



Airplanes

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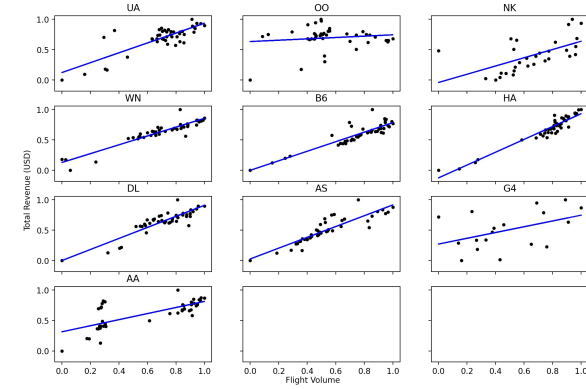
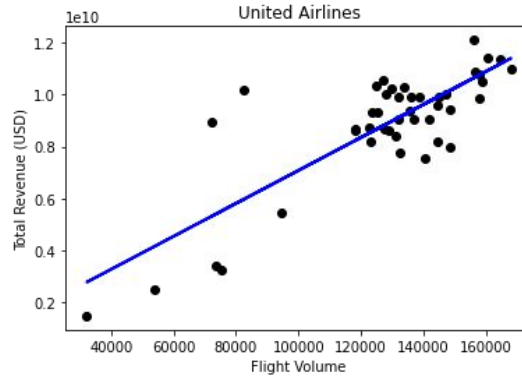
Objective

Alternative Data Trading Strategy

- Attempt to utilize Bureau of Transportation flight statistics to predict airline stock prices and build a L/S portfolio

	Number of Operations	% of Total Operations	Delayed Minutes	% of Total Delayed Minutes
On Time	423,155	73.30%	N/A	N/A
Air Carrier Delay	52,334	9.07%	3,779,744	40.48%
Weather Delay	4,911	0.85%	496,867	5.32%
National Aviation System Delay	29,228	5.06%	1,568,172	16.79%
Security Delay	338	0.06%	15,315	0.16%
Aircraft Arriving Late	47,788	8.28%	3,478,063	37.25%
Cancelled	17,876	3.10%	N/A	N/A
Diverted	1,654	0.29%	N/A	N/A
Total Operations	577,283	100.00%	9,338,161	100.00%

Initial Plan



Predict future flight volumes and delays data for 10 airlines

Estimate future profitability

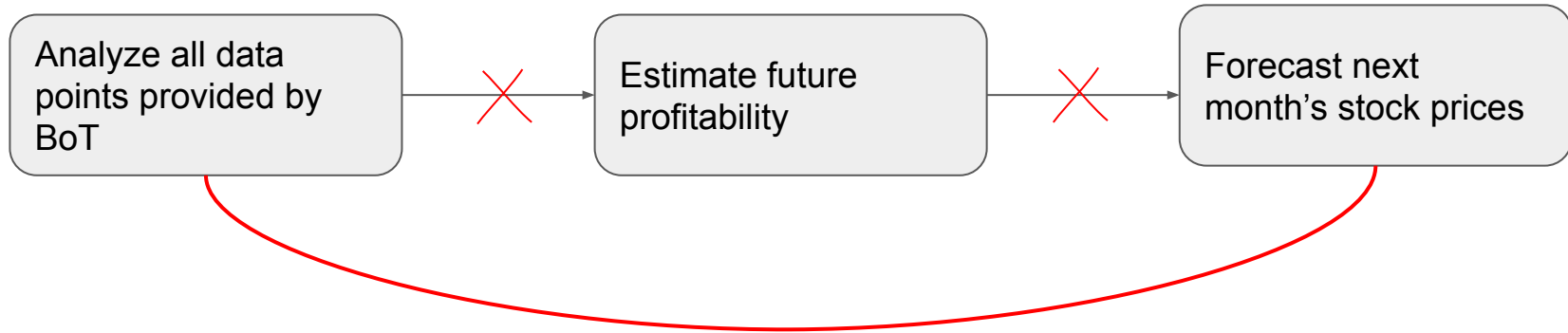
Forecast next month's stock prices

Based on intuition and literature suggesting flight volumes contribute to the top-line, and delays are a major expense

Regress flight vol and top-line revenue, and normalized delayed minutes and operating expenses

Adjusted Plan

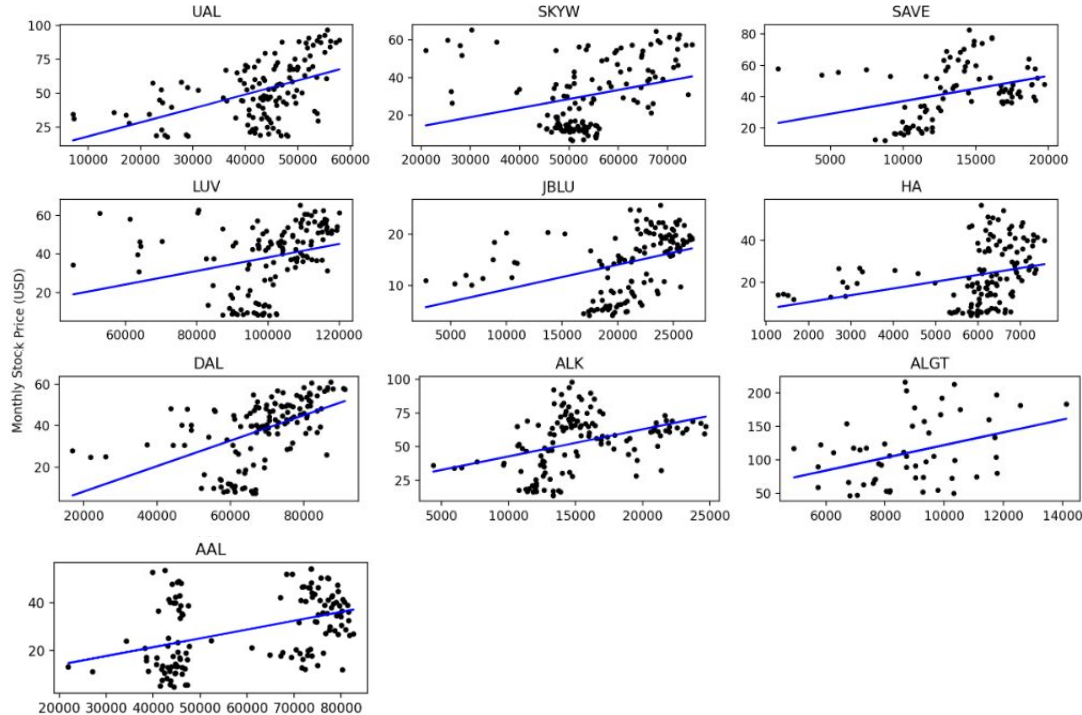
1. Too much noise; airlines derive a significant portion of revenue these days from loyalty programs and credit cards, as opposed to just flights operated and flight inefficiencies
2. Near-term profitability is no longer an 'edge'



Monthly Flight Volume vs Monthly Stock Price

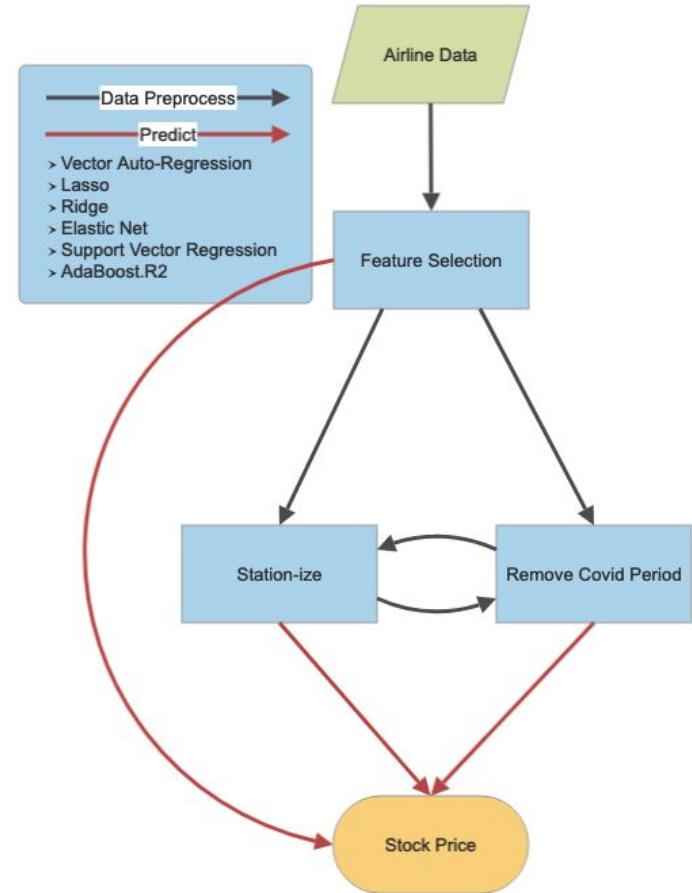
- Linear Regression of flight volume for each airline vs stock price
- July 1, 2011 to Oct 1, 2022
- Not a great fit

UAL - 0.24694112539404844
SKYW - 0.082838889110184
SAVE - 0.10990108007822275
LUV - 0.08108224037494838
JBLU - 0.14440523855237675
HA - 0.08728488711800209
DAL - 0.27294418930458964
ALK - 0.14630063165284546
ALGT - 0.1380974857073537
AAL - 0.186555721912796



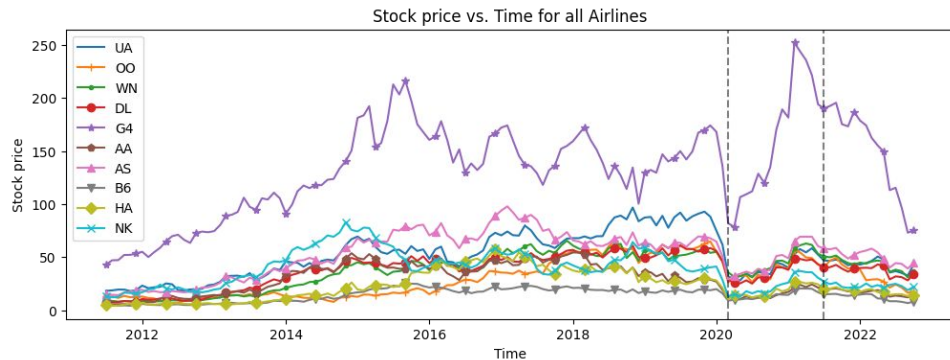
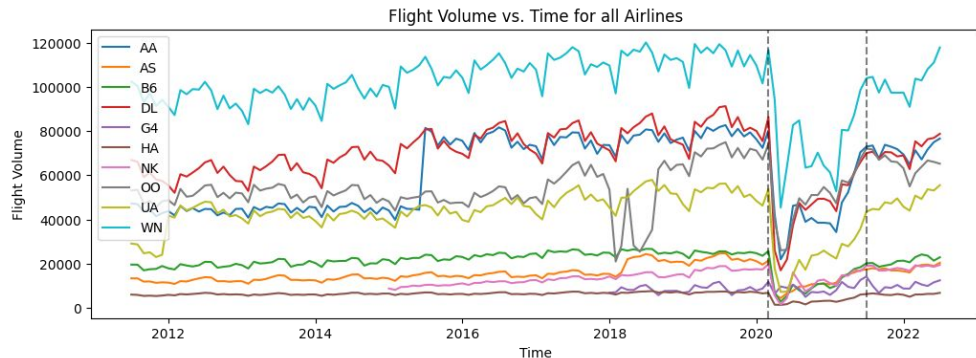
Regression Outline

1. Started the flight data for all 10 airlines.
2. Run feature selection to filter out less impactful features.
3. Preprocess data using different methods.
4. Experimented with different regression models
 - a. Vector Auto-Regression (VAR)
 - b. Lasso, Ridge, Elastic Net
 - c. Support Vector Regression
 - d. AdaBoost.R2



Data and Regressions

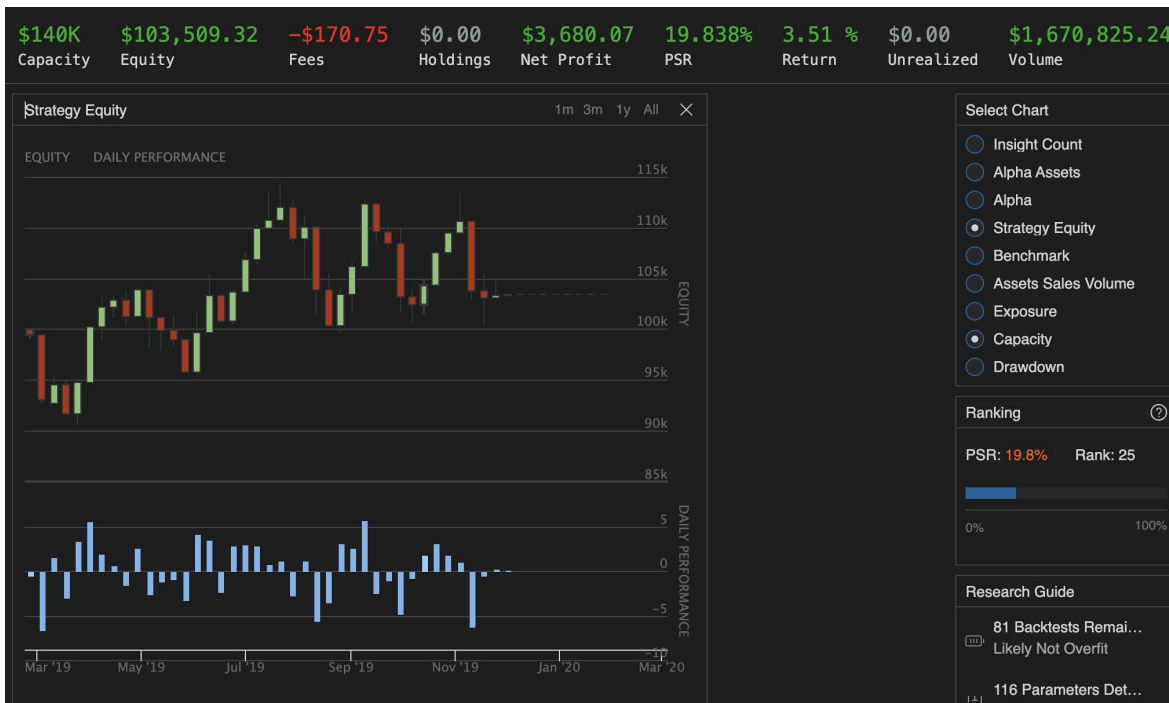
- **Principal component analysis:** arrival flights, carrier count, and national airspace system delay explains much of the variance.
- **Preprocessing**
 - Remove Covid period.
 - Make time-series stationary.
 - Remove Allegiant Air (G4).
- **Best model:** VAR(13) on relevant features and stock price.



VAR model trained on no-COVID, stationary flight data



Results on Quant Connect



- Backtested from April 4, 2019 to Feb 2, 2020
 - Started off initially with a balanced portfolio of equal weights.
- Looked at our models predictions and purchased stocks that were predicted to go higher the following month.
 - Sold stocks the following month at a profit, and continued to follow this trend or purchasing and selling following predicted prices.
- **10 Month Period: 3.5% Return**

Summary of Predictions

PSR	19.838%	Sharpe Ratio	0.269
Total Trades	42	Average Win	2.48%
Average Loss	-2.28%	Compounding Annual Return	3.810%
Drawdown	12.900%	Expectancy	0.095
Net Profit	3.509%	Loss Rate	48%
Win Rate	52%	Profit-Loss Ratio	1.09
Alpha	-0.076	Beta	0.925
Annual Standard Deviation	0.163	Annual Variance	0.027
Information Ratio	-0.642	Tracking Error	0.134
Treynor Ratio	0.047	Total Fees	\$170.75
Estimated Strategy Capacity	\$140000.00	Lowest Capacity Asset	AAL VM9RIYHM8ACL

Summary

- Algorithm/Model makes both good and bad predictions.
 - Good
 - Hawaiian, Southwest from June 2019 to July 2019
 - Bad
 - United Airline from May 2019 to June 2019
- Win Rate of 52%, Loss Rate of 48%

+ 2019-05-01 10:00:00	UAL	Buy Market	Fill: \$89.56 USD	3 Filled	
+ 2019-06-01 10:00:00	ALK	Sell Market	Fill: \$57.063207188 USD	-5 Filled	Liquidated
+ 2019-06-01 10:00:00	SKYW	Sell Market	Fill: \$57.859696456 USD	-5 Filled	Liquidated
+ 2019-06-01 10:00:00	UAL	Sell Market	Fill: \$77.38 USD	-3 Filled	Liquidated

+ 2019-06-01 10:00:00	HA	Buy Market	Fill: \$24.55871212 USD	19 Filled	
+ 2019-06-01 10:00:00	LUV	Buy Market	Fill: \$46.91825376 USD	10 Filled	
+ 2019-07-01 10:00:00	HA	Sell Market	Fill: \$27.16462048 USD	-19 Filled	Liquidated
+ 2019-07-01 10:00:00	LUV	Sell Market	Fill: \$51.10272693 USD	-10 Filled	Liquidated

Next Steps

- Optimize portfolio
 - Implement a long-bias, such as 130/30
 - Incorporate rebalancing algorithms to maximize Sharpe ratio
- Backtest over a longer period
- Experiment with dummy variables for recessions to mitigate effects of past economic downturns
- Explore other data sources (e.g. ADS-B)
- More diligent considerations for fixing COVID period data.

Thank you!