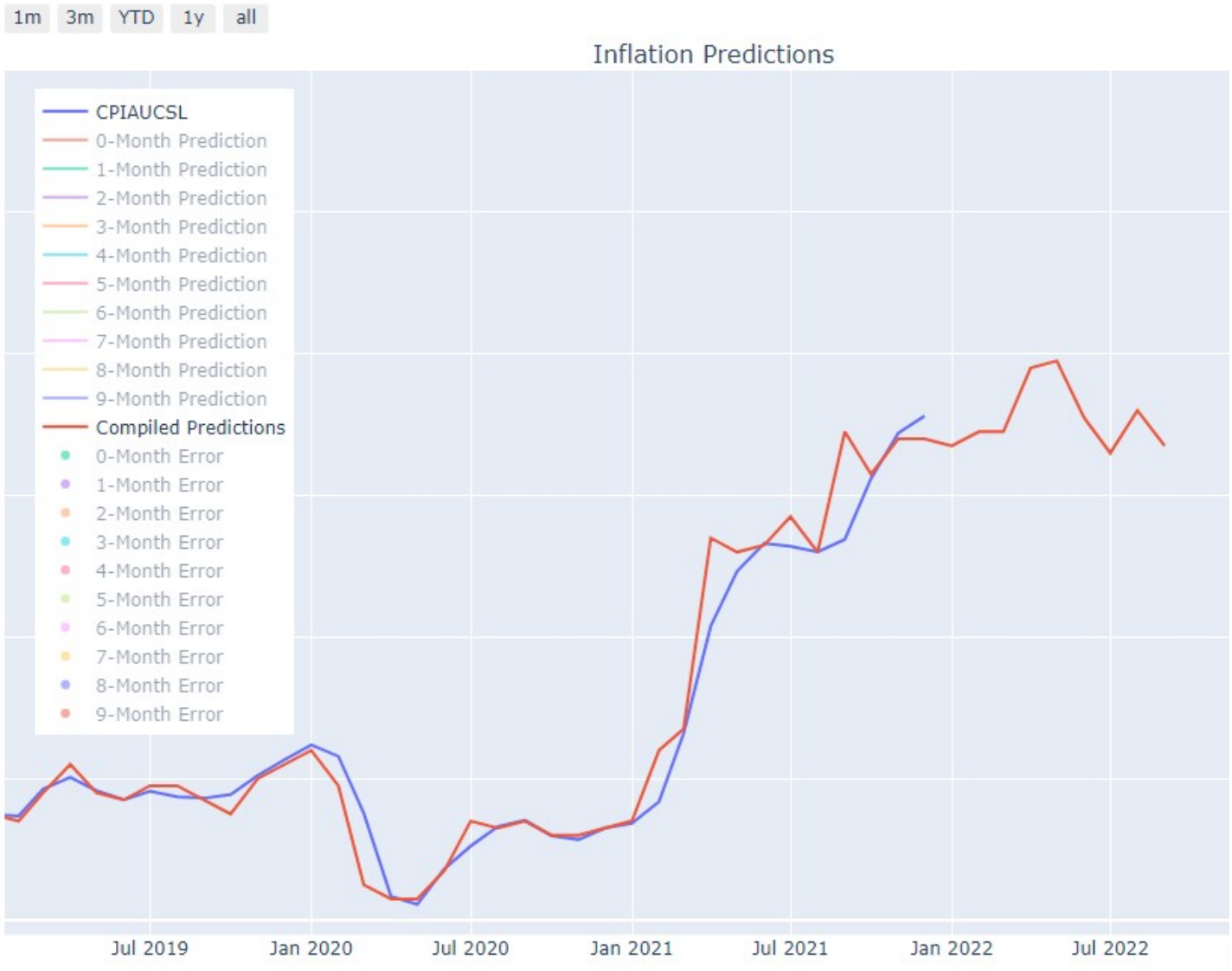
Darius Taheri

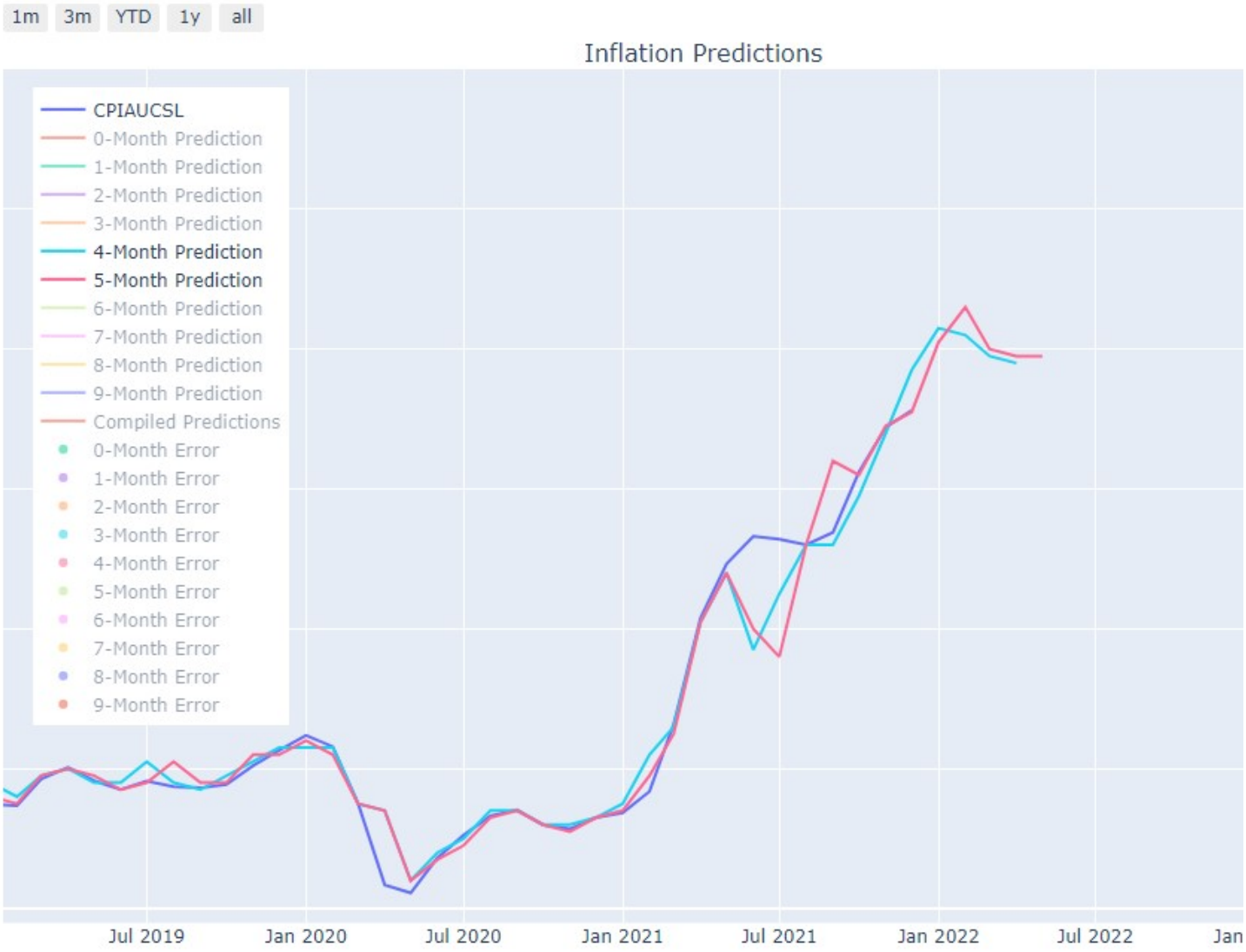
From: Taheri, Darius <Darius.Taheri@franklintempleton.ca>
Sent: Wednesday, February 2, 2022 1:03 PM
To: Darius Taheri
Subject: FW: Inflation: A Spring Time Affair?

While trying to understand our current inflationary environment, I produced a decision tree ML model that has been able to forecast inflation with a stable accuracy up to 9 months. I chose a decision tree algorithm because of its proven track record of versatile predictive power while providing sufficient granularity on how the inputs and their values affected the model (feel free to reach out if you're interested in learning more about the model and how it works).

The model output is US CPI will peak sometime in April or May before starting to normalize in the summer which indicates inflation fears will most likely be a material market driver until Q2 2022. This seems to be the consensus forecast for inflation, so this gives me confidence to go along with that view.



What's interesting is when looking at forecasts made with data from mid 2021 such as the 4- and 5-month forecasts, the model forecasts inflation to reach higher levels at a faster pace than forecasts based on more recent data. I can't help but wonder if the Fed saw something similar which caused them to become more hawkish in Q3/Q4 2021. Either way, this shows the factors affecting inflation in the summer of 2021 started to roll off during the second half of the year.



Overall, the model's accuracy was stable across the prediction curve with the predicted values being off by +/-0.4% YoY on average.

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---Running XgBoost Model---
0-Month Forecast RMSE: 0.0029
1-Month Forecast RMSE: 0.0032
2-Month Forecast RMSE: 0.004
3-Month Forecast RMSE: 0.0041
4-Month Forecast RMSE: 0.0039
5-Month Forecast RMSE: 0.0037
6-Month Forecast RMSE: 0.0041
7-Month Forecast RMSE: 0.0039
8-Month Forecast RMSE: 0.0042
9-Month Forecast RMSE: 0.004
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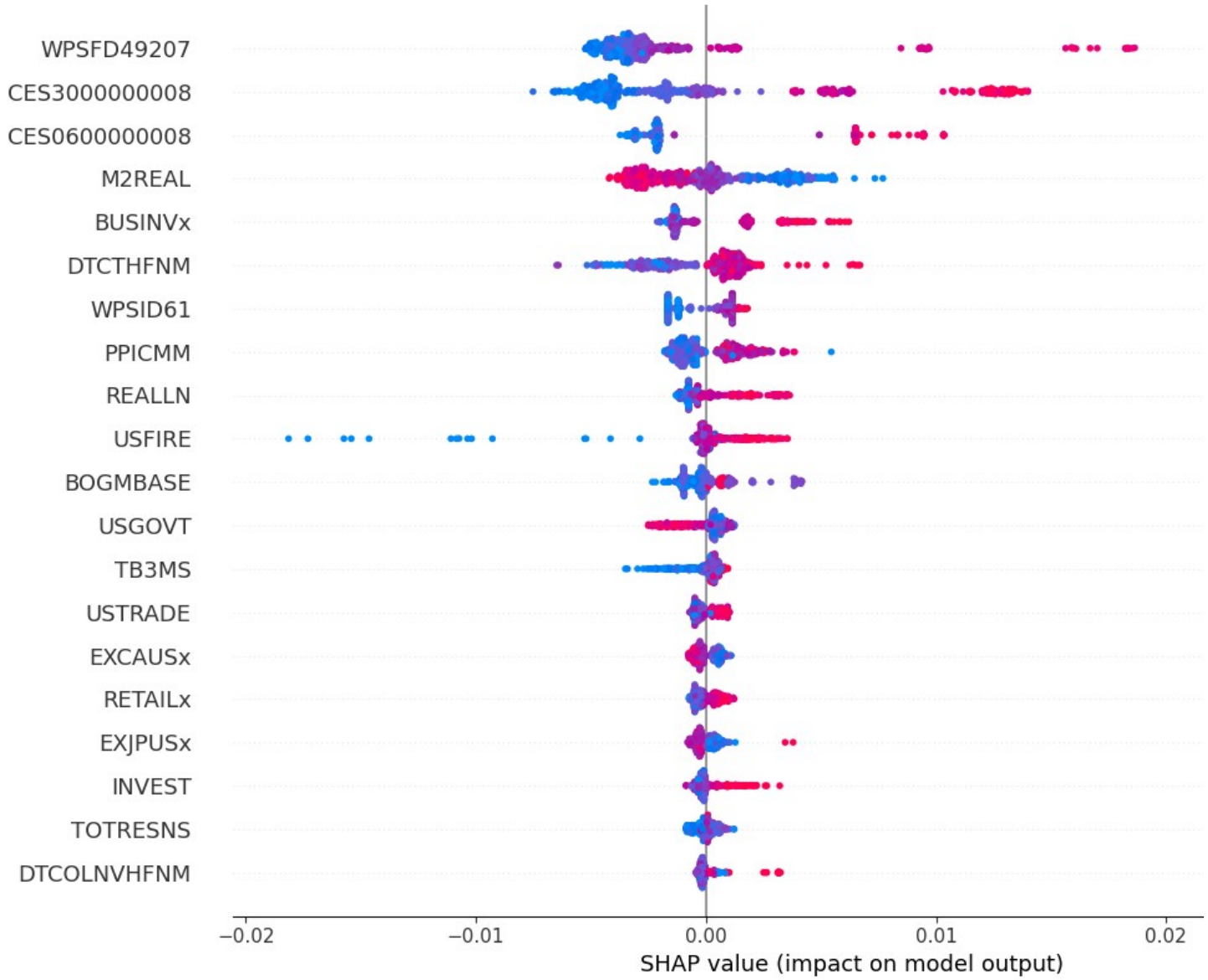
After doing the appropriate transformations, the most important factors for forecasted inflation (beyond the T+0 prediction) are listed below. I think it's important to keep these factors in mind since their impact may provide a valuable insight into future inflation even though their immediate market effect may be less pronounced.

Feature Code	Feature Name	% Contribution to CPI	Contribution to CPI
WPSFD49207	PPI: Finished Goods	15.27%	0.555%
CES3000000008	Avg Hourly Earnings : Manufacturing	13.08%	0.475%
CES0600000008	Avg Hourly Earnings : Goods-Producing	9.78%	0.356%
M2REAL	Real M2 Money Stock	5.91%	0.215%
BUSINVx	Total Business Inventories	4.93%	0.179%
DTCTHFNM	Total Consumer Loans and Leases Outstanding	4.44%	0.162%
WPSID61	PPI: Intermediate Materials	3.19%	0.116%
PPICMM	PPI: Metals and metal products:	3.14%	0.114%
REALLN	Real Estate Loans at All Commercial Banks	2.52%	0.092%
USFIRE	All Employees: Financial Activities	2.39%	0.087%
BOGMBASE	Monetary Base	2.01%	0.073%
USGOVT	All Employees: Government	1.96%	0.071%
TB3MS	3-Month Treasury Bill:	1.30%	0.047%
USTRADE	All Employees: Retail Trade	1.17%	0.042%
EXCAUSx	Canada / U.S. Foreign Exchange Rate	1.16%	0.042%
RETAILx	Retail and Food Services Sales	1.13%	0.041%
EXJPUSx	Japan / U.S. Foreign Exchange Rate	0.99%	0.036%
INVEST	Securities in Bank Credit at All Commercial Banks	0.92%	0.033%
TOTRESNS	Total Reserves of Depository Institutions	0.86%	0.031%
DTCOLNVHFNM	Consumer Motor Vehicle Loans Outstanding	0.70%	0.026%

One thing to highlight is forecasted inflation has a greater sensitivity to these inputs from higher values than lower values. For instance, forecasted inflation will be more sensitive to a 2% YoY increase of Hourly Manufacturing Earnings than an equivalent decrease (except for Real M2 Money Supply which looks to be even).

(note: these are the most important factors for the 6 month forecast. The factors change depending on the forecasted date, but 6 months seems to capture the most common factors across different forecast periods).



As with all models this is based on past US economic data and by no means can predict or factor in unforeseen risks (for example a Russian financial crisis sparking the collapse of LTCM) but can be valuable to us in formulating future inflation expectations with the information we have today.

Darius Taheri, CFA
Trader
Franklin Bissett Investment Management
Franklin Templeton
1940, 335 8 Ave SW, Calgary, AB T2P 1C9

tel +1 (403) 543-4722
darius.taheri@franklintempleton.ca

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