figure 4: Model Validation Comparison

Three separate models were built for comparison with a training split of 2 years. The ARIMA model has the lowest RMSE. The ME is negative but small, indicating a slight bias to over-predict. The ETS model shows a

large bias to the upside, perhaps indicating it's not capturing the declining trend well.

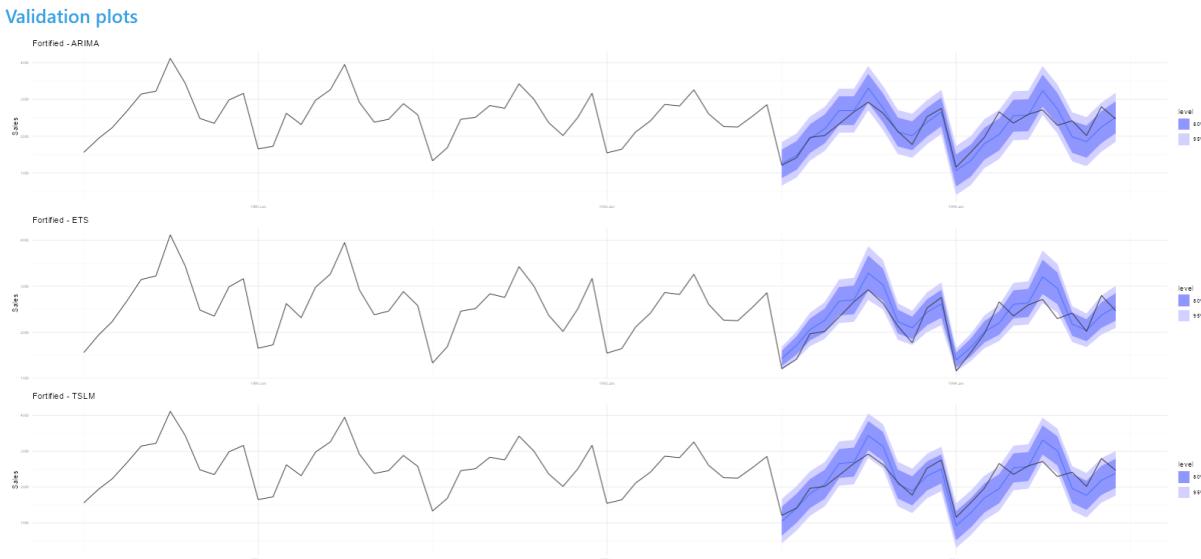


Figure 5: Model performance on validation data

We can see from the visuals that ETS and TSLM models perform better over certain time frames (ETS for example captures the change from Nov 1993 to Feb 1994 better than the other two), but the ARIMA model is better able to capture the seasonal trend, leading to lower errors overall

The Fortified wine industry is in a critical state of contraction. By utilizing a SARIMA model with a negative drift term, stakeholders can accurately project this continued decay, preventing inventory overstock that would result from using naive or purely seasonal models.

Steps to reproduce above outputs in app

- **Time Series Comparison:** Explore tab, choose Dry White, Fortified and Red varietals in left sidebar
- **Model Specs/Report:** Model Building Tab, choose 2 years for forecast horizon (default), the Fortified wine varietal, ARIMA auto (default) and select the model in the report in the sidebar
- **Validation Comparison:** Build the 3 models in the Building tab, then in the Validation tab, choose the 3 models in the left sidebar and click on Run Validation

References

“The Rise and Fall of Fortified Wine Popularity.” 2025. Boobota Wine. 2025. <https://wine.boobota.com/the-rise-and-fall-of-fortified-wine-popularity>.