Abstract:

Today whole world along with Europe is facing a severe money inflation spike and after 22 years the value of the Euro falls behind the Dollar this year. As the Federal Reserve increased the bank rate, after the Covid-19 pandemic the world is facing a horrible Russia vs Ukraine war impact in every aspect of life like Food, Education, Economy, etc. As a result, we are facing a recession in the upcoming year. We aim to find out the reason behind the inflation and recession by analyzing the public thoughts in the tweeter post.

Introduction:

High inflation rates can indicate an impending recession, as businesses react to higher costs by reducing production and increasing prices. And if the RBI acts in the form of a rate hike to curb rising inflation, there's a risk that the move could help trigger a recession.

According to the Economic Policy Institute, economists' opinions vary on which is worse for an economy, a recession or rising inflation. One common argument is that inflation is worse than a recession because it impacts everyone. By contrast, a recession—and the associated job losses that come with it—may impact a smaller number of people. We employed textual data and machine learning techniques to build new real-time measures of consumers' inflation expectations. First, we selected keywords to identify tweets related to prices and expectations thereof. Second, we built a set of daily measures of inflation expectations around the selected tweets, combining the Latent Dirichlet Allocation (LDA) with a dictionary-based approach, using manually labeled bi-grams and trigrams. Finally, we showed that Twitter-based indicators are highly correlated with both monthly survey-based and daily market-based inflation expectations. Our new indicators anticipated consumers' expectations, proving to be a good real-time proxy, and provided additional information beyond market-based expectations, professional forecasts, and realized inflation. The results suggested that Twitter can be a new timely source for eliciting beliefs.

Inflation:

Inflation is a measure of the gradual, broad increase in prices throughout the economy. It's usually expressed as a percentage, which represents the rate at which the costs of goods and services have increased over the last year. A minimal level of inflation is expected and even encouraged. But it becomes a problem if the inflation rate gets too high. In India, a common measure of inflation is the consumer price index (CPI), a basket of items consumers often purchase. This basket includes food, housing, clothing, transportation, and health care.

Excessive inflation can severely impact the economy. From grocery store prices to gas for your car, high inflation means everyday essentials are becoming much more expensive. As prices rise, consumers have less money to spend on goods and services. People adjust their financial habits, which in the aggregate, can slow down economic growth throughout the economy, potentially leading to higher unemployment. Businesses may see lower demand and higher costs.

Causes of Inflation:

There are several factors:

- **Cost-push inflation** This happens when the prices for the key inputs of goods and service rise, such as raw materials and labor. When companies must pay much more for inputs, they pass on the costs to consumers in the form of higher prices.
- **Demand-pull inflation** When there is too much money and demand chasing too few goods, it can push up inflation. It can be caused by increased government spending or a tax cut that

puts more money into people's pockets. When there is more demand for goods than supply, prices will go up.

- **Inflation expectations** Anticipating future price gains can lead people and businesses to expect higher inflation. As a result, workers may ask for higher wages to offset the increased cost of living—but this loop may create a self-fulfilling prophecy: Fears about inflation deepen the problem.

Recession:

A recession is an economic downturn, typically defined as two consecutive quarters of declining gross domestic product (GDP) growth. Generally, when the economy shrinks for six months or more, it's considered a recession. That said, the official definition of a recession is a bit more involved. In India, the RBI is tasked with judging the starting and ending dates of recessions. Its recession definition is a "significant decline in economic activity spread across the economy," lasting more than a few months, as seen in the data for GDP, income, employment, industrial production, and sales. During a recession, unemployment rates increase, wages may stagnate, and people usually have less money to spend. Those factors mean there is less demand for goods and services, which can further hurt the economy.

Reasons for Recession:

Recessions are caused by the following developments:

- **Decreased consumer spending** When people have less money to spend, they purchase fewer goods and services. This decreased demand can lead to businesses reducing production, which leads to layoffs and increased unemployment.
- **Increased business costs** Businesses may be forced to raise prices to offset higher costs, such as the cost of materials or labor. This can lead to inflation and decreased consumer spending.
- **Reduced lending** When banks are reluctant to lend money, it can impact businesses' ability to expand or invest in new projects. This reduced lending can lead to a decrease in economic growth.
- **Stock market declines** A decrease in stock prices can contribute to a recessionary environment by reducing the wealth of individuals and businesses. This can lead to less spending and investment, further slowing the economy.

Why Twitter:

- 5 million Tweets
- 1 June 2020 – 11 November 2022
- Full text and the meta-data (i.e. users' bio, ReTweets, # of followers, geo-localization, etc.)
- Tweets contain one or more of the keywords on inflation/deflation (rough initial dictionary)
- Private API, Historical Power Track (HPT)
- Tweets reflect info on current or future prices
- They can be inputs to the expectations formation process

Data Acquisition

To analyze people's sentiments, we use the message data from the social networking site Twitter. To build our database, firstly, we created an initial dictionary containing keywords relative to inflation and deflation as well as some corresponding topic words. Then we acquired the tweets data through the academic API of Twitter. Figure 1 shows a basic description of the frequency of the words in tweets we derive, from which we can see that besides inflation, which is the topic, people are also caring about wages, politics, economic circumstances, and results of inflation when the price level reaches the peak and votes.

Fig1 Keywords about inflation

Data Preprocessing

For Twitter data, there are frequently four components in the tweets: users, links, topics, and texts. Therefore, regarding each part, we applied different approaches to process the raw tweet data.

1. users: the usernames in tweets are started with'@', so we just change the username to '@user' to avoid the potential effects brought by the positive/negative words in usernames.
2. links: some tweets contain links starting with 'HTTPS', and the words in the links may contain words with sentiments, so to eliminate noises, we will convert all the link strings to 'HTTPS'.
3. topics: the topics in the tweets start with'#'. However, topic words are often components of whole sentences. Therefore, when dealing with the topic, we just drop the'#' and keep the topic words
4. text
    - punctuation: we simply eliminate punctuation from the tweets, even though we may suffer from loss of information carried by certain punctuation such as "!"
    - stop words: eliminate the stop words such as ' a, 'and' and 'the' which can appear in high frequency but have little impact on the sentiment.

When we take many data, we find some keywords that give us important data about inflation and recession. Fig2 indicates the keywords for many data.

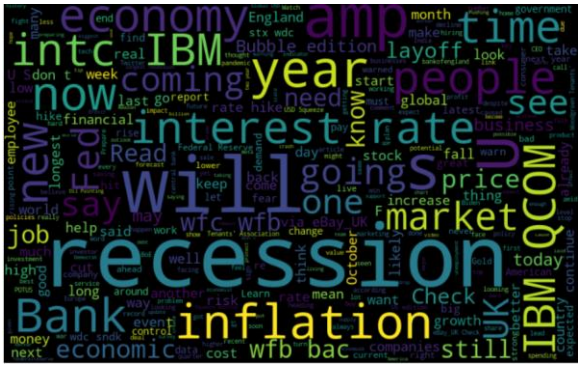

Fig2 Keywords about recession.

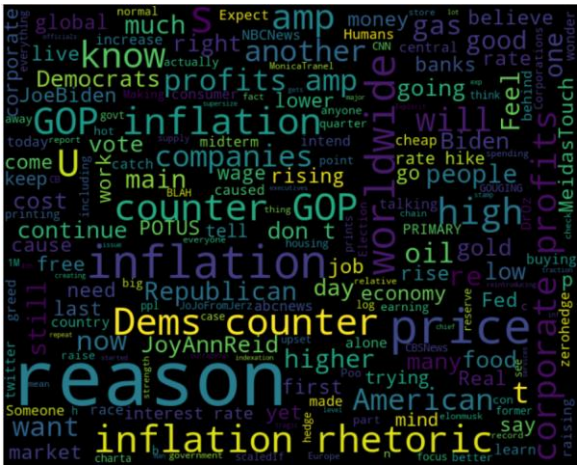

Fig3 Reasons for Inflation

As earlier mentioned, there are a lot of reasons for inflation and recession, we find that the public sentiment is mostly neutral, and in this case, the subjectivity is between 0,2 to 0,6. The scatter plot in Fig4 depicts the overall idea.

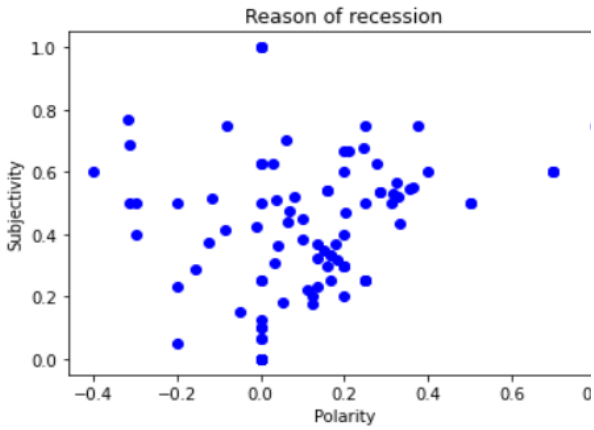

Fig4 subjectivity vs polarity of recession and inflation

After getting the subjectivity we have focused on the public sentiment analyzing the twitter data we find that three significant impacts are neutral, growing up(positive), and growing down (negative). The bar chart in Fig5 and the pie chart in Fig 6 pictorially show the public sentiment.

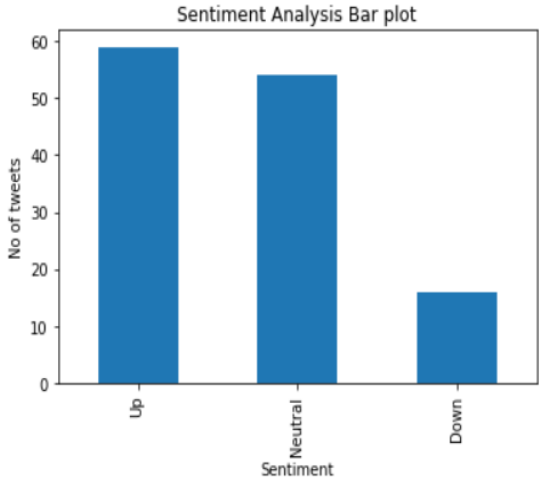

Fig 5 Sentiment Analysis

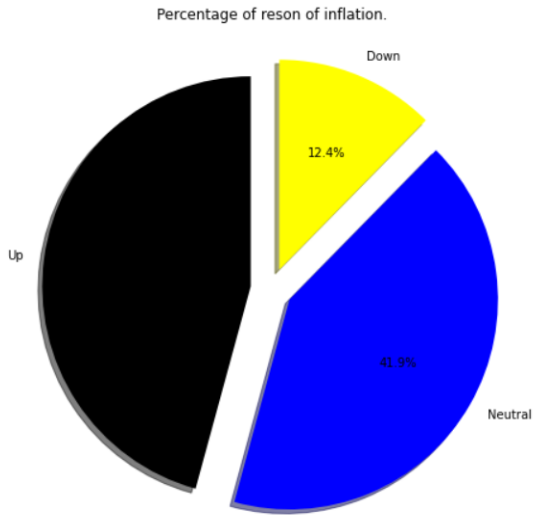

Fig6 Sentiment Analysis

Data selection

- **Neutral:** Prices, cost of living
- **Up** expensive bills, inflation, expensive, high prices, high-prices, high gas prices, higher bill, higher rents, high gasoline price, high oil prices, high gas bills
- **Down:** deflation, disinflation, sale(s), less expensive, less expensive bills

Our Findings

We find that our Twitter-based Indicators convey meaningful high-frequency signals on inflation expectations.

- Our Twitter-based Inflation Expectation indexes are significantly correlated with both survey-based and market-based measures.
- Our Twitter-based indexes are also informative, i.e., they convey additional predictive power both in-sample and out-of-sample.
- Our results are similar when we concentrate on a subset of Twitter users who are interested in economics (Econ) or work in the press (News). The suggested procedure is easily applicable to different countries and languages

Overall, we find the sentiment on the base of polarity analysis was mostly negative. The result is given below:

	Tweets	Time Stamp	Filtered Tweets	Subjectivi
489	Manufacturing should be back to normal, but ma...	2022-11-07 14:05:29	Manufacturing should be back to normal, but ma...	0.2388
134	USA all are suffering due to #inflation. We ca...	2022-11-07 16:32:34	USA all are suffering due to inflation spike. ...	0.3875
260	You mean #CPI higher than 8.2% YoY?\n\I think t...	2022-11-07 15:44:24	You mean higher than 8.2% YoY?I think that th...	0.4375
153	What if.....#China is stalling on re-opening, to...	2022-11-07 16:24:09	What if..... is stalling on re-opening, to cause...	0.4500
383	The bank had about 18,000 loans in its retail ...	2022-11-07 14:58:30	The bank had about 18,000 loans in its retail ...	0.2944

After vector analysis of the data, we apply a logistic regression that determines the accuracy of predicting the data in percentage. We also get a confusion matrix that depicts the overall scenario of Twitter users' sentiment about inflation. The data is given below:

```
The accuracy is around: 57.69%
```

```
[24] print(confusion_matrix(y_test, logreg_pred))
     print("\n")
     print(classification_report(y_test, logreg_pred))

[[0 2 2]
 [0 7 2]
 [0 5 8]]


              precision    recall  f1-score   support

        Down       0.00      0.00      0.00         4
     Neutral       0.50      0.78      0.61         9
          Up       0.67      0.62      0.64        13

    accuracy                           0.58        26
   macro avg       0.39      0.46      0.42        26
weighted avg       0.51      0.58      0.53        26
```

Conclusion

In this paper, we conduct a thorough investigation into the methodology of sentiment analysis (SA) and systematically categorize the approaches applied in the sentiment analysis domain. Based on the literature review which contains all sorts of practices in the SA field, we develop our methodology to tackle our mission of SA on inflation after Covid-19. We explored the topic via Twitter comments. During the preliminary analysis of the data gathered, we withdraw fundamental features from the Twitter comment such as geographical distinction and highly correlated keywords. From the google trend index data, we observe evident annual cyclical phenomenon and inter-country distinction in terms of index magnitude. Based on the market-oriented treasury inflation curve, we uncover similar trends and inter-country variation.

In conclusion, assessing inflation expectations from the social media perspective provides an overlay to elicit inflation expectations. Furthermore, the twitter-based sentiment index conveys valuable information whose inflation-predicting power outperforms the traditional inflation prediction model. Also, compared with the traditional macroeconomic model which contains country-specific factors and has a long adjustment cycle and time-lagging features, the twitter-based sentiment approach offers a country-universal and high-frequency methodology to tackle inflation-related issues.

Reference

- https://www.geeksforgeeks.org/python-programming-language/
- https://www.geeksforgeeks.org/data-science-tutorial/?ref=ghm
- https://developer.twitter.com/en/docs/twitter-api/tools-and-libraries/v2
- https://stackoverflow.com/
- https://docs.tweepy.org/en/stable/api.html
- https://towardsdatascience.com/how-to-access-data-from-the-twitter-api-using-tweepy-python-e2d9e4d54978
- https://blog.loginradius.com/engineering/beginners-guide-to-tweepy/