Case Study - India CPI Inflation

Overview

In India, the Consumer Price Index (CPI) is used to measure inflation, and it involves a fixed basket of goods and services. This basket is comprehensive and includes a wide array of items that an average Indian consumer uses. These items are not limited to just food and clothing but extend to transportation, medical care, electricity, education, and almost every other category that involves expenditure of money. The CPI is calculated by comparing the general price level in the markets during a particular time period with a base year. The items in the CPI basket are classified across various categories like food and beverages, clothing, housing, fuel and light, and recreation, among others.

The CPI basket contains categories like food and beverages, housing, apparel, transportation, medical care, and more. The weight of each category in the total index might differ based on its relative importance to the average consumer expenditure but for the purpose of this analysis consider equal weights across all categories.

Dataset

- The dataset provided is a CPI inflation index extracted from GOI website
- Each number represents the index value for that month and category
- There are missing values in the dataset - use suitable imputation technique (like moving averages), if required
- The CPI is an index and not a direct measure of price levels, but rather a relative indicator used to measure inflation or the average change in prices over time. Consumer Price Index (CPI) values cannot be summed across different months to derive meaningful insights or aggregate measures.
- CPI-U (Urban): Reflects spending patterns for urban consumers.
- CPI-R (Rural): Reflects spending patterns for rural consumers
- The General Index gives you the overall Inflation for the month for all the categories combined

Problem Statement

You are working with the National Statistical Office which is equipped to release inflation numbers in India. As an analyst, you are provided with CPI data and are equipped to find out insights from the data. Your senior wants you to find key trends and deep dive into the data to answer the following questions -

1️⃣ Based on the latest month's data, identify the contribution of different broader categories (food, energy, transportation, education, etc.) towards the CPI basket. Broader categories (buckets) can be created by combining similar categories into one bucket; Ex.: Meals, Beverages, Cereals, can be clubbed to create "Food" category, etc.

- ✔Which broader category has the highest contribution towards CPI calculation
- ✔Contribution is calculated by evaluating the underlying index values for broader category and should add to 100% when contribution from different broader categories are added .

2️⃣ A trend of Y-o-Y increase in CPI (rural + urban) inflation starting 2017 for the entire basket of products combined.

- ✔Create a graph depicting the growth rate Y-o-Y and identify the year with highest inflation rate
- ✔Highlight the reason why the year has the highest inflation (based on research)

3️⃣ With India's retail inflation reaching a 3-month high of 5.55% in November 2023, largely due to a sharp rise in food prices. Analyze the following for 12 months ending May'23

- ✔Investigate trends in the prices of broader food bucket category and evaluate month-on-month changes. Highlight month with highest and lowest food inflation
- ✔Identify the absolute changes in inflation over the same 12 months period and identify the biggest individual category contributor (only within broader food category) towards inflation

4️⃣ Investigate how the onset and progression of the COVID-19 pandemic affected inflation rates in India. Analyze the Impact of key pandemic milestone (first lockdown) on the CPI inflation %, specially focus on categories like healthcare, food, and essential services.
Hint: You can consider Mar'20 as the onset of covid, and can compare the inflation trend before and after Mar'20 to see if there is a change in inflation % before and after.

5️⃣ Investigate how major global economic events (like imported oil price fluctuations) have influenced India's inflation. This can include an analysis of imported goods and their price trends.

- ✔For the purpose of this analysis, focus only on the imported oil price fluctuations for years 2021 to 2023 (Month-on-month)
- ✔Identify trends in oil price change with change in inflation prices of all the categories and identify category whose inflation prices strongly changes with fluctuations in imported oil price
(Hint: you can use =correl function)

Other Information:

➡️Percentage Change: To understand inflation or deflation trends, calculate the percentage change in CPI between two periods (e.g., year-over-year or month-over-month). This shows how much prices have increased or decreased relative to the earlier period.

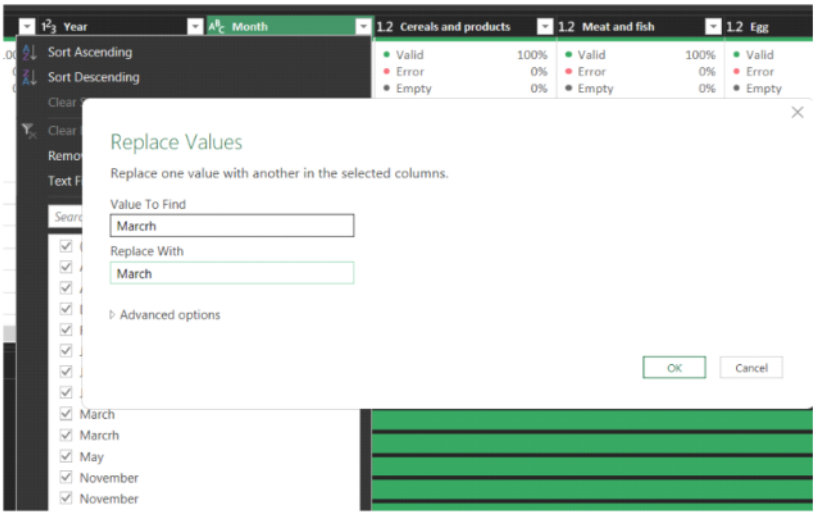
➡️For example, to calculate the monthly inflation rate between two consecutive months:

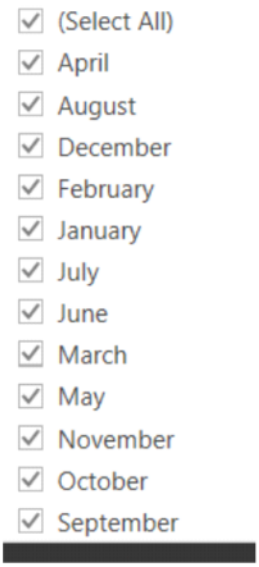
- ✔Monthly Inflation rate=(CPI in current month−CPI in previous month)/CPI in previous month)×100

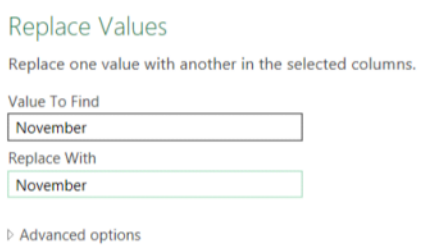
➡️Annual Inflation Rate: For longer periods, such as yearly inflation, use the CPI values at the start and end of the period. This helps in understanding the overall inflation experienced over the year.

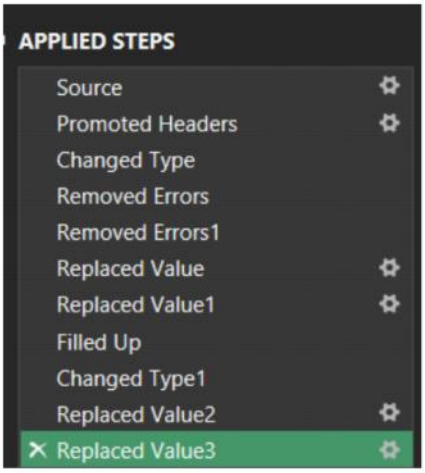
- ✔Annual Inflation rate= ((CPI at end of year−CPI at start of year)/ CPI at start of year) ×100

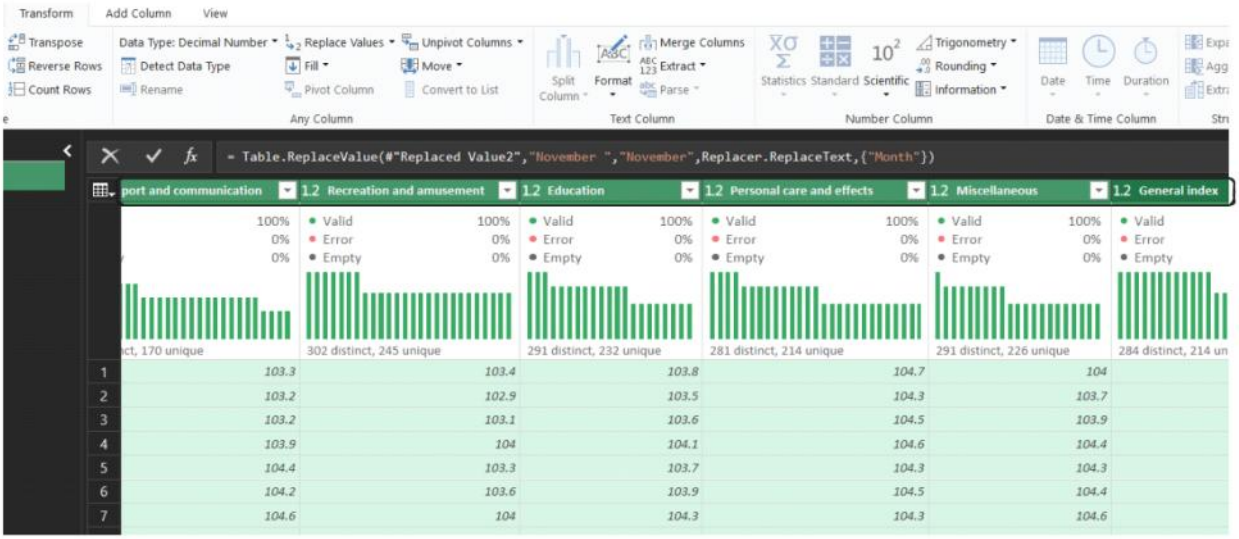
- ✔Any month can be considered as start of the year , then end of the year month will be considered 12 months after the month you have selected for start of the year



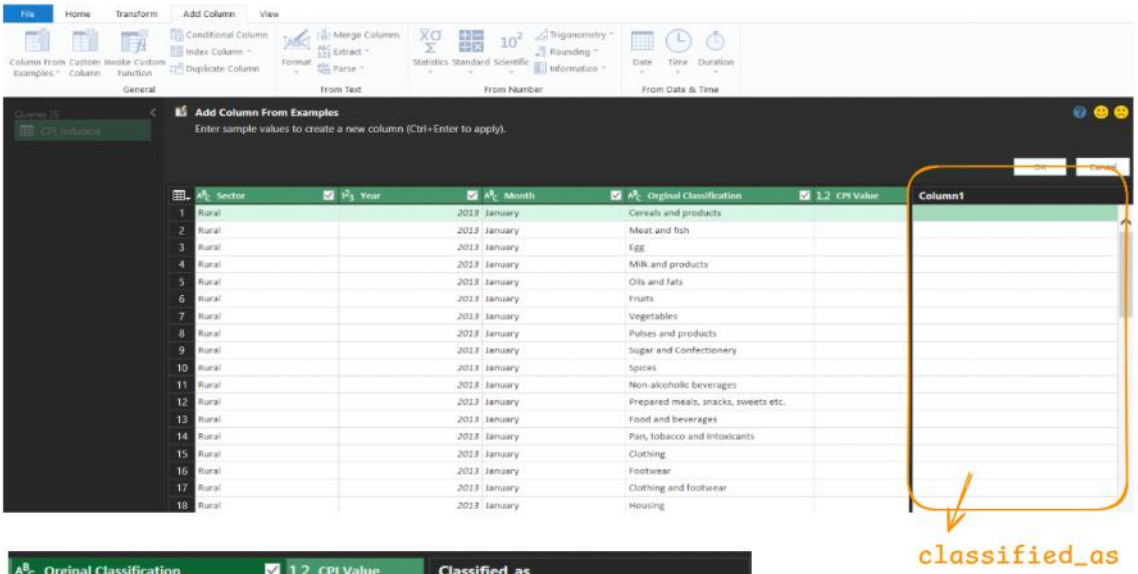








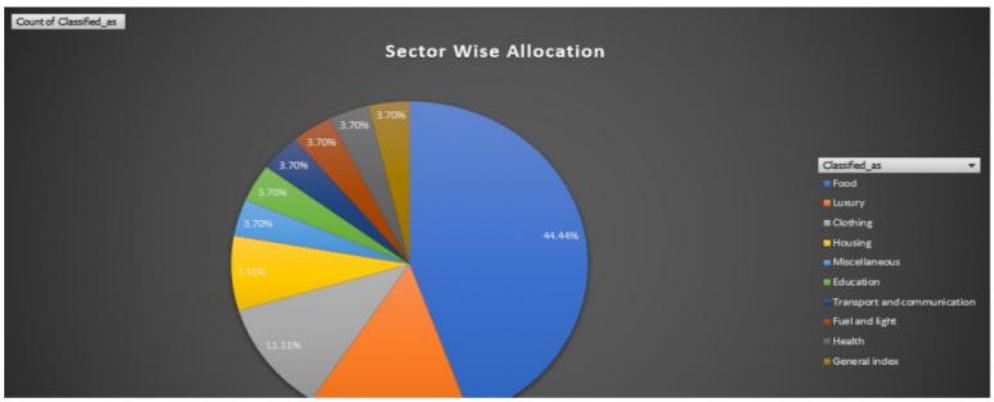
Sector	Year	Month	Attribute	Value
3 distinct, 0 unique	2 distinct, 0 unique	12 distinct, 0 unique	27 distinct, 0 unique	212 distinct, 54 unique
Rural	2013	January	Cereals and products	107.5
Rural	2013	January	Meat and fish	106.3
Rural	2013	January	Egg	108.1
Rural	2013	January	Milk and products	104.9
Rural	2013	January	Oils and fats	106.1
Rural	2013	January	Fruits	103.9
Rural	2013	January	Vegetables	101.9
Rural	2013	January	Pulses and products	106.1
Rural	2013	January	Sugar and Confectionery	106.8
Rural	2013	January	Spices	103.1
Rural	2013	January	Non-alcoholic beverages	104.8
Rural	2013	January	Prepared meals, snacks, sweets etc.	106.7
Rural	2013	January	Food and beverages	105.5
Rural	2013	January	Pan, tobacco and intoxicants	105.1
Rural	2013	January	Clothing	106.5



Orginal Classification	CPI Value	Classified_as
Cereals and products		Food
Meat and fish		Food
Egg		Food
Milk and products		Food
Oils and fats		Food
Fruits		Food
Vegetables		Food
Pulses and products		Food
Sugar and Confectionery		Food
Spices		Food
Non-alcoholic beverages		Luxury
Prepared meals, snacks, sweets etc.		Food
Food and beverages		Food
Pan, tobacco and intoxicants		Luxury
Clothing		Clothing
Footwear		Clothing
Clothing and footwear		Clothing
Housing		Housing
Fuel and light		Fuel and light
Household goods and services		Housing
Health		Health
Transport and communication		Transport and communication
Recreation and amusement		Luxury
Education		Education

Which broader category has the highest contribution towards CPI calculation

Row Labels	Count of Classified_as
Food	44.44%
Luxury	14.81%
Clothing	11.11%
Housing	7.41%
Miscellaneous	3.70%
Education	3.70%
Transport and communicatio	3.70%
Fuel and light	3.70%
Health	3.70%
General index	3.70%
Grand Total	**100.00%**



A trend of Y-o-Y increase in CPI (rural + urban) inflation starting 2017 for the entire basket of products combined.

General Index

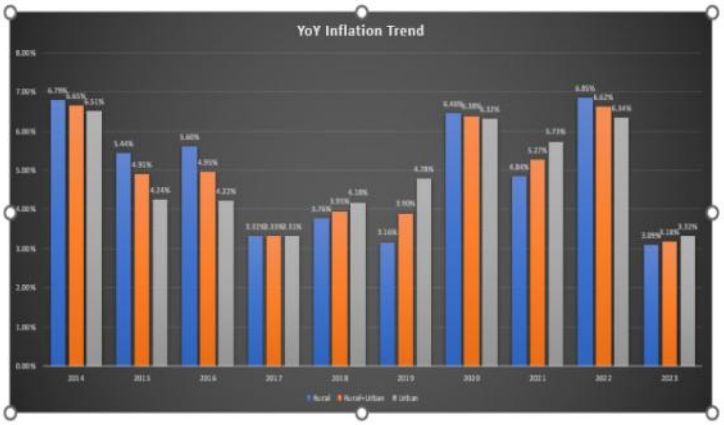
Column Lal			
Rural	Rural+Urb	Urban	Grand Total
110.4	110.03333	109.60833	110.01389
117.8916667	117.35	116.74167	117.32778
124.3083333	123.10833	121.69167	123.03611
131.275	129.2	126.825	129.1
135.6333333	133.5	131.025	133.38611
140.7333333	138.775	136.5	138.66944
145.1818182	144.18182	143.01818	144.12727
154.56	153.38	152.05	153.33
162.0333333	161.45833	160.75833	161.41667
173.125	172.15	170.95	172.075
178.48	177.62	176.62	177.57333
140.818033	**139.63**	**138.246**	**139.564**

Rural	Rural+Urb	Urban	Rural	Rural+Urb	Urban	Year
110.4	110.03333	109.60833	6.79%	6.65%	6.51%	2014
117.8916667	117.35	116.74167	5.44%	4.91%	4.24%	2015
124.3083333	123.10833	121.69167	5.60%	4.95%	4.22%	2016
131.275	129.2	126.825	3.32%	3.33%	3.31%	2017
135.6333333	133.5	131.025	3.76%	3.95%	4.18%	2018
140.7333333	138.775	136.5	3.16%	3.90%	4.78%	2019
145.1818182	144.18182	143.01818	6.46%	6.38%	6.32%	2020
154.56	153.38	152.05	4.84%	5.27%	5.73%	2021
162.0333333	161.45833	160.75833	6.85%	6.62%	6.34%	2022
173.125	172.15	170.95	3.09%	3.18%	3.32%	2023
178.48	177.62	176.62				

Year	Rural	Rural+Urb	Urban
2014	6.79%	6.65%	6.51%
2015	5.44%	4.91%	4.24%
2016	5.60%	4.95%	4.22%
2017	3.32%	3.33%	3.31%
2018	3.76%	3.95%	4.18%
2019	3.16%	3.90%	4.78%
2020	6.46%	6.38%	6.32%
2021	4.84%	5.27%	5.73%
2022	6.85%	6.62%	6.34%
2023	3.09%	3.18%	3.32%

Year: 2013, 2014, 2015, 2016, 2017, 2018, 2019, 2020

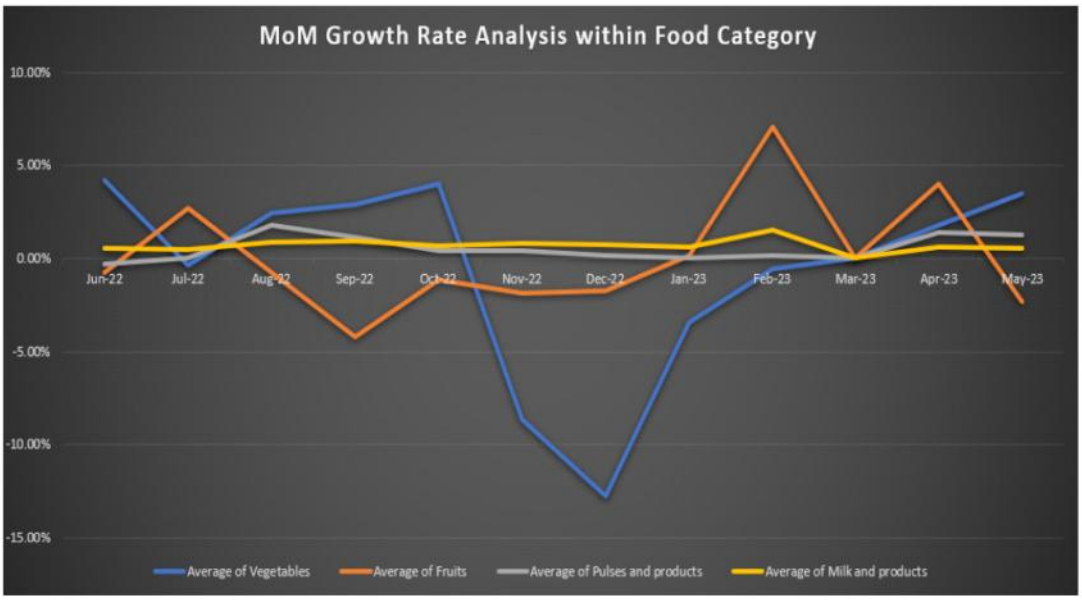
Sector: Rural, Rural+Urban, Urban



MoM Growth Rate Analysis For Vegetables,Fruits,Pulses,Milk (June22 - May23)

Average of Vegetables	Average of Fruits	Average of Pulses and product	Average of Milk and products
182.3583333	**164.5944444**	**166.3722222**	**166.6361111**
179.0333333	153.8	163.9	160.4666667
174.3	153.8333333	163.6	160.6666667
170.3666667	157.7	163.8333333	162.2666667
170.1666667	172.7333333	164.6	163.9666667
179.5	171.1666667	164.6	164.9666667
187.0333333	169.8666667	164.1666667	165.8666667
186.4	174.4333333	164.2333333	166.6666667
190.9666667	173.0666667	167.2	168.1333333
196.5	165.7666667	169.1	169.7666667
204.3666667	163.9	169.8	170.9333333
186.7333333	160.8	170.5666667	172.3
162.9333333	158.0666667	170.8666667	173.6333333
158.9266667	**169.26**	**172.5666667**	**177.4933333**
157.3666667	158.3666667	170.9333333	174.7
156.4666667	169.6	171.2	177.4
156.5333333	169.6	171.2666667	177.4
159.3666667	176.4	173.6333333	178.4666667
164.9	172.3333333	175.8	179.5
175.4666667	**165.9666667**	**168.1941176**	**169.8294118**

Year	Average of Vegetables	Average of Fruits	Average of Pulses and product	Average of Milk and products
Jun-22	4.20%	-0.76%	-0.26%	0.55%
Jul-22	-0.34%	2.69%	0.04%	0.48%
Aug-22	2.45%	-0.78%	1.81%	0.88%
Sep-22	2.90%	-4.22%	1.14%	0.97%
Oct-22	4.00%	-1.13%	0.41%	0.69%
Nov-22	-8.63%	-1.89%	0.45%	0.80%
Dec-22	-12.75%	-1.70%	0.18%	0.77%
Jan-23	-3.42%	0.19%	0.04%	0.61%
Feb-23	-0.57%	7.09%	0.16%	1.55%
Mar-23	0.04%	0.00%	0.04%	0.00%
Apr-23	1.81%	4.01%	1.38%	0.60%
May-23	3.47%	-2.31%	1.25%	0.58%

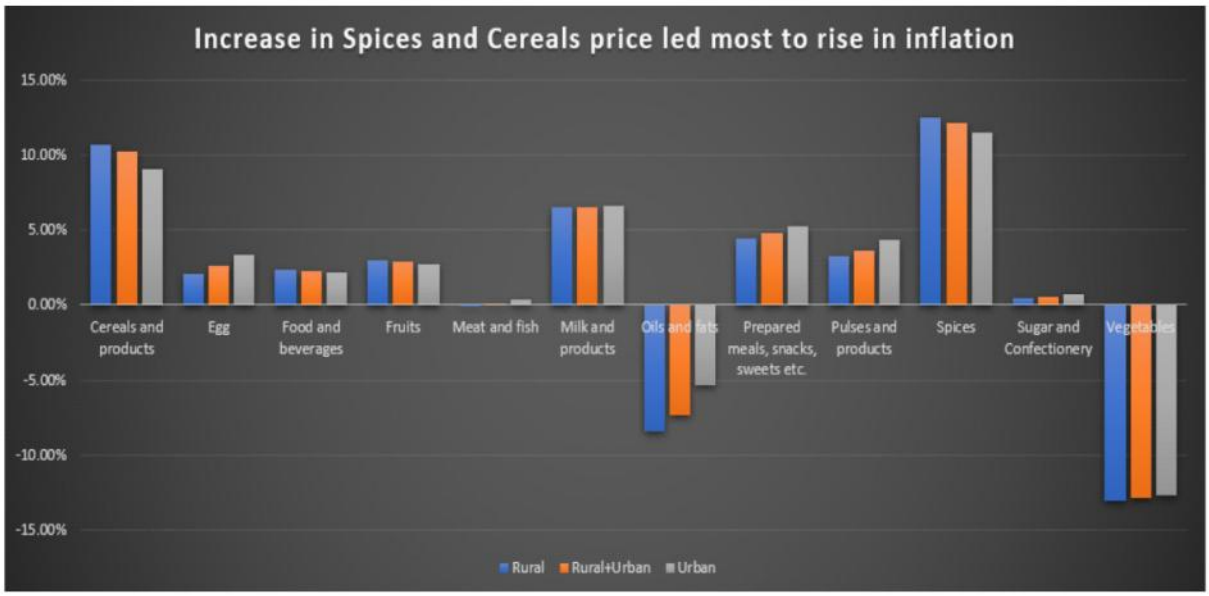


Classified_as	Food

Average of CPI Value	Column Labels								
	Rural		Rural Total	Rural+Urban		Rural+Urban Total	Urban		Urban Total
Row Labels	2022	2023		2022	2023		2022	2023	
Cereals and products	156.9833333	173.8	161.9294118	157.9083333	174.02	162.6470588	159.9416667	174.44	164.2058824
Egg	172.3416667	175.92	173.3941176	173.0583333	177.54	174.3764706	174.2333333	180.1	175.9588235
Food and beverages	171.3916667	175.38	172.5647059	173.575	177.54	174.7411765	177.3416667	181.24	178.4882353
Fruits	161.9083333	166.68	163.3117647	164.4666667	169.16	165.8470588	167.4083333	171.94	168.7411765
Meat and fish	207.425	207.42	207.4235294	209.6833333	209.94	209.7588235	213.8666667	214.54	214.0647059
Milk and products	166.4416667	177.22	169.6117647	166.6	177.42	169.7823529	166.8666667	177.84	170.0941176
Oils and fats	198.9666667	182.22	194.0411765	192.3166667	178.12	188.1411765	180.8333333	171.1	177.9705882
Prepared meals, snacks, sweets etc.	181.9	189.98	184.2764706	184.075	192.98	186.6941176	186.6	196.44	189.4941176
Pulses and products	166.475	171.86	168.0588235	166.4083333	172.4	168.1705882	166.2333333	173.44	168.3529412
Spices	190.5166667	214.24	197.4941176	188.825	211.74	195.5647059	185.4083333	206.72	191.6764706
Sugar and Confectionery	119.6416667	120.16	119.7941176	120.3833333	121.02	120.5705882	121.8333333	122.76	122.1058824
Vegetables	164.725	143.24	158.4058824	178.1333333	155.16	171.3764706	204.2166667	178.38	196.6176471

Food Category	2022	2023		2022	2023		2022	2023	
Cereals and products	157	174		158	174		160	174	
Egg	172	176		173	178		174	180	
Food and beverages	171	175		174	178		177	181	
Fruits	162	167		164	169		167	172	
Meat and fish	207	207		210	210		214	215	
Milk and products	166	177		167	177		167	178	
Oils and fats	199	182		192	178		181	171	
Prepared meals, snacks, sweets etc	182	190		184	193		187	196	
Pulses and products	166	172		166	172		166	173	
Spices	191	214		189	212		185	207	
Sugar and Confectionery	120	120		120	121		122	123	
Vegetables	165	143		178	155		204	178	

Food Category	Rural	Rural+Urban	Urban
Cereals and products	10.71%	10.20%	9.06%
Egg	2.08%	2.59%	3.37%
Food and beverages	2.33%	2.28%	2.20%
Fruits	2.95%	2.85%	2.71%
Meat and fish	0.00%	0.12%	0.31%
Milk and products	6.48%	6.49%	6.58%
Oils and fats	-8.42%	-7.38%	-5.38%
Prepared meals, snacks, sweets etc	4.44%	4.84%	5.27%
Pulses and products	3.23%	3.60%	4.34%
Spices	12.45%	12.14%	11.49%
Sugar and Confectionery	0.43%	0.53%	0.76%
Vegetables	-13.04%	-12.90%	-12.65%



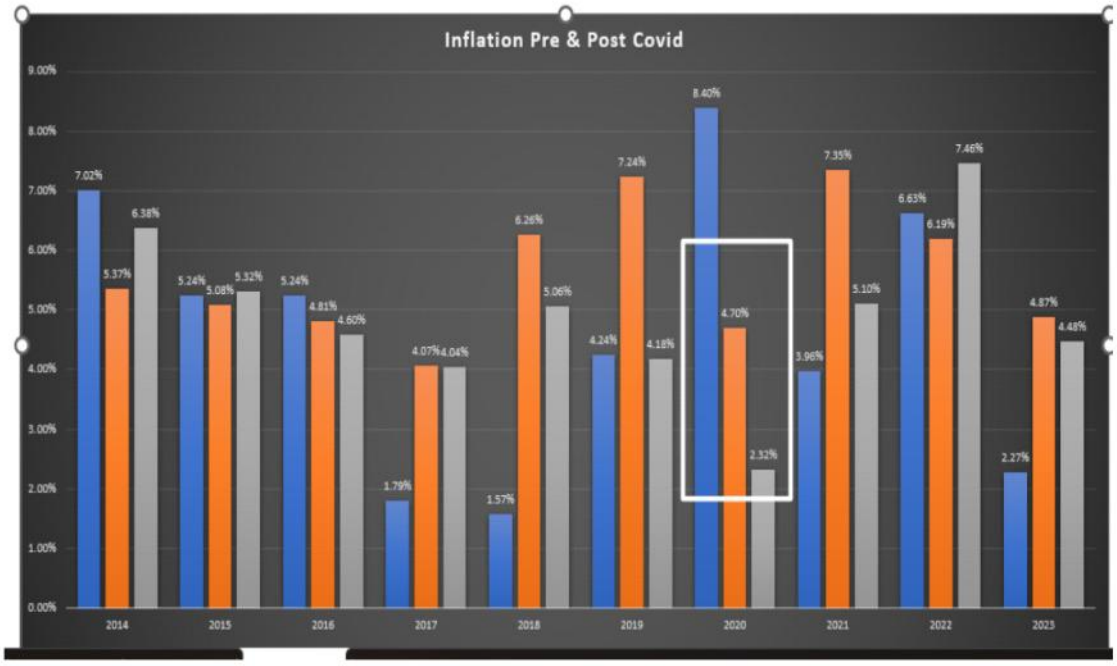
CPI inflation % before and after Covid, specially focus on categories like healthcare, food, and essential services.

Average of Food and beverage	Average of Health	Average of Household goods and services
113.4194444	106.7666667	108.0055556
121.3805556	112.4972222	114.9
127.7444444	118.2138889	121.0138889
134.4388889	123.9	126.575
136.8472222	128.9388889	131.6944444
138.9916667	137.0055556	138.3583333
144.8848485	146.9242424	144.1363636
157.0566667	153.8266667	147.4766667
163.2833333	165.1333333	155
174.1027778	175.3527778	166.5666667
178.0533333	183.9	174.0333333
142.4349727	**138.423224**	**136.6868852**

Food and beverages	Health	Household goods and services
113	107	108
121	112	115
128	118	121
134	124	127
137	129	132
139	137	138
145	147	144
157	154	147
163	165	155
174	175	167
178	184	174

Food and beverages	Health	Household goods and services
7.02%	5.37%	6.38%
5.24%	5.08%	5.32%
5.24%	4.81%	4.60%
1.79%	4.07%	4.04%
1.57%	6.26%	5.06%
4.24%	7.24%	4.18%
8.40%	4.70%	2.32%
3.96%	7.35%	5.10%
6.63%	6.19%	7.46%
2.27%	4.87%	4.48%

Year	Food and beverages	Health	Household goods and services
2014	7.02%	5.37%	6.38%
2015	5.24%	5.08%	5.32%
2016	5.24%	4.81%	4.60%
2017	1.79%	4.07%	4.04%
2018	1.57%	6.26%	5.06%
2019	4.24%	7.24%	4.18%
2020	8.40%	4.70%	2.32%
2021	3.96%	7.35%	5.10%
2022	6.63%	6.19%	7.46%
2023	2.27%	4.87%	4.48%



Identify trends in oil price change with change in inflation prices of all the categories and identify category whose inflation prices strongly changes with fluctuations in imported oil price

Row Labels	Average of Fuel and light	Average of Transport and communication
2021	158.7083333	150.7
January	147.2333333	142.1
February	151.9666667	145.2666667
March	155.4333333	146.4
April	155.5	146.8
May	158.8666667	149.0333333
June	159.3333333	150.8
July	160.3	153.2333333
August	162.1333333	154.0333333
September	162.3666667	154.1
October	163.9666667	155.8
November	163.6	154.9666667
December	163.8	155.8666667
2022	174.9694444	161.2416667
January	163.8666667	156.6666667
February	165.3666667	157.0666667
March	166.8666667	158.0333333
April	172	162.7
May	174.4666667	163.1666667
June	175.8666667	161.2666667
July	179.5666667	161.7666667
August	178.7666667	162.0666667
September	179.4666667	162.4666667
October	180.4333333	163.0333333
November	181.1666667	163.1333333
December	181.8	163.5333333
2023	182.1133333	164.4133333
January	181.7666667	163.7666667
February	182.1666667	164.3333333
March	181.9666667	164.3333333
April	181.7666667	164.6666667

Date	Fuel	Transport	Correlation	67%
			Fuel Change	Transport Change
Jan-21	147.233333	142.1		
Feb-21	151.966667	145.266667	0.0321485	0.022284776
Mar-21	155.433333	146.4	0.022812	0.007801744
Apr-21	155.5	146.8	0.0004289	0.00273224
May-21	158.866667	149.033333	0.0216506	0.015213442
Jun-21	159.333333	150.8	0.0029375	0.011854171
Jul-21	160.3	153.233333	0.0060669	0.016136163
Aug-21	162.133333	154.033333	0.0114369	0.005220796
Sep-21	162.366667	154.1	0.0014391	0.000432807
Oct-21	163.966667	155.8	0.0098542	0.011031798
Nov-21	163.6	154.966667	-0.002236	-0.005348738
Dec-21	163.8	155.866667	0.0012225	0.005807701
Jan-22	163.866667	156.666667	0.000407	0.005132592
Feb-22	165.366667	157.066667	0.0091538	0.002553191
Mar-22	166.866667	158.033333	0.0090708	0.006154499
Apr-22	172	162.7	0.0307631	0.029529635
May-22	174.466667	163.166667	0.0143411	0.002868265
Jun-22	175.866667	161.266667	0.0080245	-0.011644535
Jul-22	179.566667	161.766667	0.0210387	0.003100455
Aug-22	178.766667	162.066667	-0.004455	0.001854523
Sep-22	179.466667	162.466667	0.0039157	0.00246812
Oct-22	180.433333	163.033333	0.0053863	0.003487895
Nov-22	181.166667	163.133333	0.0040643	0.000613371
Dec-22	181.8	163.533333	0.0034959	0.002451982
Jan-23	181.766667	163.766667	-0.000183	0.001426824
Feb-23	182.166667	164.333333	0.0022006	0.003460208
Mar-23	181.966667	164.333333	-0.001098	0
Apr-23	181.766667	164.666667	-0.001099	0.002028398
May-23	182.9	164.966667	0.0062351	0.001821862

HARMEAN =(F47-F46)/F46

Row Labels	Average of Fuel and ligh	Average of Education
2021	158.7083333	162.5361111
January	147.2333333	159.6
February	151.9666667	159.9
March	155.4333333	160.5333333
April	155.5	160.6666667
May	158.8666667	161.8
June	159.3333333	162.2
July	160.3	163.5666667
August	162.1333333	163.9
September	162.3666667	164.1666667
October	163.9666667	164.4
November	163.6	164.8
December	163.8	164.9
2022	174.9694444	170.1972222
January	163.8666667	165.2
February	165.3666667	165.9
March	166.8666667	166.4333333
April	172	167.2666667
May	174.4666667	168.3
June	175.8666667	169.3666667
July	179.5666667	171.7333333
August	178.7666667	172.6333333
September	179.4666667	173.4
October	180.4333333	173.7
November	181.1666667	174.0333333
December	181.8	174.4
2023	182.1133333	175.8733333
January	181.7666667	174.6333333
February	182.1666667	175.3333333
March	181.9666667	175.3333333
April	181.7666667	176.6666667

Date	Fuel	Education	Correlation	34%
			Fuel Change	Education Change
Jan-21	147.233333	159.6		
Feb-21	151.966667	159.9	F46	0.001879699
Mar-21	155.433333	160.533333	0.02281202	0.003960809
Apr-21	155.5	160.666667	0.00042891	0.000830565
May-21	158.866667	161.8	0.02165059	0.007053942
Jun-21	159.333333	162.2	0.00293747	0.002472188
Jul-21	160.3	163.566667	0.00606695	0.008425812
Aug-21	162.133333	163.9	0.01143689	0.002037905
Sep-21	162.366667	164.166667	0.00143914	0.001627008
Oct-21	163.966667	164.4	0.00985424	0.00142132
Nov-21	163.6	164.8	-0.0022362	0.00243309
Dec-21	163.8	164.9	0.00122249	0.000606796
Jan-22	163.866667	165.2	0.000407	0.001819284
Feb-22	165.366667	165.9	0.00915378	0.004237288
Mar-22	166.866667	166.433333	0.00907075	0.003214788
Apr-22	172	167.266667	0.03076308	0.00500701
May-22	174.466667	168.3	0.01434109	0.00617776
Jun-22	175.866667	169.366667	0.00802446	0.006337889
Jul-22	179.566667	171.733333	0.02103867	0.013973627
Aug-22	178.766667	172.633333	-0.0044552	0.005240683
Sep-22	179.466667	173.4	0.00391572	0.004441012
Oct-22	180.433333	173.7	0.00538633	0.001730104
Nov-22	181.166667	174.033333	0.00406429	0.001919017
Dec-22	181.8	174.4	0.00349586	0.002106876
Jan-23	181.766667	174.633333	-0.0001834	0.00133792
Feb-23	182.166667	175.333333	0.00220062	0.004008399
Mar-23	181.966667	175.333333	-0.0010979	0
Apr-23	181.766667	176.666667	-0.0010991	0.007604563
May-23	182.9	177.4	0.0062351	0.004150943