# Generate Feature-Set for Forex rate

# Abstract

In this paper we have discussed on the factors affecting forex rate and the sources which gives us the intimation about these factors. We are using these factors for creating the model which predict the forex rate. This research will help the investors who are trading on forex and multinational organization trading in various currencies. Here we are using selected economical sections of various online newspapers to extract daily news and multiple twitter handles to fetch media opinion on the factors which effect Forex rates.

Twitter is a popular online social network where users can share their opinions. It is also an instrument to measure social events, and each day millions of people tweet to express their opinions across any topic.

# Factors affecting foreign exchange rate

There are multiple factors which are affecting the foreign exchange rate, we have listed some of the key factors. We have identified and used these factors in our predictive model.

### 2.1 Terms of Trade

Related to current accounts and balance of payments, the terms of trade are the ratio of export prices to import prices. A country's terms of trade improves if its exports prices rise at a greater rate than its imports prices. This results in higher revenue, which causes a higher demand for the country's currency and an increase in its currency's value. This results in an appreciation of exchange rate.

### 2.2 Public Debt

Country’s balance of payments and debt between imports and exports, and debt and foreign investments. If a country is spending more on imports than it gets from exporting goods and services, more money is going out of the economy which often results in the currency depreciating in value. In addition, countries with higher amounts of debt are less likely to obtain foreign capital which means that they will have to inject more money into the economy by raising inflation levels.

### 2.3 Interest Rates

The interest rates of an economy are determined exclusively by the Central Bank (FED in US). When the interest rates of a Forex currency are increasing, that means that more investment funds are attracted and buy that currency in order to achieve higher interest return. On the other hand, when interest rates are decreasing a Forex currency is less attractive to investment funds and thus it is expected to fall against other currencies.

Interest Rates Correlation

1) When Interest Rates ↑ then the Forex Currency ↑

2) When Interest Rates ↓ then the Forex Currency ↓

### 2.4 Economic Growth (GDP)

Economic growth which is measured by GDP change (%) is a key factor determining the demand of a Forex currency. High growth means that an economy is doing well, especially if growth is accompanied by relative low inflation. Usually, growth more than 2.5% is followed by high inflation. Additionally, high growth means low unemployment and higher national income, in other words, high growth means higher consumer spending.

Following are some of the important factors that affect the economic growth of a country:

1. Human Resource:

Refers to one of the most important determinants of economic growth of a country. The quality and quantity of available human resource can directly affect the growth of an economy.

1. Natural Resources:

Affect the economic growth of a country to a large extent. Natural resources involve resources that are produced by nature either on the land or beneath the land. The resources on land include plants, water resources and landscape.

1. Capital Formation:

Involves land, building, machinery, power, transportation, and medium of communication. Producing and acquiring all these manmade products is termed as capital formation. Capital formation increases the availability of capital per worker, which further increases capital/labor ratio. Consequently, the productivity of labor increases, which ultimately results in the increase in output and growth of the economy.

1. Technological Development:

Technology involves application of scientific methods and production techniques. In other words, technology can be defined as nature and type of technical instruments used by a certain amount of labor.

1. Social and Political Factors:

Play a crucial role in economic growth of a country. Social factors involve customs, traditions, values and beliefs, which contribute to the growth of an economy to a considerable extent.

 Economic Growth Correlation

1) When GDP ↑ then the Forex Currency ↓

2) When GDP ↓ then the Forex Currency ↑

### 2.5 Recession

When a country experiences a recession, its interest rates are likely to fall, decreasing its chances to acquire foreign capital. As a result, its currency weakens in comparison to that of other countries, therefore lowering the exchange rate.

### 2.6 Inflation Rates

The inflation rate of an economy has a very strong impact on the value of Forex currency. When the level of prices increases in an economy, each unit of a currency can buy fewer goods and services, and thus the purchasing power of money is decreasing and consequently the real value of the domestic currency is decreasing too. On the other hand, lower inflation increases the purchasing power of money and the real value of a domestic currency is increasing against foreign currencies.

Measures of Inflation rate are:

1. Inflation based on Consumer Price Indices (CPI)
2. Inflation based on Wholesale Price Index (WPI):
3. Global Commodity Prices (based on the World Bank Pink Sheet data)

Inflation Correlation

1) When Inflation ↑ then the Forex Currency ↓

2) When Inflation ↓ then the Forex Currency ↑

### 2.7 The Rate of Unemployment

At periods when unemployment increases the jobless workers have less income to spend on goods and services and consequently the overall consumer spending is decreasing. Additionally, higher unemployment results to lower consumer confidence and lower expectations about the future economic growth and consumer spending.

Unemployment Correlation

1) Unemployment ↑ then the Forex Currency ↓

2) When Unemployment ↓ then the Forex Currency ↑

### 2.8 Political stability

Political stability is a very important factor regarding the future value of a Forex currency. Political uncertainty increases the risk of an economy and furthermore it reduces the consumer and the investor confidence. When there is no political stability the potential of future economic growth is jeopardized. Furthermore, in periods of global political uncertainty investors are after “Safe-Heavens”. That means that they will exchange weak currencies for strong currencies like US dollar or Euro.

Major economic decisions taken by government would also impact the forex currency.

Political Stability Correlation

1) Political Stability ↑ then the Forex Currency ↑

2) Political Stability ↓ then the Forex Currency ↓

### 2.9 Central Bank Actions / The Monetary Policy

The monetary policy and the strategy of the Central Bank of a state can determine in a high extend the current and future value of a Forex Currency. As it is already mentioned a Central Bank may interfere by maneuvering interest rates, but also in many other ways. For example an intervention may involve the purchasing of domestic bonds (i.e. the European Central Bank during 2011-2012).

**What are the factors that affect the effectiveness of monetary policy?**

<https://www.sciencedirect.com/science/article/abs/pii/0304393281900167>

* Independence of the central bank from political influence. Full policy independence is essential.
* Clarity of the central bank’s mandate. Should simply concern maintenance/management of the purchasing power of the currency consistent with equilibrium in the labor market, with prohibition of direct monetary financing of the government.
* Quality and integrity of the people making the monetary policy decisions within the central bank.
* If the exchange rate of the currency is determined by free market forces, the scope and effectiveness of monetary policy is less restricted than if the authorities are trying to manage the exchange rate at a fixed level.
* The less physical money (notes and coins) in circulation and the more non-physical money (electronic money in bank accounts), the more free the central bank is to create negative nominal interest rates whenever this might be appropriate to ward off any deflation threat during recession/depression.
* Monetary policy in a large “closed” economy (in terms of trade and capital flows) tends to be less compromised by monetary policy and conditions in the rest of the world than would be the case in respect of monetary policy in a small “open” economy.
* The effectiveness of monetary policy is also influenced by the extent to which local financial markets are both liquid and deep.

### 2.10 Market factors

Market factors may affect also the value of a Forex Rate. For example, when the price of **oil goes up, oil-exporting currencies are moving higher against oil-importing currencies**. Countries like Norway, Russia and Canada are affected highly by the market prices of energy commodities and thus their currencies are reflecting and incorporating those price changes very quickly.

### 2.11 Commodity prices

Countries, such as Australia, that are large exporters of raw materials are affected by movements in commodity prices. When commodity prices rise, countries who export heavily are likely to see their currency rise as they are getting more money in exchange for goods. The opposite is true of countries who are large importers of commodities, such as China. Higher import costs mean the cost of manufacturing becomes higher and profit margins are squeezed.

### 2.12 Natural disasters

Serious natural disaster may disturb the growth potential of a country or even increase the amount of government debt. Furthermore, if a natural disaster has a strong impact on the growth potential of an economy it is likely that the Central Bank will decrease the level of interest rates in order to achieve faster recovery. Natural disasters have an unfavorable impact to domestic currency valuation.

### 2.13 Currency Speculation

Currency speculation can affect highly the real value of a Forex currency. Large institutional speculators (i.e. hedge funds) have the power to bet against a particular currency aiming profits.

### 2.14 Agriculture and Food Management

Production of food-grain impact the economy and import export of the country: the total production of rabi and kharif food grains are based on.

* Rainfall: The actual rainfall received
* Procurement: Total Procurement of food grains.
* Grain Stocks: Total stocks of rice and wheat held by FCI.

# 3. Data Extraction

We have extracted the information about above factors from online newspapers and twitters feeds. This process of news extraction from twitter has been discussed in below section.

## 3.1 Twitter Application Programming Interface (API)

Twitter provides a very rich [REST](http://en.wikipedia.org/wiki/Representational_state_transfer) API for querying the system, accessing data, and controlling your account. It is a tool that makes the interaction with computer programs and web services easy. Many web services provide APIs to developers to interact with their services and to access data in programmatic way. This API provided free access for the first month and enable us to extract 3000 tweets per day.

### Step 1: To get the Twitter API Keys

* Go to <https://apps.twitter.com/> and log in with your twitter credentials.
* Click "Create New App".
* Fill out the form, agree to the terms, and click "Create your Twitter application"
* In the next page, click on "API keys" tab, and copy your "API key" and "API secret".
* Click "Create my access token and copy your "Access token" and "Access token secret".

### Step 2: Connecting to twitter streaming API:

We will be using a Python library called Tweepy to connect to Twitter Streaming API.



### Step 3: Get home timeline:

First, we connect to twitter streaming using step 2, if you want your home timeline uses below script and generated output file is “home\_timeline.json”.

  **Output File**

### Step 4: Get user timeline

Get user timeline data is dependent on twitter auth file which we are generating in step 2. This file contains the authentication keys.

Run get\_use\_time\_line.py script as pass the username( Newspaper name “livemint” ) through the command line argument. It’s will generate output file is “user\_timeline\_livemint.json”

** Output File**

### Step 5: Reading JSON data:

The data home\_timeline.json , user\_timeline\_livemint.json is in JSON format. We are converting JSON to CSV format by using below script.

  **Output File**

### Step 6: Extract the complete tweet text:

In the step 4 and 5 we are not getting complete tweet text (means they provided half of tweet and URL link), for complete tweet we are using below script, it runs on each tweet’s URL and extract complete text from the tweet. We are passing the input file that has been generated in step 5 to get\_twitter\_data.py. Here we are getting the complete tweet text data as an output (Content\_Extract\_livemint.csv) it contains (Date, tweet text, metadata, raw text).

  **Output File**

### Step 7: Analyze Indian tweet or news:

We will get all the tweet of a user or page in step 6. Then we find whether a tweet based on India or Not. We are using #(hash) tag and @(targeting keyword) to determine the location of the tweet. Here we are using the Wikipedia API and user location.



## 3.2 Data Extraction from Online Newspapers.

Multiple news papers are publishing online content which keeps on updating on timely manner. We have created a Web Crawler which will crawl through multiple online newspapers and fetch the content. Any newspaper consists of various section, where each news has been categories. For example, “The Economic Times consist of the section like: Markets, News, Industry, Politics, Wealth, Mutual Fund, etc. We have provided few selected sections to be scrapped from each newspaper. It means each online newspaper is following different architecture for publishing the news content, so we have different scripts running for scrapping the news based on specific newspaper.

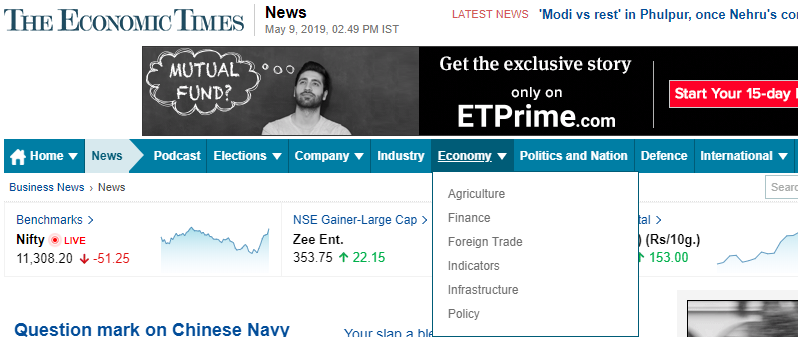
For this research we have considered the newspapers “The Economic Times”, “The Hindu Business Line”, “Live Mint” and “Financial Express”. If any of the factors which affect the forex rate would be coming in news considered by few newspapers but not by others, then by considering multiple newspapers we can increase the chances of occurrence.

### 3.2.1 Web Crawler:

A web crawler (also known as a web spider or web robot) is a program or automated script which browses the web in a methodical, automated manner. Web crawlers are mainly used to create a copy of all the visited pages for later processing by a search engine, that will index the downloaded pages to provide fast searches. Crawlers can also be used for automating maintenance tasks on a Web site, such as checking links or validating HTML code.

We are going to pass the newspapers link as an input to this crawler.

For example: <https://economictimes.indiatimes.com/news>



Crawler will automatically open a browser window and hit this link. Inside this crawler we have defined the underlying structure of the web page and content needs to be clicked. Crawler will click on the categories as well as save the states of crawled pages. From this step we will gather all the text information/ News present on the web page along with the date time information. We are saving this news content along with name of the newspaper and date time information in an external csv file format.

# Feature set generation:

Firstly, we are considering all the factors affecting the forex rate as the main features. Moreover, we need to identify how these factors are varying on daily basis. It means any news which indicates the rise or fall (increase or decrease) information about these features.

Feature generation task has been sub divided into two parts. 1. Feature identification 2. Finding the polarity of identified feature. For feature identification task we are simply matching the string of input with the extracted news. Then on the matched news we are finding the polarity of the matched features. For doing this we are considering 5 words window. This window will check if any intensifier or modifier present in the surrounding of identified feature. This intensifier will help us in identifying the polarity of the feature set. Now we are updating the feature set by including these intensifiers to form the final feature set list.

Resultant is a matrix in which rows contains all the entities that affect the Indian currency and columns contain tweets/news date, if these entities present in the tweets, corresponding to that entities and date we marked as one otherwise zero.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **Date/ Features** | **Increase in wholesale price index** | **Increase in foreign exchange reserves** | **Increase in gdp rate** | **Decrease in interest rate** | **Increase in foreign direct investment** |
| **07/01/2019** | 0 | 0 | 0 | 0 | 1 |
| **07/02/2019** | 1 | 1 | 0 | 1 | 0 |
| **08/01/2019** | 0 | 0 | 1 | 0 | 0 |
| **08/02/2019** | 0 | 0 | 0 | 0 | 0 |
| **09/01/2019** | 0 | 1 | 0 | 0 | 0 |
| **09/02/2019** | 0 | 0 | 1 | 0 | 0 |
| **10/02/2019** | 0 | 0 | 0 | 1 | 0 |
| **11/02/2019** | 1 | 0 | 0 | 0 | 0 |
| **12/02/2019** | 0 | 0 | 0 | 1 | 1 |

## Software Installation:

* Anaconda 3.6
* Tweepy: pip install tweepy
* Urllib: pip install urllib
* Beautiful Soup: pip install beautifulsoup4