Inflation Persistence in Malaysia: An Empirical Measure and Analysis

Zi Yun Chow
Central Bank of Malaysia, Malaysia

August 22, 2023

Abstract

This paper presents evidence on the inflation persistence in Malaysia from 1971 to 2023 using monthly year-on-year headline inflation, and its components, as well as quarterly year-on-year core inflation series. Inflation persistence is measured by the sum of coefficients of the lagged dependent variables up to a year in a univariate autoregressive (AR) model. Rolling regression estimates with a 14-year window suggest that inflation persistence evolves over time. Notably, it declined after 2009, reaching its minimum in 2019, but increased following the onset of the COVID-19 pandemic. Nevertheless, inflation persistence dropped slightly following every crisis reflecting the more sudden change in inflation during the period. Inflation components such as food and home essential also exhibit a similar trend. A positive relationship between inflation and persistence is observed in Malaysia, and this is consistent with the empirical findings in other countries.

Keywords: Inflation persistence, Malaysia, Autoregressive model
JEL Codes: E31, O53

1 Introduction

Inflation persistence is of great interest recently, given sustained high inflation since 2022 globally, including in Malaysia. High and persistent inflation negatively affects welfare, primarily through lower purchasing power of households, and raising costs for firms due to increased expenses for labour and production inputs. At the macro level, such inflation can amplify uncertainty, leading to cautious spending and volatile investments. This uncertainty can weaken the anchoring of the inflation expectations, compromising the effectiveness of monetary policy. Nevertheless, inflation persistence can vary over time as suggested by Murray et al. (2008). As such, it is crucial to understand how the persistence of inflation changes over time and its implications for monetary policy strategy.

The literature generally adopted two approaches in estimating inflation persistence — reduced form, and structural form. Irrespective of approach, there is substantial evidence of high inflation persistence, with a notable decrease in persistence, especially for the United States (US). Pivetta & Reis (2007) found evidence of stable, and high inflation persistence in the US. However, Williams et al. (2006) and Fuhrer (2010) suggested the US inflation persistence in inflation may have fallen over time. Fuhrer (2010) further argued that Gross Domestic Product (GDP) deflator tends to yield a weaker evidence of declining persistence compared to those using Consumer Price Index (CPI) given the deflator's broader coverage, which possibly explains the different conclusion drawn by Pivetta & Reis (2007) from other studies. This diversity in empirical views lays the stage for further analysis on inflation persistence, especially for emerging market economies, where evidence is generally sparser, and not necessarily generalisable from findings in advanced economies.

There are two structural sources of persistence — inherited, and intrinsic persistence (Fuhrer, 2005). Inherited inflation persistence means the source of inflation persistence is from persistence of other factors, such as output gap. On the other hand, intrinsic persistence is different from inherited inflation persistence, where the source of persistence is dependent of its past trend. Fuhrer (2010) suggested that most of the previous studies focus on intrinsic persistence. This is because despite high persistence in other factors, there is reducing persistence in many countries' inflation.

Cheng & Tan (2002) and Singh (2016) provided a comprehensive background on Malaysia's inflation. Malaysia faced generally high inflation in the 1970s-80s until the 1985-86 commodity price shock. Remarkably, despite having strong economic growth in 1988-1996, Malaysia maintained a low and stable inflation. Recent reviews, such as Singh (2016), show declining inflation persistence over time in Malaysia until 2015. We also examined if inflation persistence varies among the CPI categories. This inquiry was motivated by Clark (2006), who studied inflation persistence by CPI component, and Abdul Karim et al. (2011), who observed that inflation components respond differently to monetary policy shocks. Collectively, these findings hint at the potential for diverse dynamics across inflation components. To the best of my knowledge, and at the point of writing, there is no similar and published analysis on Malaysia.

This paper provides an empirical analysis of inflation persistence in Malaysia, esti-

mated by the serial correlation from an auto-regressive (AR) model, as in Pivetta & Reis (2007). Two breakpoints corresponding to major global economic crises are of special interest — (i) the Global Financial Crisis (GFC), and (ii) the onset of COVID-19. The discussion of findings will make reference to visible changes in inflation persistence corresponding to these breakpoints. Malaysia's inflation persistence is then compared with a basket of advanced, and emerging market economies, selected based on their prominence in the global economy, and trade and financial linkages with Malaysia.

2 Data and Methodology

This study adopts the estimation of the persistence of inflation, ρ, with a univariate auto-regressive (AR) model from O'Reilly & Whelan (2005), described in Equation 1.

$$\pi_t = \alpha + \rho\pi_{t-1} + \sum_{k=1}^{p} \psi_k \Delta\pi_{t-k} + \epsilon_t \tag{1}$$

This equation is numerically equivalent to the sum of auto-regressive terms in the following representation:

$$\pi_t = \alpha + \sum_{k=1}^{p} \beta_k \pi_{t-k} + \epsilon_t \tag{2}$$

where:

$$\rho = \sum_{k=1}^{p} \beta_k \tag{3}$$

The number of lags included, p, is up to 12 for monthly data, and up to 4 for quarterly data. The measure of persistence ρ is then computed as a sum of all of the coefficient estimates on the lagged dependent variables, described in Equation 3. Essentially, persistence is backed out from actual inflation over a 1-year period. Dossche & Everaert (2005) suggested that if $\rho \leq 0.5$ then the persistence in the inflation series is low. Conversely, if $\rho > 0.5$ then the inflation persistence is high. Specifically when $\rho = 1$, the inflation persistence is close to a persistence of random walk model. To estimate the evolution of inflation persistence over time, the model described in Equation 2 is re-estimated using a rolling window of 14 years, as suggested by Pivetta & Reis (2007).

In terms of data, this study analyses (i) monthly data on headline Consumer Price Index (CPI), (ii) and its components, and (iii) quarterly data on core CPI from Malaysia. All CPI data are published by the Department of Statistics, Malaysia (DOSM). The monthly CPI covers January-1971 to June-2023. The core CPI measure used in this study is based on the exclusion approach, which excludes the most volatile items of

fresh food and administered prices of goods and services, and is available quarterly from March-1992 to June-2023. For components of headline CPI, we focus on a shorter time period from January-1990 to June-2023 due to data availability.

The methodology described here is then applied to extract the persistence of headline inflation of seven advanced economies (France, Germany, Italy, Singapore, Spain, United Kingdom, United States) and five emerging market economies (Chile, Indonesia, Philippines, Thailand, Turkey). These countries are selected for their prominence in the global economy, and proximity through economic linkages with Malaysia. All available data is used. Inflation is calculated as the year-on-year growth of CPI, which is compiled by CEIC from national authorities.

3 Results

3.1 Aggregate Inflation Persistence

Headline inflation is highly persistent over 1971-2023, as shown by persistence measure, ρ of 0.951. The rolling window estimates shown in Figure 1 suggest the inflation persistence changes over time. While persistence declined steadily since 2009, bottoming out in 2019, persistence has increased since the COVID-19 pandemic, despite being lower than the pre-GFC period. Specifically, headline inflation persistence pre-GFC averaged 0.919, 0.837 post-GFC but pre-COVID-19, and 0.854 since the onset of COVID-19. The trend of inflation persistence up to 2015 is broadly consistent with previous studies, such as Singh (2016). Kurozumi & Van Zandweghe (2018) suggested that trend of headline inflation and inflation persistence move in the same direction: when inflation trended lower, inflation persistence was also lower. This was broadly observed in the case of Malaysia, where periods of higher inflation coincided with heightened inflation persistence. Furthermore, inflation persistence decreased during or after economic crisis periods (as indicated by the highlights in Figure 1 below), reflecting the more sudden change in inflation during the period.

Similarly, core inflation is highly persistent over 1992-2023, with an estimated ρ of 0.880, somewhat lower than that of headline inflation. Such high level of persistence is observed despite excluding price-volatile items, such as fresh food items, and price-administered items. Similar to headline inflation, core inflation persistence bottomed out in 2019, as shown in Figure 2. Core inflation persistence pre-GFC averaged 0.909, 0.835 post-GFC but pre-COVID-19, and 0.776 since the onset of COVID-19. Similarly as headline inflation persistence, there is drop in persistence during or after the economic crisis periods.

As discussed earlier, both headline and core inflation persistence exhibit time-varying patterns, notably decreasing during or after economic crisis periods. Nonetheless, despite variations in persistence across time, the overall conclusion of high persistence remains consistent. This result indicates that intrinsic persistence might be the dominant driver of inflation persistence in Malaysia. However, further research shall
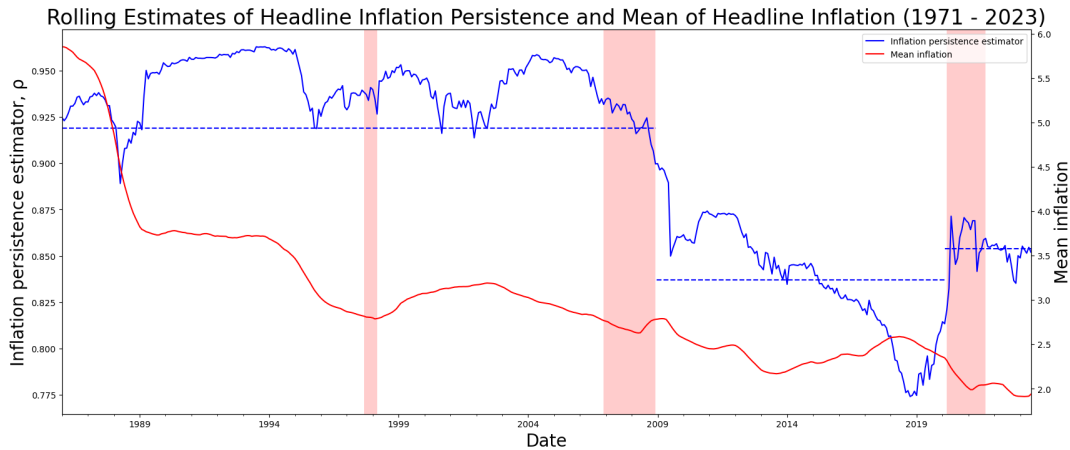
Note: The highlighted periods are when Malaysia faced economic crises.

Figure 1: Dynamic of Headline Inflation Persistence
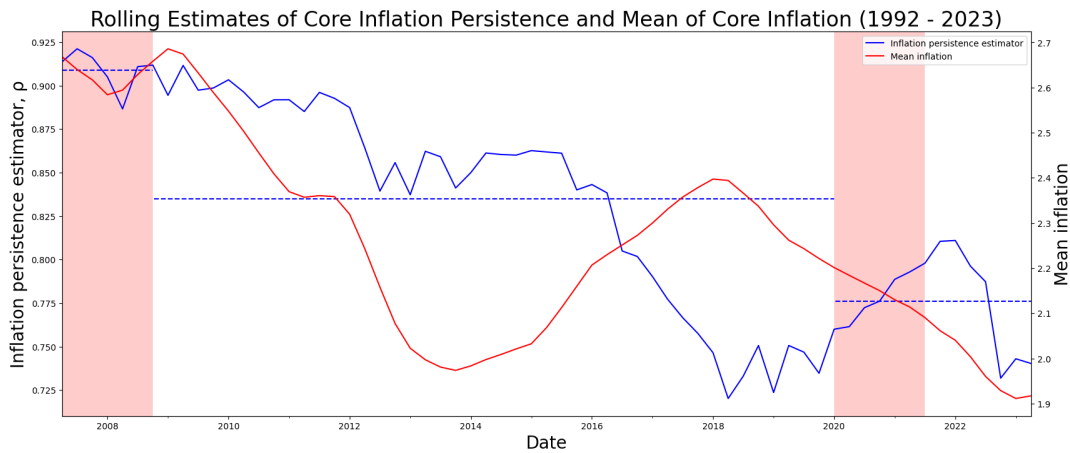
Note: The highlighted periods are when Malaysia faced economic crises.

Figure 2: Dynamic of Core Inflation Persistence

be done to determine whether the inflation persistence in Malaysia is aligned more with an inherited or intrinsic type.

3.2 Component-Specific Inflation Persistence

The estimates of the component-specific inflation persistence are shown in Table 1. In general, the CPI components show a high degree of persistence. While Clark (2006) observed that the persistence of every component-specific inflation was lower than that of aggregate inflation, the findings for Malaysia are more mixed. A notable number of components exhibit higher persistence than the aggregate inflation, while others show lower persistence. Components exhibiting lower inflation persistence include the more discretionary components—like miscellaneous goods, alcoholic beverages, clothing & footwear, and recreation items. One possible hypothesis is that these items are priced more flexibly, responding more strongly to shifts in demand conditions. The transport and fuel component also demonstrated low inflation persistence, which is reflective of

the sharp price adjustments that resulted from changes in the fuel subsidy policy during the observed period.

Component	Persistence
Communication	0.958
Healthcare	0.951
Restaurant	0.948
Food Away From Home	0.946
Non-alcoholic Beverages	0.933
Accommodation	0.923
Education	0.911
Headline	0.909
Home Essential	0.904
Food At Home	0.904
Miscellaneous Goods	0.888
Alcoholic Beverages	0.869
Clothing&Footwear	0.868
Recreation	0.825
Transport&Fuel	0.817

Table 1: Estimates of Inflation Persistence By Components of Consumer Price Index (1990-2023)

In Figure 3, the estimated trend of inflation persistence tend to be similar across communication, food away from home, food at home, home essential and recreation items, while healthcare, clothing & footwear, utilities and miscellaneous goods exhibit a separate co-movement among themselves. The trend exhibited by the first five mentioned components mirrors headline inflation persistence. The transport & fuel component had similar trend with headline inflation persistence before 2020. However, distinct trends have emerged since the onset of the COVID-19 pandemic.
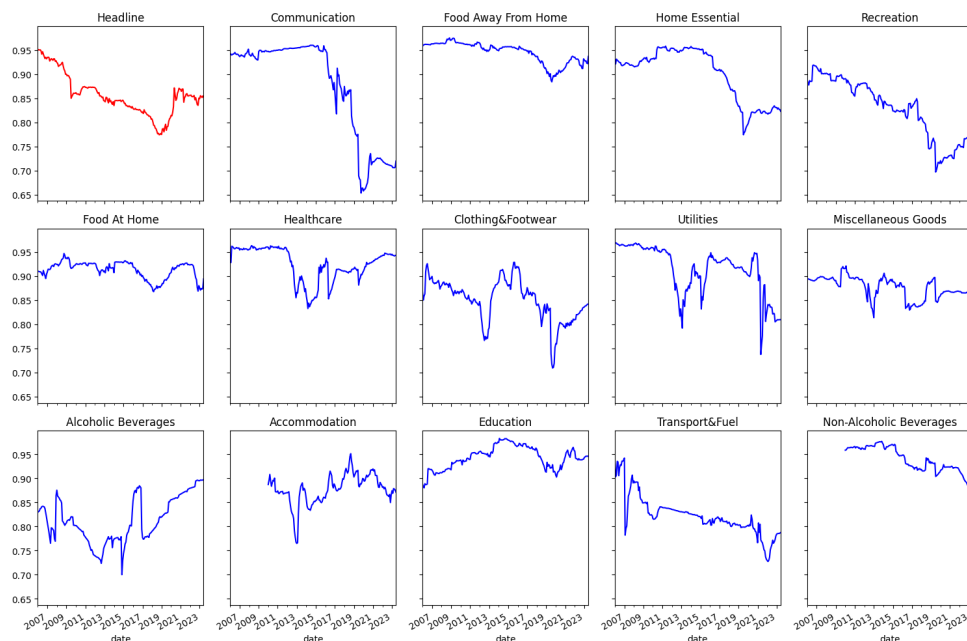

Figure 3: Dynamic of Persistence for Inflation by Component

Given the distinct trends in both headline and core inflation following 2009, as well as onset of COVID-19, persistence of each inflation component is calculated for the following periods: (i) before 2009, (ii) 2009 to Feb-2020, and (iii) Mar-2020 and after, to determine if there is similar trend exist for the disaggregated components of inflation. As summarised in Table 2, the persistence for majority components in post-GFC and pre-COVID-19 is lower than observed in pre-GFC, except in the education category. Inflation persistence of most components continue to decline since COVID-19 onset, except in alcoholic beverages, healthcare and accommodation.

Component	Before 2009	2009 - Feb-2020	Mar-2020 and after
Alcoholic Beverages	0.822	0.792	0.877
Clothing&Footwear	0.887	0.851	0.813
Communication	0.940	0.906	0.711
Education	0.909	0.952	0.941
Food At Home	0.919	0.912	0.910
Food Away From Home	0.964	0.947	0.921
Home Essential	0.922	0.918	0.823
Healthcare	0.956	0.913	0.937
Utilities	0.965	0.917	0.856
Miscellaneous Goods	0.895	0.875	0.867
Recreation	0.899	0.834	0.744
Accommodation	-	0.874	0.889
Restaurant	-	-	0.948
Transport&Fuel	0.888	0.82	0.774
Non-Alcoholic Beverages	-	0.948	0.912

Table 2: Mean of Rolling Estimates of Headline Inflation Persistence By CPI Components

3.3 Comparison with Selected Countries

Table 3 compares the full-sample estimate of mean inflation and headline inflation persistence across different countries over 1971-2023. Between 1971 and 2023, the analysed countries exhibited high degree of inflation persistence, similar to Malaysia. The mean persistence is 0.980 for advanced economies and 0.974 for emerging market economies, indicating no significant difference between them. This is consistent with previous studies, such as Arize et al. (2005) and Canarella & Miller (2016), who concluded there is evidence of high inflation persistence for emerging market economies and advanced economies respectively. However, notice that there are four advanced economies (France, Italy, Spain, United Kingdom) having headline persistence near to random walk persistence, as their ρ near to 1.

Country	Mean Inflation	Estimate of Inflation Persistence
Chile	41.851	0.980
France	4.270	0.995
Germany	2.649	0.973
Indonesia	10.526	0.965
Italy	5.569	0.995
Malaysia	2.785	0.951
Philippines	8.123	0.963
Singapore	2.585	0.944
Spain	6.432	0.991
Thailand	4.328	0.968
Turkey	31.948	0.989
United Kingdom	5.022	0.991
United States	3.718	0.981

Table 3: Summary of Headline Inflation and its Persistence By Country

Table 4 summarises the mean of rolling estimate for three periods: (i) before 2009, (ii) 2009 until Feb-2020, and (iii) Mar-2020 onwards in selected countries. Most countries experienced relatively high inflation persistence preceding year 2009, which then decreased over time until the onset of COVID-19. As shown in both Table 4 and Figure 4, many countries demonstrated increased persistence in headline inflation since the COVID-19 pandemic. It's important to note that despite the increase, headline inflation persistence remains lower than that observed before the GFC.

Country	Before 2009	2009 - Feb-2020	Mar-2020 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 States	0.943	0.852	0.915

Table 4: Summary of Mean of Rolling Estimate of Headline Inflation Persistence By Country
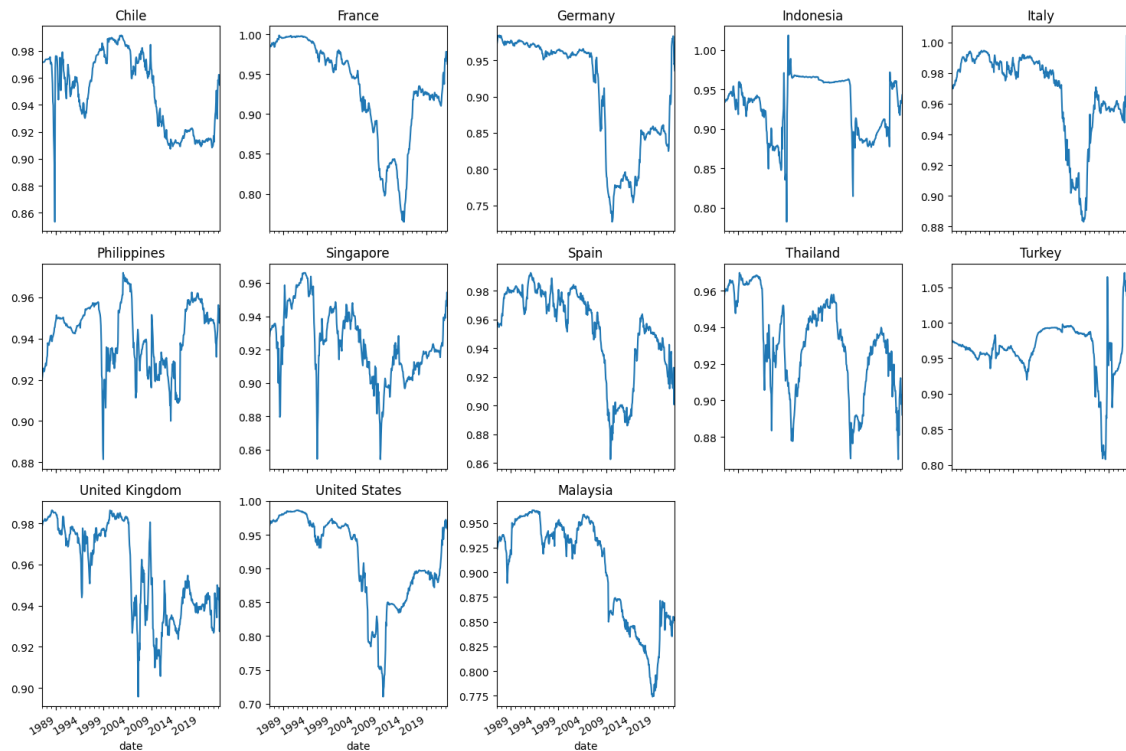
Figure 4: Dynamic of Persistence for Headline Inflation by Country

Table 5 summarises the correlation between the rolling estimates of headline inflation persistence and the rolling average of inflation for the countries studied.

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 States	0.631***
United Kingdom	0.672***
Germany	0.740***

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

Table 5: Correlation Between Rolling Estimates of Inflation Persistence and Moving Average of Inflation By 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. The observed positive correlation aligns with established findings suggesting that inflation persistence

is greater in a high-inflation environment, as noted by de Carvalho Filho (2023). At the heart of this relationship is the self-perpetuating interaction between wages and prices—commonly referred to as the wage-price spiral. This phenomenon becomes particularly pronounced when inflation rates are high, primarily due to its influence on inflation expectations and the wage-bargaining process.

4   Conclusion

This study examined inflation persistence in Malaysia over the long-term since 1971 using serial correlation method in an auto-regressive setting. Three metrics of inflation were used — (i) monthly headline CPI, (ii) quarterly core CPI, and (iii) monthly components of CPI. To track the evolution of inflation persistence over time, auto-regression estimates with a rolling window of 14 years were reported, alongside the full sample estimates.

There is high degree of persistence in all inflation series studied. Rolling window estimates suggested that the inflation persistence changes over time, specifically dropping since 2009 and reaching the minimum in year 2019. Inflation persistence increased thereafter following the onset of the COVID-19 pandemic. Persistence according to components of headline inflation reveals not all the components follow the same trend as headline inflation. Only the communication, food away from home, food at home, home essential and recreation components mirror this trend. Furthermore, healthcare, clothing & footwear, utilities and miscellaneous goods exhibit similar trend among themselves.

The persistence of Malaysia's headline inflation series is also compared with selected countries. This comparison suggests that the movement in inflation persistence in Malaysia over time mirrors those in the other countries in this study. Notably, persistence was lower post-GFC, but increased following the onset of COVID-19. Across these countries, the positive relationship between inflation persistence and inflation aligns with the findings by de Carvalho Filho (2023).

Malaysia's high inflation persistence, which exhibits time-varying behaviour, is not unique. Given the welfare implications, there remains scope for policymakers to further understand the macroeconomic dynamics surrounding inflation persistence especially the implications on output and design of monetary policy.

References

Abdul Karim, Z., Zaidi, M. A. S. & WNW, A.-S. (2011), 'Relative price effects of monetary policy shock in malaysia: a svar study'.

Alogoskoufis, G. S. & Smith, R. (1991), 'The phillips curve, the persistence of inflation, and the lucas critique: Evidence from exchange-rate regimes', *The American Economic Review* pp. 1254–1275.

Arize, A. C., Malindretos, J. & Nam, K. (2005), 'Inflation and structural change in 50 developing countries', *Atlantic Economic Journal* **33**, 461–471.

Benati, L. (2008), 'Investigating inflation persistence across monetary regimes', *The Quarterly Journal of Economics* **123**(3), 1005–1060.

Canarella, G. & Miller, S. M. (2016), 'Inflation persistence and structural breaks: The experience of inflation targeting countries and the usa', *Journal of Economic Studies* **43**(6), 980–1005.

Cheng, M.-Y. & Tan, H.-B. (2002), 'Inflation in malaysia', *International Journal of Social Economics* **29**(5), 411–425.

Clark, T. E. (2006), 'Disaggregate evidence on the persistence of consumer price inflation', *Journal of Applied Econometrics* **21**(5), 563–587.

de Carvalho Filho, I. E. (2023), 'Is higher inflation also more persistent inflation? threshold effects on inflation persistence'.

Dossche, M. & Everaert, G. (2005), 'Measuring inflation persistence: a structural time series approach', *National Bank of Belgium Working Paper* (70).

Fuhrer, J. C. (2005), 'Intrinsic and inherited inflation persistence'.

Fuhrer, J. C. (2010), Inflation persistence, *in* 'Handbook of monetary economics', Vol. 3, Elsevier, pp. 423–486.

Gilchrist, S., Schoenle, R., Sim, J. & Zakrajšek, E. (2017), 'Inflation dynamics during the financial crisis', *American Economic Review* **107**(3), 785–823.

Kurozumi, T. & Van Zandweghe, W. (2018), 'Variable elasticity demand and inflation persistence', *Federal Reserve Bank of Kansas City Working Paper No. RWP* pp. 16–09.

Murray, C., Nikolsko-Rzhevskyy, A. & Papell, D. (2008), 'Inflation persistence and the taylor principle'.

O'Reilly, G. & Whelan, K. (2005), 'Has euro-area inflation persistence changed over time?', *Review of economics and statistics* **87**(4), 709–720.

Pivetta, F. & Reis, R. (2007), 'The persistence of inflation in the united states', *Journal of Economic dynamics and control* **31**(4), 1326–1358.

Singh, S. (2016), 'Economic changes, inflation dynamics and policy responses: the malaysian experience', *BIS Paper* (89p).

Williams, J. C. et al. (2006), 'Inflation persistence in an era of well-anchored inflation expectations', *FRBSF Economic Letter* .