MINISTRY OF ECONOMY
DEPARTMENT OF STATISTICS MALAYSIA

# Empirical Measure and Analysis of Inflation Persistence in Malaysia

**10TH MALAYSIA**
**STATISTICS CONFERENCE**

"*Looking Beyond GDP: Towards Social Well-being and Environmental Sustainability*"

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Organised by:

MINISTRY OF ECONOMY
DEPARTMENT OF STATISTICS

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# High and/or sustained inflation may negatively impact both welfare

① **Visibly higher cost of living**

- *Households have lower purchasing power, given nominal rigidities*

- *Firms may be unable to keep up with market-clearing nominal wages*

- *Generally, slower economic growth in the near-term*

② **Uncertainty and volatility in financial markets, especially emerging market economies**

③ **Risk of dis-anchoring of inflation expectations, potentially leading to policy instruments becoming ineffective, and volatility in relative prices**

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# Concurrence on presence of inflation persistence, but some debate on its characteristics

| Reduced form | Structural Persistence |
|---|---|
| **Tillmann and Wolters (2014)**<br>• US (1940s – 2013), EA (1990s – 2013)<br>• CPI, PCE, GDP Deflator (monthly, quarterly)<br>• Evidence of inflation persistence, time-varying in US but not in EA | **Alogoskoufis and Smith (1991)**<br>• US and UK (1850s – 1987)<br>• Log of CPI (annually)<br>• Using Philips Curve: Evidence of inflation persistence |
| **Canarella and Miller (2016)**<br>• OECD countries (1976 – 2013)<br>• Log first difference of CPI (monthly)<br>• Evidence of inflation persistence, structural break consistent with financial events | **Cogley and Sbordone (2006)**<br>• US (1947Q1 – 2003Q4)<br>• Log Implicit GDP deflator (quarterly)<br>• Using New Keynesian Philips curve (NKPC): Evidence of inflation persistence |
| **Arize et al (2005)**<br>• 50 developing countries (1973 – 2000)<br>• First difference of log CPI (quarterly)<br>• Evidence of inflation persistence, but resistant to structural changes | **Murray et al (2008)**<br>• US (1954Q3 – 2007Q1)<br>• GDP deflator (quarterly)<br>• Using Taylor rule<br>• Evidence of inflation persistence, but time-varying |

**①** **Most studies focus on <u>developed countries</u>.**

**②** **Evidence of inflation persistence but different characteristics.**

**③** **Different price indices with different frequencies being used.**

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# Stylised fact: Inflation has mostly hovered around the 0-5% range since the 1980s, with visibly little fluctuation



Headline Inflation (Monthly YoY)



Core Inflation (Monthly YoY)
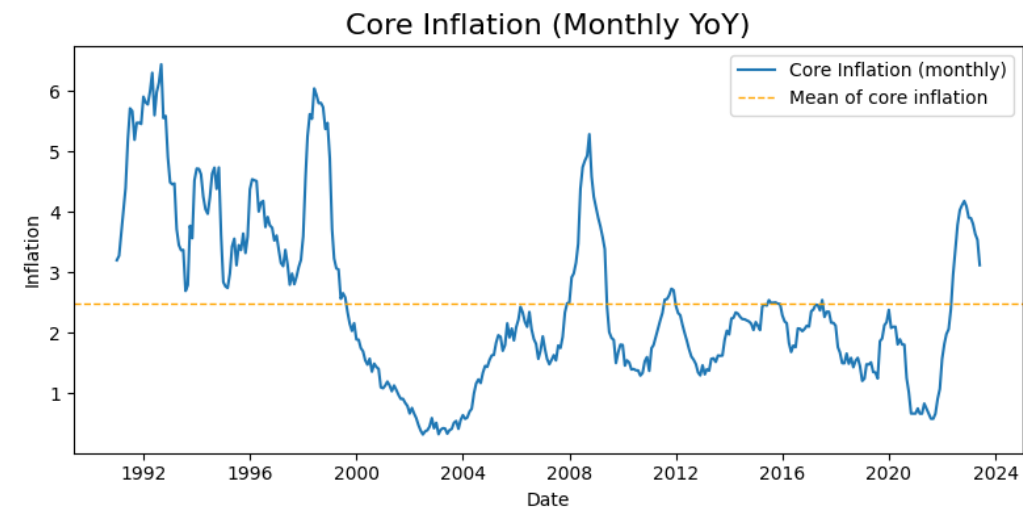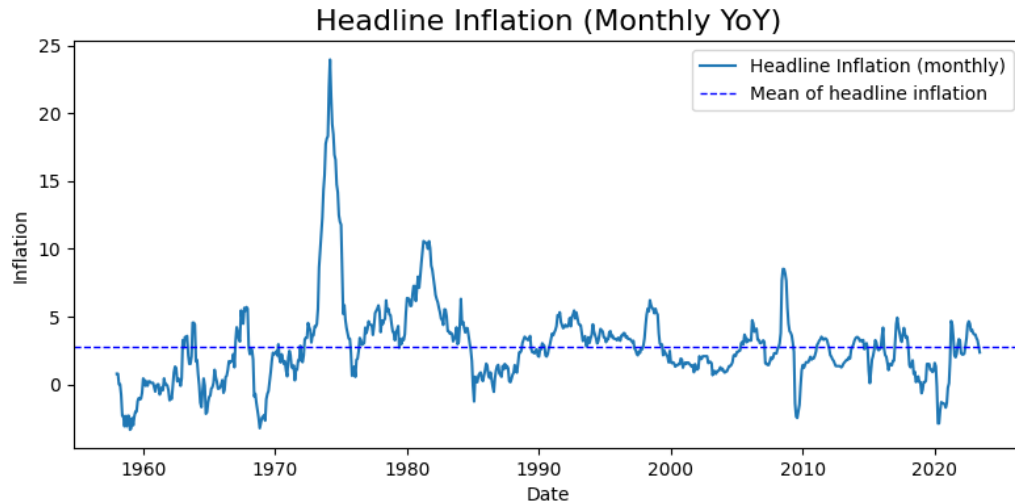
## Summary of Inflation in Malaysia

1. Headline and core inflation hovered around 0-5% most of the time, with respective mean of 2.786% and 2.484%.

2. High inflation throughout the 1970s and 1980s until the commodity price shock in 1985-86.

3. Singh (2016) demonstrates a decline in inflation persistence in Malaysia until 2015.

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# Estimating inflation persistence (1970 – 2023)* with the serial correlation definition in an AR(p) setting

For a $AR(p)$ process:

$$\pi_t = \alpha + \sum_{i=1}^{p} \beta_i \pi_{t-i} + \varepsilon_t$$

where :
$\pi_t$ is the Y-o-Y inflation
$\alpha$ is an intercept term
$\varepsilon_t$ is serially uncorrelated error term

**Measurement of inflation persistence** , $\boldsymbol{\rho}$:

$$\rho = \sum_{i=1}^{p} \beta_i$$

- Inflation persistence is high when the current inflation rate is strongly influenced by the lag values, i.e $\boldsymbol{\rho \approx 1}$

- Dossche and Everaert (2005) suggested that if $\boldsymbol{\rho \leq 0.5}$ then the inflation has low persistence.

**Robustness Testing:**

- Rolling-window approach is adopted using window size of 14 years as suggested by Pivetta & Reis (2007)

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**Analysis flow**

Estimate persistence using **full sample** for headline, and core inflation, and their components

↓

Estimate persistence using **rolling regression** with 14-year window

↓

Apply methodology to **other countries** for comparison

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\* subject to availability of the dataset. Some series have shorter period.

\*\* $p = 12$ are included for monthly data..

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# Headline inflation: Generally, inflation persistence is high, but drops around downturns

## Model using Full Sample (1971M1 – 2023M5):

$$\pi_t = 0.164 + \sum_{i=1}^{12} \widehat{\beta_i} \pi_{t-i} + \varepsilon_t, \qquad \boldsymbol{\rho} = \sum_{i=1}^{12} \widehat{\beta_i} = 0.951 > 0.5$$

## Rolling sample estimates of $\rho$ using window size of 14 years:



Rolling Estimate of Headline Inflation Persistence (1971-2023)
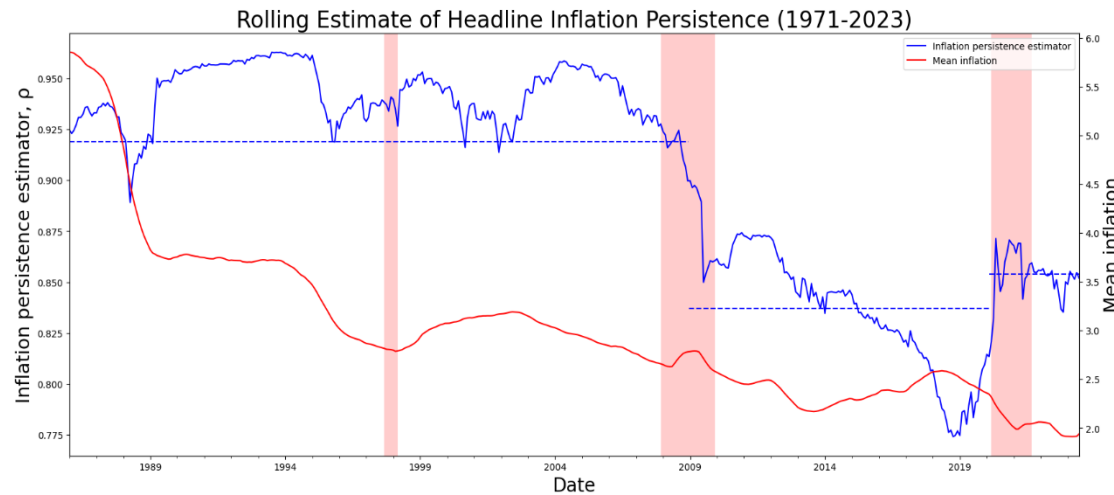
- Headline inflation persistence (i) declined steadily since 2009, (ii) bottomed out in 2019, and (iii) increased since 2020

- Average headline persistence: (i) pre-GFC: 0.919, (ii) post-GFC but pre-COVID-19: 0.837, (iii) onset of COVID-19: 0.854.

- Trend of inflation persistence up to 2015 is broadly consistent with Singh (2016).

- Inflation persistence decreased during or after the economic crisis, reflecting the more sudden change in inflation during the period.

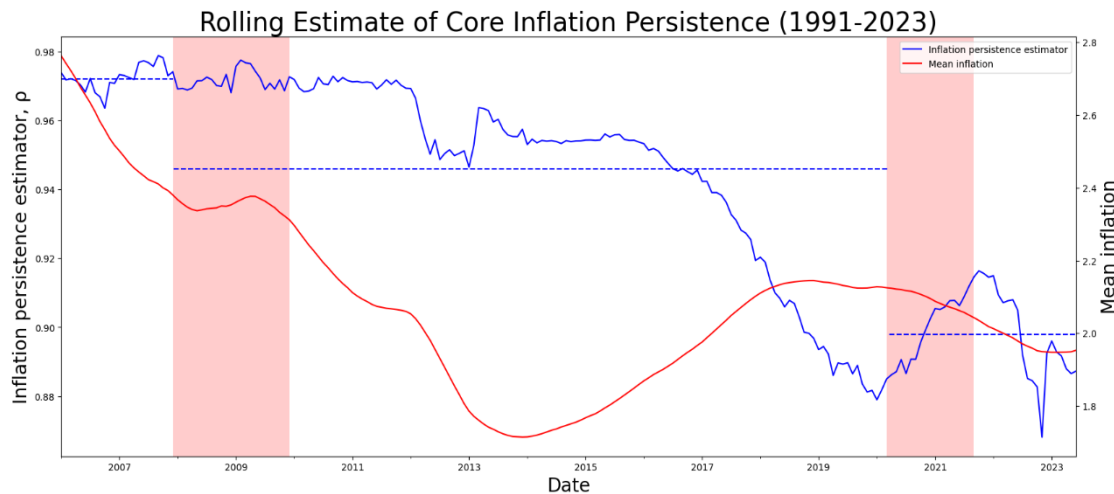- Robustness check using different window sizes (10, 12, 16 years) confirm a similar conclusion.

\* Highlighted periods are the periods when Malaysia faced economic crisis.

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# Core inflation: Persistence remains high after removing price-volatile and price-administered items

## Model using Full Sample (1991M1 – 2023M5):

$$\pi_t = 0.079 + \sum_{i=1}^{12} \widehat{\beta_i}\, \pi_{t-i} + \varepsilon_t, \qquad \boldsymbol{\rho} = \sum_{i=1}^{12} \widehat{\beta_i} = 0.966 \; {\color{red}> 0.5}$$

## Rolling sample estimates of $\rho$ using window size of 14 years:



Rolling Estimate of Core Inflation Persistence (1991-2023)

* Core inflation is more persistent than headline inflation over 1991-2023 ($\rho = 0.909$).

* Average core inflation persistence: (i) pre-GFC: 0.972, (ii) post-GFC but pre-COVID-19: 0.946, (iii) onset of COVID-19: 0.898.

* Similar trends as headline inflation around economic downturns.

* Robustness check using different window sizes (10, 12, 16 years) confirm a similar conclusion.

\* **Highlighted periods are the periods when Malaysia faced economic crisis.**

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# Headline inflation by Component: Generally persistent, but about half of the components exhibit lower persistence than aggregate inflation



— Headline persistence          — Respective component persistence

Headline | Communication | Food Away From Home | Home Essential | Recreation
Food At Home | Healthcare | Clothing&Footwear | Utilities | Miscellaneous Goods
Alcoholic Beverages | Accommodation | Education | Transport&Fuel | Non-Alcoholic Beverages
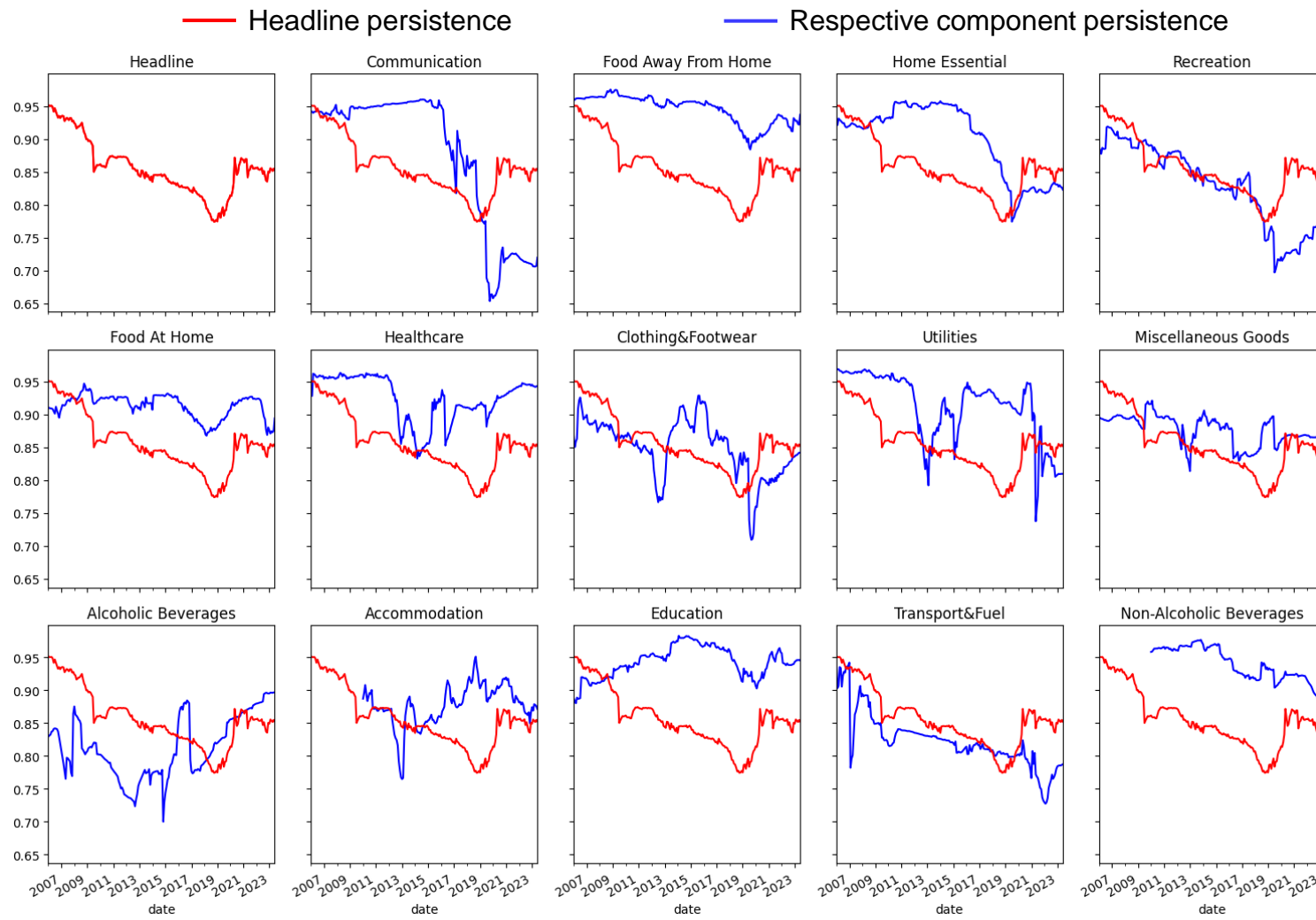
- Component-specific inflation rates are persistent

- Clark (2006) observed persistence of component-specific inflation to be lower than that of aggregate inflation, but estimates for Malaysia are mixed.

- Components exhibiting general lower inflation persistence tend to be discretionary spending (alcoholic beverages, clothing & footwear, recreation items)
    – Likely because they can adjust prices flexibly in response to demand shifts.

- Transport & Fuel demonstrated low inflation persistence, reflecting sharp price adjustments.

- Service consumption components are stickier.

* The estimations above are using data since 1990, and some of the components have shorter series.          ** Estimate for restaurant component is removed due to data availability.

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# Comparison: Most countries exhibit drop in persistence since GFC, and fluctuates over time gently, consistent with Malaysia (1/2)

| Country | Before 2009 | 2009 - Feb2020 | March2020 and after |
|---|---|---|---|
| Chile | 0.968 | 0.921 | 0.925 |
| France | 0.965 | 0.860 | 0.933 |
| Germany | 0.959 | 0.802 | 0.879 |
| Indonesia | 0.937 | 0.914 | 0.936 |
| Italy | 0.985 | 0.934 | 0.958 |
| **Malaysia** | **0.942** | **0.837** | **0.854** |
| Philippines | 0.943 | 0.937 | 0.948 |
| Singapore | 0.933 | 0.906 | 0.927 |
| Spain | 0.971 | 0.921 | 0.929 |
| Thailand | 0.942 | 0.918 | 0.908 |
| Turkey | 0.966 | 0.955 | 0.981 |
| United Kingdom | 0.97 | 0.935 | 0.939 |
| United State | 0.943 | 0.852 | 0.915 |

- The selected countries comprise a basket of advanced and emerging market economies, chosen based on their prominence in the global economy and their trade and financial linkages with Malaysia.

- There is evidence of high inflation persistence for all selected countries.

- Many countries demonstrated increase persistence in headline inflation since the COVID-19 pandemic, but it remains lower than that observed before the Global Financial Crisis (GFC).

# Comparison: Most countries exhibit drop in persistence since GFC, and fluctuates over time gently, consistent with Malaysia (2/2)
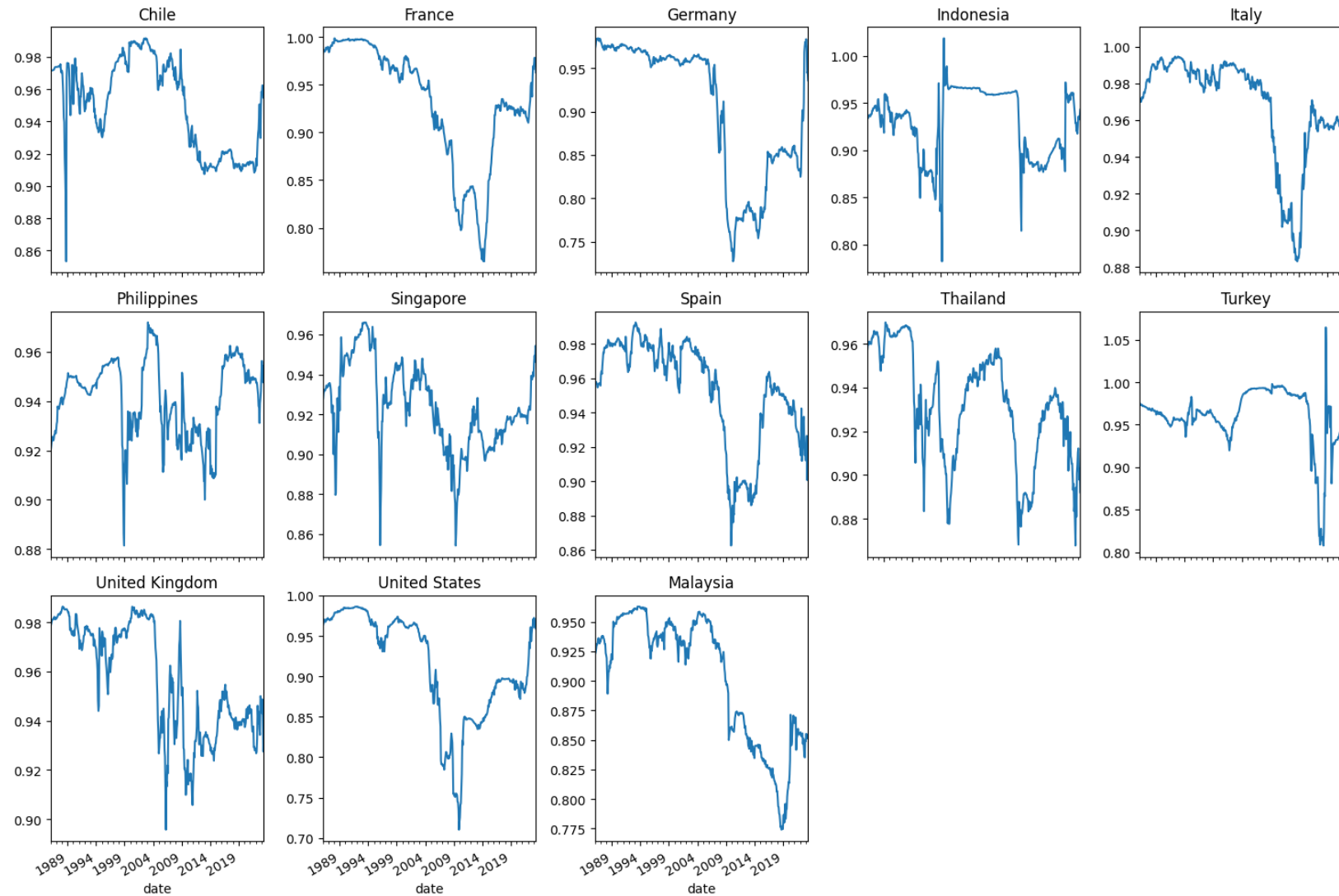
# Positive correlation between headline inflation and its persistence

| Country | Correlation |
|---|---|
| Philippines | 0.114 |
| Turkey | 0.154*** |
| Chile | 0.276*** |
| Singapore | 0.342*** |
| Italy | 0.520*** |
| Spain | 0.553*** |
| Malaysia | 0.577*** |
| Indonesia | 0.584*** |
| Thailand | 0.623*** |
| France | 0.628*** |
| United State | 0.631*** |
| United Kingdom | 0.672*** |
| Germany | 0.740*** |

- Correlation between the rolling estimates of headline inflation persistence and the rolling average of inflation is computed for each country.

- Malaysia exhibited a moderately **positive** correlation between headline inflation persistence and headline inflation.

- The same is observed for most countries, except Philippines, in which no significant correlation were observed.
    - Consistent with findings from de Carvalho Filho (2023)
    - This is the self-perpetuating interaction between wages and prices – commonly referred as the **wage-price spiral**.

Note: ***, **, * indicate 1%, 5%, and 10% significant levels respectively.

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# Summary

1.  **Using serial correlation to measure inflation persistence in an auto-regressive setting, the degree of estimated persistence is high across for: (i) headline inflation, and (ii) its components, and (ii) core inflation.**

2.  **The nature of inflation persistence in Malaysia is time-varying: (i) downtrend since 2009, (ii) minimum around year 2019, and (iii) uptrend since onset of the COVID-19 pandemic.**

3.  **Component-specific inflation rates exhibit high persistence, except during crises; inflation of discretionary items tend to be less persistent.**

4.  **The nature of inflation persistence in Malaysia is not unique – also applicable in other advanced, and emerging market economies.**

5.  **Positive relationship between inflation persistence and inflation aligns with de Carvalho Filho (2023).**

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# Robustness Check in Headline Inflation Persistence: Conclusion holds despite using different window sizes



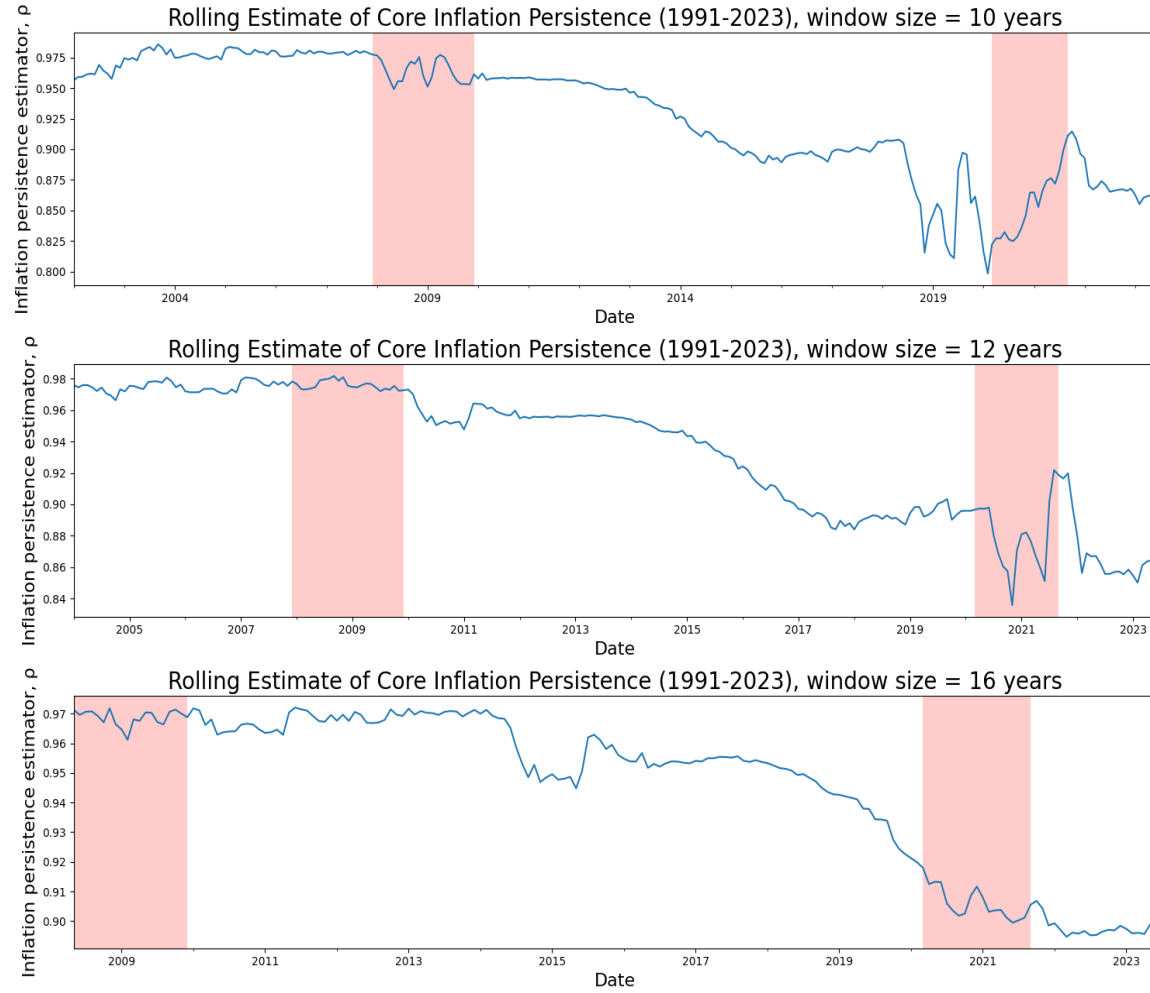* Highlighted periods are the periods when Malaysia faced economic crisis.
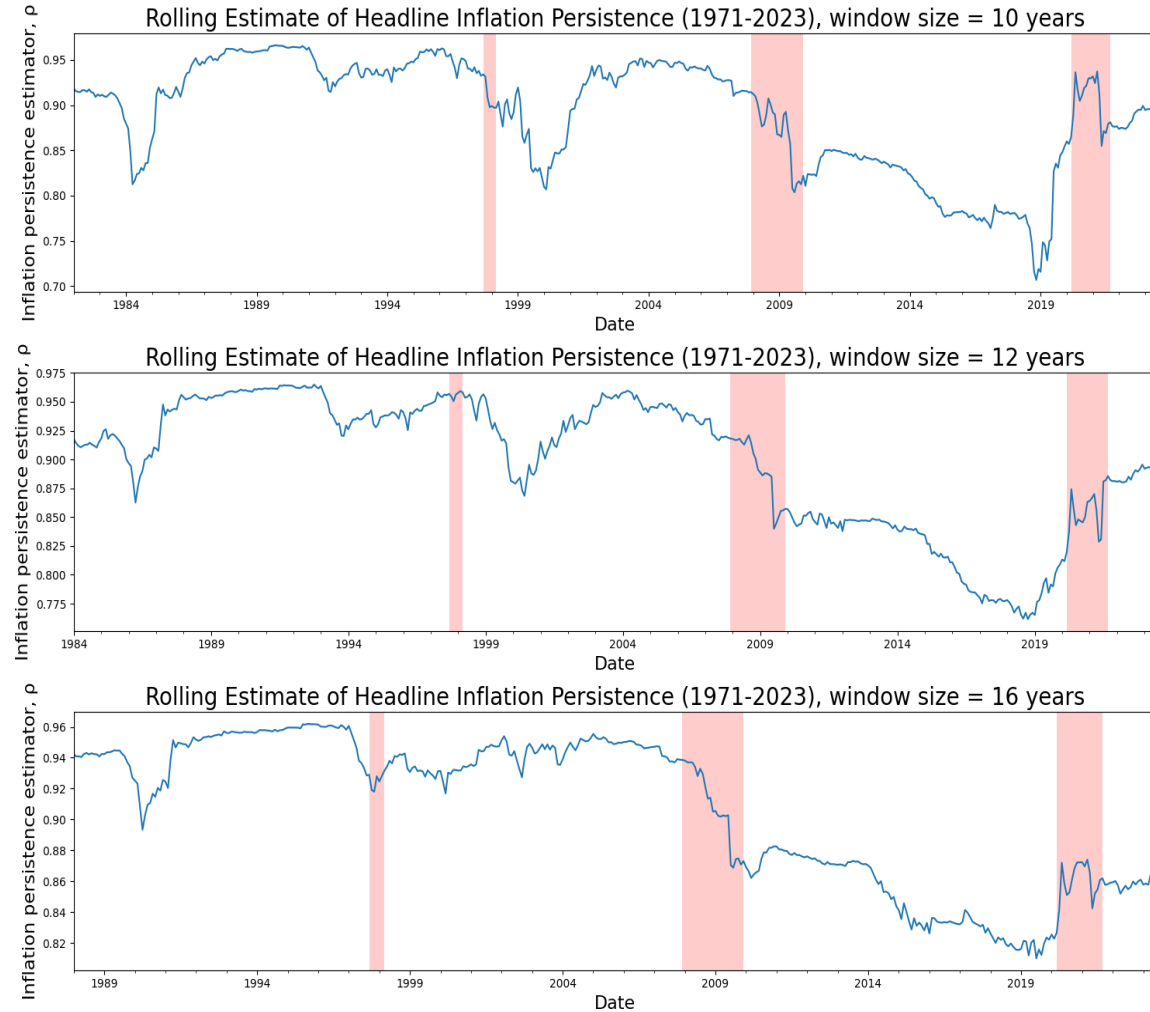
- Robustness checks are performed using different window sizes: 10 years, 12 years and 16 years.

- Similar trends observed in the headline inflation persistence with using window size of 14 years: (i) decreased steadily since 2009, (ii) reaching its lowest point in 2019, and (iii) increase since 2020

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# Robustness Check in Core Inflation Persistence: Conclusion holds despite using different window sizes



Rolling Estimate of Core Inflation Persistence (1991-2023), window size = 10 years

Rolling Estimate of Core Inflation Persistence (1991-2023), window size = 12 years

Rolling Estimate of Core Inflation Persistence (1991-2023), window size = 16 years

- Robustness checks are performed using different window sizes: 10 years, 12 years and 16 years.

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