

ANALYSIS ON FACTORS AFFECTING CANADIAN DOLLAR Madhur Chopra, Simranjit Singh Bhatia, Udit Gupta

Motivation and Background

Predicting exchange rates is not an easy task as some experts may suggest. Many factors combined contribute towards the fluctuations of the exchange rate; economic fundamentals are only a part of the whole equation. There are a number of different methods for predicting exchange rates, likely because none of them have been proven to be better than the other. This speaks to the difficulty of generating a quality forecast. Our motivation for predicting future trends in the CAD-USD exchange rate was arisen from the above specified scenario.

Problem Statement

- Examine which factors affect the value of the Canadian dollar i.e. inflation, population, commodities, stock prices, housing price.
- Which factors have maximum influence and what kind of correlation do they have?
- Build a model to predict the future CAD-USD exchange rate.
- Explore which currency has the strongest correlation with the CAD.

Data Processing Pipeline

1. Data Collection:

- Data is gathered for years ranging from 1990 2016. 20 features were selected:
- O World Bank:
 - Metals(\$US/lb): Gold, Silver, Nickel, Copper, Aluminum, Zinc, Led, Potash
 - Forestry(\$US/tonne): Pulp, Lumber, Newsprint
 - Fish: Finfish, Shellfish
 - Agriculture(\$US/100lb): Potatoes, Cattle, Wheat, Barley, Corn, Hogs, Canola
 - Energy: Coal, Oil, Natural Gas
- o Bank of Canada: Lending Rate, Deposit Rate
- o Worldometers: Population, Migrants, World Population, Urban Population
- o World Bank: Exports, GDP, Imports (\$US in millions)
- o Inflation.eu: Inflation
- o Investing.com: CAD US, AUS US, GBP US, CNY US, EUR US, JPY US

2. <u>Feature Engineering</u>

- o Data Integration: Date/Year is used to join data from various sources
- o Missing Values: Data had different intervals
- o Population Yearly, Exports/Imports Monthly, Currency Daily
- o Interpolation technique was used to fill the missing values after join
- \circ Scaling: MinMaxScaler was used to bring the features in the range of (0,1)



rear	Pop	ulation	Year	Month	Inflation Rate	Date	CAD_US Exchange Rate
	2017	3,66,26,083	1990			19900102	0.8619203586
	2016	3,62,86,378	1990		5.46%	19900103	0.8618460743
	2015		1990		5.30%	19900104	0.8611780916 0.8614748449
		3,59,39,927	1990			19900103	0.8619946556
	2010	3,41,26,173	1990	May	4.42%	19900109	0.8616232983
	2005	3,22,56,333	1990		4.11%	19900110	0.8634087377
	2000	3,07,01,903	1990		4.1196	19900111	0.8651267411
	1995	2,92,99,478	1990		4.2396	19900112	0.8641548566
			1990	Oct	4,7496	19900115	0.858885167
	1990	2,76,62,440	1990	Nov	5.12%	19900116	0.8593280055 0.8580744809
	1985	2.58.48.173	1990		4.99%	19900117	0.8580744809
	1980	2,45,15,788	1991		0.91%	19900119	0.8449514153
	1975	2.31.40.609	1991		0.22%	19900122	0.8478168716
			1991		6.19%	19900123	0.8479606546
	1970	2,14,39,200		May	6.16%	19900124	0.8437394533
	1965	1.96.93.538	1991		6.27%	19900125	0.8413967186
	1960	1,79,09,232	1991		5.99%	19900126	0.8363301832
			1991		6 0000	19900129	0.8413967186
						19900130	0.8419634588
	1955	1,57,33,858	D_US Exch	NTERP	OLATION Inflation	Populat 27	
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	1955	Date 19900102 19900103 19900104 19900105 19900108	D_US Exch 0 0 0 0	NTERPO ange Rate .861920358 .861846074 .861178091 .861474844 .861994658 .861623298	OLATION	Populat 27 27663697.3 27664954.6 27666211.9 27667469.3 27668726.6	lon 552440 556528 513057 769585 026114 282642
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	1955	Date CA 19900102 19900103 19900104 19900105 19900109	D_US Exch	NTERP 861920356 861846074 861178091 861474844 861994656 8661623298 863408737	OLATION e Inflation 96 0.055 33 0.0549818182 16 0.0549636304 99 0.0549454545 66 0.0549272727 33 0.0549999999 77 0.05489099991 11 0.0548727273	Populat 27663697.3 27664954.6 27666211.9 27667469.3 2766983. 27669983. 27671241.2	lon 552440 556528 513057 769585 026114 282642 953917 795699
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 $X_{std} = (X - X.min(axis=0)) / (X.max(axis=0) - X.min(axis=0))$

3. Feature selection

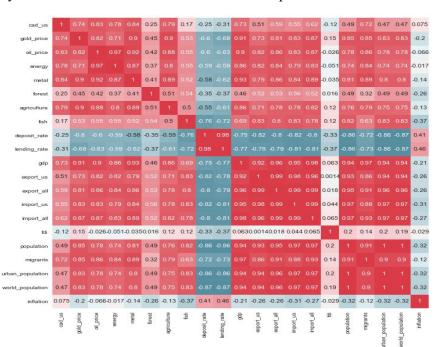
o Features which were highly correlated between themselves were removed.

 $X_{scaled} = X_{std} * (max - min) + min$

o Features which were highly correlated to the Canadian Dollar were kept.

Features Removed:

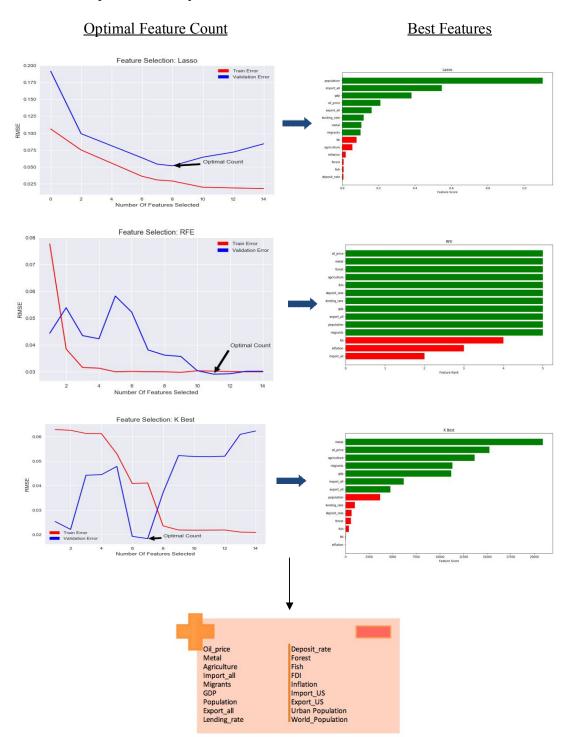
Urban Population
World Population
Gold_Price
Energy
Export_US
Import_US



Used different feature selection methods: Lasso, K-Best and RFE



o Combined the outputs do identify the best features

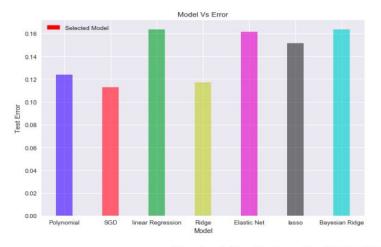


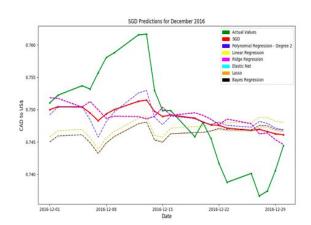
o Finally 9 out of 20 features were selected and considered to be the most influential ones: oil, metal, agriculture, imports, migrants, gdp, population, exports and lending rate.



Model Training

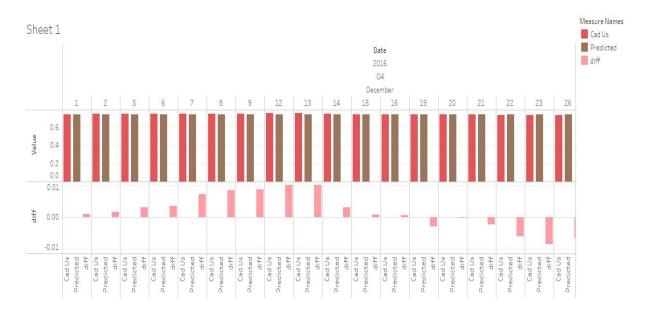
- Various regression models were trained on the features selected
 - Polynomial, SGD, Linear Regression, Ridge, Elastic Net, Lasso, Bayesian
- o Training Data: January 1990 to December 2014
- o Validation Data: January 2015 to November 2016
- Predictions were made for December 2016





The best Predictions for CAD-USD exchange rate was given by SGD

o Below Graph shows difference in actual and predicted values for each day in December 2016:



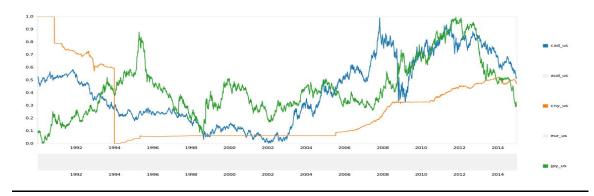
Correlation with Other Currencies

o Canadian Dollar shows high correlation with Euro and Australian Dollar:

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Low correlation with Chinese and Japanese Yen:



Data Product

- 1. The 9 most influential features on CAD_US exchange rate: oil, metal, agriculture, imports, migrants, gdp, population, exports and lending rate.
- 2. Predictions made on December 2016 CAD US exchange rates.

Conclusion and Learning

- 1. Feature selection should not be left to a single feature selection technique. We should apply multiple feature selection techniques for selecting features for insightful results.
- 2. For time series data, it is necessary to capture the current trends and thus model should be trained with the most recent data available along with the historical data.
- 3. Canadian Dollar, European Euro and Australian Dollar are highly correlated whereas Japanese Yen and Chinese Yuan have no correlation with the Canadian Dollar.

Summary

- From our analysis, factors which have the most influence on the Canadian Dollar are: Oil Price, Metal, Agriculture, Import, Migrants, GDP, Population, Exports, Lending Rate.
- o Prediction of Canadian Dollar is not easy based on the training from the past data, however training the model on recent data produced better predictions.
- More confidence can be introduced by combining the project with other factors that influence exchange rates like - sentiments.