Inflation cycles: evidence from international data[1]

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Abstract

We use long-term data series to study inflation cycles and identify patterns similar to those found in business cycles. Our findings show that the distance between inflation peaks averages seven years in both advanced and emerging economies. Inflation cycles are slightly longer than GDP growth cycles. The median amplitude of the inflation cycle has been around 2 percentage points in advanced economies and 4 percentage points in emerging markets over the past 40 years, lower than in previous periods. We find a high correlation in inflation cycles among advanced economies, but this correlation is less pronounced in emerging markets. A core contribution is a rule-of-thumb that identifies most periods of high inflation across countries, while we also find that the onset of such periods substantially increases the probability of a recession one year later. We propose that this novel concept of inflation cycles offers a fresh perspective on economic fluctuations and monetary policy. A cross-country dataset with the inflation cycles is made publicly available.

Keywords: Inflation Cycles, Business Cycle, Monetary Policy

JEL classification: E31, F44, C53, C55

[1] Alberto, Douglas, Johannes, Daniel, Rafael and Christian are affiliated with the Bank for International Settlements. Sjur is affiliated with the Norges Bank. The authors are thankful to Julián Caballero and Ben Cohen for comments. All errors are our own. The opinions in this paper do not necessarily reflect the views of the Bank for International Settlements.

1. Introduction

Understanding the dynamics of inflation across different countries is of central importance to market participants, investors, economic decision-makers and central bankers. A key consideration is to distinguish periods of low inflation from those when inflation is considerably higher, given that higher inflation can be self-reinforcing (BIS (2022)). The patterns of inflation in general and the different phases of the inflation cycles have a strong bearing on the latitude for monetary policy actions, and consequently for private and public sector economic decisions. In addition, it might influence the dynamics of business and financial cycles.

In this paper, we provide a descriptive, long-term international perspective on inflation patterns.[2] We analyse key patterns of inflation cycles and identify periods of cyclically high inflation. Using these findings, we estimate the effect on recession probability caused by a country entering a period of high inflation. To the best of our knowledge, this is the first cross-country endeavour to present a definition of inflation cycles that is consistently applied across multiple countries (14 advanced and 13 emerging economies) and with long time series. Some of the series start in the 1920s, and we have near-complete coverage from 1970 onward for the advanced economies.[3]

We introduce a working definition of inflation cycles to facilitate the understanding of inflation dynamics, mirroring corresponding papers on business cycles (eg Wolla (2023)). While for business cycles, the economically interesting measurements are often the deviations from growth trends, in the case of inflation lower-frequency movements offer considerable policy-relevant insights. Accordingly, we identify inflation cycles numerically using filtering techniques to remove the influence of short-term fluctuations from raw data. We then use these filtered series to calculate cycle metrics such as length (distance between peaks) and amplitude (distance between one peak and the subsequent trough). Moreover, we develop a rule of thumb to characterise high inflation periods and document the implications of the onset of high inflation periods on economic growth.

This work builds on a voluminous literature. Collectively, the literature emphasises the complexity of inflation dynamics and the crucial role of adaptive monetary policies in different economic contexts.

Since inflation is a complex phenomenon with multiple drivers, a well-grounded definition of inflation cycles (eg high vs normal inflation periods) as presented herein can facilitate understanding of these complex dynamics. Key inflation drivers include economic activity (Blanchard and Fischer (1989); Friedman (1968); Phillips (1958)) and financial conditions (Mishkin (1990)). Inflation cycles also reciprocally influence economic cycles. For instance, high inflation can lower purchasing power and instigate uncertainty, while excessively low inflation may result in lower expenditure and investment (Mishkin (2019); Blanchard (2016); Fischer, Sahay and Végh (2002)). Inflation expectations are also relevant to current spending and saving habits, which

[2] One related study by Protasov, Kotcofana, and Stazhkova (2017) hypothesis that in the second half of the 20th century, inflation cycles replaced earlier inflation-deflation cycles. This hypothesis is based on data from various countries between 1950 and 2016, highlighting the dynamic nature of inflation and its evolving patterns over time.

[3] Our cycles time series are publicly available at [website].

subsequently can affect actual inflation (Mankiw and Reis, (2002); Bernanke (2007); Clarida, Galí, & Gertler (1999); Woodford (2003)). Cecchetti and Schoenholtz (2020), examine how inflation dynamics have changed since the Great Recession, with a focus on the role of global factors and monetary policy in shaping these dynamics. More broadly, central bank policy (Jordà et al (2020), Castillo-Martinez and Reis (2024)) and even communication (Blinder et al (2008); Araujo et al (2024)) influence inflation levels.

Distinguishing between short-term fluctuations and longer-term trends in inflation is crucial. Short-term fluctuations may be influenced by temporary factors such as supply shocks, while longer-term trends reflect underlying structural changes in the economy (Mankiw, 2019). Evaluating these structural trends – which we refer to as inflation cycles – helps policymakers make informed decisions to address inflationary pressures effectively. The recent literature has focused on understanding the nuances of inflation and the impact of monetary policy in different inflationary regimes.[4] Complementing this perspective, Borio et al (2023b) propose a novel framework that divides inflation dynamics into two distinct regimes: low-inflation and high-inflation. This view emphasises the differing nature of inflation behaviours in these regimes, including the influence of sector-specific price changes in the low-inflation regime and the common component in price changes during high-inflation periods. Their findings suggest the necessity of flexible monetary policy in low-inflation regimes and pre-emptive measures to avoid transitioning to high-inflation scenarios.

In the first step of our analysis, we establish stylised facts about inflation cycles. We find that the average length of inflation cycles hovers around 7 years. This length is surprisingly stable over time and across countries, both in advanced and emerging market economies. Inflation cycles also tend to be fairly symmetric vis-à-vis their four stages (recovery, expansion, slowdown and contraction), especially the cycles with larger amplitudes. Inflation cycles are highly correlated between advanced economies, but less correlated between emerging market economies. Correlations among inflation rates tend to increase during periods of elevated inflation. This hints at the effects from common shocks on inflation, as observed during the 1970s' oil shock and the 2022 supply shock, even if basal rates of inflation depend more on local factors.

While some cycle characteristics have remained stable for the last 7-10 decades, we also observe some changes over time. Since 1985, the median amplitude of inflation cycles has dropped substantially compared to the earlier periods, from 4.1 to 2.1 percentage points for the advanced economies; for the emerging market economies, the median amplitude dropped from 6.5 to 4.5 percentage points.

Second, armed with a range of numerical definitions of inflation cycles, we summarise these results into a simple heuristic, a rule of thumb that combines two criteria. High inflation periods are those where (a) the year-on-year inflation is more than 2 percentage points (p.p.) higher than in the same quarter of the previous year (1 p.p. for historically low-inflation countries such as Germany, Japan and Switzerland)

[4] Amatyakul et al (2023) examine the role of central banks in addressing the unique and persistent inflation spike during the 2021-2023 period. The analysis underscores the pivotal role of proactive monetary policies in managing inflation, especially in the face of sectoral shocks like energy price hikes. The study uses model simulations to argue that without timely interventions by central banks, such as raising policy rates, the economy would have suffered from stimulated aggregate demand and persistently high inflation levels.

and (b) this condition persists for at least five consecutive quarters. Importantly, this rule broadly corresponds to the outcome of more sophisticated methods: across countries and periods, this heuristic matches the cyclically high periods identified with the Hamilton (2018) method. Barring structural changes, this relationship may continue to hold for a reasonable amount of time.

In the third and final step, we compare inflation cycles with growth cycles. We find that inflation cycles are about one year longer than with the corresponding definition for business cycles (6.5 vs 5.5 years). The correlations between inflation rates and GDP growth rates are moderate across the whole cycle, underscoring the challenge of defining a common dynamic across these cycles. This is also consistent with the observed complexity of monetary policy, which at times faces a multifaceted environment when the business cycle (or the financial cycle) is in an opposite state as would be "desirable" from an inflation policy perspective.

But while contemporaneous correlation is only moderate, the dynamic effects of inflation cycles on business cycles over time can be considerable, especially when economies move into a high inflation regime. Using a panel local projections approach (Jordà (2005), Jordà and Taylor (2024)), we find that the onset of high inflation periods is associated with an almost 10 percentage points higher probability of a recession after one year.[5]

The rest of the paper is organised as follows: In section 2, we outline our data and broader concept. Section 3 presents stylised facts about inflation cycles, followed by analysis of high inflation periods in Section 4. Section 5 documents our analysis on the relationship between inflation and GDP growth and section 6 concludes.

2. Empirical definition of inflation cycles: data and concept

We use quarterly long-term time series[6] on Consumer Price Indices (CPI) in 27 economies, of which 13 are advanced economies and 14 emerging economies (see Annex 1 for a list of countries). The series go back to the 1910s for several advanced economies and to the 1950s for some of the emerging market economies (Graph 1).[7]

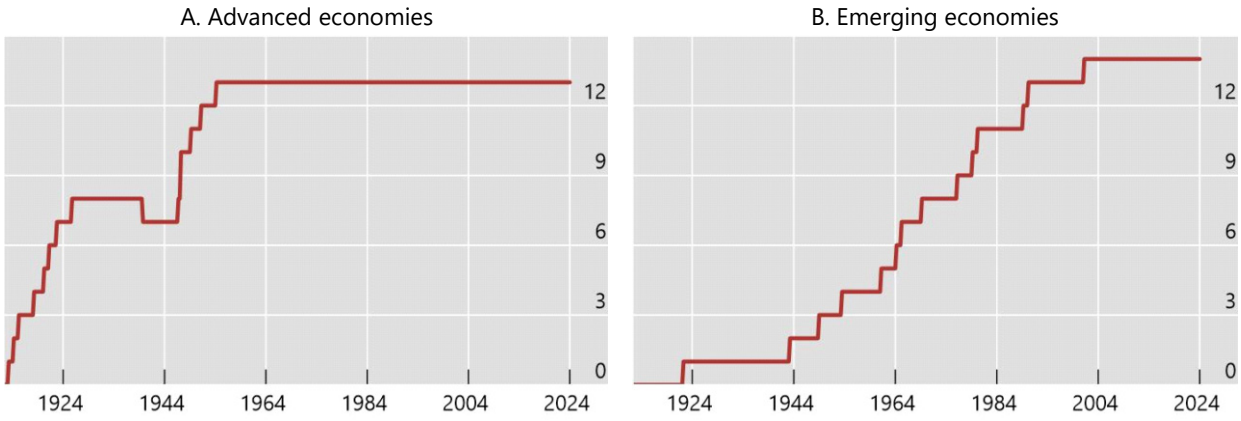
[5] A related paper by the same authors explains and forecasts inflation, business and financial cycles, Americo et al (2024a, forthcoming), and another (2024b) proposes a neural network-based model to nowcast inflation with high-dimensionality data.

[6] The series are sourced from the BIS Statistics page but are originally published by the respective national statistical offices. See https://www.bis.org/statistics/cp/cp_long_documentation.pdf. In some cases, the series were extended using the proxy indicators, such as a consumer price index with limited coverage or the retail price index.

[7] Mumtaz et al (2021) also use historical inflation data for a varied panel of countries, in their case going back to the XIXth century. Their data is sourced from a vendor, who in turn compiled it originally from historical tables such as from the League of Nations. In our case, our dataset comes directly from the national official sources and BIS calculations.

Inflation data sample

Number of economies Graph 1



Source: BIS.

In the first step of our analysis, we establish stylised facts about inflation cycles using the Hodrick-Prescott (HP) filter (Hodrick and Prescott 1980, 1997), henceforth "HP", to identify slow-moving trends, ie our purpose in using this technique is to smooth the series to facilitate the definition of cycle metrics described below. Using light filtering (λ = 100), the inflation rate series become smooth (which is not the case for λ = 50), while the peaks and troughs do not shift (Graph 2, first row; Graph 4, bottom right; Box 1).[8]

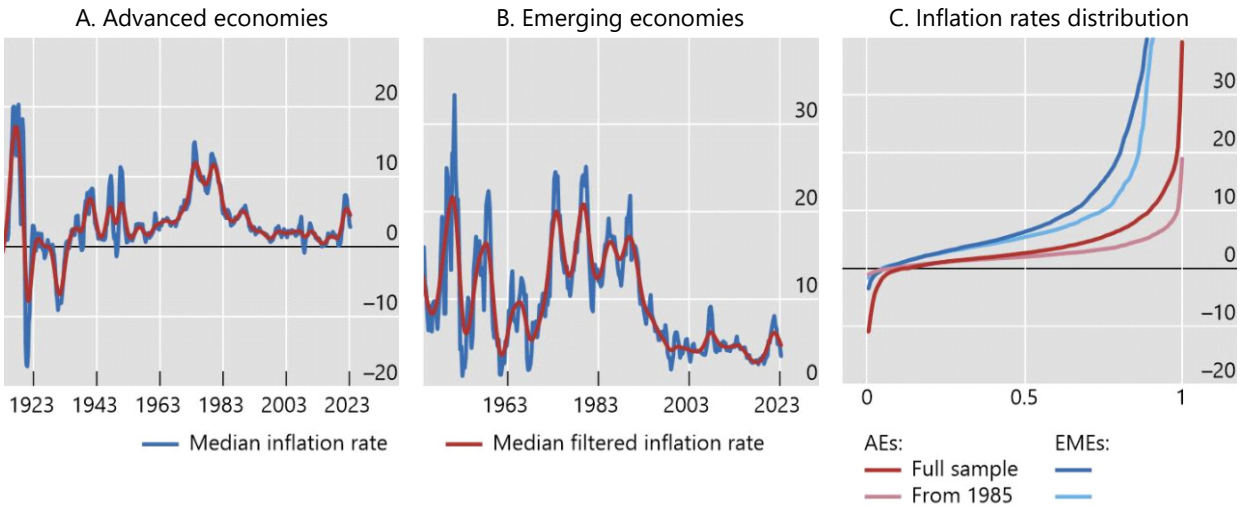
The key characteristics of inflation cycles we document are (1) the peaks and troughs of each cycle, defined respectively as the maximum and minimum values in each cycle; (2) cycle length, measured as the time distance between two consecutive peaks; and (3) amplitude, or the difference between a peak value and the ensuing trough value. The stages of the inflation cycle are four, in sequence: expansion, when inflation rates are increasing and positive marginal growth; slowdown, when inflation rates still increase but with negative marginal growth; contraction, when inflation rates decrease with negative marginal change; and recovery, or declining inflation rates with positive marginal change.

[8] Ravn and Uhlig (2002) present analytical insights for adjusting λ according to the frequency of observations.

Inflation rates: the big picture for the long term

In per cent

Graph 2



The left and middle graphs show the median inflation rates for those countries (AE / EMEs) for the data available for that particular quarter. These series were then HP filtered using λ = 100. The right graph shows the distribution of inflation rates for all observed values across time as available, and for the last 40 years, respectively. Observations with inflation rates above 40 percent were removed from the sample.

Sources: BIS; authors' calculations.

Box 1

Use of filtering to characterise inflation cycles

We use filtering techniques for two purposes: first, to smooth the raw series, to identify trends in inflation rates and therefore more easily establish stylised facts about inflation cycles; and second, more traditionally, to separate its higher frequency components, associated with cyclical dynamics, from lower-frequency trends of the cycle.

The Hodrick and Prescott (HP) filter is used to establish – ex post – stylised facts about inflation cycles for historical data. This method requires the definition of a smoothing parameter $\lambda > 0$. Lower values of λ cause the trend to be closer to the variable itself; higher values of lambda broadly correspond to flatter trends that approximate a least squares regression fit on a time trend. Our fitting parameter (λ = 100) smoothens the series, without removing more defined peaks and troughs that define a cycle (Graph 2, Graph 4 bottom right graph).

The Hamilton filter (Hamilton (2018)) is used to characterise deviations of inflation rates from the trend, akin to the definition of business cycles. The Hamiton filter avoids important drawbacks of the HP filter when the latter is used to detrend time series, namely the creation of spurious dynamics in the data, end-of sample bias and the need to set parameters ad-hoc. In addition, its definition is based on the intuitive interpretation that the cyclical component reflects short-term variations that were not captured in the longer-term structure of the data. In other words, it is as "model-free" as possible for a filter.

The cyclical developments identified by the Hamilton filter are the difference between the inflation series at time $t + h$ (for h set to multiples of one year), and a projection of the same series from the last 4 quarterly (or 12 monthly) values up to time t. The intuition is that such a difference represents the unexpected value of the series considering a seasonality-adjusted projection – any such difference in outcomes would be attributable to "cyclical" as opposed to more structural, as longer-term developments which would be reflected in the projection. This is also more consistent than the HP filter with the fact that a random walk is an extremely challenging benchmark for out-

of-sample inflation forecasting (Atkeson and Ohanian (2001)), since the HP filter adds structure to cyclical data even when it is purely random (Cogley and Nason (1995)).

More formally, the Hamilton filter breaks down the inflation observation for country i in time periods $t+h$, $\pi_{i,t+h}$, into components representing the trend, $\mathbb{E}[\pi_{i,t+h}|\pi_{i,t}, \dots, \pi_{i,t-\ell}]$, and a cyclical component, $c_{i,t+h} = \pi_{i,t+h} - \mathbb{E}[\pi_{i,t+h}|\pi_{i,t}, \dots, \pi_{i,t-\ell}]$. The trend-cycle breakdown can be estimated with a linear regression, with ℓ being the number of lags that complete the number of periods in one year (eg, ℓ =3 for quarterly data and ℓ =11 for monthly data). Using from now on the definitions for a quarterly dataset, the filter estimator is:

$$\hat{c}_{i,t+h} = \pi_{i,t+h} - (\hat{\alpha}_i + \sum_{L=0}^{\ell} \hat{\beta}_{i,L}\pi_{i,t-L}), \quad (1)$$

with the coefficients of the country-specific regressions estimated via OLS using the whole sample. This decomposition nests a variety of cases of practical importance, including the random walk case (where $\hat{\beta}_{i,0}$ will be close to 1 and the others, to zero) as well as higher orders of integration. Another advantage is that it can be estimated only autoregressively, dispensing with a panel dimension or other covariates.

We use h=8 quarters (2 years) to reflect the period of time when most price adjustment constraints would no longer be binding (see Wulfsberg (2016) for an example of micro-data study of price adjustment frequency). Put differently, this cycle measure captures the changes in inflation within the usual frequency of price changes that are not accounted for by its past trend. The values of $\hat{c}_{i,t+h}$ for the countries in the sample are shown in Graph 7.

The Hamilton filter has important limitations to be considered, originating from the fact that it is not a band pass filter designed to keep a constant variance across frequencies. For our purposes, the main drawback is that the Hamilton filter can alter the variance of the different frequencies that form the cyclical component (Schüler (2024) details these trade-offs, while Phillips and Shi (2021) argue that a boosted version of the HP filter can be more consistent than the Hamilton filter). However, this is not as important given that it fulfils the primary role of detrending the inflation series "in real time", without spurious ability to predict the future as shown for the HP filter. This in turn allows the use of the onsets of high-inflation periods as shocks to see the dynamic effects on business cycle recessions, as shown later in this paper.

In sum, we recognise that filtering is by definition empirical as it does not explicitly consider a structural definition of which values are due to cyclical variations and which ones are attributable to longer-term factors. Filtering techniques also abstain from relating the dynamics of cyclical variations to other economic series. Hence, our definitions trade off the model risk associated with theory-based estimates (the possibility of not using an adequate type of structural model) with estimation risk, ie accepting in return the possibility that the numerical estimations do not correctly identify cyclical elements of inflation, especially in case of structural breaks.

In the second step, we use the Hamilton (2018) regression filter to more precisely identify the cyclical components of inflation series (Box 1, Graph 7), especially the onsets of high-inflation periods.

Our analysis using the Hamilton filter serves as a precursor to develop a simple rule of thumb to define high inflation periods. Here it is important to draw a distinction to business cycles, where variations in both directions around a trend could pose specific policy problems – eg, policymakers tend to avoid both a negative output gap but also an overheating of economic activity, which could lead to price and wage pressures. In the case of inflation, central banks usually fine-tune monetary policy to keep inflation around the target at the medium term, and take effort to avoid a persistent move into a high inflation period, which can fundamentally change the dynamics of prices and in fact the whole economy. For this reason, we explore the feasibility of a simple and intuitive

heuristics that can be applied to different countries in identifying periods when inflation is cyclically high.

In the third and final step, we investigate the relationship between inflation and business cycles, especially the onset of the high-inflation periods and the possibility that a country will subsequently experience a recession.[9] There are a number of reasons linking both developments. The most intuitive one is that high inflation periods might warrant a particularly hawkish tightening of monetary policy, leading to recession. Other channels are not directly explored in this work, as they would require structural models outside the current scope. Our goal with these analyses is merely to document empirically a causal relationship of the onset of high inflation periods on recession probability, controlling for country fixed-effects and benefitting from a long panel time series.

Additional information on the use of filtering is provided in Box 1.

3. Stylised facts about inflation cycles

We empirically study three core features of cycles in inflation rate trends using HP-filtered series: their length, amplitude and cross-country co-movement.

We find that inflation rates exhibit significant skewness, suggesting infrequent instances of sharp inflation escalations and declines (Graph 2, left and middle panels; Annex 1). The median inflation level in advanced economies has been at 2.6% for the entire sample going back to the mid-1910s, and 2% since 1985. For emerging market economies, the equivalent levels are 6.3% and 5.4%. The comparative level of inflation rates between EMEs and AEs remains relatively stable within the median range of the distribution, but this is not the case in the tail, as clearly depicted in Graph 2 (right panel), given the potential for more extreme inflation levels in emerging markets.

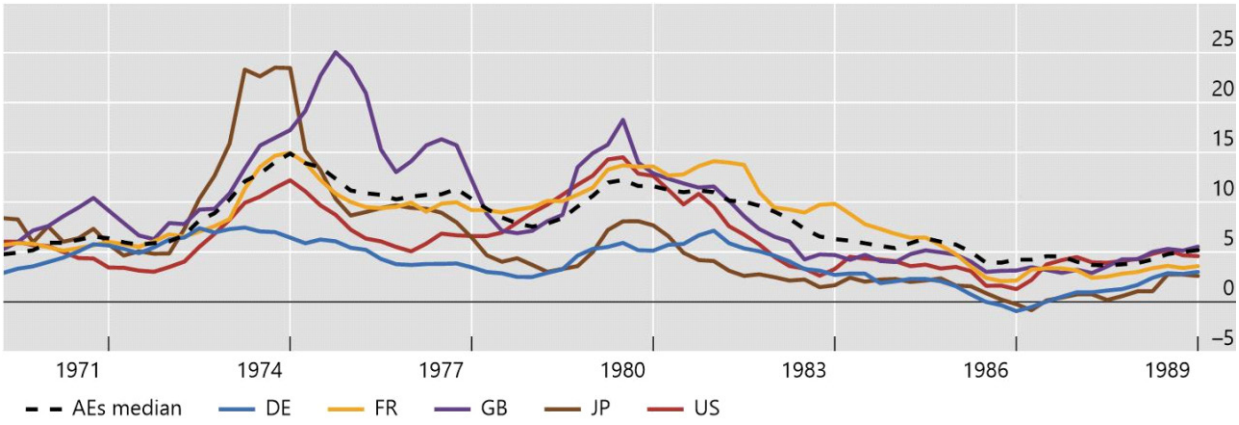
Looking at long-term patterns of inflation cycles, we observe that inflation rates in the advanced economies reached three defining peaks during the past 100 years (Graph 2, left panel) – after the two World Wars, which had been a defining pattern in the past, but also during the late 1970s / early 1980s, which surfaced new phenomena (Box 2). For the emerging market economies, inflation was also elevated after the second World War period, and from the 1970s till the 1990s (Graph 2, middle panel). During the other periods, inflation had been contained, especially from 1990 till the recent Covid-19 pandemic, where it saw a sharp increase, especially in the advanced economies. A striking observation is that inflation rates in emerging markets have dropped massively in recent decades.

Box 2

[9] A voluminous literature studies the Phillips Curve, including how inflation responds to recessions; see Ball and Mazumder (2011) and Del Negro et al (2015) as examples re-examining inflation in the wake of the GFC. In our case, we are interested in switching roles between these variables, examining the role of entering a high-inflation state has on recession.

High inflation episode in the advanced economies in the 1970s and 1980s

In the advanced economies, the 1970s and 1980s were characterised by prolonged periods of high inflation (see Graph below), with levels well above 10 percent in all countries under study but a few exceptions (Germany, Switzerland). This era, often referred to as the "Great Inflation," had profound implications for economic policy and the global financial system.



Several factors contributed to the high inflation experienced during this period:

1. *Oil Shocks:* The 1970s witnessed two major oil crises. The first, in 1973, was triggered by the Yom Kippur War, leading to an oil embargo by OPEC nations. The second, in 1979, followed the Iranian Revolution. Both events caused sharp increases in oil prices, leading to higher production costs and widespread inflation.
2. *Expansionary Monetary Policy:* In response to economic slowdowns and rising unemployment, many central banks in advanced economies adopted expansionary monetary policies. This included lowering interest rates and increasing money supply, which, while stimulating economic activity, also fuelled inflationary pressures.
3. *Wage-Price Spirals:* The period saw strong labour unions and frequent wage negotiations, leading to wage-price spirals. Workers demanded higher wages to keep up with rising living costs, and businesses increased prices to cover higher wage costs, creating a self-reinforcing cycle of inflation.
4. *Supply Chain Disruptions:* Various geopolitical and economic events disrupted global supply chains, contributing to shortages and higher prices for goods and services.

The high inflation episode prompted significant changes in economic policy:

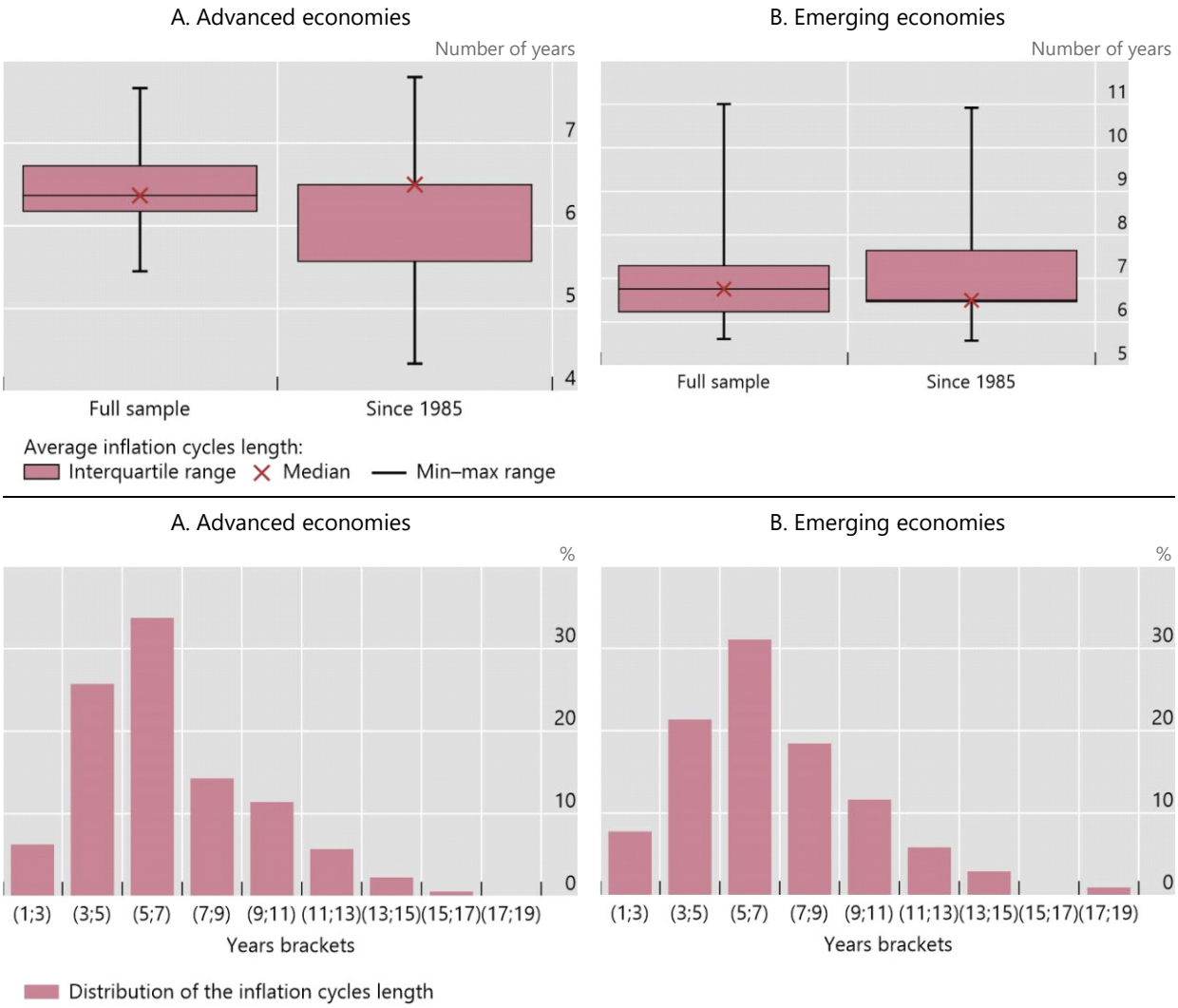
1. *Monetary Policy Tightening:* Central banks, most notably the Federal Reserve under Chairman Paul Volcker, adopted a more aggressive stance on controlling inflation. This included raising interest rates to historically high levels, which eventually succeeded in bringing down inflation but also led to a severe recession in the early 1980s.
2. *Inflation Targeting:* The experience of the 1970s and 1980s led to the adoption of inflation targeting as a central component of monetary policy in many advanced economies. Specifically, central banks set explicit inflation targets to anchor expectations and guide monetary policy decisions.
3. *Structural Reforms:* Governments in advanced economies implemented various structural reforms aimed at increasing economic efficiency and competitiveness. This included deregulation, tax reforms, and efforts to contain the power of labour unions.

The high inflation episode of the 1970s and 1980s left a lasting legacy on economic policy and theory. It underscored the importance of maintaining price stability and the risks associated with unchecked inflation. The lessons learned during this period continue to influence central banking practices and economic policies in advanced economies to this day.

Using the series denoised by the HP filter, we find that the average length of inflation cycles is 6-7 years in advanced economies and seven years in emerging market economies (Graph 3, first row). We identify some defining characteristics for the length of inflation cycles:

- The average duration of inflation cycles has remained stable over time (Graph 3, first row). In the advanced economies, the average duration of the inflation cycle from 1910 to 2024 was 6.7 years, compared to 6.2 years post-1985. A similar pattern is observed in emerging market economies since 1945, where the average cycle length was 7.4 years, and 7.1 years post-1985.
- The average duration of inflation cycles is remarkably consistent across countries, with the vast majority of countries clustering within one year around the mean (Graph 3, first row). For the 13 advanced economies, the country-specific average length varies from 5.5 years to 7.7 years since 1910 and between 4.3 years to 7.8 years post-1985. For the 14 emerging market economies, the average cycle lengths range from 5.6 years to 11 years for the entire sample and from 5.6 years to 10.9 years for the last 40 years since 1985.
- At the level of individual cycles, the variation in duration is slightly higher, although 55% of the cycles in the advanced economies fall into a length between 3.5 and 7 years (Graph 3, second row). The distribution for the emerging market economies is similar, with a higher likelihood for comparably short and longer inflation cycles.

Inflation cycles: stylised facts about duration of inflation cycles Graph 3



The boxplot graphs in the first row show the range of the average length of the inflation cycle across the AE and EME sample of countries. The graphs in the bottom row illustrate the distribution of the length of each specific inflation cycle across all AEs (left graph) and EMEs (right graph).

Sources: BIS; authors' calculations.

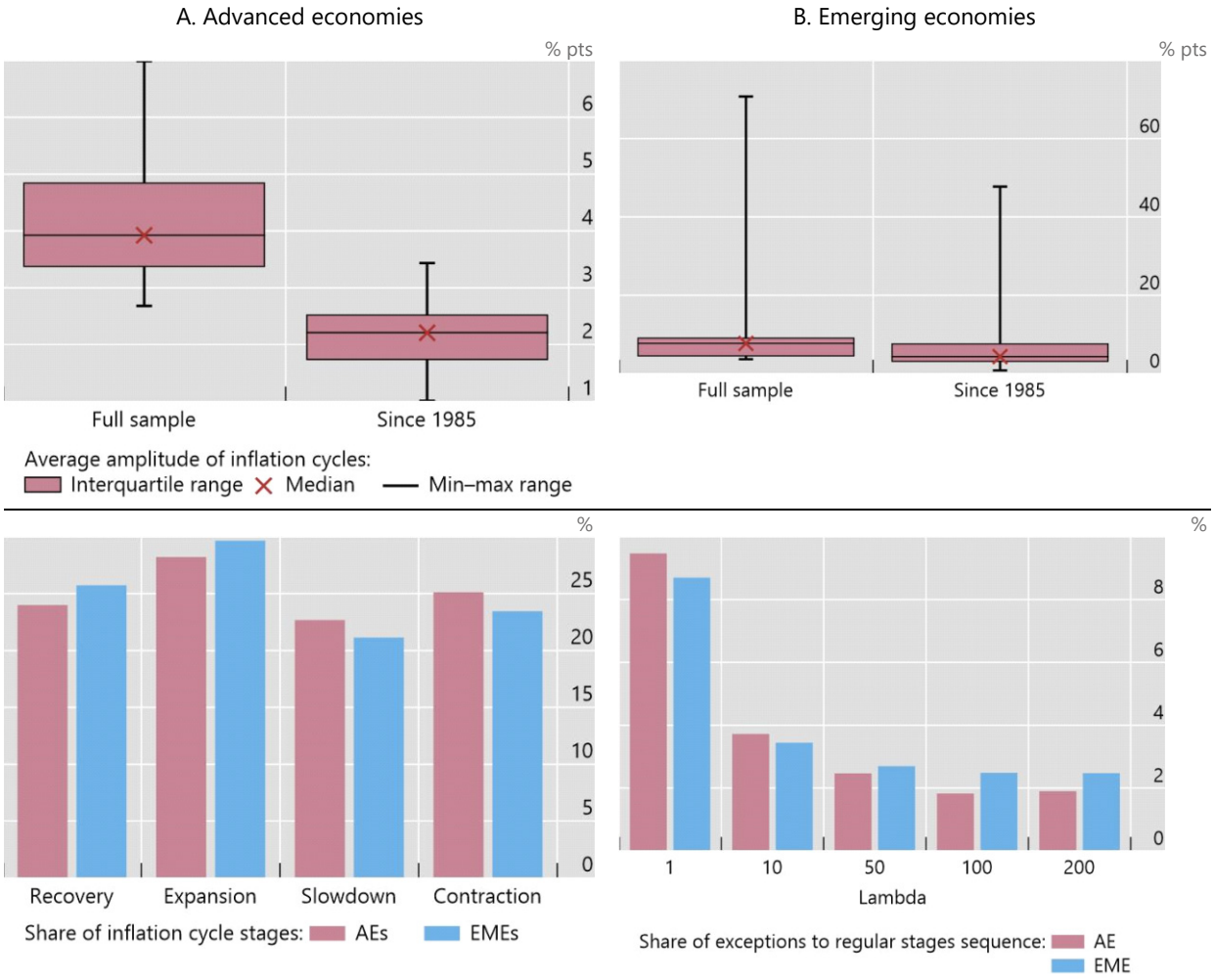
The amplitude of inflation cycles decreased over time, especially for the emerging economies. We find an average (median) amplitude of about 6 (4) percentage points for the past 100 years, compared to 3 (2) percentage points for the most recent 40 years (Graph 4, first row). For the emerging market economies, the median amplitude for the individual cycles was 6.5 percentage points for the past 70 years, compared to 4.5 percentage points since 1985. As illustrated in the graph, the variation for the emerging markets was very high, especially in the years before the 1990s.

The sequence of the inflation stages is fairly regular (Graph 4, left panel in second row): Although the cycles do not strictly follow the distinct phases (expansion, slowdown, contraction, recovery), with the applied soft filtering, only about 2-3% of the sequence of the stages is irregular. Moreover, the cycles are fairly symmetric with respect to the peaks and troughs, especially for those cycles with a higher amplitude

(Graph 2). We find that expansion phases are slightly longer than recovery phases, while contraction and slowdown phases are shortest (Graph 4, left panel in second row), also a common feature of business cycle phases. However, the difference between their length is rather minor, with very similar patterns for advanced and emerging economies.

Inflation cycles: stylised facts about the amplitude and cycle shape

Graph 4



The boxplot graphs in the first row show the range of the median amplitude of the inflation rates by country in the AEs (left) and EMEs (right). The bottom left graph shows the share of the different inflation stages observed for AEs and EMEs (ie the count of observations assigned to the different cycles using the HP filtered series). The bottom right graph depicts the share of observations in the HP filtered series that do not follow the expected sequence (recovery – expansion – slowdown – contraction) conditional on the level of filtering.

Sources: BIS; authors' calculations.

There have been various studies on the co-movement of inflation across countries. For example, Mumtaz et al (2021) use a dynamic factor model that decomposes inflation movements into global, regional and national factors, and document a greater importance for global factors in explaining inflation after 1985. Forbes (2019) also argues for a greater role of global factors in modelling inflation, also consistent with Cicarelli and Mojon (2010). Relatedly, Auer et al (2024), building upon seminal work by Bordo et al (2005), posit that global factors have increasingly influenced national inflation rates. This suggests that the globalisation of goods and financial markets has resulted in more synchronised inflation cycles across countries,

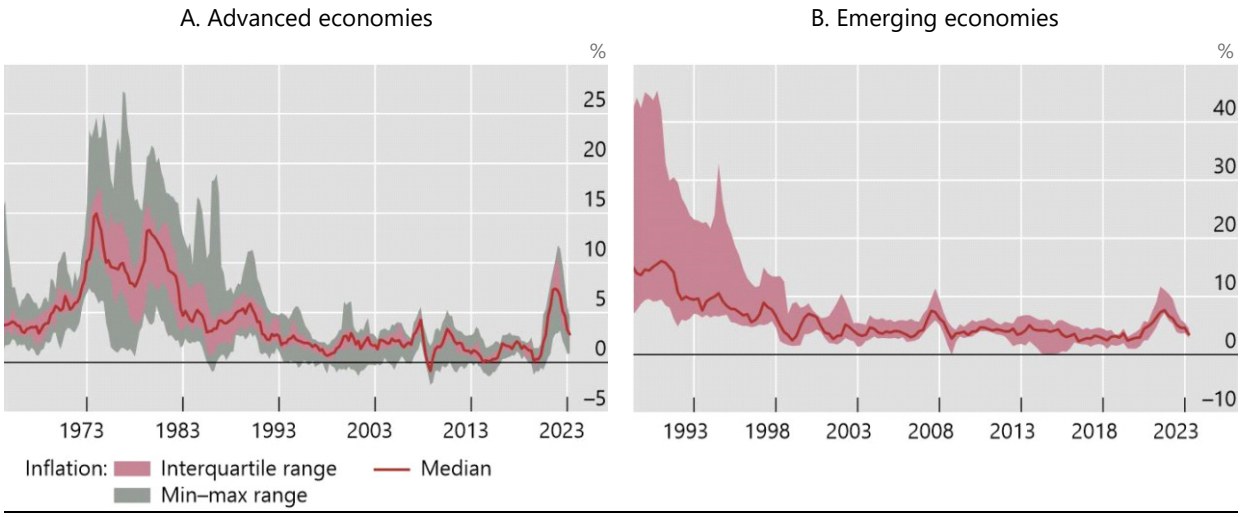
including emerging market economies (Aizenman et al (2016)). Prior research also underscores the role of global commodity prices, particularly oil prices, in affecting inflation (Barsky and Kilian (2004)), while highlighting the influence of global output gaps as a driver of inflation (Borio and Filardo (2007)). Additionally, the spillover effects of the monetary policy from major economies, notably the United States, are identified as significant contributors (e.g., Neely (2015)).

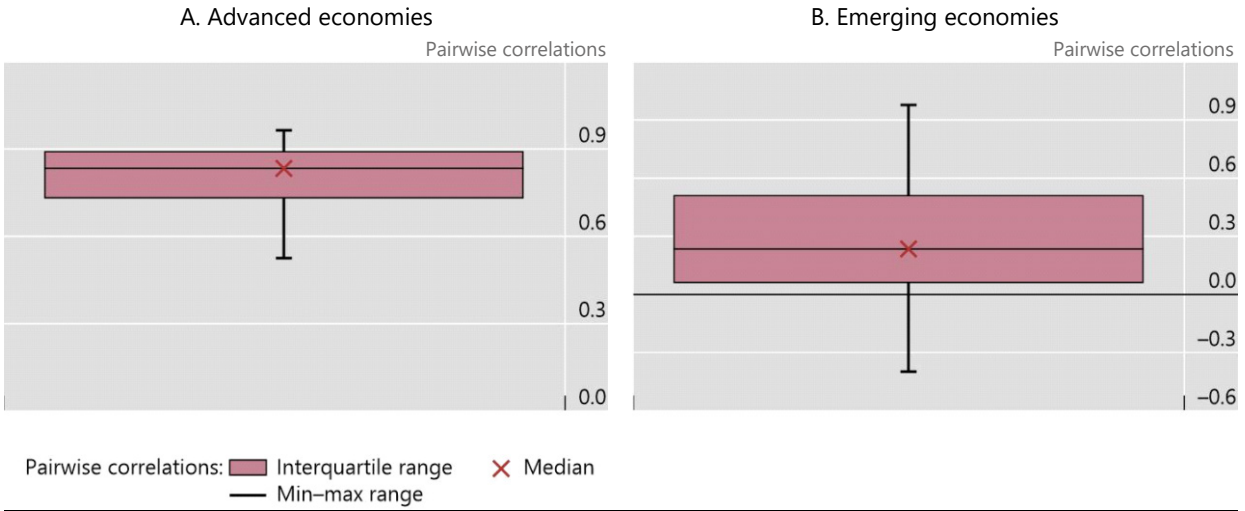
The inflation cycles for each country are shown in Annex 2.

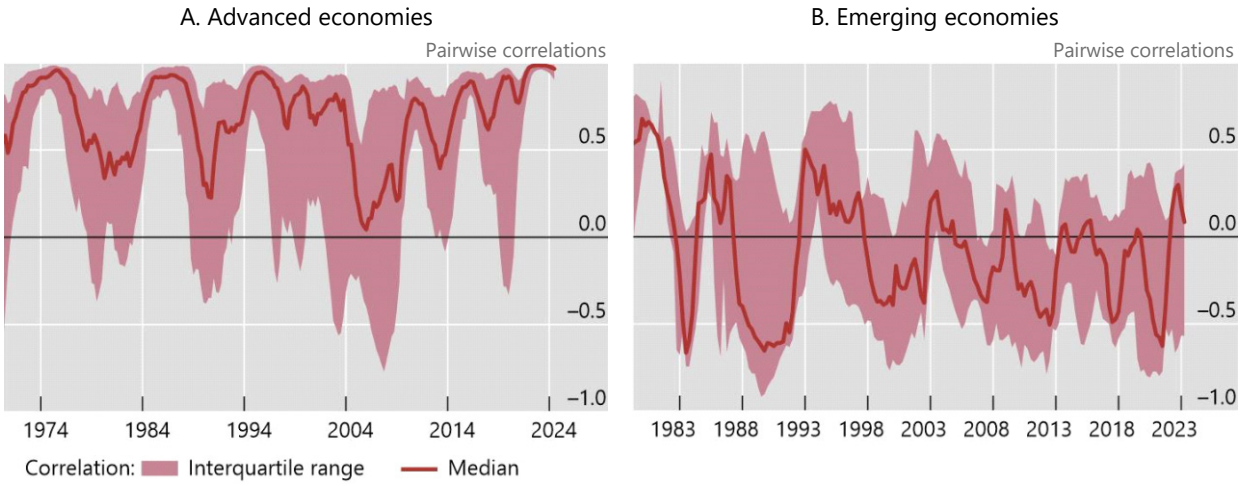
In line with previous studies, we observe that the range of inflation rates across AE and EME countries has narrowed (Graph 5, first row) and that inflation rates are correlated between countries, especially for the advanced economies (Graph 5, second row). But these correlation patterns change substantially over time. For the advanced economies, we find that long-term pairwise correlations are consistently surpassing 0.5, averaging at 0.8 (Graph 5, third row). During the 1970s and the Covid-pandemic, elevated inflation levels coincide with high inflation correlation, while the opposite was true during the GFC (Graph 6). Conversely, pairwise correlations among inflation rates in the emerging market economies are more volatile and less correlated than in advanced economies (Graph 5, rows 2 and 3). However, many periods of high inflation, including during the 1970s, the GFC and the pandemic, were associated with high levels of correlation (Graph 6).

Inflation cycles: cross-country comparison

Graph 5



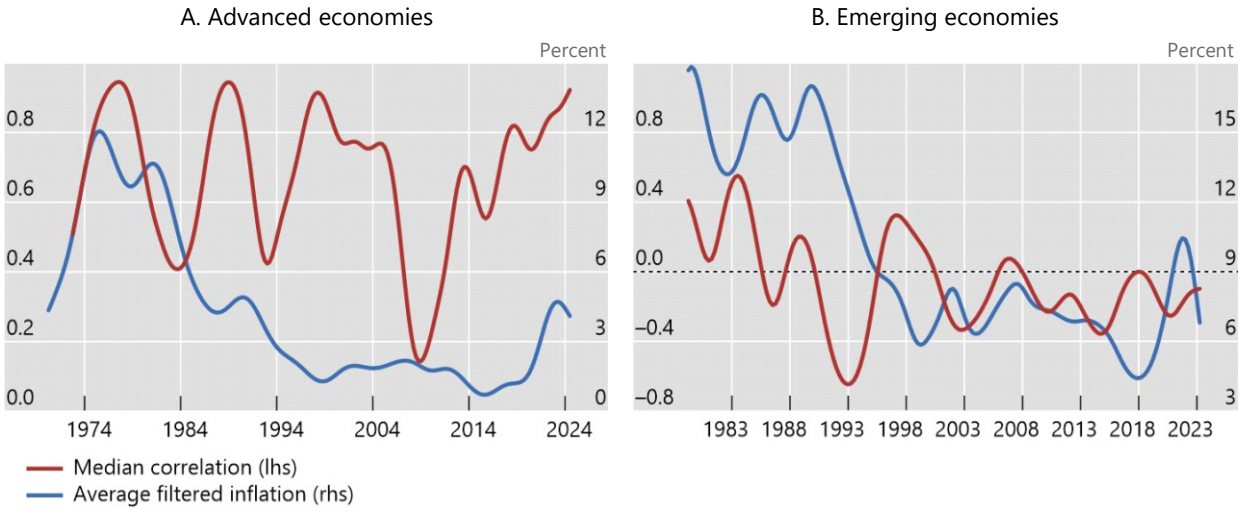




Note: Pairwise correlation computed for all years available; correlations over time computed for 5-year sliding window (eg correlation for Q1/1960 is correlation during Q2/1955-Q1/1960), For the graph comparing inflation correlations with the level of inflation the correlations are centred (eg correlation for Q1/1980 is correlation during Q3/1977-Q2/1983),

Sources: BIS; authors' calculations.

Inflation cycles: Pairwise correlations vis-a-vis level of inflation Graph 6



The pairwise correlations computed are computed for 5-year sliding windows. For this graph, the correlations are "centred" (ie correlation for Q1/1980 is the correlation computed for the period Q3/1977-Q2/1983),

Sources: BIS; authors' calculations.

4. Identification of high inflation periods

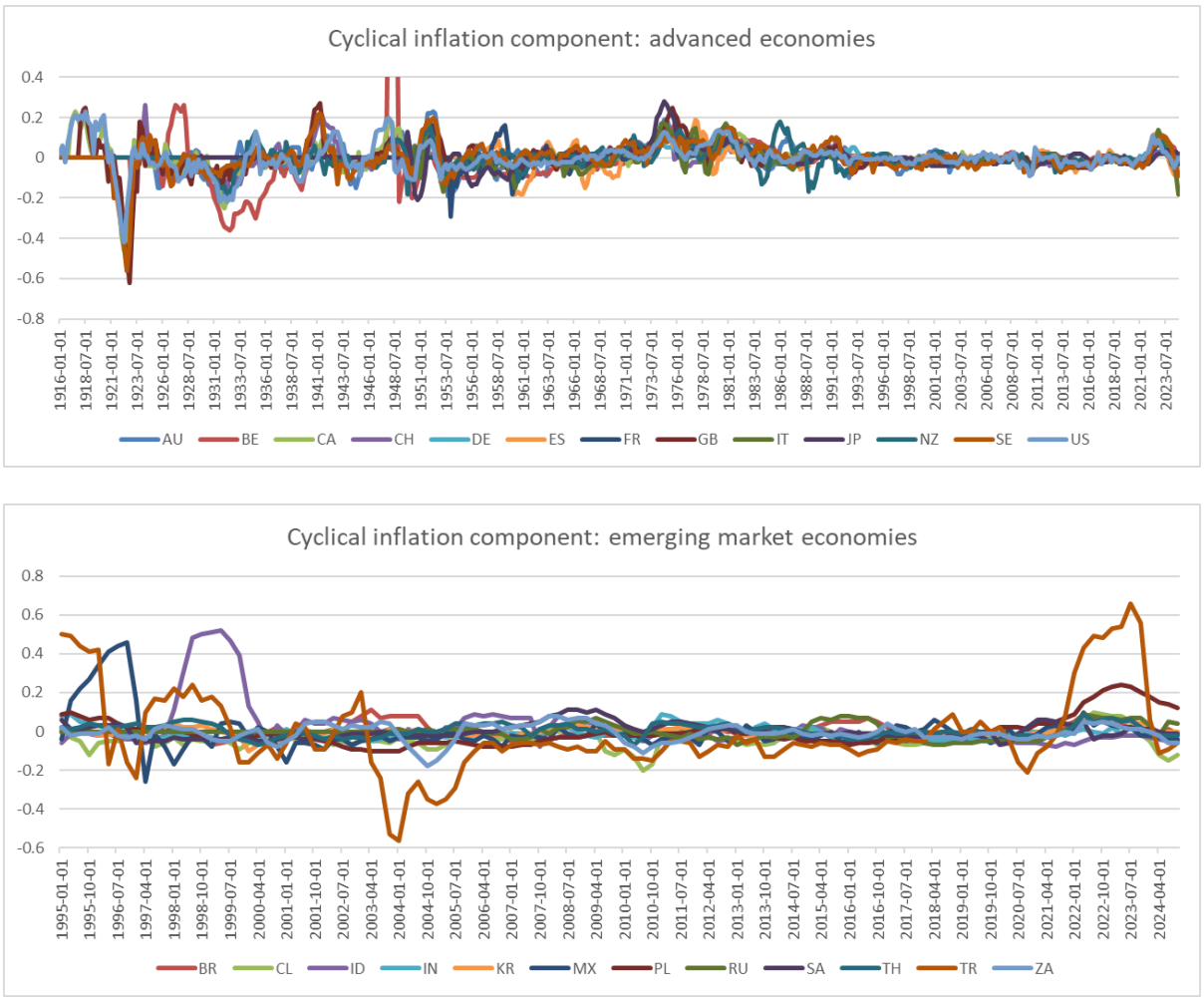
Graph 7 displays the cyclical components of country-specific inflation series using the Hamilton (2018) regression filter. The periods of high cyclical inflation correspond to those in Graph 2, ie after the two World Wars, during the 1970s/80s/(90s) and most recently during the pandemic episode.

Inflation heuristic established in this paper

In addition to these formal cycle definitions, we also consider how a simple heuristic might be applied more broadly to identify periods of high inflation. We have identified the following calibration:

- Inflation is cyclically high when the year-on-year inflation is more than 2 percentage points higher than in the same quarter of the previous year in advanced economies (1 p.p. for Germany, Japan and Switzerland) or 3 p.p. in emerging markets,
- In addition, this condition would have to persist for at least 5 consecutive quarters.

Cyclical components of inflation: Hamilton filter Graph 7



Note: cyclical component calculated at the country level with the Hamilton cycle, using a two year (8 quarter) offset.

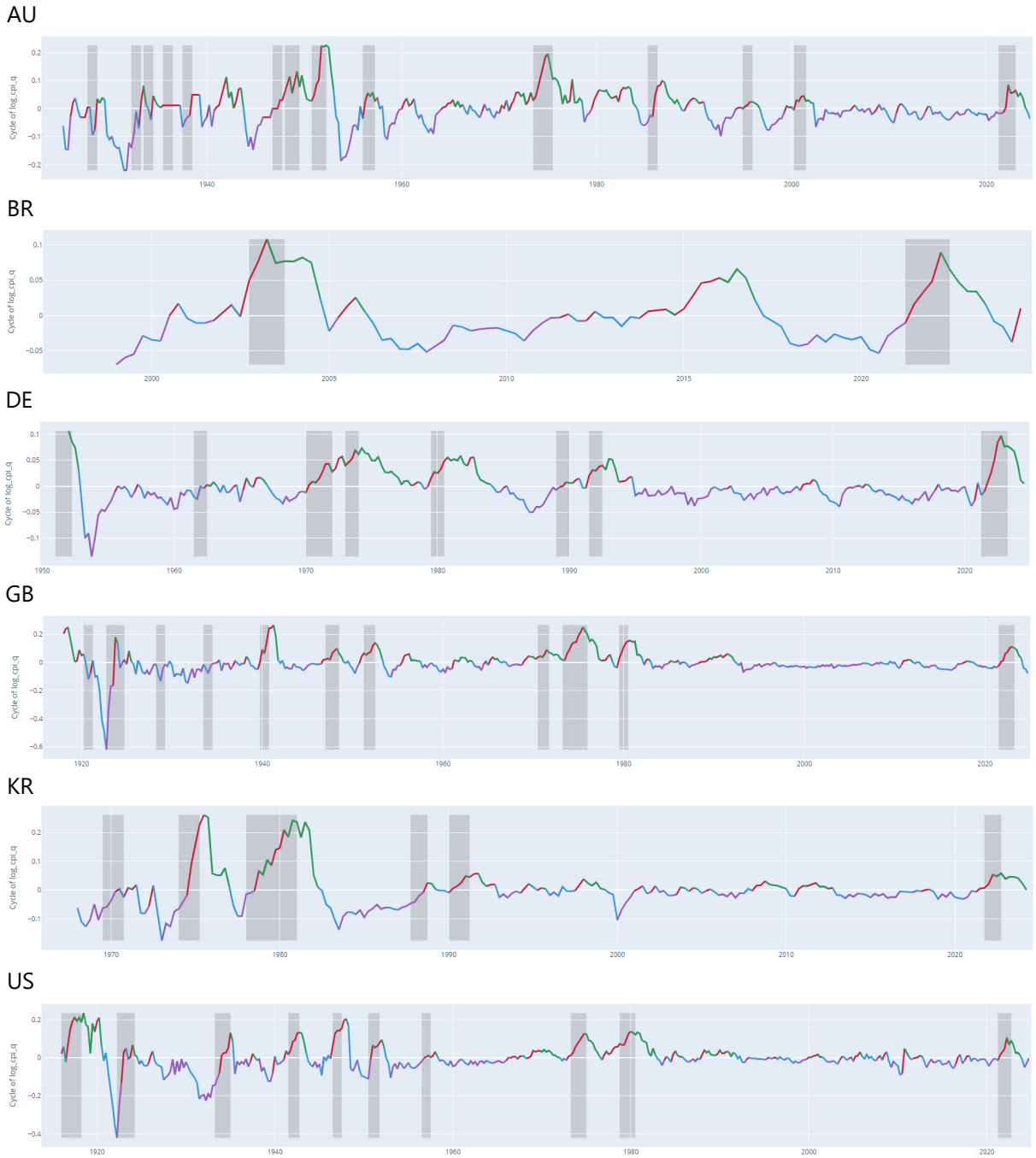
Source: BIS data portal; Author computations.

Graph 8 below illustrates for selected jurisdictions (a full set of graphs is in Annex 3) that the rising inflation phases of the Hamilton-filtered cyclical component track well this simple heuristic (grey areas). Specifically, the lines in Graph 8 (and in A3.1 in Annex 3) represent the breakdown of these individual cycles into the four periods relating to whether inflation is rising or falling, and whether it is historically high or low. Each colour is a phase of the cycle.

Our analysis documents that a simple heuristic rule can be applied for various types of economies to identify the onset of periods of high cyclical inflation quite well. Of course, an inflation signal provided by this heuristic is far from ideal. The goal is simply to offer a straightforward way that can be applied to a number of countries as a sanity check on identified periods of high inflation – and our findings suggest that the heuristic can indeed be useful for that purpose.

Cyclical components of inflation: Hamilton filter

Graph 8



Note: cyclical component calculated at the country level with the Hamilton cycle, using a two year (8 quarter) offset. Red: positive and increasing. Green: positive and decreasing. Purple: negative and increasing. Blue: negative and decreasing. Jurisdictions selected to illustrate diversity of inflation cycles.

Source: BIS data portal; Author computations.

5 Relationship with the GDP growth cycle

Inflation cycles interact with business and financial cycles in potentially complex ways. But while a considerable literature examines the effects of business cycles on inflation (eg, Bianchi et al (2023) and references therein), it is rarer to find systematic studies of the effects of inflation on business cycles. In addition to directly influencing wealth distribution and risk aversion, inflation cycles change the policy function (and policy space) and thus also how policy affect financial stability (Smets (2018)). All of this in a context where high inflation episodes are historically difficult to tame (Ari et al (2023)).

Inflation cycles, measured by the HP filtered series, are slightly longer than the corresponding business cycles (GDP growth), by about one year (6.5 vs 5.5 years, Graph 9 top row).[10] There is little difference in the length of the inflation and GDP growth cycles between advanced and emerging market economies, at least on average.

The pairwise, country-specific correlation between the inflation and business cycles is moderately positive (Graph 9, second row), both in the advanced and emerging economies. However, there is considerable variation in each country group, documented by countries that exhibit no or even a small negative correlation between the two cycles. These findings underline the complex interrelation between inflation and economic activity.

To uncover time patterns in the relationship between the onset of high-inflation periods and business cycle downturns, we use panel local projections (Jordà (2005), Jordà and Taylor (2024)) to explore what happens to business cycle indicators over time after the *onset* of a high-inflation regime. This onset is defined as a dummy that identifies the quarter where a country's inflation turns to from a normal to a high-inflation regime according to our inflation heuristic.

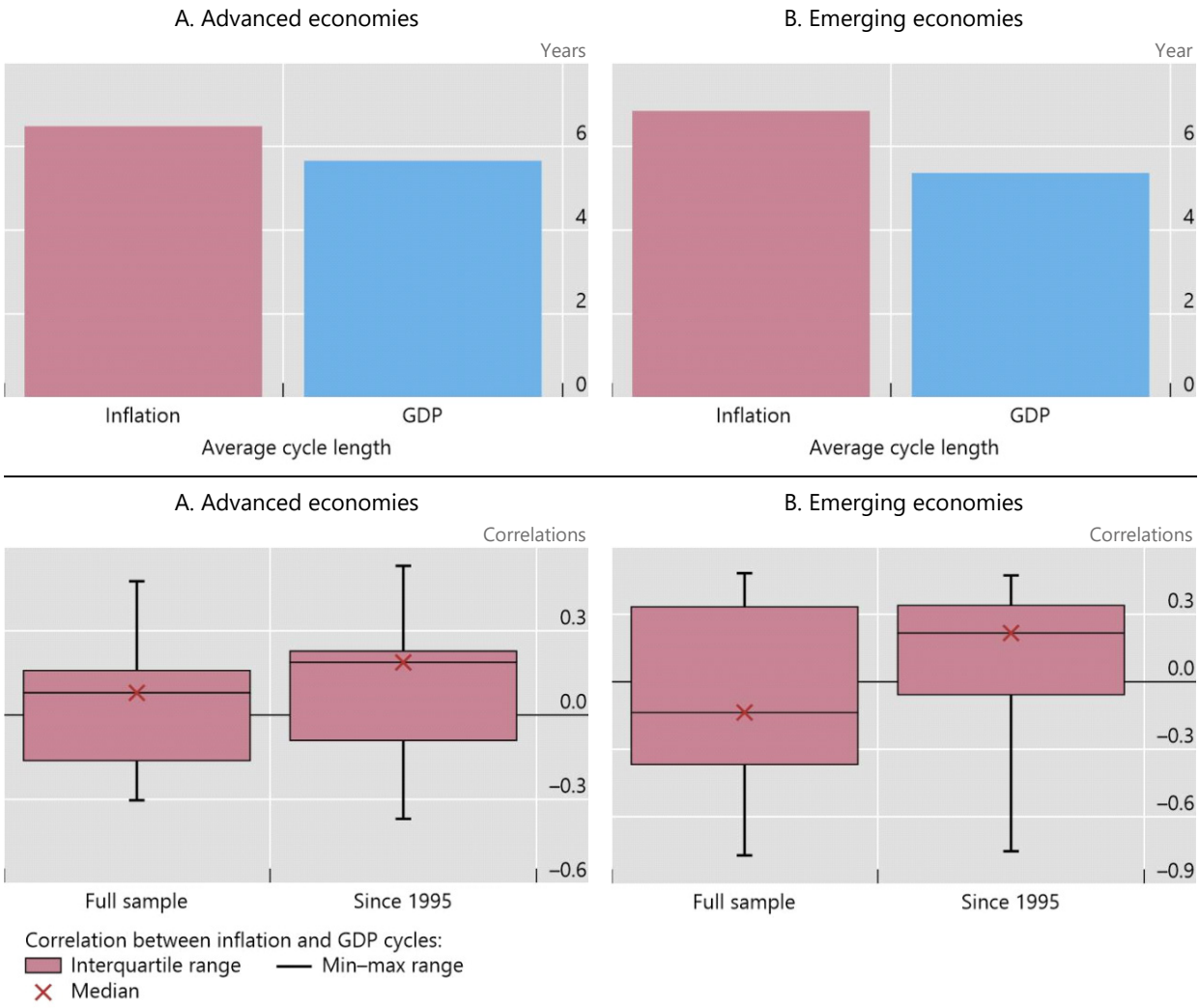
Formally, we aim to estimate the impulse response of the onset of a high-inflation period on the variables that represent business and financial cycles, controlling for the dynamic interrelationship between these cycles. To facilitate interpretation, we use dummy variables representing business cycle downturns or recessions and financial cycle downturns; this allows coefficients to be interpreted as in a linear probability model. We build on the connection between local projection and vector autoregressions (Plagborg-Møller and Wolf (2021)) to construct panel local projections that consider the dynamics of financial cycles that estimate, for each business cycle dummy time series encoded by $y_{t,}$[11] the average effect θ_h in the h-th quarter ahead after onset of the high inflation regime, $\bar{\pi} = 1$:

$$\theta_h = E\left[y_{t+h} \middle| \bar{\pi} = 1; y_{t-1,\dots,t-p}, \bar{\pi}_{t-1,\dots,t-p}\right] - E\left[y_{t+h} \middle| \bar{\pi} = 0; y_{t-1,\dots,t-p}, \bar{\pi}_{t-1,\dots,t-p}\right].$$

[10] Business cycles are found to be shorter in duration and exhibit a lower amplitude compared to financial cycles (Claessens et al (2012), ECB (2014), IMF (2017) and Borio et al (2018)).

[11] All these series are normalised such that a value of 1 corresponds to the undesirable outcome (eg, recession for business cycles or lower tail of returns for financial cycle variables).

Comparison of characteristics of inflation and GDP cycles Graph 9



Sources: BIS; authors' calculations.

We estimate θ_h as a coefficient in a set of panel local projections regressions as:

$$y_{i,t+h} = \alpha_i + \beta_h + \beta_q + \theta_h \eta_{i,t} + \sum_{p=1}^{4} \theta_h^p \eta_{i,t-p} + \epsilon_{i,t+h},$$

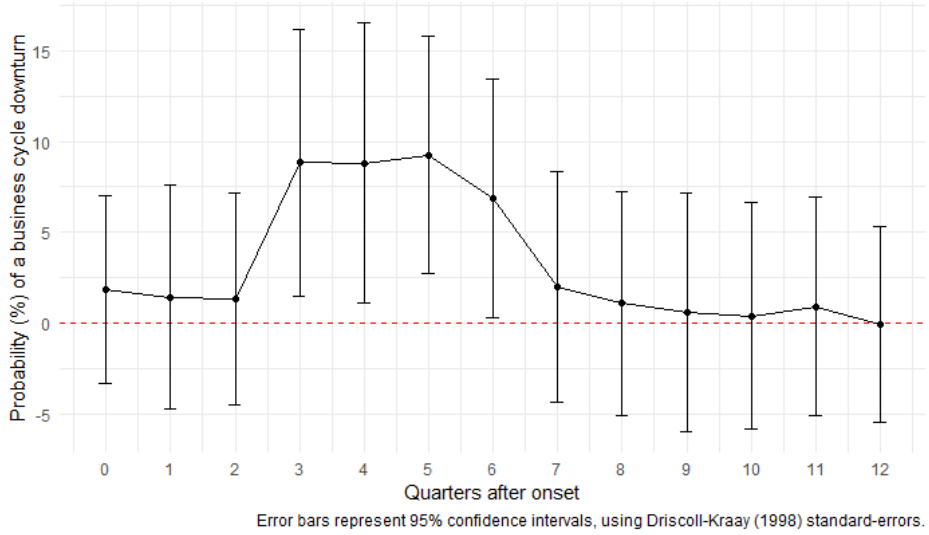
where p=4 is the number of lags to capture the dynamic relations between these two variables,[12] α_i is the fixed effect for each country, β_h and β_q are fixed effects for each date and the quarter of the year, $\eta_{i,t}$ is a dummy marking the onset of the high-inflation period for country i, ie the first quarter of the "high and rising" inflation cycle estimated with the Hamilton filter. The dependent variable itself is an indicator of business cycle downturn: for the US, it is the NBER recession dummies; for other countries, it corresponds to quarters where the amplitude, or difference between

[12] It is known that the asymptotic convergence of the impulse response differs from a VAR beyond the lags used in the local projection estimates. We use p=4 to keep the smallest lag structure that is still able to represent the full seasonalty within a year, to keep data also for countries that have shorter time series. However, the shape of the results and their statistical significant are essentially the same with lags up to 24 quarters (not shown).

peaks and troughs (as identified by the Bry-Boschan algorithm) is greater than 2 percentage points. The coefficient of interest is θ_h.

Since the model is a linear panel regression with a dummy as dependent variable, it corresponds to a linear probability model, with an interpretation of θ_h as follows: within a country, when inflation *becomes* cyclically high in one period, what is the impact on the probability of a business cycle downturn occurring some quarters later? In line with expectations, moving to a high-inflation regime is negative to growth, as the probability that countries will face a recession increases by almost 9 percentage points one year afterwards (Graph 10). Interestingly, the effect lasts for about one year before it disappears.

Response of business cycle downturn to onset of high-inflation regime — Graph 10



Source: Author computations.

6 Conclusion

The recent surge in inflation has reignited interest in understanding inflation trends, particularly in the advanced economies, which had experienced low inflation levels for an extended period of time. While inflation has somewhat subsided in the meantime, not least due to tighter monetary policies, the potential for ongoing (supply-side) inflationary pressures remains a concern.

With this study, we seek to contribute to the general understanding of inflation cycles, ie what to expect for their duration and amplitude, as well as their relationship vis-à-vis economic growth cycles, based on long-term patterns. Our findings suggest that there are some defining characteristics which have remained stable over time – inflation cycle length, pairwise cross-country correlations and relationship with growth cycles – other dimensions, most notably the amplitude of inflation cycles, have changed over time. We also point to differences for emerging market economies, which have more distinct inflation patterns, although the trend has become more aligned to advanced economies in recent decades.

We offer a simple rule of thumb to identify periods of high inflation, which tracks well a more formal definition for a broad range of countries. Along with the stylised facts on inflation cycles established in this paper, our work can serve other research endeavours to clarify this important question in macroeconomics. For instance, we show evidence that the onset of cyclically high inflation periods significantly increases the chance of worse business cycle outcomes starting one year ahead.

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Annex 1: Inflation data by country: Overview

Country name	ISO code	Type	Series starts in
Australia	AU	AE	1923
Belgium	BE	AE	1921
Canada	CA	AE	1915
Switzerland	CH	AE	1922
Germany	DE	AE	1950
Spain	ES	AE	1955
France	FR	AE	1952
United Kingdom	GB	AE	1916
Italy	IT	AE	1948
Japan	JP	AE	1947
New Zealand	NZ	AE	1926
Sweden	SE	AE	1919
United States of America	US	AE	1914
Argentina	AR	EM	1944
Brazil	BR	EM	1981
Chile	CL	EM	1949
Indonesia	ID	EM	1980
India	IN	EM	1954
Korea (the Republic of)	KR	EM	1966
Mexico	MX	EM	1970
Poland	PL	EM	1990
Russian Federation	RU	EM	2002
Saudi Arabia	SA	EM	1991
Singapore	SG	EM	1962
Thailand	TH	EM	1977
Turkey	TR	EM	1965
South Africa	ZA	EM	1923

AE: Advanced economy; EM: Emerging market economy

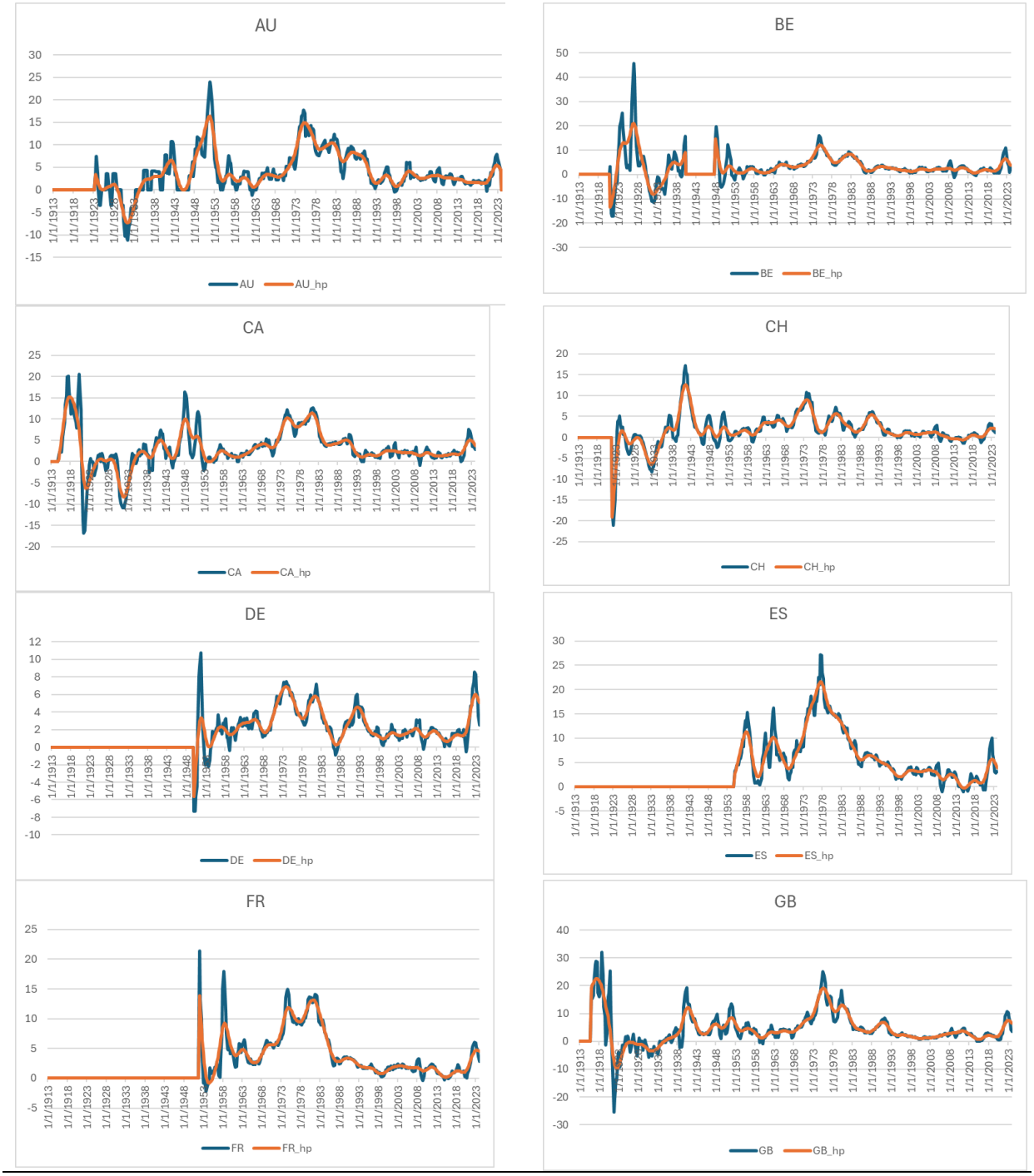
Source: Consumer prices - data | BIS Data Portal

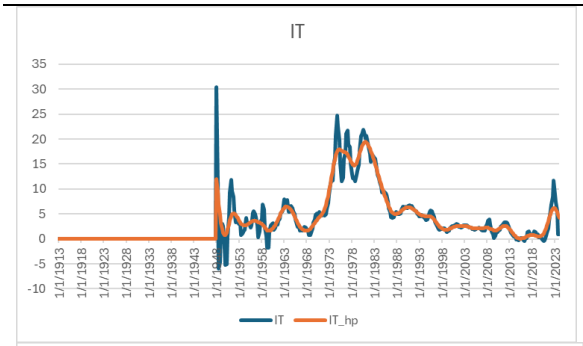
Annex 2: Inflation series by country

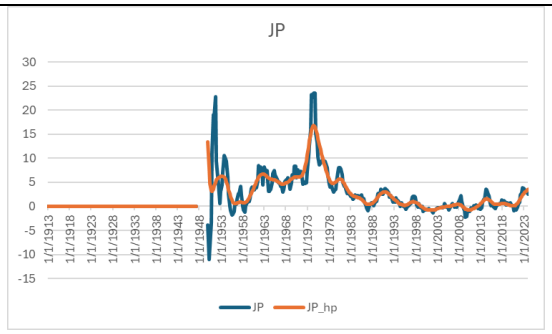
Inflation cycles by country

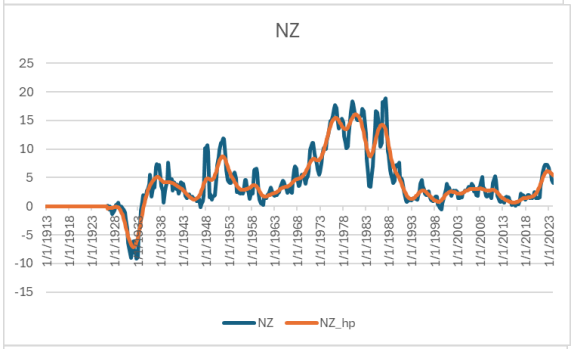
Graph A2.1

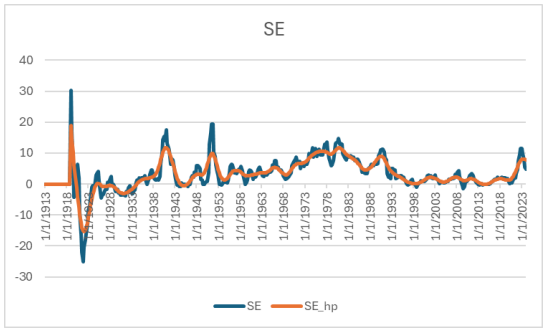
Advanced economies

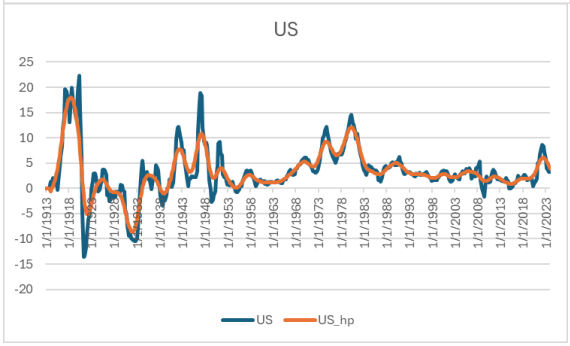




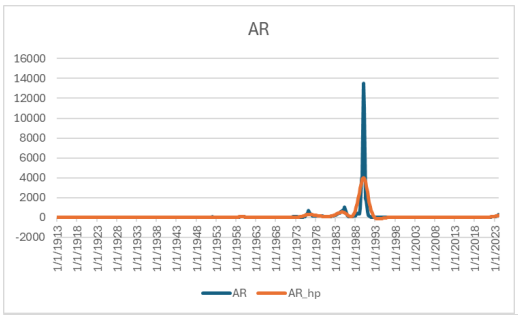


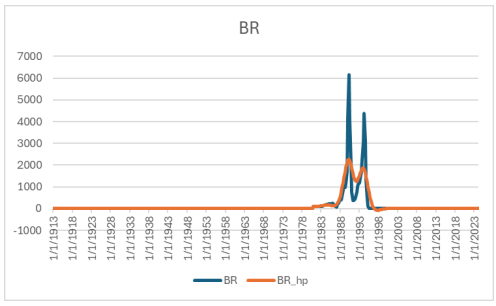


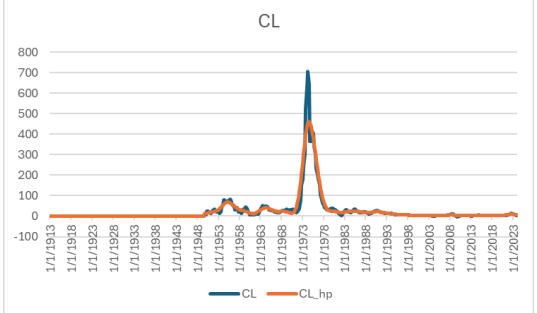


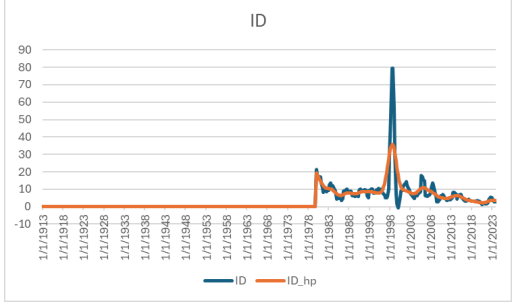


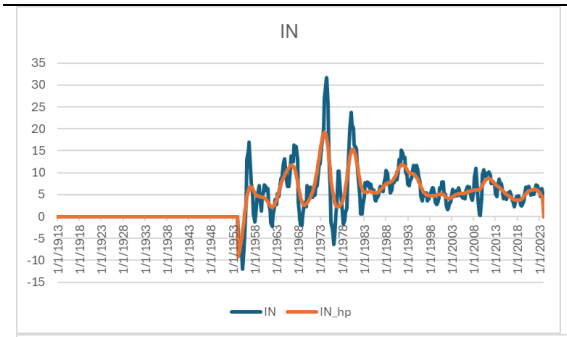
Emerging market economies

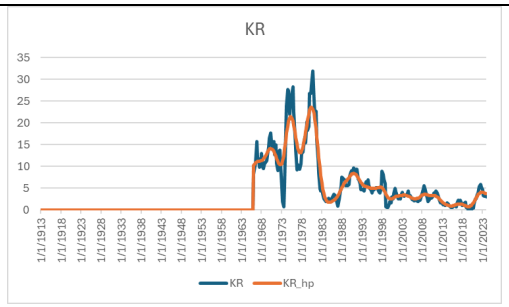


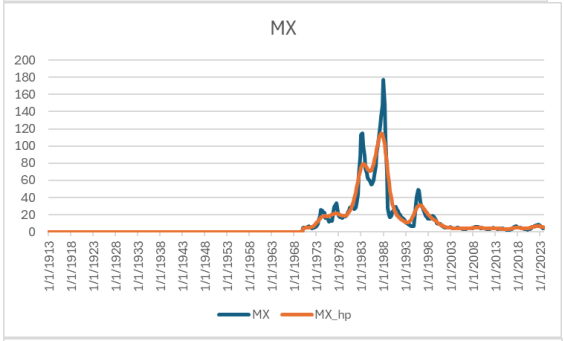


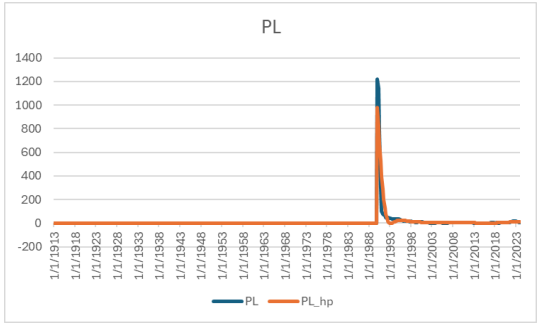


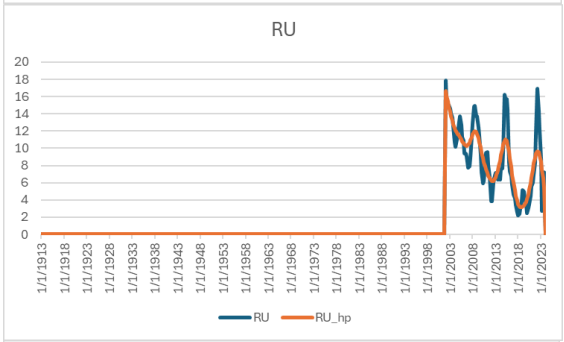


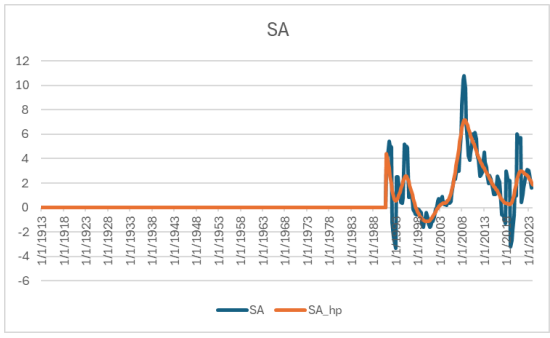


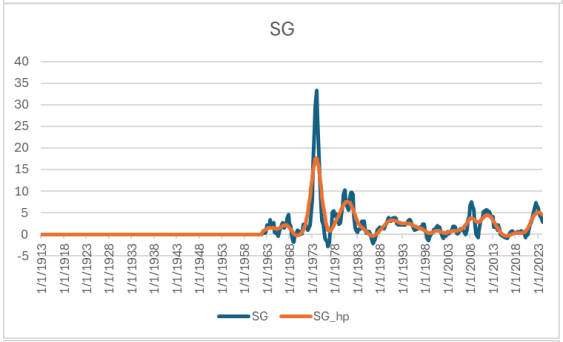


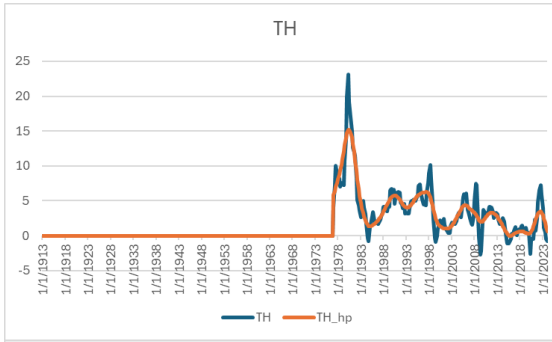


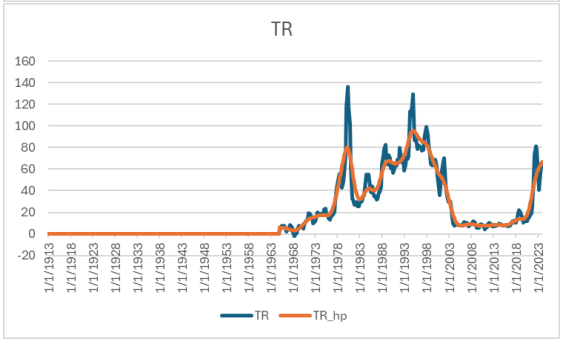


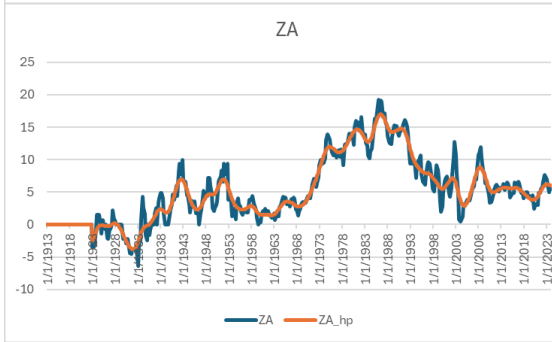












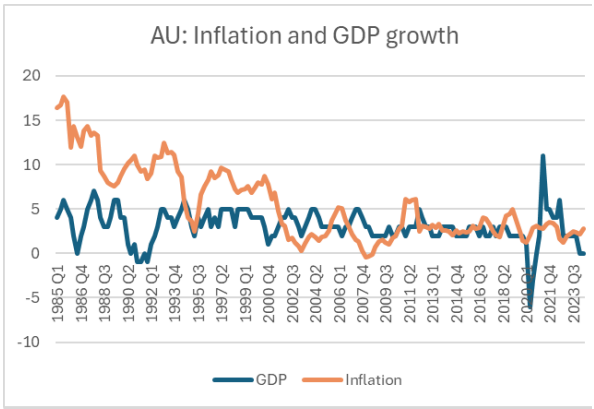
The graphs show the raw vs HP filtered data with lamda 100

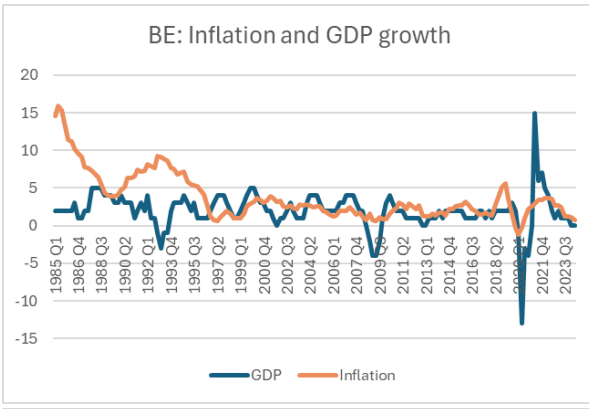
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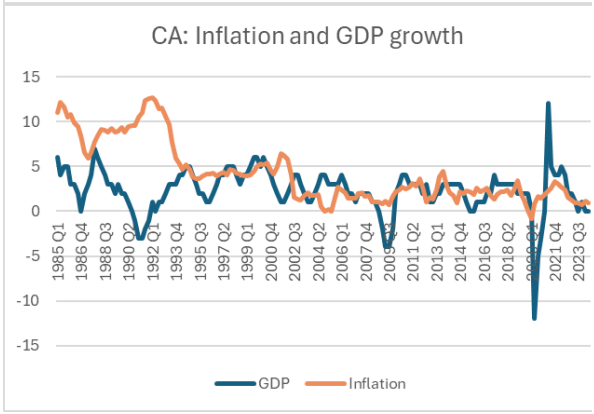
Inflation vs GDP growth by country

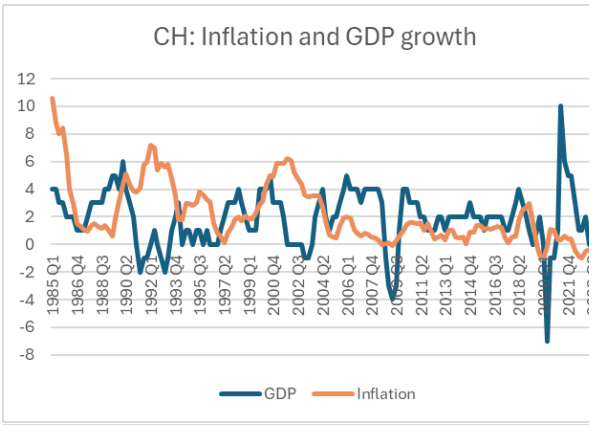
Graph A2.1

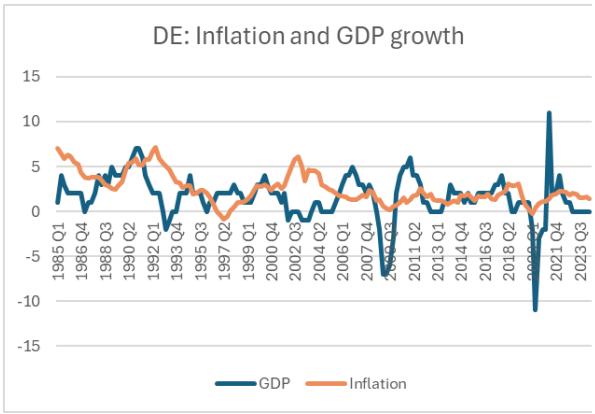
Advanced economies

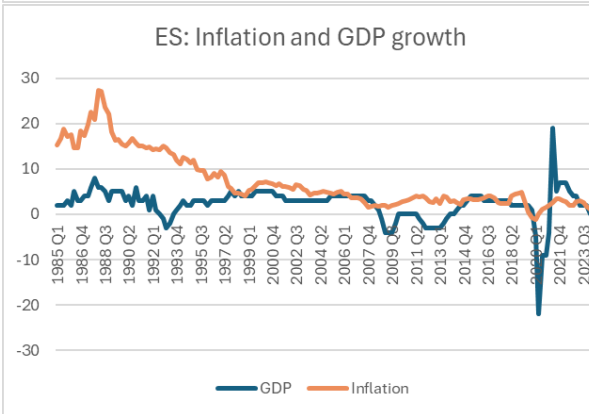


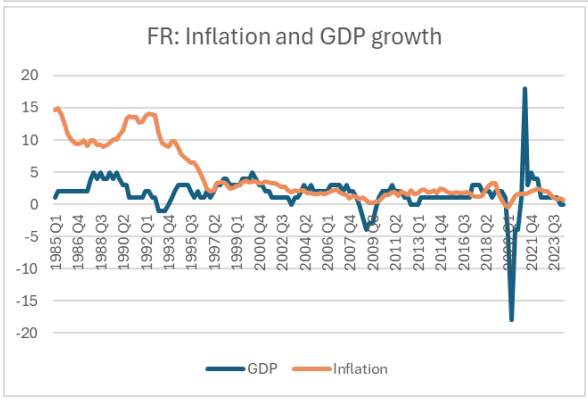


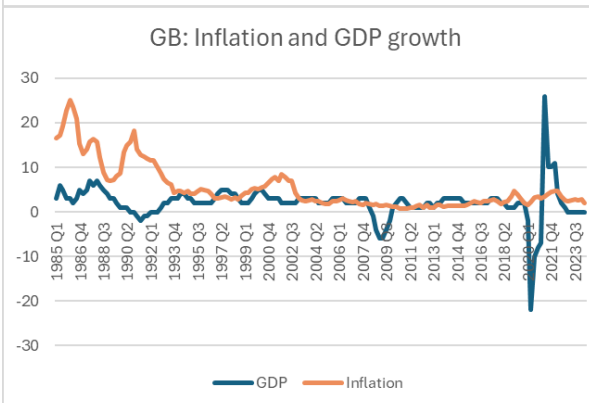


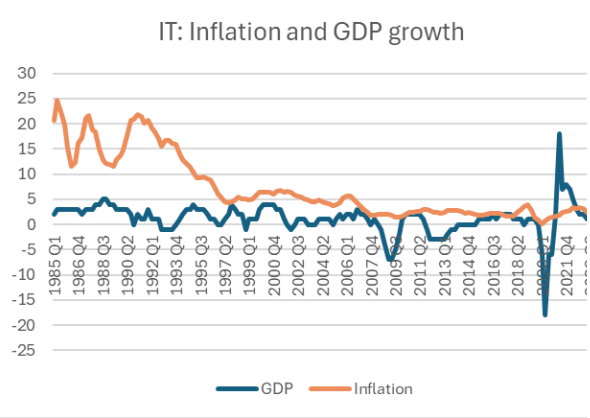


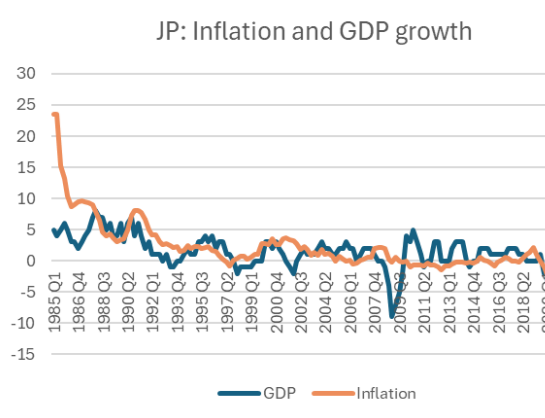


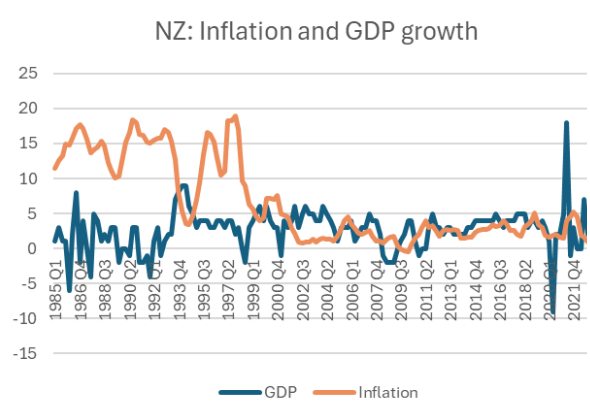


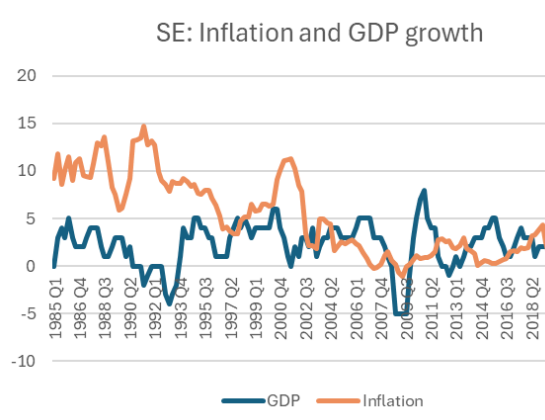


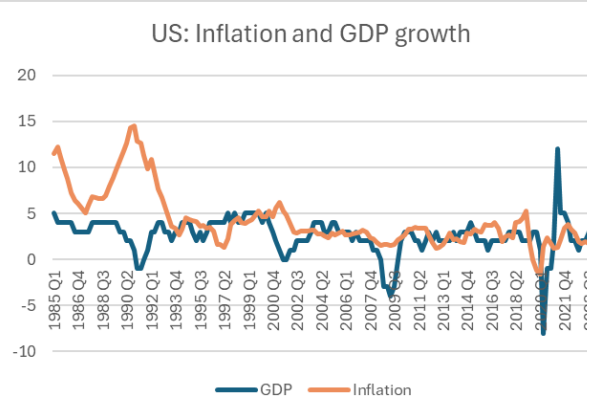



IT: Inflation and GDP growth
GDP
Inflation


JP: Inflation and GDP growth
GDP
Inflation


NZ: Inflation and GDP growth
GDP
Inflation

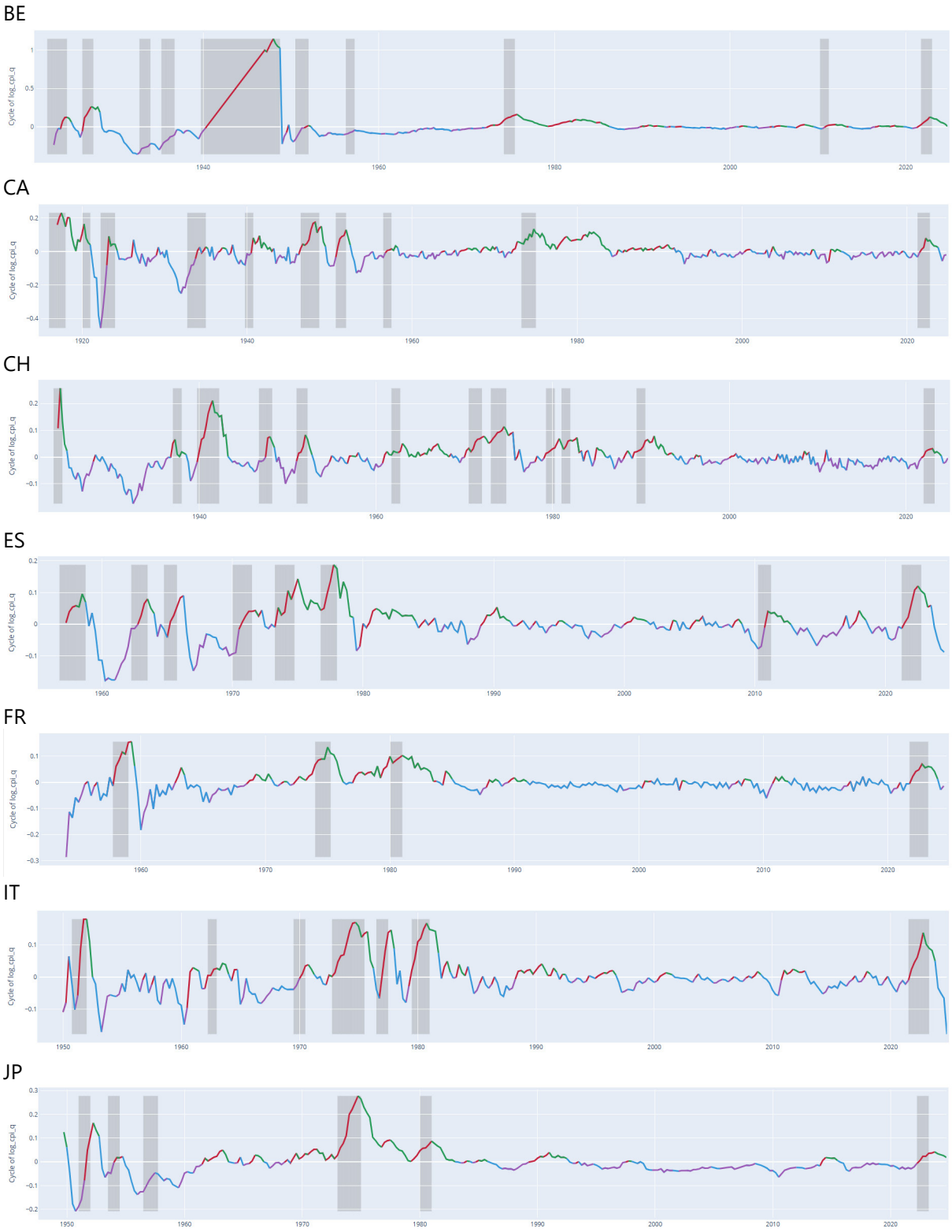

SE: Inflation and GDP growth
GDP
Inflation


US: Inflation and GDP growth
GDP
Inflation

Annex 3: Inflation cycles by country

Cyclical components of inflation: Hamilton filter (cont. from Graph 8)

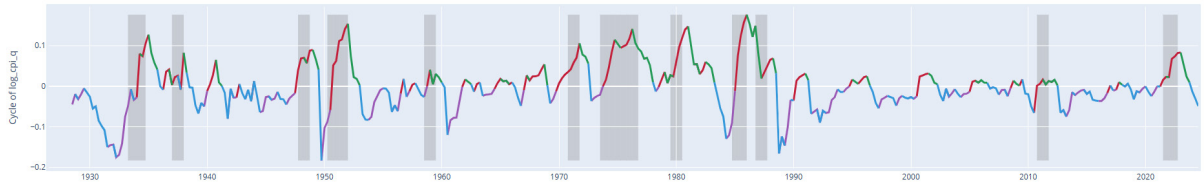
Graph A3.1



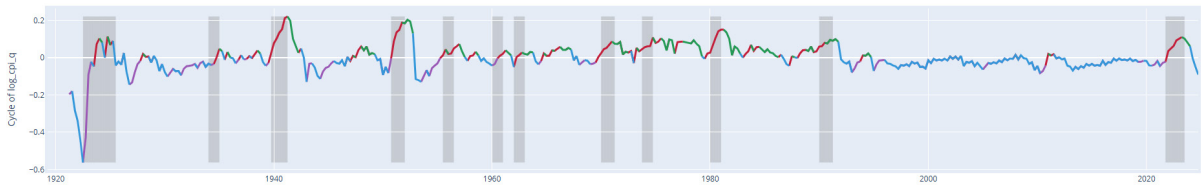
Note: cyclical component calculated at the country level with the Hamilton cycle, using a two year (8 quarter) offset. Red: positive and increasing. Green: positive and decreasing. Purple: negative and increasing. Blue: negative and decreasing. Jurisdictions selected to illustrate diversity of inflation cycles.

Source: BIS data portal; Author computations.

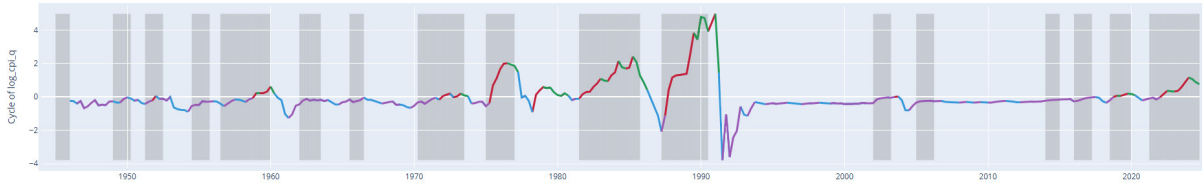
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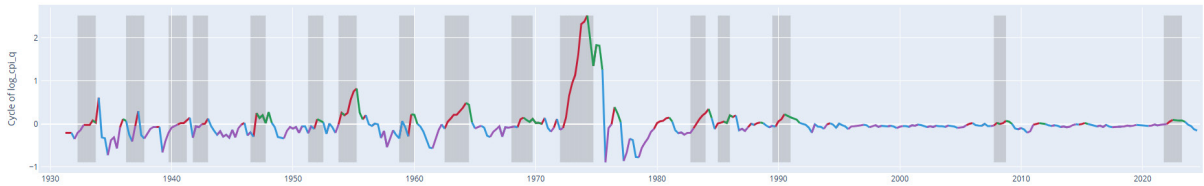
SE



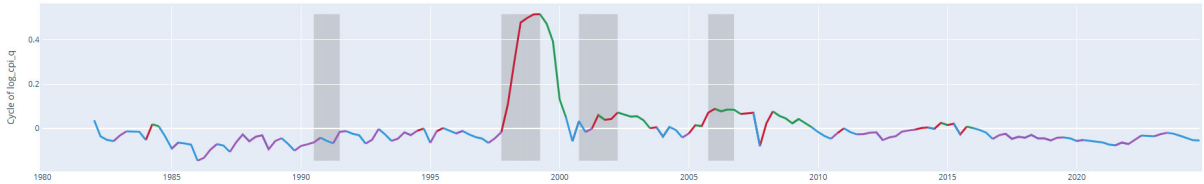
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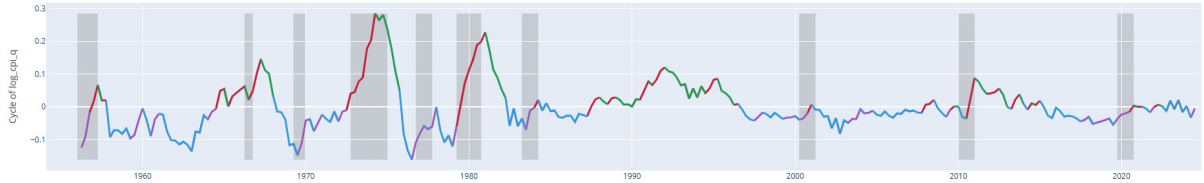
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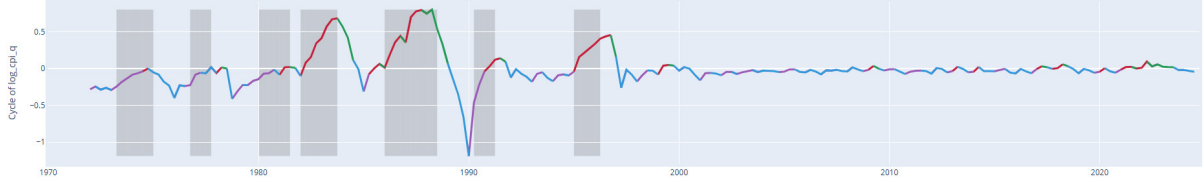
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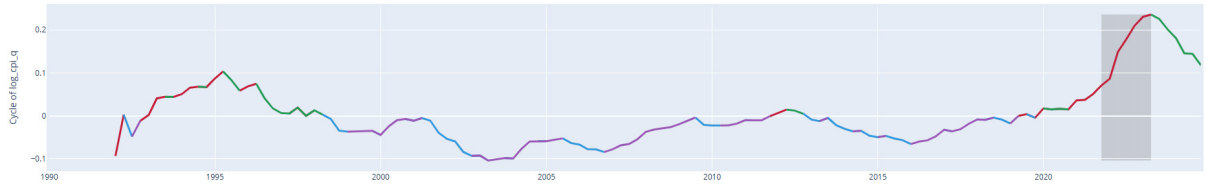
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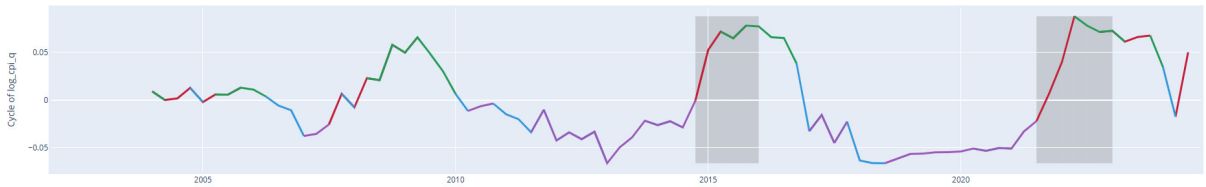
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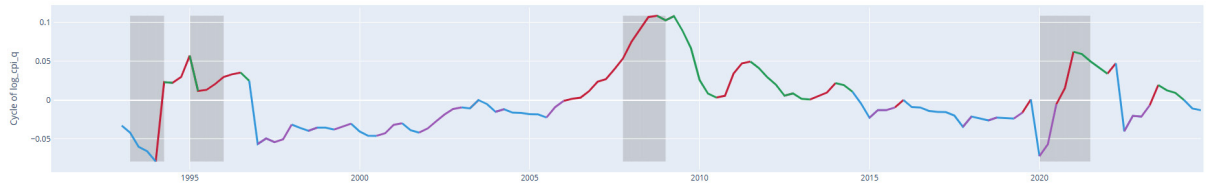
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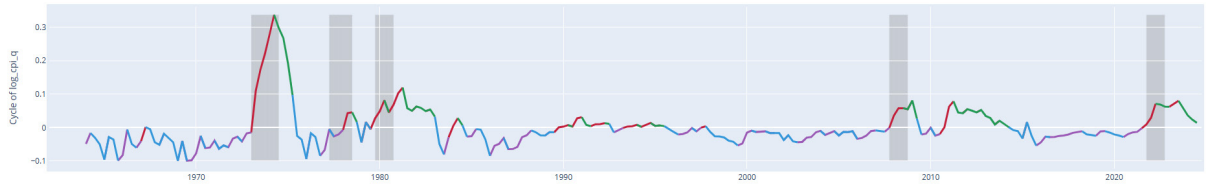
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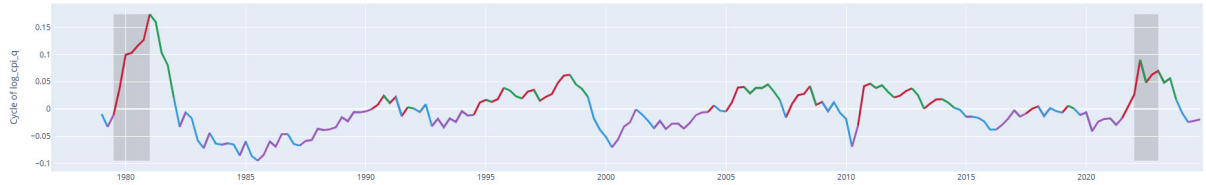
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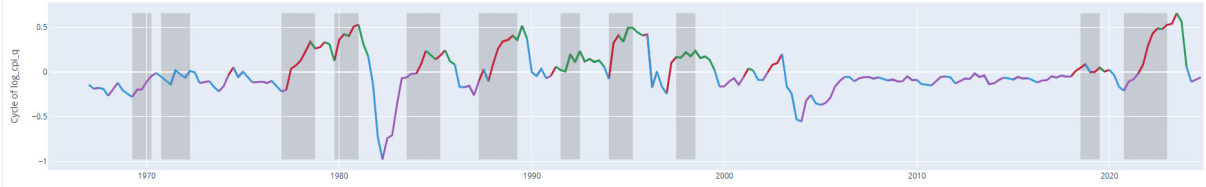
SG



TH



TR



ZA

