Analysis: Fastest-Inflating Food Categories (CPI PPI)

Alistair Clark   Emily Hsu   Fiona Li   Thomas Lee

Thursday 18th December, 2025

0.1 Analysis Question: Which food categories have had the fastest increase in prices over the past 20–50 years?

We will explore this question using two preprocessed forecast datasets:

- Historical Consumer Price Index (CPI) forecast series
- Historical Producer Price Index (PPI) forecast series

Each contains annual percent-change forecasts by food-related category from 1974–2024.

To quantify "fastest increase," we will measure the average annual percent change in each category over different time windows:

- A long-run window (~50 years): 1974–2024*
- A recent window (20 years): 2004–2024

For each dataset (CPI and PPI), we will:

1. Convert wide data to tidy long format (`Year`, `category`, `pct_change`)
2. Compute mean annual inflation by category within each window
3. Rank categories and identify the top 5 fastest-inflating categories
4. Compare whether categories that inflate quickly in CPI also do so in PPI

0.2 Imports + Load Data

```
import os
import pandas as pd
import matplotlib.pyplot as plt
import sys
sys.path.append('..')  # Just add the parent directory for utils
from utils.data_loader import load_inflation_data
from utils.transformers import reshape_to_long_format

plt.rcParams["figure.figsize"] = (14, 6)
plt.rcParams["axes.grid"] = True

# Load processed data
cpi_wide, ppi_wide = load_inflation_data()

display(cpi_wide.head())
display(ppi_wide.head())
```

	Year	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	...	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0	1974	14.3	2.9	29.9	18.6	0.4	41.9	15.3	14.9	12.7	...	16.5	1.8	2.2	19.3	21.4	3.1	-0.5	-5.1	NaN	52.4
1	1975	8.5	1.0	11.3	3.1	-1.8	10.7	8.5	8.2	9.4	...	3.1	8.5	8.5	15.0	12.8	5.9	22.4	10.5	NaN	26.1
2	1976	3.0	-3.2	-2.2	8.1	9.2	-12.5	11.7	2.1	6.8	...	2.6	0.2	0.9	19.6	4.1	5.9	1.3	-4.1	NaN	-11.3
3	1977	6.3	-0.7	1.6	2.7	-3.2	10.1	10.8	5.9	7.6	...	9.2	-2.3	-0.6	50.6	3.4	-0.6	-5.4	0.7	NaN	5.0
4	1978	9.9	22.9	9.0	6.8	-5.4	9.6	9.4	10.5	9.1	...	11.1	18.6	16.7	5.8	8.0	17.7	12.9	10.4	NaN	12.3

5 rows × 23 columns

	Year	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
0	1974	-10.2	-3.0	6.3	19.3	-4.7	17.4	33.3	14.0	18.9	5.2	-3.1	11.6	59.4	1.1	-11.3	29.4
1	1975	-1.7	-0.6	9.5	4.2	-18.4	-8.7	-19.7	8.4	-2.4	1.3	11.1	6.5	-13.1	32.4	17.0	-13.5
2	1976	-7.1	12.1	1.2	11.6	6.0	-7.7	-13.3	-0.3	-5.1	-0.8	-11.4	8.1	-20.9	-6.2	-9.7	-9.5
3	1977	2.3	-9.6	11.1	0.8	18.8	3.7	-22.5	5.3	2.8	0.9	0.9	3.0	16.5	-5.6	4.3	-19.6
4	1978	32.4	-2.1	20.3	8.4	-5.8	7.0	24.3	9.0	6.5	12.6	28.3	8.6	8.5	15.3	12.0	19.1

0.3 Convert to tidy long format

The preprocessed files are in wide format (one column per category). For analysis, we will convert them to long format with columns:

- `Year`
- `category`
- `pct_change` (annual percent change forecast)

```
cpi_long = reshape_to_long_format(cpi_wide)
ppi_long = reshape_to_long_format(ppi_wide)

display(cpi_long.head())
display(ppi_long.head())
```

	Year	category	pct_change
0	1974	All_food	14.3
1	1975	All_food	8.5
2	1976	All_food	3.0
3	1977	All_food	6.3
4	1978	All_food	9.9

	Year	category	pct_change
0	1974	Farm_level_cattle	-10.2
1	1975	Farm_level_cattle	-1.7
2	1976	Farm_level_cattle	-7.1
3	1977	Farm_level_cattle	2.3
4	1978	Farm_level_cattle	32.4

0.4 Defining the metric: average annual percent change

For each category and time window, we compute 'pct_change,' which is the annual percent change forecast in that category. A higher value means the category is, on average, expected to experience faster price growth in that period.

```
# Helper function:
def mean_inflation_by_category(df_long: pd.DataFrame,
                               start_year: int,
                               end_year: int) -> pd.Series:
    """
    Compute mean annual percent change per category within a given year window.
    Parameters
    - - - - - - - - - -
    df_long : pd.DataFrame
        Long -format data with columns: Year, category, pct_change.
    start_year : int
        Inclusive start of the window.
    end_year : int
        Inclusive end of the window.

    Returns
    - - - - - - -
    pd.Series
        Mean pct_change per category, sorted descending order.
    """
    window = df_long[
        (df_long["Year"] >= start_year) & (df_long["Year"] <= end_year)
    ]
    means = (
        window.groupby("category")["pct_change"]
        .mean()
        .sort_values(ascending=False)
    )
    return means

# Define Time Windows:
full_start, full_end = 1974, 2024   # ~50 -year window
recent_start, recent_end = 2004, 2024  # Last 20 years
```

0.5 CPI: Fastest-inflating categories (long-run vs last 20 years)

We first look at CPI forecasts and compute average annual inflation by category for:

- 1974–2024 (approximately 50 years)
- 2004–2024 (recent 20-year window)

0.5.1 Compute Means

```
cpi_mean_full = mean_inflation_by_category(cpi_long, full_start, full_end)
cpi_mean_recent = mean_inflation_by_category(cpi_long, recent_start, recent_end)

display(cpi_mean_full.head())
display(cpi_mean_recent.head())
```

```
category
```

```
Sugar_and_sweets              4.588235
Fresh_fruits                  4.576471
Cereals_and_bakery_products   4.321569
Food_away_from_home           4.278431
Fresh_fruits_and_vegetables   4.268627
Name: pct_change, dtype: float64

category
Beef_and_veal         4.395238
Eggs                  4.304762
Fats_and_oils         3.519048
Food_away_from_home   3.423810
Meats                 3.376190
Name: pct_change, dtype: float64
```

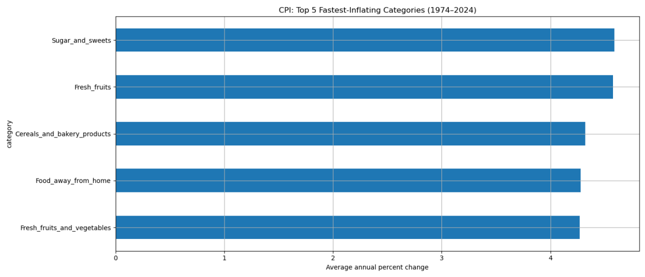
0.5.2 Top 5 Tables

```
cpi_top5_full = cpi_mean_full.head(5)
cpi_top5_recent = cpi_mean_recent.head(5)

display(cpi_top5_full)
display(cpi_top5_recent)
```

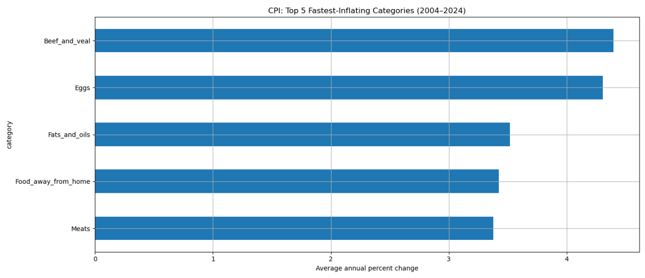
```
category
Sugar_and_sweets              4.588235
Fresh_fruits                  4.576471
Cereals_and_bakery_products   4.321569
Food_away_from_home           4.278431
Fresh_fruits_and_vegetables   4.268627
Name: pct_change, dtype: float64

category
Beef_and_veal         4.395238
Eggs                  4.304762
Fats_and_oils         3.519048
Food_away_from_home   3.423810
Meats                 3.376190
Name: pct_change, dtype: float64
```

0.5.3 Bar Plots

```
fig, ax = plt.subplots()
cpi_top5_full.plot(kind="barh", ax=ax)
plt.gca().invert_yaxis() # top to bottom
ax.set_title("CPI: Top 5 Fastest -Inflating Categories (1974-2024)")
ax.set_xlabel("Average annual percent change")
plt.tight_layout()
plt.savefig('../figures/cpi_top_5_inflating_categories_1974_2024.png')
plt.show()
```



```
fig, ax = plt.subplots()
cpi_top5_recent.plot(kind="barh", ax=ax)
plt.gca().invert_yaxis() # top to bottom
ax.set_title("CPI: Top 5 Fastest -Inflating Categories (2004-2024)")
ax.set_xlabel("Average annual percent change")
plt.tight_layout()
plt.savefig('../figures/cpi_top_5_inflating_categories_2004_2024.png')
plt.show()
```



0.6 PPI: Fastest-inflating categories (long-run vs last 20 years)

We will now repeat the same analysis using PPI forecasts, which focus on producer-level prices.

0.6.1 Compute means

```
ppi_mean_full = mean_inflation_by_category(ppi_long, full_start, full_end)
ppi_mean_recent = mean_inflation_by_category(ppi_long, recent_start, recent_end)

display(ppi_mean_full.head())
display(ppi_mean_recent.head())
```

```
category
```

```
Farm_level_eggs           6.534694
Wholesale_fats_and_oils   4.131373
Farm_level_milk           3.476471
Farm_level_vegetables     3.450980
Wholesale_beef            3.409804
Name: pct_change, dtype: float64

category
Farm_level_eggs           13.176190
Farm_level_wheat           5.128571
Farm_level_milk            4.914286
Wholesale_fats_and_oils    4.890476
Farm_level_vegetables      4.747619
Name: pct_change, dtype: float64
```

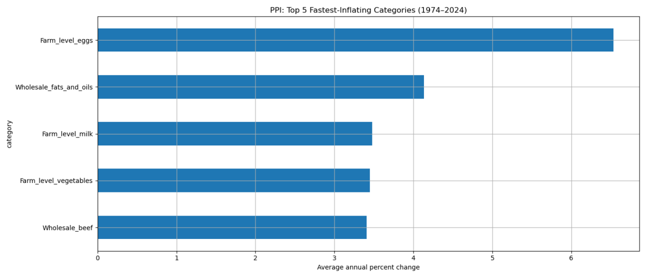
0.6.2 Top 5 Tables

```
ppi_top5_full = ppi_mean_full.head(5)
ppi_top5_recent = ppi_mean_recent.head(5)

display(ppi_top5_full)
display(ppi_top5_recent)
```

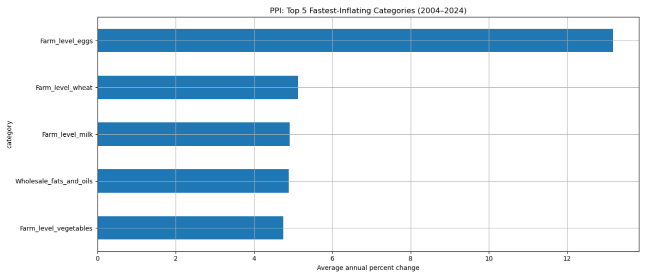
```
category
Farm_level_eggs           6.534694
Wholesale_fats_and_oils   4.131373
Farm_level_milk           3.476471
Farm_level_vegetables     3.450980
Wholesale_beef            3.409804
Name: pct_change, dtype: float64

category
Farm_level_eggs           13.176190
Farm_level_wheat           5.128571
Farm_level_milk            4.914286
Wholesale_fats_and_oils    4.890476
Farm_level_vegetables      4.747619
Name: pct_change, dtype: float64
```

0.6.3 Bar Plots

```
fig, ax = plt.subplots()
ppi_top5_full.plot(kind="barh", ax=ax)
plt.gca().invert_yaxis() # top to bottom
ax.set_title("PPI: Top 5 Fastest -Inflating Categories (1974-2024)")
ax.set_xlabel("Average annual percent change")
plt.tight_layout()
plt.savefig('../figures/ppi_top_5_inflating_categories_1974_2024.png')
plt.show()
```



```
fig, ax = plt.subplots()
ppi_top5_recent.plot(kind="barh", ax=ax)
plt.gca().invert_yaxis() # top to bottom
ax.set_title("PPI: Top 5 Fastest -Inflating Categories (2004-2024)")
ax.set_xlabel("Average annual percent change")
plt.tight_layout()
plt.savefig('../figures/ppi_top_5_inflating_categories_2004_2024.png')
plt.show()
```



1 Side-by-Side Comparison Tables

1.1 CPI:

```
cpi_q1_summary = pd.DataFrame({
    "CPI_top5_full": cpi_top5_full.index,
    "CPI_full_mean": cpi_top5_full.values,
    "CPI_top5_recent": cpi_top5_recent.index,
    "CPI_recent_mean": cpi_top5_recent.values,
})

cpi_q1_summary
```

	CPI_top5_full	CPI_full_mean	CPI_top5_recent	CPI_recent_mean
0	Sugar_and_sweets	4.588235	Beef_and_veal	4.395238
1	Fresh_fruits	4.576471	Eggs	4.304762
2	Cereals_and_bakery_products	4.321569	Fats_and_oils	3.519048
3	Food_away_from_home	4.278431	Food_away_from_home	3.423810
4	Fresh_fruits_and_vegetables	4.268627	Meats	3.376190

1.2 PPI:

```
ppi_q1_summary = pd.DataFrame({
    "PPI_top5_full": ppi_top5_full.index,
    "PPI_full_mean": ppi_top5_full.values,
    "PPI_top5_recent": ppi_top5_recent.index,
    "PPI_recent_mean": ppi_top5_recent.values,
})

ppi_q1_summary
```

	PPI_top5_full	PPI_full_mean	PPI_top5_recent	PPI_recent_mean
0	Farm_level_eggs	6.534694	Farm_level_eggs	13.176190
1	Wholesale_fats_and_oils	4.131373	Farm_level_wheat	5.128571
2	Farm_level_milk	3.476471	Farm_level_milk	4.914286
3	Farm_level_vegetables	3.450980	Wholesale_fats_and_oils	4.890476
4	Wholesale_beef	3.409804	Farm_level_vegetables	4.747619

2 Combine CPI + PPI into a single comparison table

```
combined_q1_summary = pd.DataFrame({
    "CPI_top5_full": cpi_top5_full.index,
    "CPI_full_mean": cpi_top5_full.values,
    "PPI_top5_full": ppi_top5_full.index,
    "PPI_full_mean": ppi_top5_full.values,
    "CPI_top5_recent": cpi_top5_recent.index,
    "CPI_recent_mean": cpi_top5_recent.values,
    "PPI_top5_recent": ppi_top5_recent.index,
    "PPI_recent_mean": ppi_top5_recent.values,
})

combined_q1_summary
```

	CPI_top5_full	CPI_full_mean	PPI_top5_full	PPI_full_mean	CPI_top5_recent	CPI_recent_mean	PPI_top5_recent	PPI_recent_mean
0	Sugar_and_sweets	4.588235	Farm_level_eggs	6.534694	Beef_and_veal	4.395238	Farm_level_eggs	13.176190
1	Fresh_fruits	4.576471	Wholesale_fats_and_oils	4.131373	Eggs	4.304762	Farm_level_wheat	5.128571
2	Cereals_and_bakery_products	4.321569	Farm_level_milk	3.476471	Fats_and_oils	3.519048	Farm_level_milk	4.914286
3	Food_away_from_home	4.278431	Farm_level_vegetables	3.450980	Food_away_from_home	3.423810	Wholesale_fats_and_oils	4.890476
4	Fresh_fruits_and_vegetables	4.268627	Wholesale_beef	3.409804	Meats	3.376190	Farm_level_vegetables	4.747619

3 Saving Results

```
# make a directory called food_price_trend_summary under ../outputs/
save_directory = "../outputs/food_price_trend_summary/"
os.makedirs(save_directory, exist_ok=True)

# Save CPI results:
cpi_mean_full.to_csv(save_directory + "cpi_mean_full_window.csv")
cpi_mean_recent.to_csv(save_directory + "cpi_mean_recent_window.csv")
cpi_q1_summary.to_csv(save_directory + "q1_cpi_top5_summary.csv", index=False)

# Save PPI results:
ppi_mean_full.to_csv(save_directory + "ppi_mean_full_window.csv")
ppi_mean_recent.to_csv(save_directory + "ppi_mean_recent_window.csv")
ppi_q1_summary.to_csv(save_directory + "q1_ppi_top5_summary.csv", index=False)

# Save combined CPI + PPI comparison table:
combined_q1_summary.to_csv(save_directory + "q1_combined_cpi_ppi_summary.csv",
                           index=False)

print("All Q1 outputs saved successfully!")
```

```
All Q1 outputs saved successfully!
```