

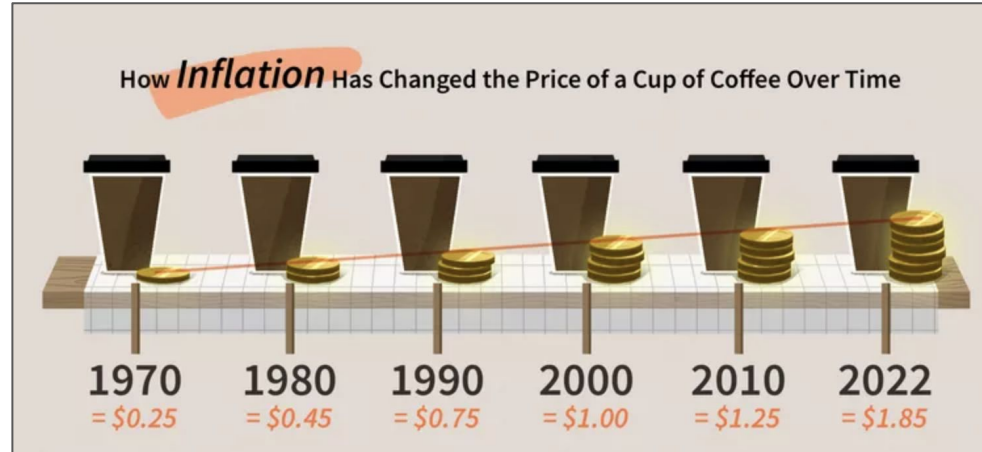
Case study of Sri Lankan Inflation using Web Archives

Web Archiving Forensics Study

Presented by Bhanuka Mahanama
December 05, 2022

What is Inflation?

- General increase in prices of goods and services
 - Price level rises => currency buys fewer
 - Reduction in purchasing power
- Economic growth require optimum level of inflation
 - Higher inflation: Bad



<https://www.investopedia.com/>

Calculation of Inflation

- Measured using Consumer Price Index (CPI)
 - Examines weighted average prices of basket of goods over time
 - Includes food, housing, transportation, medical, etc.
 - Sampled selected locations
 - Types: CPI-U (U=Urban), CPI-Core, etc.
- CPIs in Sri Lanka
 - Two CPIs
 - National CPI (NCPI)
 - Colombo CPI (CCPI)
 - Similar to CPI-U

Sri Lanka CCPI

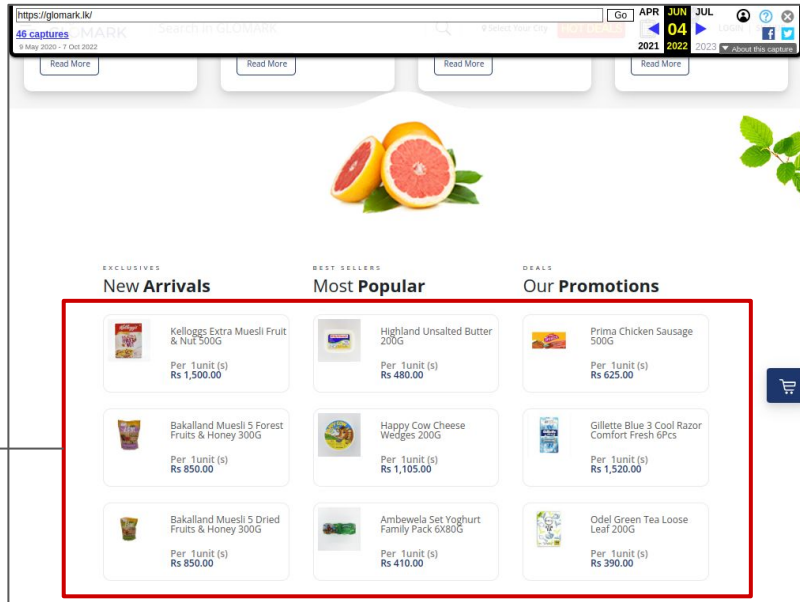
- CCPI
 - Index: 2013 (2013 =100)
 - 2022 January: 158.4
 - 2022 November: 242.6
 - Inflation during period: 53.1%
- CCPI - Core
 - Excludes food and energy
 - 2022 January: 154.1
 - 2022 November: 223.2
 - Inflation during period: 44.8%

Methodology

- Data collection
 - Archived web pages of online retailers
 - Glomark (glomark.lk)
 - Internet Archive
 - Time between January 2022 - November 2022
 - ~ 2000 Mementos
- Analysis
 - Three product categories
 - Rice, Dairy products, Soap
 - Advertised prices
 - Ignore discounts
 - Monthly average price
 - Compute price hikes

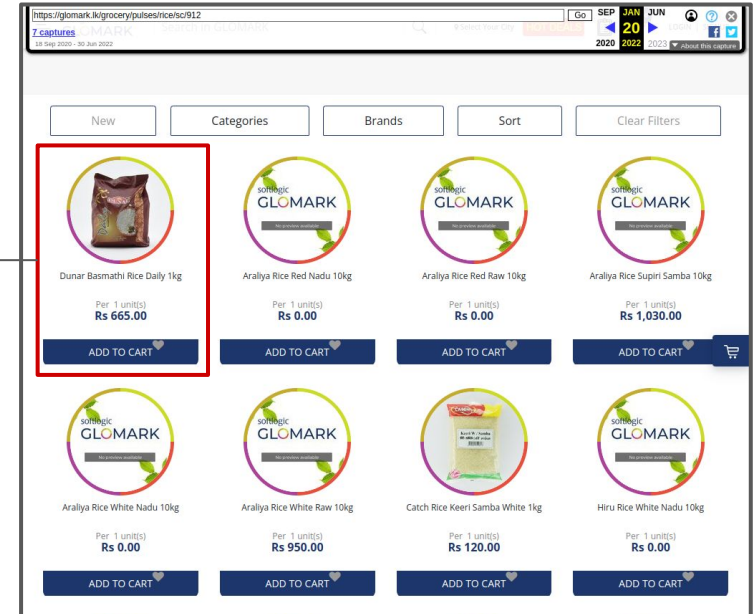
Types of Archived Pages

Prices on homepage



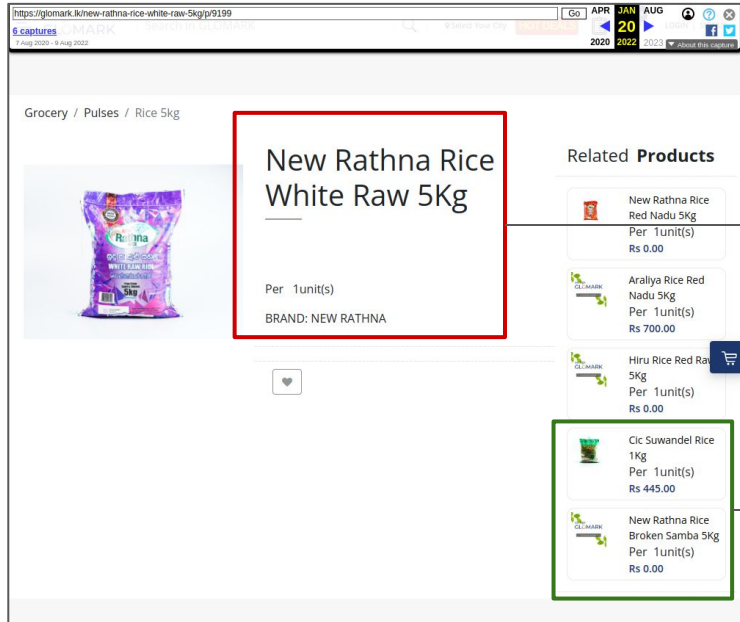
<https://web.archive.org/web/20220604191805/https://glomark.lk/>

Category page - Rice



<https://web.archive.org/web/20220604191805/https://glomark.lk/>

Types of Archived Pages: Product Pages



<https://web.archive.org/web/20220120041727/https://glomark.lk/new-rathna-rice-white-raw-5kg/p/9199>

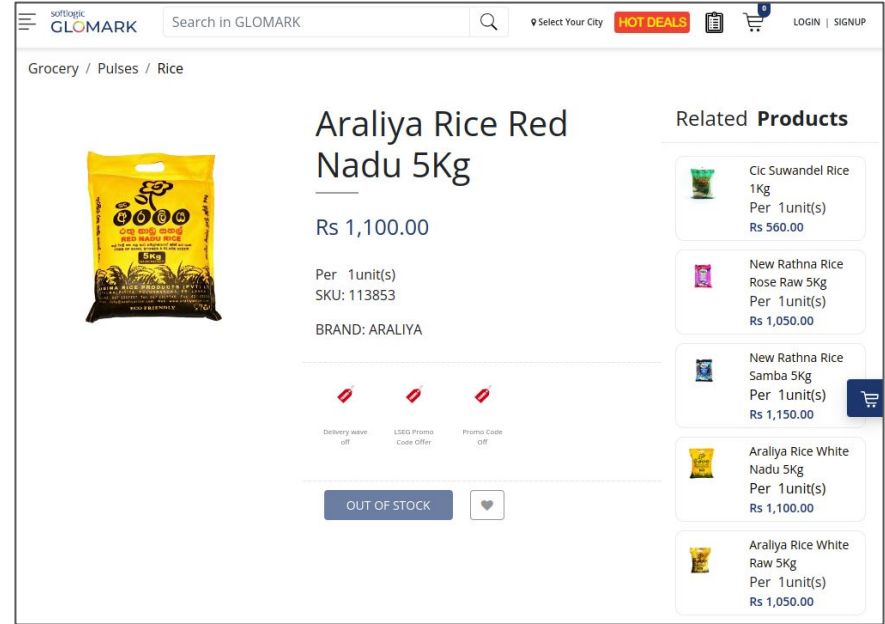
Missing price available on source

Related products with pricing



Product Category: Rice

- Two staple rice variants
 - Nadu: Araliya Rice Red
 - Samba
- Price controlled
 - Ceiling price per kilogram
 - Same price for all manufacturers
- 5 Kg packaging



<https://glomark.lk/araliya-rice-red-nadu-5kg/p/7250>

Rice: Nadu

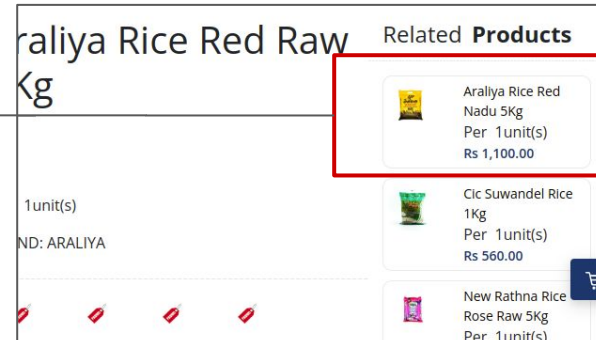
Month	# Mementos	Price
January	1	700.00
May	3	1100.00
December	Live	1100.00

Same product
(Jan 2022)



<https://web.archive.org/web/20220120041727/https://glomark.lk/new-rathna-rice-white-raw-5kg/p/9199>

Same product
(May 2022)

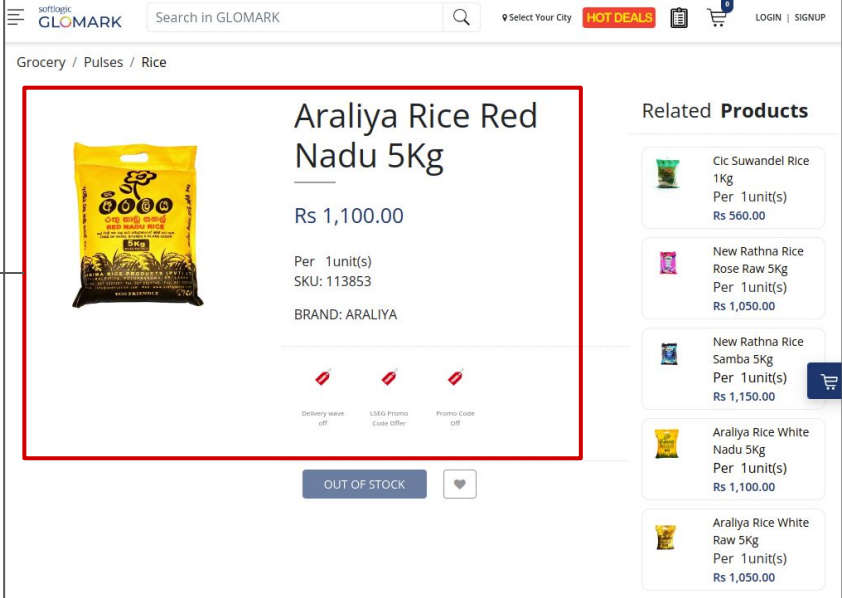


<https://web.archive.org/web/20220517174348/https://glomark.lk/araliya-rice-red-raw-5kg/p/13215>

Nadu: 57% Price Increase

Month	# Mementos	Price
January	1	700.00
May	3	1100.00
December	Live	1100.00

- Price hike: January 20 - May 17
- Most popular variant
 - Healthier
 - Cheaper



The screenshot shows the GLOMARK website interface. The main product displayed is 'Araliya Rice Red Nadu 5Kg' with a price of Rs 1,100.00. The product is marked as 'OUT OF STOCK'. The page includes a search bar, navigation links, and a list of related products. A red box highlights the product details section.

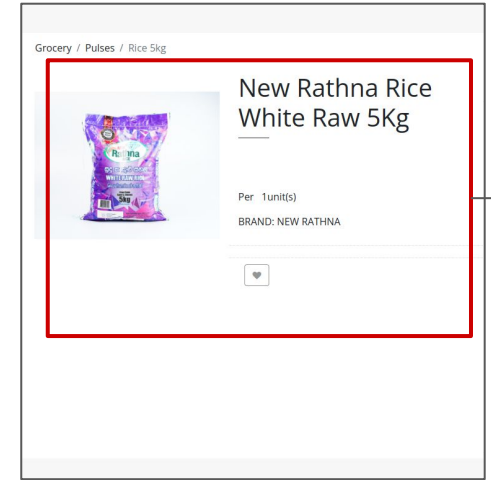
Related Products:

- Cic Suwandel Rice 1Kg Per 1unit(s) Rs 560.00
- New Rathna Rice Rose Raw 5Kg Per 1unit(s) Rs 1,050.00
- New Rathna Rice Samba 5Kg Per 1unit(s) Rs 1,150.00
- Araliya Rice White Nadu 5Kg Per 1unit(s) Rs 1,100.00
- Araliya Rice White Raw 5Kg Per 1unit(s) Rs 1,050.00

<https://glomark.lk/araliya-rice-red-nadu-5kg/p/7250>

Rice: Samba

Month	# Mementos	Price
January	1	465.00
May	3	515.00
June	1	1150.00
December	Live	1150.00



<https://web.archive.org/web/20220120041727/https://glomark.lk/new-rathna-rice-white-ra-w-5kg/p/9199>

```
<script type="application/ld+json">
{
  "@context": "https://web.archive.org/web/20220120041727/https://glomark.lk/new-rathna-rice-white-ra-w-5kg/p/9199",
  "@type": "Product",
  "productID": "9199",
  "name": "New Rathna Rice White Raw 5Kg",
  "description": "New Rathna Rice White Raw 5Kg",
  "url": "/new-rathna-rice-white-raw-5kg/p/9199",
  "image": "https://web.archive.org/web/20220120041727/https://glomark.lk/new-rathna-rice-white-raw-5kg/p/9199",
  "brand": "NEW RATHNA",
  "offers": [
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      "@type": "Offer",
      "price": "465",
      "priceCurrency": "LKR",
      "itemCondition": "https://web.archive.org/web/20220120041727/https://glomark.lk/new-rathna-rice-white-raw-5kg/p/9199",
      "availability": "https://web.archive.org/web/20220120041727/https://glomark.lk/new-rathna-rice-white-raw-5kg/p/9199"
    }
  ]
}
```

Samba: Price Hikes

Month	# Mementos	Price
January	1	465.00
May	3	515.00
June	1	1150.00
December	Live	1150.00

Same product
(May 2022)

Araliya Rice Red Raw

Related Products

- Araliya Rice Red Nadu 5Kg Per 1 unit(s) Rs 1,100.00
- Cic Suwandel Rice 1Kg Per 1 unit(s) Rs 560.00
- New Rathna Rice Rose Raw 5Kg Per 1 unit(s) Rs 465.00
- New Rathna Rice Samba 5Kg Per 1 unit(s) Rs 515.00**
- Araliya Rice White

ALIYA

Delivery wave off

LAST Promo Code Offer

Promo Code Off

Same product
(June 2022)

Rice White

Related Products

- Araliya Rice Red Nadu 5Kg Per 1 unit(s) Rs 1,100.00
- Cic Suwandel Rice 1Kg Per 1 unit(s) Rs 560.00
- New Rathna Rice Rose Raw 5Kg Per 1 unit(s) Rs 465.00
- New Rathna Rice Samba 5Kg Per 1 unit(s) Rs 1,150.00**

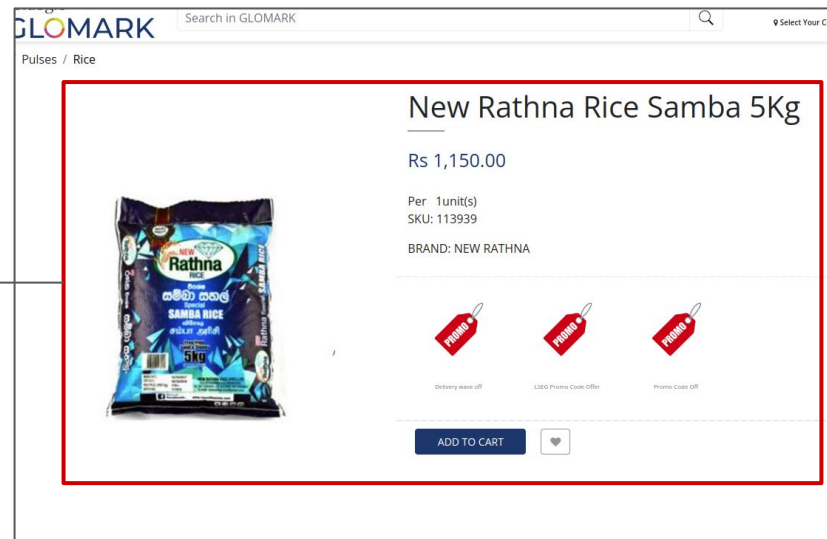
Promo Code Off

<https://web.archive.org/web/20220517174348/https://glomark.lk/araliya-rice-red-raw-5kg/p/13215>

<https://web.archive.org/web/20220628092803/https://glomark.lk/araliya-rice-white-raw-5kg/p/9185>

Samba: 147% Price Increase

Month	# Mementos	Price
January	1	465.00
May	3	515.00
June	1	1150.00
December	Live	1150.00



<https://glomark.lk/new-rathna-rice-samba-5kg/p/8228>

- Possible reasons:
 - Mostly Imported
 - Depreciation of LKR

Product Category: Dairy Products

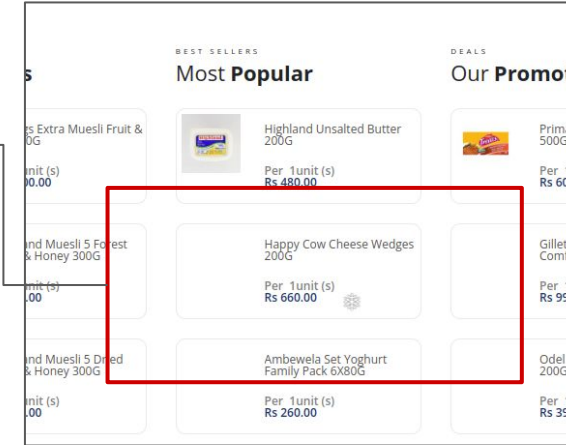
- Three types of dairy products
 - Cheese: Happy Cow Cheese Wedges (200G)
 - Yoghurt: Ambewela Yoghurt Family Pack (6X80G)
 - Butter: Highland Unsalted Butter (200G)
- Not price controlled
 - Manufacturer-dictated pricing

Dairy Products: Cheese

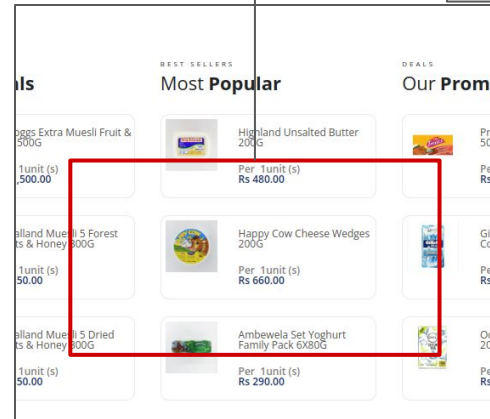
Month	# Mementos	Price
January	1	660.00
February	1	660.00
March	3	784.00
April	2	884.00
May	2	1105.00
June	1	1105.00
July	1	1390.00
August	1	1390.00
December	live	1341.00

January 03

February 05



<https://web.archive.org/web/20220103102534/https://glomark.lk/>

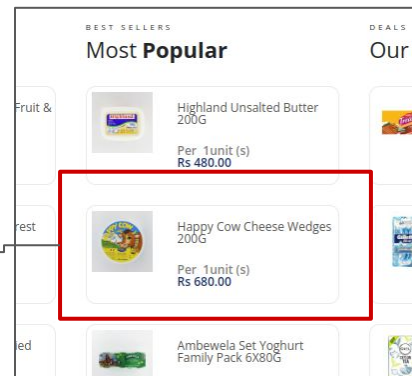


<https://web.archive.org/web/20220205094523/https://glomark.lk/>

Cheese: First Price Hike in March

Month	# Mementos	Price
January	1	660.00
February	1	660.00
March	3	784.00
April	2	884.00
May	2	1105.00
June	1	1105.00
July	1	1390.00
August	1	1390.00
December	live	1341.00

March 05: 680.00
March 11: 680.00
March 27: 884.00



<https://web.archive.org/web/20220311040905/https://glomark.lk/>

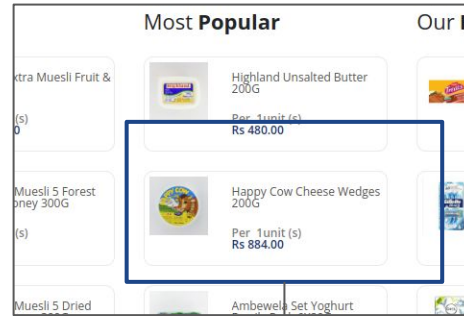


<https://web.archive.org/web/20220327122307/https://glomark.lk/>

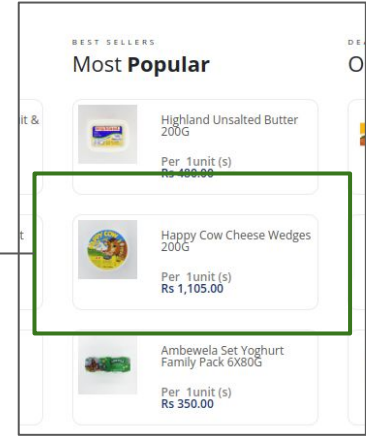
Cheese: More Price Hikes

Month	# Mementos	Price
January	1	660.00
February	1	660.00
March	3	784.00
April	2	884.00
May	2	1105.00
June	1	1105.00
July	1	1390.00
August	1	1390.00
December	live	1341.00

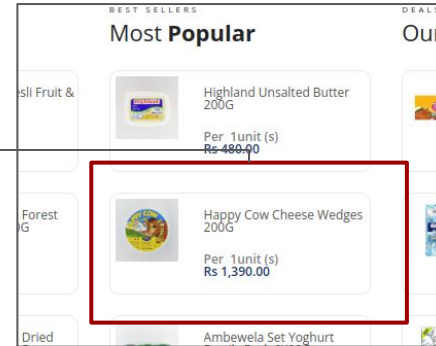
April 23



May 18 - June 04



July 20



<https://web.archive.org/web/20220423132517/https://glomark.lk/>

<https://web.archive.org/web/20220518181139/https://glomark.lk/>

<https://web.archive.org/web/20220720003940/https://glomark.lk/>

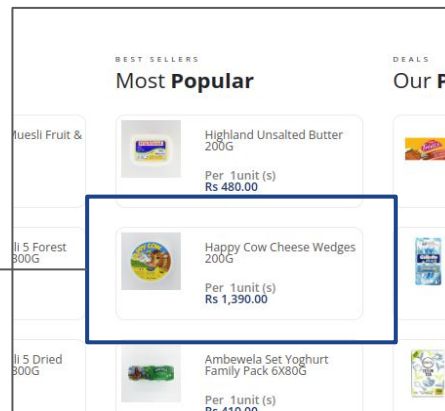
Cheese: Missing Price Hike

Month	# Mementos	Price
January	1	660.00
February	1	660.00
March	3	784.00
April	2	884.00
May	2	1105.00
June	1	1105.00
July	1	1390.00
August	1	1390.00
December	live	1341.00

August 09

1490.00
When ??

1490.00
(10% off)



<https://web.archive.org/web/20220809125618/https://glomark.lk/>



<https://glomark.lk/happy-cow-cheese-wedges-200g/p/7675>

Cheese: **203%** Price Increase

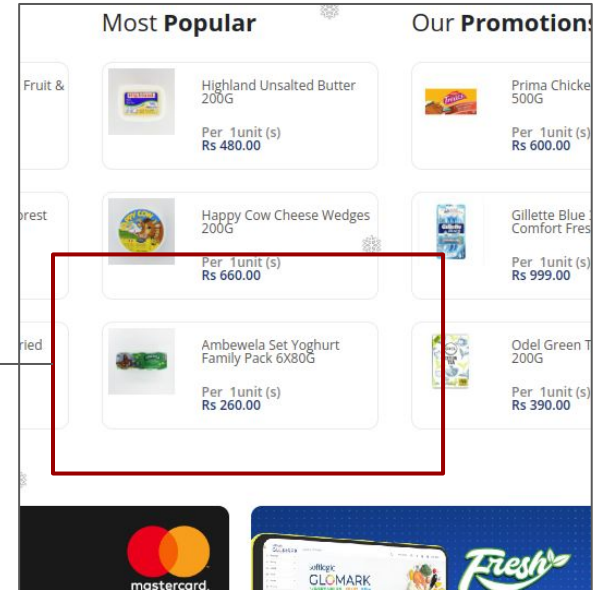
Month	# Mementos	Price
January	1	660.00
February	1	660.00
March	3	784.00
April	2	884.00
May	2	1105.00
June	1	1105.00
July	1	1390.00
August	1	1390.00
December	live	1341.00

- 225% ignoring discounts
- Price hikes between,
 - March 11 - March 27 (33%)
 - April 23 - May 18 (25%)
 - June 04 - July 20 (26%)
- Product made in Austria
 - LKR depreciation
 - Import restrictions

Dairy Products: Yoghurt

Month	# Mementos	Price
January	1	260.00
February	1	290.00
March	3	290.00
April	2	350.00
May	2	350.00
June	1	410.00
July	1	410.00
August	1	410.00
December	live	460.00

January 03



<https://web.archive.org/web/20220103102534/https://glo.mark.lk/>

Yoghurt: Price Hikes

Month	# Mementos	Price	
January	1	260.00	
February	1	290.00	February 05 - March 27
March	3	290.00	
April	2	350.00	April 19 - May 20
May	2	350.00	
June	1	410.00	June 04 - Aug 09
July	1	410.00	
August	1	410.00	
December	live	460.00	

Yoghurt: 70% Price Increase

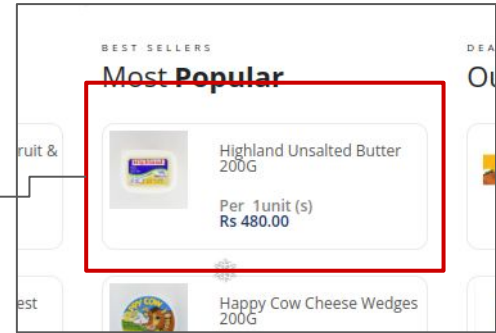
Month	# Mementos	Price
January	1	260.00
February	1	290.00
March	3	290.00
April	2	350.00
May	2	350.00
June	1	410.00
July	1	410.00
August	1	410.00
December	live	460.00

- 70% price increase in 2022
- Price hikes between,
 - January 3 - February 05 (33%)
 - March 27 - April 19 (25%)
 - May 20 - June 04 (26%)
- Missing price hike to 460.00
- Product manufactured locally
 - Lesser impact of LKR depreciation

Butter: No price increase?

Month	# Mementos	Price (LKR)
January	1	480.00
February	1	480.00
March	3	480.00
April	2	480.00
May	2	480.00
June	1	480.00
July	1	480.00
August	1	480.00
December	live	480.00

January 03



<https://web.archive.org/web/20220103102534/>
<https://glomark.lk/>

- Possible reason

- Product manufactured by Milko (Pvt) Ltd.
- 100% state owned company
- Locally manufactured
- Relies on government subsidies

Product Category 3: Soap

- Product: Dettol soap 110g
 - Same price for different scents
 - Manufacturer-dictated pricing



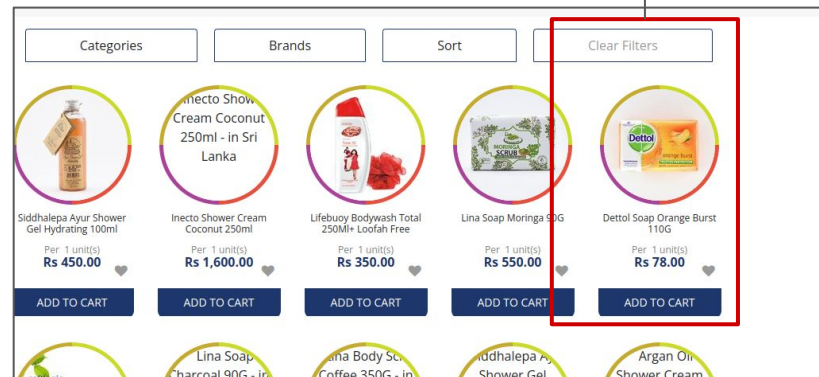
<https://glomark.lk/dettol-soap-skincare-110g/p/10119>

Soap: 169% price increase

Month	Price
October (2021)	78.00
May	110.00
June	160.00
December	210.00

- No mementos with price in January
 - Assuming no price change after October 2021

October 27, 2021
(Closest to January)



<https://web.archive.org/web/20211027090658/https://glomark.lk/household/body-care/eansing/body-care/sc/1035>

Summary

- Quantifying price hikes using web archives
 - Timeline of price hikes
 - Events not captured by macro-economic metrics
 - e.g. Inflation, Price Indices
- Limitations
 - Cannot capture price hikes between mementos
 - Accuracy depends on relevant archived content
 - Costly and time-consuming
 - Depends on pricing strategies of sellers
 - Discounts, Markups, Regulations
- Applications
 - Understanding price behavior of different products
 - Fact checking
 - Supplementary evidence for economic performance
- Future Directions
 - Expansion to other archives and retailers

Github: <https://github.com/mahanama94/cs895-sri-lanka-inflation>