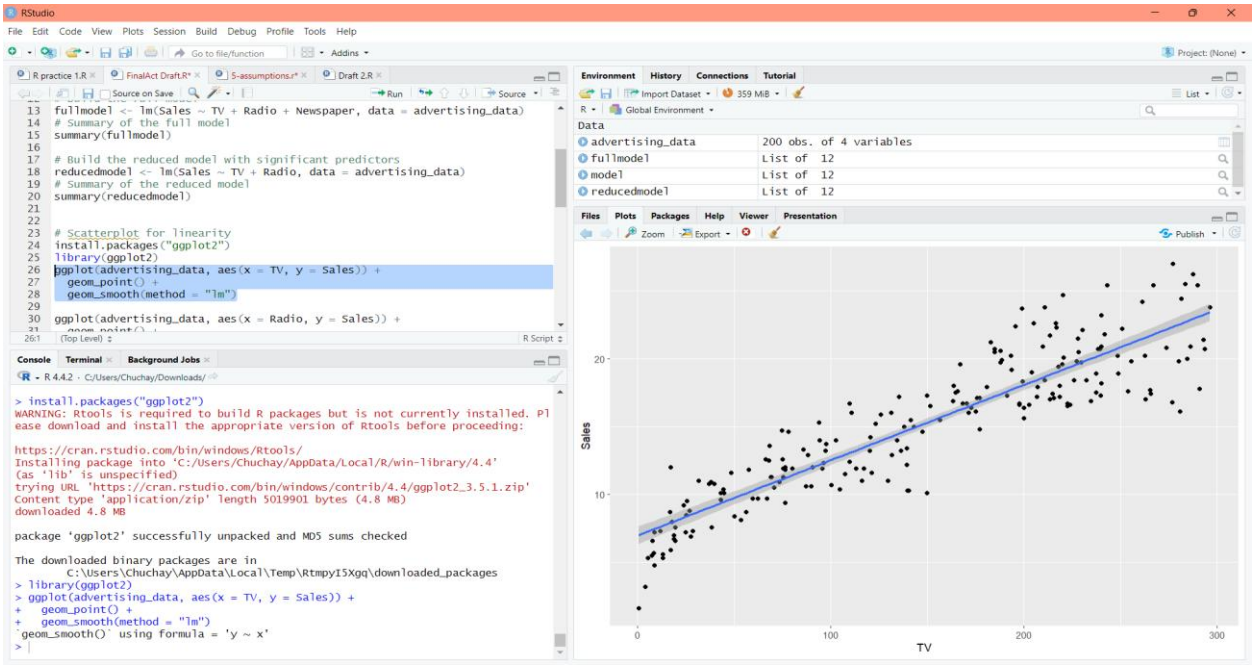
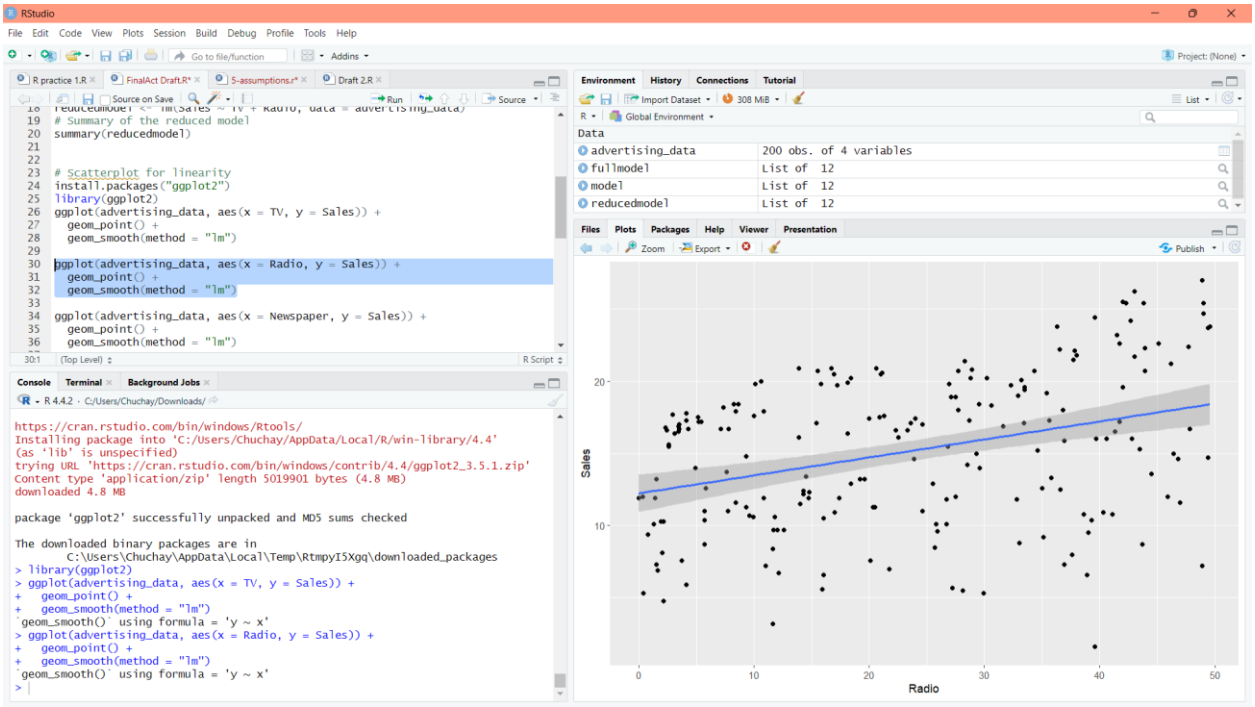
Linearity

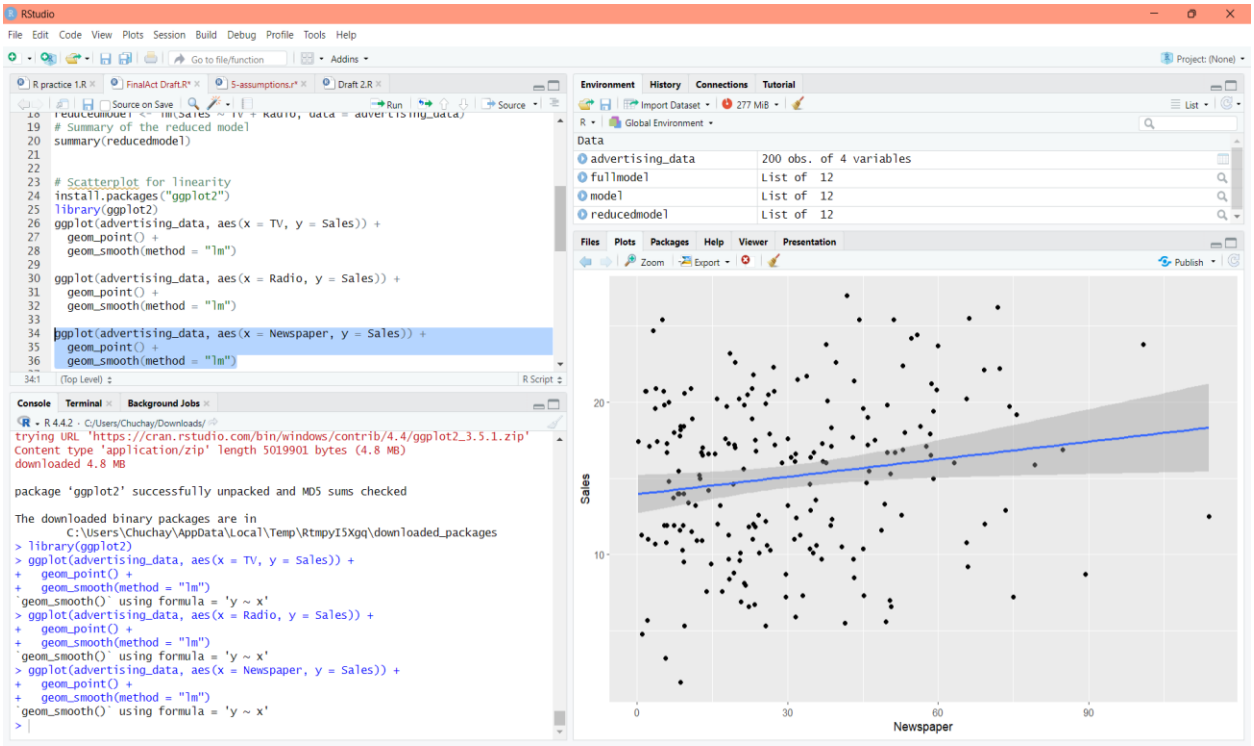
TV vs. Sales - The relationship between TV advertising and Sales is linear, suggesting that as spending on TV advertising increases, Sales increase proportionally in a consistent manner.



Radio vs. Sales - The relationship between Radio advertising and Sales is linear, indicating that higher spending on Radio advertising leads to proportional increases in Sales.



Newspaper vs. Sales - The relationship between Newspaper advertising and Sales does not appear to be strongly linear. This may suggest that spending on Newspaper advertising has little to no consistent impact on Sales.

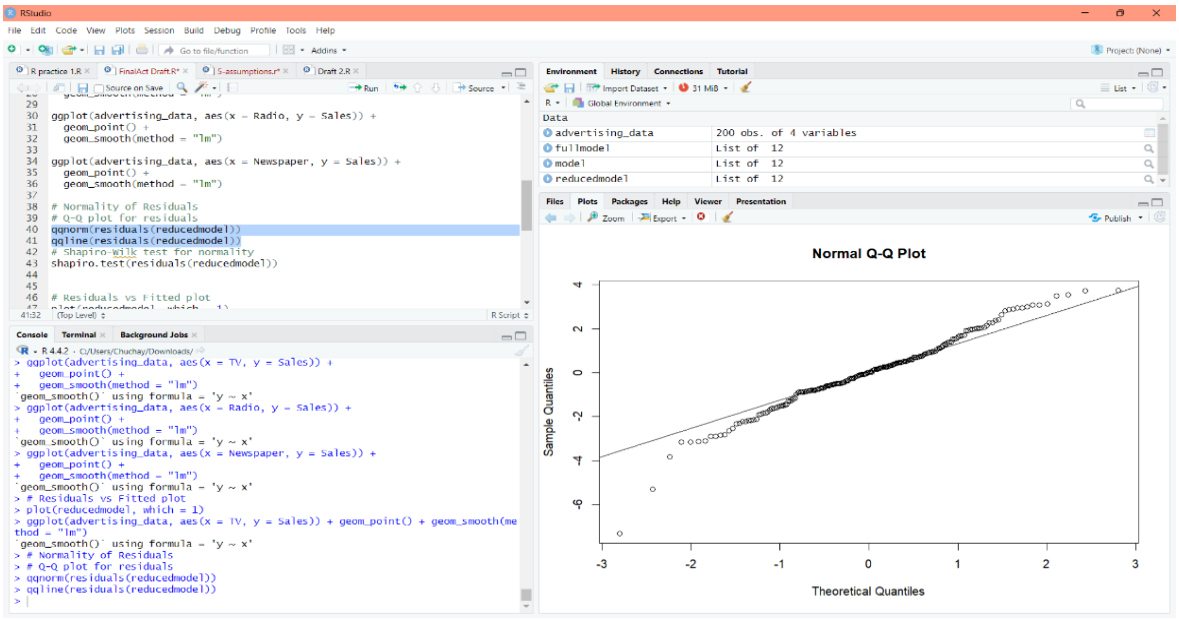


The linearity assumption is satisfied for TV and Radio, indicating they have a clear linear relationship with Sales. However, the Newspaper variable may not exhibit linearity, and its inclusion in the model should be reconsidered or further analyzed. Transformations or exclusion might be necessary for Newspaper.

Normality of Residuals

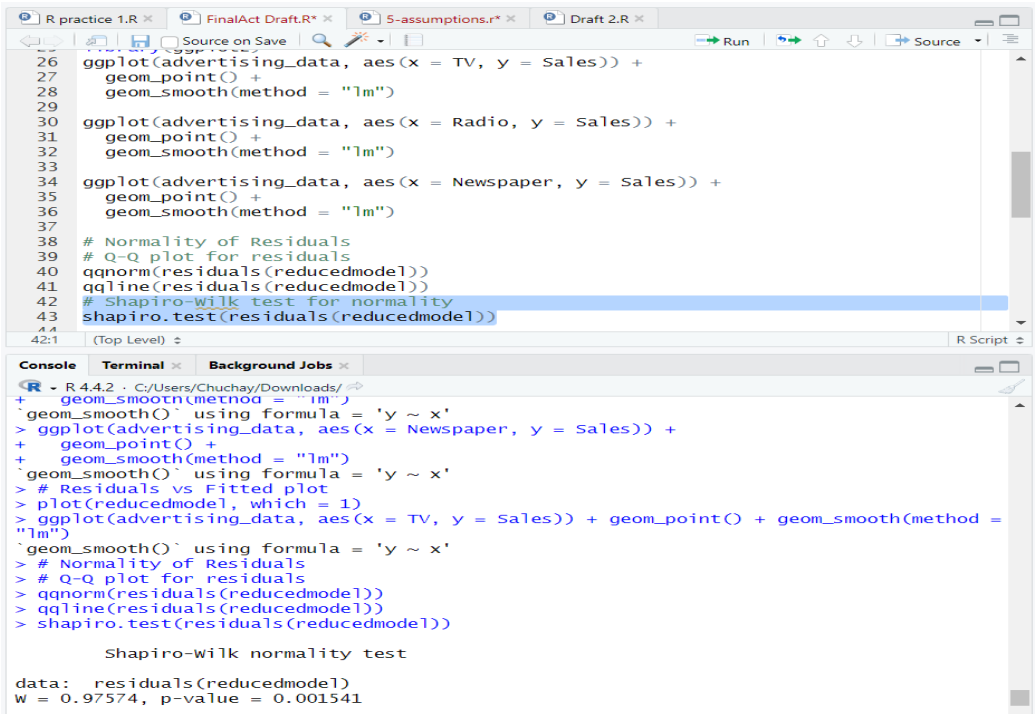
QQ plot for Residuals

The residuals mostly align with the diagonal line, suggesting approximate normality. However, there are noticeable deviations at the tails (both ends of the plot), where points diverge from the line. This indicates that the residuals might have heavier or lighter tails than a normal distribution. To address the deviations observed in the Q-Q plot, several remedial measures can be considered. A common approach is to transform the dependent variable using techniques such as a logarithmic transformation, or a Box-Cox transformation, which identifies the best power transformation for the data.



Shapiro-Wilk test for Normality

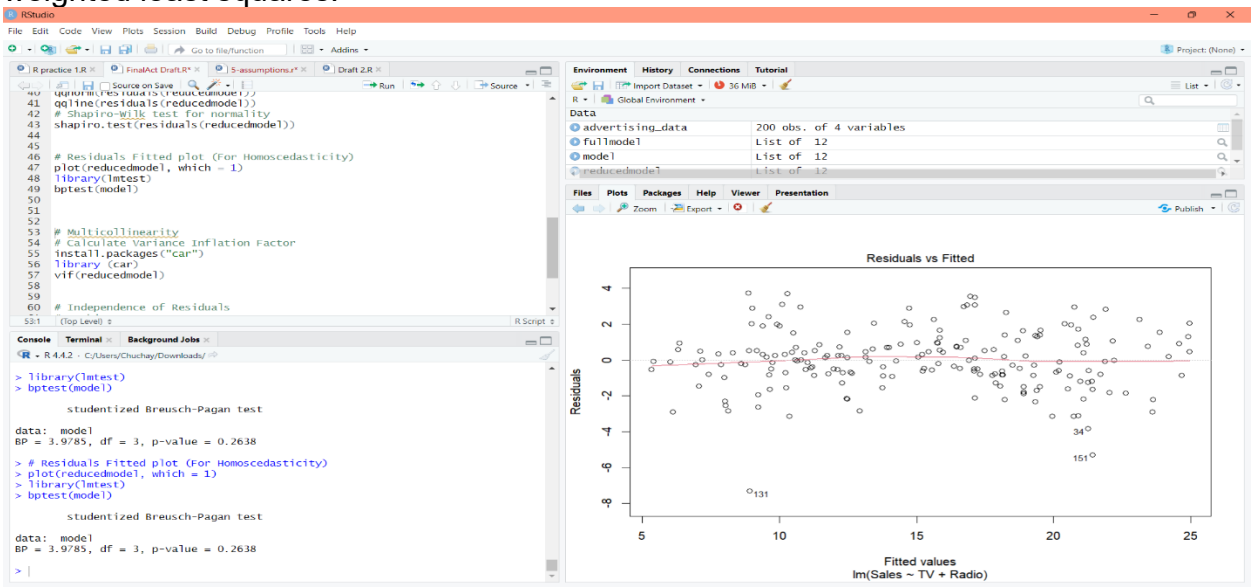
The Shapiro-Wilk test result (**W = 0.97574, p-value = 0.001541**) indicates that the residuals of the reduced model are **not normally distributed**. This violates the normality assumption of multiple linear regression. Remedial measures, such as transforming the dependent variable (e.g., logarithmic or Box-Cox transformation), may be necessary to address this issue.



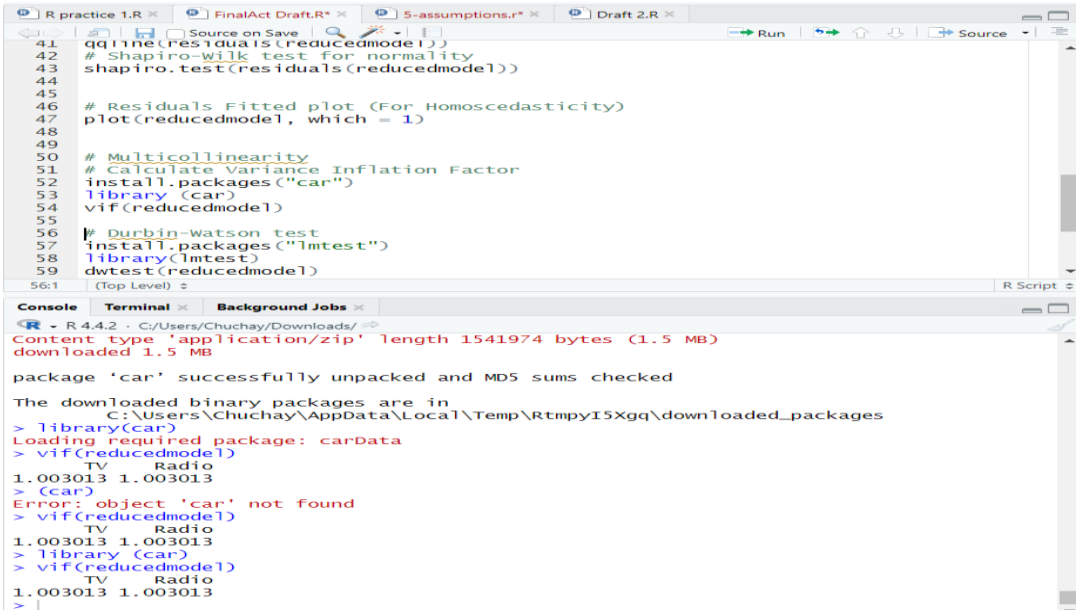
Homoscedasticity

Residuals vs. Fitted plot

Based on the Residuals vs. Fitted plot, the residuals display a slight increase in variance at higher fitted values, suggesting a potential heteroscedasticity issue. To confirm this observation, by Breusch-Pagan test, **p-value ≤ 0.05 then** reject H_0, indicating evidence of heteroscedasticity. Since heteroscedasticity is present, consider applying a transformation to the dependent variable, using robust standard errors, or employing weighted least squares.

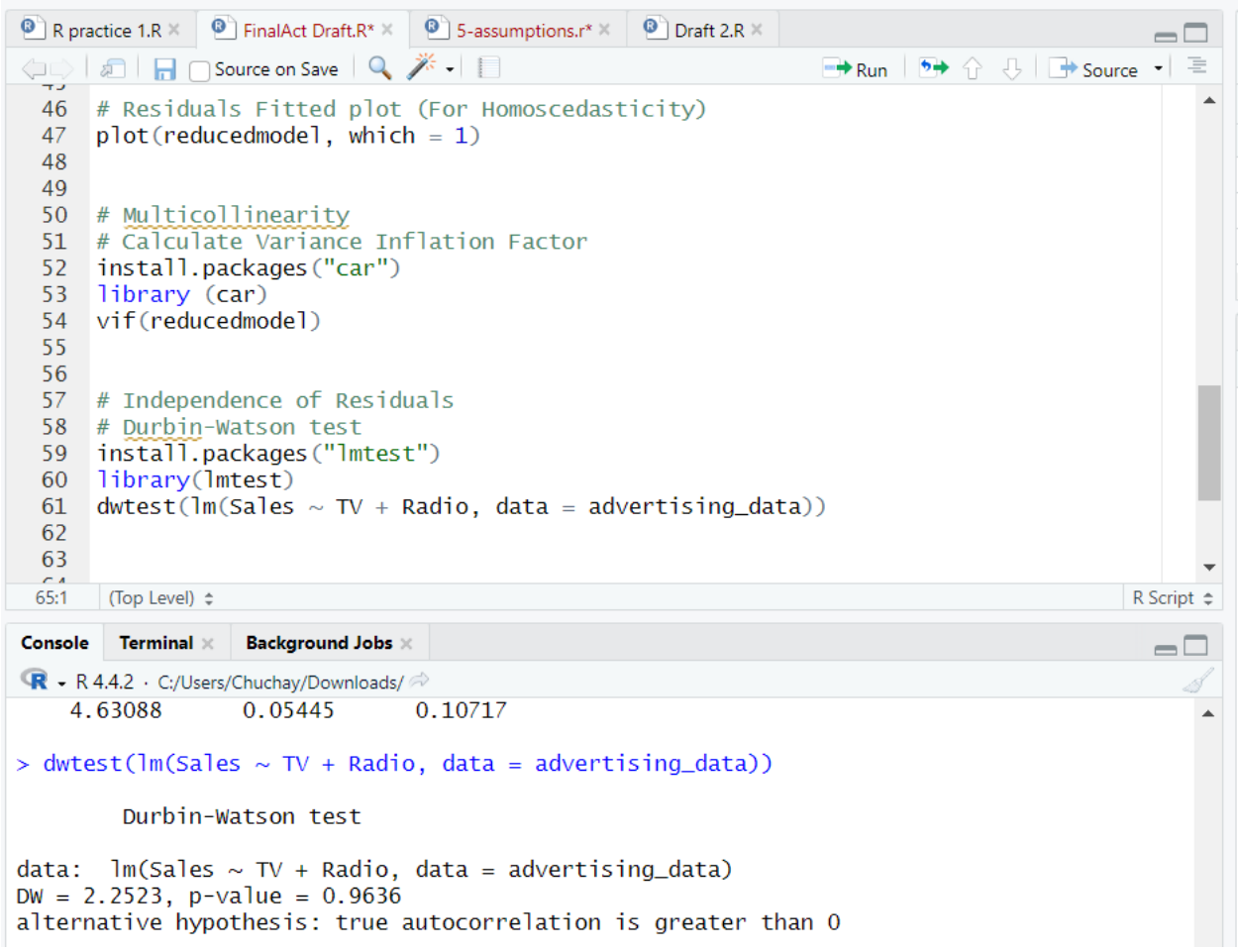


Multicollinearity - VIF values close to 1 indicate that there is no multicollinearity between the predictors. This suggests that the predictors are not highly correlated with each other, and each contributes unique information to the model.



Independence of Residuals

The Durbin-Watson test results show a statistic of 2.2523 with a p-value of 0.9636. Since the p-value is significantly high, we fail to reject the null hypothesis that there is no autocorrelation in the residuals. This suggests that the residuals are independent and that the assumption of no autocorrelation is valid for this model. Overall, the model appears well-specified, with no evidence of autocorrelation, making it suitable for making predictions about the relationship between advertising expenditures and sales.



Table

Assumptions	**Method of Detection**			**Satisfied (✓) or Violated (×)**	**Possible Remedial Measures**
	Graphical	*Statistical*	*Both*		
Linearity (TV & Radio)	✓			✓	
Normality of Residuals			✓	×	logarithmic transformation, or a Box-Cox transformation
Homoscedasticity			✓	×	transformation to the dependent variable (logarithmic transformation, or a Box-Cox transformation), use robust standard errors, or employ weighted least squares
Multicollinearity		✓		✓	
Independence of Residuals		✓		✓	