

Inflation: do all good and services increase in price equally?

Intersession 2023:
Data analysis and visualization

Inflation and cost of living in 2022

The
Economist

Menu



Finance & economics | An expensive issue

2022 has been a year of brutal inflation

What will be next year's big economic

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Americans are buying less at the supermarket



Emily Peck, author of [Axios Markets](#)



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America In The Grip Of Inflation

Rents across U.S. rise above \$2,000 a month for the first time ever

June 9, 2022 · 2:48 PM ET

Is inflation in 'necessities' outpacing average inflation?

- What is inflation?

- “In [economics](#), **inflation** is an increase in the general price level of goods and services in an economy”
- “the annualized percentage change in a general [price index](#) ... the Consumer Price Index”
 - Wikipedia

- What is the Consumer Price Index?

- “measure of the average change over time in the prices paid by consumers for a market basket of goods and services.”
 - US Bureau of Labor Statistics

$$CPI_t = \frac{C_t}{C_0} * 100$$

- What is in the basket of goods?

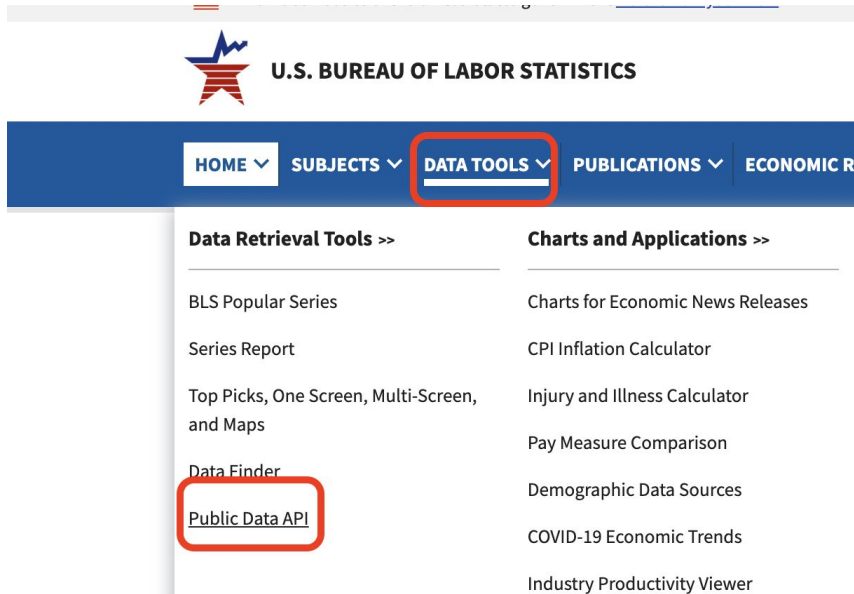
10. What goods and services does the CPI cover? ▼

The CPI represents all goods and services purchased for consumption by the reference population (U or W). BLS has classified all expenditure items into more than 200 categories, arranged into eight major groups (**food and beverages, housing, apparel, transportation, medical care, recreation, education and communication, and other goods and services**). Included within these major groups are various government-charged user fees,

- US Bureau of Labor Statistics

Getting the data

US Bureau of Labor Statistics:



Accessing the Public Data API with Python

On This Page:

- [API Version 2.0 Python Sample Code](#)
- [API Version 1.0 Python Sample Code](#)

API Version 2.0 Python Sample Code

Multiple Series and Multiple Years

Use this code to retrieve data for more than one timeseries and more than one year.

Side note: APIs

Application programming interface

- “APIs are mechanisms that enable two software components to communicate with each other”
 - AWS
- E.g. enables you to query an online database to get data programmatically

Getting the data: creating queries

From sample code:

series ID corresponds to data (e.g. CPI), area (e.g. state), and item (e.g. food)

```
1 import requests
2 import json
3 import prettytable
4 headers = {'Content-type': 'application/json'}
5 data = json.dumps({"seriesid": ['CUUR0000SA0', 'SUUR0000SA0'], "startyear": "2011", "endyear": "2014"})
6 p = requests.post('https://api.bls.gov/publicAPI/v2/timeseries/data/', data=data, headers=header)
7 json_data = json.loads(p.text)
8 for series in json_data['Results']['series']:
9     x=prettytable.PrettyTable(["series id", "year", "period", "value", "footnotes"])
10    seriesId = series['seriesID']
11    for item in series['data']:
12        year = item['year']
13        period = item['period']
14        value = item['value']
15        footnotes=""
16        for footnote in item['footnotes']:
17            if footnote:
18                footnotes = footnotes + footnote['text'] + ', '
19        if 'M01' <= period <= 'M12':
20            x.add_row([seriesId, year, period, value, footnotes[0:-1]])
21    output = open(seriesId + '.txt', 'w')
22    output.write(x.get_string())
23    output.close()
```

[Help & Tutorials](#)

Series ID Formats

On This Page

- [Employment & Unemployment](#)
- [Inflation & Prices](#)
- [Spending & Time Use](#)

Consumer Price Index - All Urban Consumers

[Survey Overview](#) The following is a sample format description of the Consumer Price Index - All Urban Consumers series identifier:

	1	2
	12345678901234567890	
Series ID	CUUR0000SA0L1E	
Positions	Value	Field Name
1-2	CU	Prefix
3	U	Not Seasonal Adjustment Code
4	R	Periodicity Code
5-8	0000	Area Code
9	S	Base Code
10-16	A0L1E	Item Code

To assist you in formatting series IDs, access any of the following for a list of codes and their corresponding titles:

- [Area Codes](#)
- [Item Codes](#)

Getting the data: creating queries

From sample code:

series ID corresponds to data (e.g. CPI), area (e.g. state) and item (e.g. food)

area_code	area_name	display_level	selectable	sort_sequence
0000	U.S. city average	0 T	1	
0100	Northeast	0 T	5	
0110	New England	1 T	10	

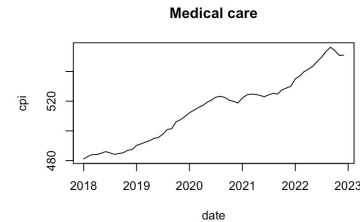
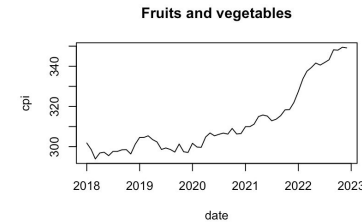
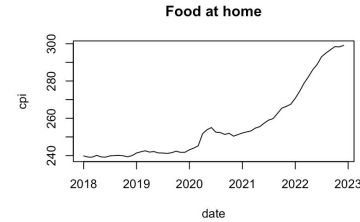
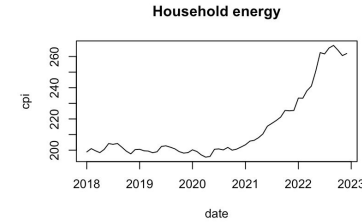
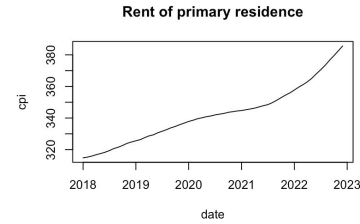
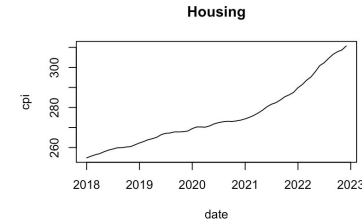
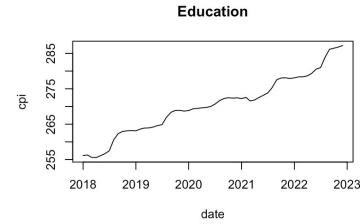
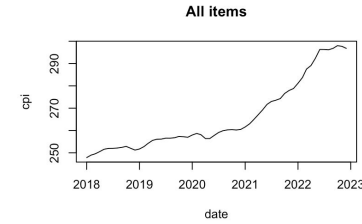
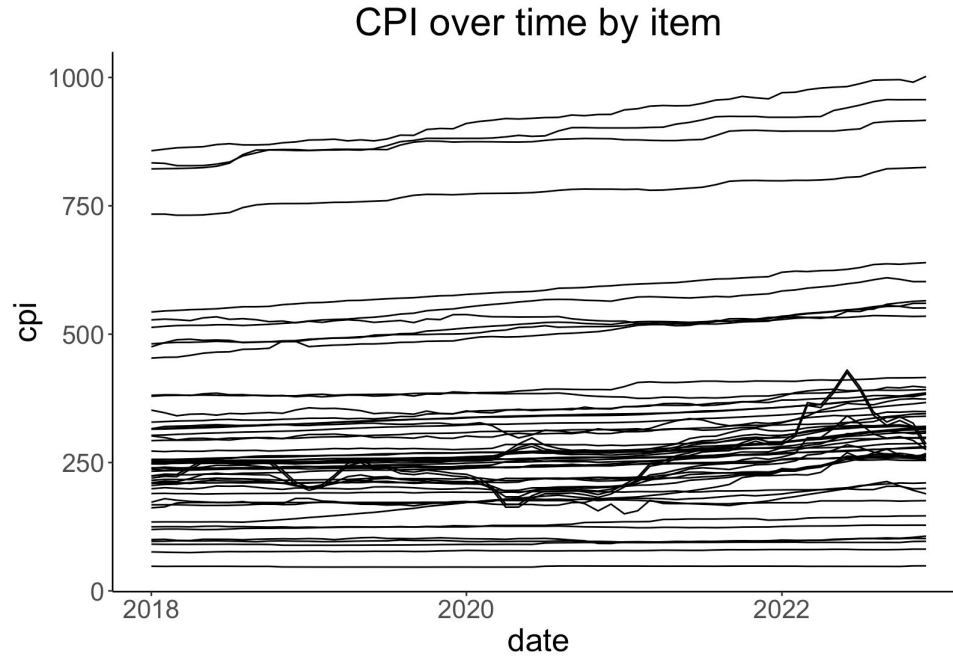
item_code	item_name	display_level	selectable	sort_sequence
AA0	All items - old base	0 T	2	
AA0R	Purchasing power of the consumer dollar - old base			0 T 400
SA0	All items	0 T	1	
SA0E	Energy	1 T	375	
SA0L1	All items less food	1 T	359	
SA0L12	All items less food and shelter	1 T	362	

Getting the data and cleaning

- Necessities
- All items
- Query in batches
- Cleaning into interpretable data frame

series id	year	period	value	item
CUUR0000SA0	2022	M12	296.797	All items
CUUR0000SA0	2022	M11	297.711	All items
CUUR0000SA0	2022	M10	298.012	All items
CUUR0000SA0	2022	M09	296.808	All items
CUUR0000SA0	2022	M08	296.171	All items
CUUR0000SA0	2022	M07	296.276	All items
CUUR0000SA0	2022	M06	296.311	All items
CUUR0000SA0	2022	M05	292.296	All items
CUUR0000SA0	2022	M04	289.109	All items
CUUR0000SA0	2022	M03	287.504	All items
CUUR0000SA0	2022	M02	283.716	All items
CUUR0000SA0	2022	M01	281.148	All items
CUUR0000SA0	2021	M12	278.802	All items
CUUR0000SA0	2021	M11	277.948	All items
CUUR0000SA0	2021	M10	276.589	All items
CUUR0000SA0	2021	M09	274.31	All items
series id	year	period	value	item
CUUR0000SAF	2013	M08	237.348	Food and beverages
CUUR0000SAF	2013	M07	236.957	Food and beverages
CUUR0000SAF	2013	M06	236.726	Food and beverages
CUUR0000SAF	2013	M05	236.474	Food and beverages
CUUR0000SAF	2013	M04	236.761	Food and beverages
CUUR0000SAF	2013	M03	236.267	Food and beverages
CUUR0000SAF	2013	M02	236.23	Food and beverages
CUUR0000SAF	2013	M01	236.183	Food and beverages
CUUR0000SAF1	2022	M12	316.839	Food
CUUR0000SAF1	2022	M11	315.857	Food
CUUR0000SAF1	2022	M10	315.323	Food
CUUR0000SAF1	2022	M09	313.142	Food
CUUR0000SAF1	2022	M08	310.875	Food
CUUR0000SAF1	2022	M07	308.532	Food
CUUR0000SAF1	2022	M06	305.041	Food
CUUR0000SAF1	2022	M05	302.038	Food
CUUR0000SAF1	2022	M04	298.711	Food
CUUR0000SAF1	2022	M03	295.728	Food

Exploratory data analysis - price index trends over time



Comparing price increases over time: computing inflation

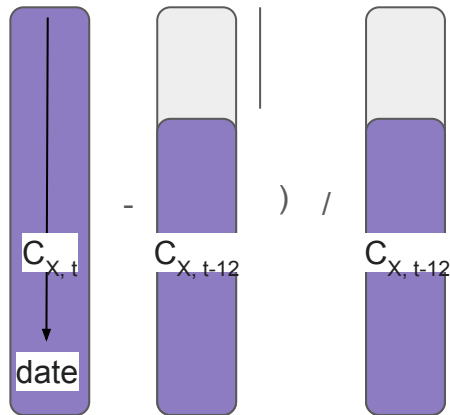
Inflation Rate Formula

$$\text{Inflation Rate} = ((B - A)/A) \times 100$$

A = Starting Cost
B = Ending Cost

- “the annualized percentage change in a general [price index](#) ... the Consumer Price Index”
 - Wikipedia
- A and B are 1 year apart

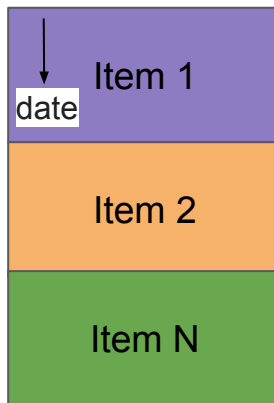
Item X
CPI



Lag =
1 year

...So I want to
reshape the data to
date (row) x item
(column)

Date Item CPI



```
tidyr::pivot_wider(names_from = item,  
                    values_from = cpi)
```



items



```
> data[1:5,]  
  series.id year month   cpi   item    date  
1 CUUR0000SA0 2022   12 296.797 All items 2022-12-01  
2 CUUR0000SA0 2022   11 297.711 All items 2022-11-01  
3 CUUR0000SA0 2022   10 298.012 All items 2022-10-01  
4 CUUR0000SA0 2022    9 296.808 All items 2022-09-01  
5 CUUR0000SA0 2022    8 296.171 All items 2022-08-01
```

```
> data.wide[1:5,1:5]  
# A tibble: 5 x 5  
  date      `All items` Energy Education `Food and beverages`  
  <date>      <dbl>    <dbl>    <dbl>    <dbl>  
1 2018-01-01      248.    211.    256.    252.  
2 2018-02-01      249.    214.    256.    252.  
3 2018-03-01      250.    213.    256.    252.  
4 2018-04-01      251.    219.    256.    253.  
5 2018-05-01      252.    227.    256.    253.
```

Comparing price increases over time: computing inflation

Inflation Rate Formula

$$\text{Inflation Rate} = ((B - A)/A) \times 100$$

A = Starting Cost
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- “the annualized percentage change in a general [price index](#) ... the Consumer Price Index”
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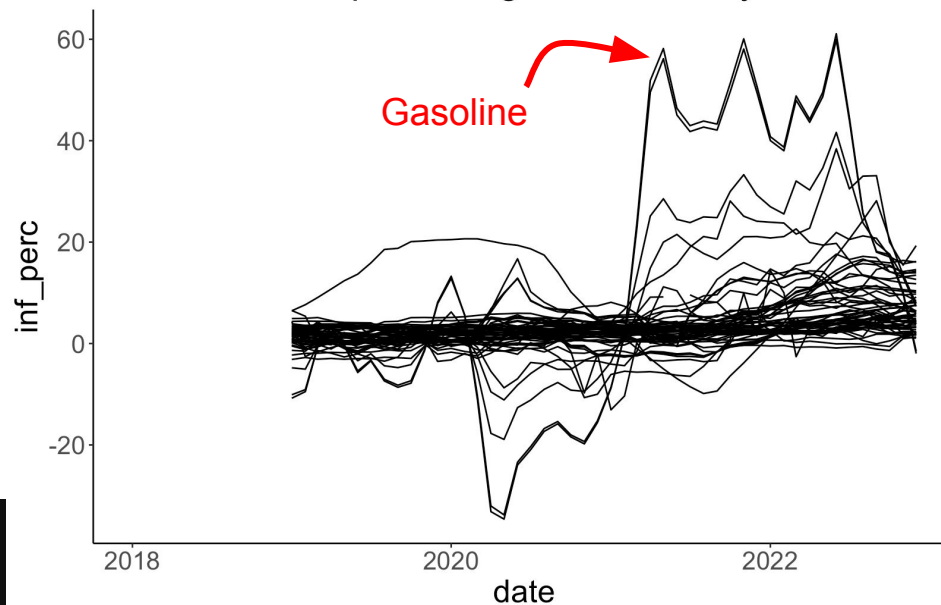
Item X
CPI



Lag =
1 year

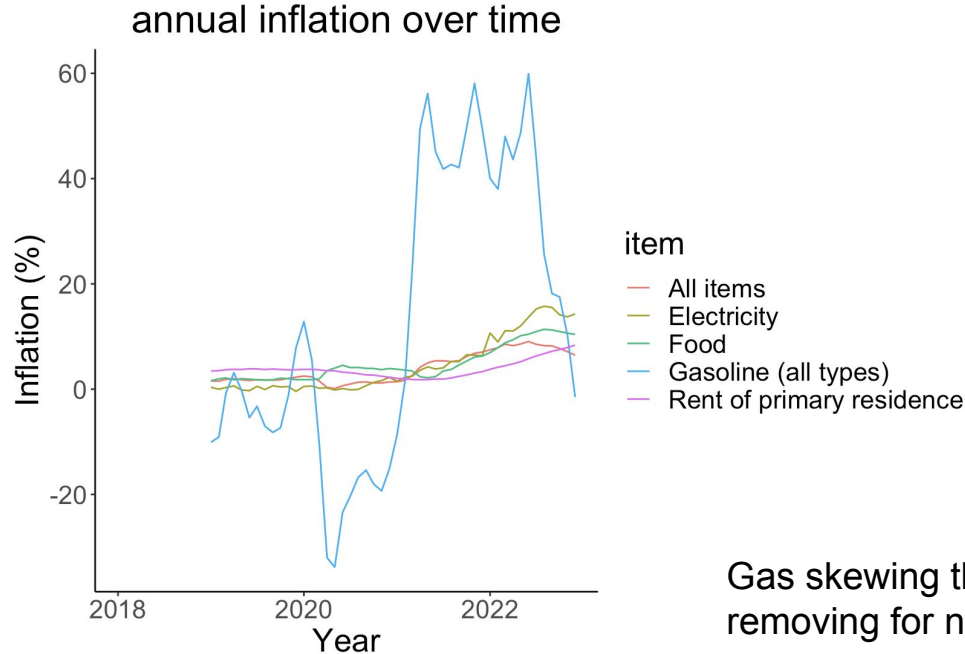
```
item.inflation <- apply(data.wide[,2:(ncol(data.wide))], 2, function(x) {  
  ## inflation = 100*(t2-t1)/t1 where t1 and t2 are one year apart  
  100*((x - dplyr::lag(x,n=12))/dplyr::lag(x,12))  
})
```

Inflation percentage over time by item

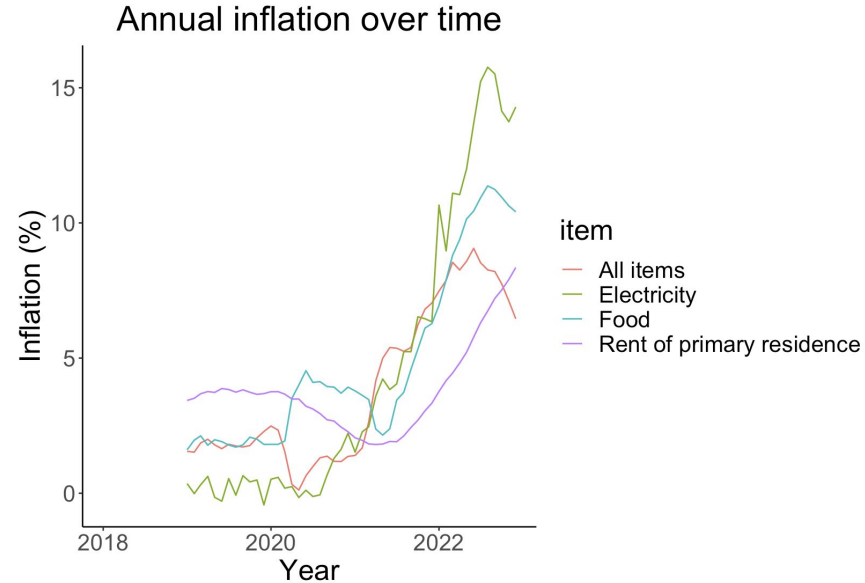


Is inflation in 'necessities' outpacing average inflation?

Picking some necessities: rent, gas, electricity, food



Gas skewing the graph...
removing for now



Is inflation in 'necessities' outpacing average inflation? ... maybe

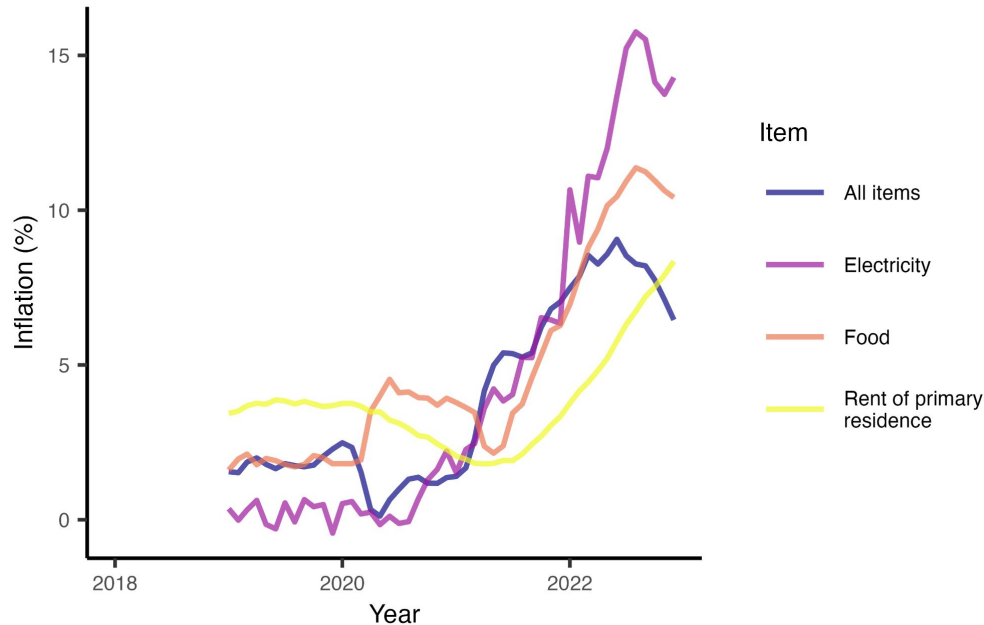


Figure 1: Annual inflation of select items over time. Annual inflation from the start of 2019 to the end of 2022 calculated as the change in the item Consumer Price Index over 12 months for electricity, food, rent of primary residence, and all items in the market basket of goods.

Next questions:

Inflation in non-necessities e.g. technology, entertainment

Is there a “lag” in the inflation of certain items e.g. housing?

How do these price increases compare to increases in wages?

What proportion of (median) income is spent on ‘necessities’?

Were low wage earners more affected by the 2022 inflation spike than others?