DISCUSSION PAPER SERIES

DP15914

INTERNATIONAL CO-MOVEMENTS OF INFLATION, 1851-1913

Stefan Gerlach and Rebecca Stuart

ECONOMIC HISTORY

MONETARY ECONOMICS AND FLUCTUATIONS

ISSN 0265-8003

INTERNATIONAL CO-MOVEMENTS OF INFLATION, 1851-1913

Stefan Gerlach and Rebecca Stuart

Discussion Paper DP15914
Published 14 March 2021
Submitted 11 March 2021

Centre for Economic Policy Research
33 Great Sutton Street, London EC1V 0DX, UK
Tel: +44 (0)20 7183 8801
www.cepr.org

INTERNATIONAL CO-MOVEMENTS OF INFLATION, 1851-1913

Abstract

We study co-movements of inflation in a group of 15 countries before and during the classical Gold Standard by fitting a generalisation of the Ciccarelli-Mojon (2010) model on annual data spanning 1851-1913. We find that international inflation functions as an “attractor” for domestic inflation rates. The cross-sectional dispersion of inflation declined gradually over the sample and Bai-Perron tests for structural breaks at unknown points in time suggest that there are breaks in six of reduced-form inflation equations. However, sub-sample estimates indicate that the overall finding that international inflation is an important influence on domestic inflation.

JEL Classification: E31, F40, N10

Keywords: international inflation, gold standard, principal components, Factor Analysis

Stefan Gerlach - hms.gerlach@gmail.com
EFG Bank and CEPR

Rebecca Stuart - rebecca.j.stuart@gmail.com
University of Neuchatel and Queen's University Belfast

Acknowledgements
We are grateful to Gabriel Fagan and Daniel Kaufmann for helpful comments and suggestions.

INTERNATIONAL CO-MOVEMENTS OF INFLATION, 1851-1913

Stefan Gerlach
EFG Bank and CEPR

Rebecca Stuart
Université de Neuchâtel
and
Queen's University Belfast

11 March 2021

Abstract

We study co-movements of inflation in a group of 15 countries before and during the classical Gold Standard by fitting a generalisation of the Ciccarelli-Mojon (2010) model on annual data spanning 1851-1913. We find that international inflation functions as an "attractor" for domestic inflation rates. The cross-sectional dispersion of inflation declined gradually over the sample and Bai-Perron tests for structural breaks at unknown points in time suggest that there are breaks in six of reduced-form inflation equations. However, sub-sample estimates indicate that the overall finding that international inflation is an important influence on domestic inflation.

Keywords: international inflation, Gold standard, principal components, factor analysis.
JEL Number: E31, F40, N10

We are grateful to Gabriel Fagan and Daniel Kaufmann for helpful comments and suggestions. The views expressed in this paper are solely our own. Contact information : : Rebecca Stuart (corresponding author), email: rebecca.j.stuart@gmail.com, website: https://www.rebeccastuart.net/, address: Université de Neuchâtel, Institut de recherches économiques, Rue A.-L. Breguet 2, CH-2000, Neuchâtel, Switzerland.

1. Introduction

In this paper we study the domestic and international components of inflation in a sample of 15 countries over the period 1851-1913, a period that includes the Gold Standard, which was adopted by many countries during the 1870s. The behaviour of inflation across countries in recent data is well-documented. For instance, Mumtaz and Surico (2008) and Monacelli and Sala (2007) decompose sectoral inflation rates into world and domestic components using factor models. Ciccarelli and Mojon (2010) argue that inflation in 22 industrialized countries was largely a global phenomenon over the period 1960 to 2008.

The inflation processes in individual economies during the Gold Standard have been studied in several papers. One set of papers exploit the fact that deflationary periods were common during the Gold Standard to study the link between these deflation episodes and output (Kaufmann (2020), Bordo and Filardo (2005)). Benati (2008) studies the persistence of inflation across monetary regimes over a sample period spanning from the Gold Standard to the current era of inflation targeting. There are also a number of papers which study the properties of US inflation during the period. Several focus on forecasting inflation during the period, particularly in the context of the Fisher equation (Barsky (1987), Barsky and De Long (1991), Mishkin (1992), Summers (1983)).

However, this is, to our knowledge the first study focussing on international co-movements of inflation during the Gold Standard. The lack of such studies is surprising since economic integration is generally perceived as high in that period. The increasing industrialisation of the period created international markets for raw materials, while factory-made products were exported around the globe. Advances in transportation and communications enabled and supported the boom in international trade, barriers to migration were limited and capital flowed freely across borders. These factors provide powerful mechanisms that allow shocks and economic disturbances to be transmitted internationally. Several studies have documented the globalisation and integration of financial markets, including Obstfeld and Taylor (2005), Volosovych (2011) (bond markets), Bekaert and Mehl (2019), Stuart (2020) (stock markets), as well as international trade (Estevadeordal et al., (2003)). Given the fixed exchange rate regime of the Gold Standard, price developments would also have been expected to be closely linked across countries.

Indeed, data on individual commodity prices have been used to measure changes in integration during this period. For instance, Klovland (2005) uses the prices of 39 commodities in Britain and Germany to show that absolute price variability declined over the period 1850 to 1913, although the decline was not uniform across all markets. Jacks (2005) studies intra- and international commodity market integration in the US and Europe from 1800 to 1913 and argues that a substantial increase in integration had already occurred by the mid-nineteenth century. Findlay and O'Rourke (2001) study commodity market integration over the period 1500 to 2000 and argue that the level of integration was periodically interrupted by shocks such as wars and world depressions. This co-movement in commodity prices suggests that changes in the cost of living may have been correlated across countries.

To study the behaviour of inflation across countries, we use the methodology proposed by Ciccarelli and Mojon (2010) (hereafter CM). We consider several measures of international inflation: we follow CM and study the cross-sectional mean and the first principal component of domestic inflation rates. We also consider a single factor from a factor model and the cross-sectional median. These four measures yield strikingly similar estimates of the common component of inflation. Our preference is to use the cross-sectional median since it involves no estimation and is robust to outliers. Below we estimate reduced-form inflation equations of the type pioneered by CM for the 15 countries in our sample.

There are five main findings. First, inflation is strongly correlated across countries, suggesting the existence of a common international component of inflation. At the same time, idiosyncratic shocks are also present and their behaviour differs across countries, suggesting that the relative importance of the international component varies across countries. Second, the cross-sectional dispersion of inflation declines gradually throughout the sample period. In this sense, inflation became more of an international phenomenon in this time period. Third, the results of our reduced-form inflation equations suggest that the international inflation rate functions as an "attractor" for the domestic inflation rates. Fourth, we find a structural break in six of our reduced form equations, generally in the period 1867-77, corresponding with the widespread adoption of the Gold Standard. However, subsample estimates do not change the main conclusion that international inflation exerted powerful influences on domestic inflation rates. Fifth and finally, a comparison with more recent data suggests that there has been little change in the international inflation process, except in the dynamics.

Before proceeding, it is useful to define some terminology. In what follows we refer to inflation in an individual country as “domestic” inflation. While one is tempted to use the term “global inflation” for the common component of inflation across countries, this term would be misleading. Our sample consists only of relatively developed countries, implying that the term “global” inflation is a misnomer. Instead, we use the term “international” inflation.

The rest of the paper is organised as follows. In the next section we turn to the data. Section 3 comprises a discussion about how to measure the international component of inflation and Section 4 a discussion of how our proposed measure, the cross-sectional median of the domestic inflation rates, has evolved over the sample. In Section 5 we present the model, proposed by Mojon and Ciccarelli (2010), that we use to study the relationship between the domestic and international components of inflation. In Section 6 we turn to the estimates of the reduced-form inflation equations. Section 7 compares the results for the Gold Standard period with those obtained using more recent data. Section 8 concludes.

2. The data

The data used in this study are drawn from a variety of sources, which are indicated in Table 1. The data should be thought of as capturing the cost of living. One problem with studying historical episodes of inflation is that often little detail is known about how the various price indices used are measured. Furthermore, it seems likely that the price indices in different countries are constructed in different ways, potentially complicating the comparison of inflation across countries. The work by Kaufmann (2020) points to several reasons why price levels and therefore inflation rates may be measured with error. These include the use of data from major cities to represent the economy more broadly, relatively narrow baskets of retail goods, very limited coverage of services and often missing data on rents and housing, and the interpolation of some prices when data are collected at too low frequency.

But while measurement errors are likely to introduce some noise in the country-specific inflation rates, it is much less clear that they will impact much on our estimates of the international inflation rate which is the focus of this paper. To see this, consider the international inflation component as measured by the cross-sectional mean of the individual inflation rates.

Suppose for simplicity the benchmark case in which the measurement errors are normally distributed, serially uncorrelated, have the same variance in all countries and are mutually uncorrelated. If so, they will add a term to the variance of the international inflation component equal to σ^2/N , where N = 15 is the number of countries. Thus, while measurement errors increase the variance of inflation in individual countries by σ^2, they increase the variance of the international component by 1/15 or 7% of that. The same argument holds in the case in which we use the cross-sectional median to measure the international inflation component.[1] Overall, while measurement errors are likely to impact on domestic inflation rates, it is much less clear that they are important for the common component of inflation which is the focus of this paper.

With those caveats in mind, Table 2 provides descriptive statistics of the various measures of inflation used here. The median and average annual inflation rate are both around 0.5%, and the interquartile range and the standard deviation of inflation are around 4%. Interestingly, no country is an obvious outlier.

Before commenting on the paths of the inflation rates in the different countries and their correlation with the international component of inflation, it is useful to define the latter.

3. Measuring international inflation

CM consider three measures of international inflation: the cross-country average, the first principal component of the inflation rates in the individual countries, and a weighted measure of the different countries' inflation rates computed by the OECD. They find that the first two measures are extremely closely related and use the cross-country average in their analysis since it is so simple to compute.

Of course, there is no formal reason why the cross-sectional average and the principal component should be so similar so this finding may be sample specific and not carry over

[1] Wonnacott and Wonnacott (1977, p. 182) state that the variance of the sample median is approximately given by $(\pi/2)(\sigma^2/N)$ and thus declines in the same way as the variance of the mean when N increases.

to the data we consider. We therefore consider several different measures of international inflation: we follow CM and compute the cross-sectional mean and the first principal component of domestic inflation rates. We also consider a single factor from a factor model and the cross-sectional median of the domestic inflation rates.[2]

Figure 1 shows that the four different measures of the common movement of inflation behave in a highly similar way over time. Since the measures have different means and variances, the series have been normalised (that is, their means have been subtracted and they have been divided by their standard deviations).

Table 3 shows correlation coefficients for the data in Figure 1. Not surprisingly, the correlations are typically a little over 0.9. There is therefore no obvious reason to choose between measures on empirical grounds. However, the mean is a poor measure of the central tendency of a distribution if that is asymmetric. To explore the potential importance of this, we compute the cross-sectional skew of the domestic inflation rate for each year in the sample. While the mean of the cross-sectional skew over the period 1851-1913 is 0.06, which suggests that the distribution in not asymmetric, looking at the distribution for individual years we note that it ranges from -3.3 in 1904 to 2.3 in 1864. Overall, it appears that in a given year one or a few countries experience inflation far below or above the other countries.

To see how this asymmetry impacts on the measurement of the international component of inflation, we regress the annual difference between cross-sectional mean and median on a constant and the cross-sectional skew for the 1851-1913 sample. The estimated parameter on skew is 0.6 (t = 6.5). Not surprisingly, variations in skew thus have a large impact on the cross-sectional mean but not on the cross-sectional median. For this reason we use the cross-sectional median as our measure of the international component of inflation.

We proceed by following CM (2010, Table 1, p. 528) and report in the last column of Table 2 the R^2 from a regression of the domestic inflation rate on the international components of

---

[2] For a discussion of the differences between principal components analysis and factor analysis, see Mardia, Kent and Bibby (2003).

inflation. On average, the correlation is 0.42. The correlation is highest for the UK, 0.77, and lowest for the US, 0.02.

To explore the behaviour of domestic and international inflation better, Figure 2 plots the two measures of inflation for the 15 countries in the study. The plots make clear that there are obvious commonalities in inflation across countries but also that there are large idiosyncratic shocks. For instance, Belgium records a sharp fall in prices in 1904, Canada in 1868, Germany in 1857, Iceland in 1892 and Switzerland in 1858. The US experienced a burst of inflation in 1863-64 during the Civil War and unusually low inflation in the immediate aftermath of the war. This appears to be the main factor behind the low correlation of US inflation with the international inflation component: if the years 1861-1868 are dropped from the sample the R^2 rises from 0.02 to 0.37.

4. International inflation

Three broad periods are evident in the measures of international inflation in Figure 1.[3] The first subsample up to the early 1870s is characterised by rising prices. On average, the median international inflation rate increased 1.1 per cent per year over this period. This reflected the discovery of gold in California in 1848-9, and in Australia in 1851 which led to economic expansions, increases in money supplies and a burst of inflation.[4] In addition, there were significant reductions in the cost of extracting gold during this period, particularly since some of the discoveries related to rich alluvial deposits (Rockoff (1984)).

Of course, there are some notable spikes and dips in inflation during this period. Inflation is particularly strong in the early-1850s, reflecting the immediate pass-through of gold discoveries to inflation. Indeed, the world precious metal supply increased by 30 per cent in the 9 years after 1848 (Hughes (1956)). By the end of the 1850s however, inflation was at its lowest for the entire sample period. The Crimean War ended in 1856. Having disrupted Russian grain exports to Europe, causing an increase in European imports from the US, the end of the war reversed this process. The severe US financial panic of 1857 followed, the effects of which were felt across Europe, causing a sharp decline in inflation in 1858 (Figure

[3] These are broadly the same periods as identified by Bordo and Filardo (2005).
[4] For a discussion, see Maddock and McLean (1984).

1). Thus, there were important co-movements of inflation in these 15 countries even before the start of the classical Gold Standard.

The second period from the early 1870s through to the mid-1890s, is characterised by generally falling prices. Indeed, between 1873 and 1896, international inflation averages -0.86 per cent per year. One factor driving this price trend was an excess demand for gold as a number of large countries joined the Gold Standard over the course of the 1870s (Bordo and Haubrich (2004)).[5]

This period has been referred to as a "good deflation" by Bordo and Filardo (2005, p. 9) who argue that it was coupled with growth in real incomes worldwide. This growth is attributed to a productivity shock arising from the refinement and adoption of technologies invented during the industrial revolution, including the proliferation of railroads. The effect of such a shock on prices would tend to be deflationary.

Despite this, there were several recessions during the period, which are visible in international inflation (Figure 1): in the mid-1870s, the mid-1880s and through the first half of the 1890s. The final recession was perhaps the worst. The initial shock arose in 1890 with the Barings crisis, which led to a financial crisis affecting London, several continental European countries, the United States and some of Latin America. This was followed by a wave of banking panics which began in 1893 in the United States and spread to Europe and Australia (Bordo and Filardo (2005)).

The final period is from 1897 to 1913 and is characterised by average international inflation of 1.39 per cent. Like the first subsample period, this inflationary period was the consequence of large gold discoveries, this time in South Africa and Alaska. Eichengreen and McLean (1994) argue that during this period gold discoveries were linked to the price of gold: the fall in economy-wide prices in the previous sub-sample led to an increase in the relative price of gold, causing a search for new gold mines and technologies to improve the output of existing ones. Nonetheless, prices declined on a number of occasions. One

[5] Within the sample here, Germany, France, Belgium, Denmark, Iceland Norway, Sweden, Finland, the Netherlands, Switzerland and the US all joined the Gold Standard over the course of the 1870s.The UK, Canada and Australia were already on the Gold Standard at this time, leaving just Austria, which joined in 1892.

notable instance is around the recession of 1907-1908 which followed the 1907 banking panic in the US.

5. The model

CM (2010, p. 530) proposes an inflation equation in which domestic inflation depends on international inflation and an error that follows a first-order autoregressive structure. We use a generalised version of their inflation equation:

$$\pi_{i,t} = \alpha + \beta\pi_t^* + \gamma\pi_{i,t-1} + \delta\pi_{t-1}^* + \lambda ec_{i,t-1} + \varepsilon_{i,t}$$

It says that the inflation rate in country i, $\pi_{i,t}$, depends on the contemporaneous international inflation rate, π_t^*, its lagged value, π_{t-1}^*, the lagged domestic inflation rate, $\pi_{i,t-1}$, and an error-correction term, $ec_{i,t-1}$, that we discuss further below. CM's model imposes restrictions across the parameters on this model.

This specification warrants several comments. First, the equation should be interpreted as a reduced-form relationship useful for characterizing the joint behaviour of inflation in a group of countries, and not as a structural inflation equation. Most obviously, the model is silent on what economic factors generate the international inflation rate.

Second, CM studied quarterly data for 22 OECD economies over the period 1960 to 2008, during which the inflation rate was plainly nonstationary. To focus on the behaviour of inflation over the business cycle, they used a band pass filter to remove all frequencies outside the 6 to 32 quarter periodicities, rendering the inflation rates stationary. Here we use annual data over the period 1851 -1913, during which period inflation is stationary.[6] We therefore do not filter the data.

Third, CM identify international inflation with the cross-sectional average of inflation in the countries in their study and argue that this measure is strongly correlated with the first principal component of the country-specific inflation rates. For the reasons discussed above, we use the median of the domestic inflation rates to capture international inflation.

Fourth, CM do not incorporate any exchange rate variable in their analysis. This makes sense since there is little evidence that the choice of exchange rate arrangement has a large

[6] For brevity, results of unit root tests are not reported here. However, this is a common finding in Gold Standard inflation data. See for instance Barro (1979 and 1982) and Benati (2008).

impact on inflation over the short run. As the experiences of many countries indicate, a floating exchange rate will evolve over time to offset economy-wide inflation differentials. However, relative price shocks, such as a sharp increase in energy prices, are nevertheless transmitted internationally and generate strong co-movements of inflation across countries independently of the exact exchange rate arrangements. Indeed, as CM note (p. 525), inflation has been dominated by common shocks in their sample, which is noteworthy given the differences in exchange rate regimes between countries and over time in their study.

6. Cointegration and the error-correction term

As noted above, our inflation equation (1) includes an error-correction term, involving the domestic and the international price levels. To ensure consistency with the median inflation rate that we use to measure international inflation, we measure the international price level by the cumulative sum of median inflation.

Next, we use FM-OLS to regress the domestic price level on a constant and the international price level and test the residuals for a unit root using an Augmented Dickey-Fuller (ADF) test. We also re-estimate the equation including a time trend and perform the unit root test again. In 13 of the 15 countries the time trend is significant (the exceptions being Finland and the US).

Table 4 shows p-values from the ADF tests. We can reject the hypothesis of a unit root in 6 cases when no time trend is included, and in 9 cases when a time trend is included. Unit root tests are known to lack power. We therefore tentatively assume that the price levels are cointegrated and include the residuals from the regressions including a time trend as error-correction terms in the inflation equations.

7. Estimates

In order to study how domestic inflation in our sample of 15 countries responds to international inflation developments, we proceed by estimating our inflation model over the sample 1852-1913 (62 observations). The results are provided in Table 5.

Several findings are of interest. First, international inflation is significant at the 5% level in all countries except in Australia and in the US. In the latter case, however, this is due to the

US civil war, which led to an inflation spike that is particular to the US: dropping the period 1860-65 leads to highly significant parameter on international inflation.[7] Large differences in the sensitivity of domestic inflation rates to international inflation are apparent. The impact is largest in Switzerland (2.5) and smallest in France (0.4) and the US (0.4). Not surprisingly given that the international inflation component is defined as the median domestic inflation rate, the average impact appears to be about unity.

Second, the lagged international inflation and domestic inflation rates are rarely significant.

Third, the parameters on the error-correction terms are highly significant except in the case of Canada, which we interpret as evidence of cointegration between the domestic and international price levels.[8] CM refers to this finding as the international inflation rate serving as an "attractor" for domestic inflation. Such a finding is of course not surprising, given that a number of countries were on the Gold Standard from 1870 onward.

Fourth, the r-squareds suggest that the model typically explains about half of the variation of the dependent variable. However, there is some dispersion across countries: while the models explains 1/3 of the variation of the inflation rate in Australia, it explains more than 8/10s of the variation of the inflation rate in the UK.

The main question that these results give rise to concern the cross-country differences in the estimated parameters. While these may reflect differences in economic structure, it seems likely that to some extent they arise from differences in the price indices used and from measurement errors.

7.1 Testing for a structural break

The 19th century was characterised by tremendous economic progress. Transportation costs and speeds fell as steam power was refined and the number of steam powered railways and ships increased rapidly. This made it profitable to exploit differences in the pricing of goods and commodities in different markets. Developments in the telegraph in the first half of the century led to a rapid increase in its use and made it possible for exporters and

[7] The parameter is 0.59 with a t-statistic of 4.23. The parameter on the error correction term remains unchanged, and the lagged domestic and international inflation rates are now both insignificant.
[8] If the residuals from the cointegrating regressions excluding a time trend are used, then the error-correction terms are insignificant in the cases of Canada, Germany, Netherlands and the UK.

importers to compare prices across markets and sell and purchase where it was most profitable to do so. And the growing adoption of the Gold Standard arguably increased the transparency of prices.

Taken together, one would expect these and other innovations which led to increases in international trade to have changed gradually the international inflation process, while permitting better arbitrage of prices across economies. Looking at the (logarithm) of the cross-sectional standard deviation of inflation in Figure 3, it is striking that it fell gradually over the sample period.[9] This suggests a clear convergence of inflation.

That said, there are several other factors that may explain this convergence. For instance, better measurement of inflation may have played a role. The inclusion of a growing number of services may have stabilised inflation, as may the inclusion of an increasing number of goods.[10]

The declining cross-sectional variance of inflation raises the issue whether the inflation process changed during the sample period. To explore that, we compute Bai and Perron tests for potentially multiple breaks at unknown points in time.[11] Given that the model has five parameters and there are 62 observations, we adopt 25% trimming and restrict the number of potential breaks to two.

As Table 6 shows, in the cases of Belgium, Denmark, Germany, Switzerland and the UK, the test indicates a break at a 5% significance level. We therefore go on to estimate the model for the identified subperiods.

The results are presented in Table 7. It is interesting to note that in all cases, a break is identified between 1867-77 (in Germany a second break is identified in 1895/95). Turning to the estimates, it is important to recall that with shorter samples, the significance of the parameters naturally fall. The impact of international inflation is much smaller and

[9] This finding is compatible with Kaufmann (2019) who found that estimates of trend inflation in Switzerland became increasingly precise over a similar period.

[10] Increasing the number of prices in the basket considered will reduce the part of the standard deviation that is due to idiosyncratic price movements.

[11] Since the model involves 5 parameters and there are 62 observations, we use 25% trimming and allow for at most 2 breaks. Moreover, since the standard deviation of the inflation rates fell during the sample, we allow the error distributions in any identified subsamples to differ.

insignificant in the second Danish subsample (1870-1913). The parameter on the error-correction term is smaller and insignificant for the first Danish subsample (1852-1869) and for the second UK subsample (1878-1913). The parameters on the lagged domestic and international inflation rates have in many cases changed but without a clear pattern, suggesting that the dynamics of inflation has changed. Overall, the subsample estimates do not change the main conclusion from the analysis above that international inflation exerted powerful influences on domestic inflation rates in all the countries that we study in the 60-year period before World War I.

8. Comparison with recent data

Finally, we compare these historical results with estimates of the international inflation process using more recent data.[12] To that end, we collected annual data on CPI inflation for the period 1956-2020 from OECD for the same countries as we studied above.[13] Figure 4 shows the cross-sectional median of the domestic inflation rates, which we used as our preferred measure of international inflation above, for this sample.

The figure shows that inflation fluctuated a little below 4% until 1969, when it started to rise sharply. It peaked at 13.6% in 1974 after the first oil shock and reached a new peak of 12.3% after the second oil shock. Following a collapse of oil prices, it declined to a low of 3.6% in 1986 (when prices in Germany fell). With the exception of the years 1987-1989, it fluctuated around a declining trend until 2020, when it reached 0.7%. The lowest inflation rate, 0.4%, was observed in 2009 after the international financial crisis struck.

It is natural to think of there being a "high inflation" period in 1970-1985 and a "normal inflation" period before and after that period. Next, we compare the behaviour of inflation before World War I with inflation in the "normal" period, defined as the period 1956-1969; 1986-2020.

---

[12] For long time series studies of the statistical properties of inflation, see Cogley and Sargent (2015) and Cogley, et al., (2015), who argue that there is no systematic evidence that the price level in the UK and US, respectively, was more unstable or uncertain before or after the Second World War.
[13] Because of missing data, we used Mitchell (2003) for Austria for the period 1956-59, and FRED for Denmark 1956-66, Iceland 1968-70 and Netherlands 1956-60.

As a preliminary, it is interesting to note that while the average inflation rate in these 15 countries was 0.46% before World War I, it was 2.85% during the "normal" period. Similarly, while the average standard deviation of inflation was 4.01% before World War I, it was 2.03% during the "normal period." Inflation has thus been higher but also more stable in recent years. Furthermore, while the average R^2 in a regression of the domestic inflation rate on the international inflation rate in the 1851-1913 period was 0.42, in the 1956-1969, 1986-2019 period it was 0.44, suggesting that the importance of international inflation was virtually unchanged.

Before estimating the inflation equations, we explored the stationary and cointegration properties of the data, using the same approach as in the case of the historical data (the results are not presented in the interest of brevity). That analysis led us to conclude that the very same specification as estimated above would be appropriate also for the modern data. Thus, we estimated using FM-OLS over the sample 1956-2020 a cointegrating relationship between domestic and international inflation, allowing for a deterministic trend. The residuals were used as an error-correction term in the inflation equations, which were estimated on data for the "normal" inflation period, that is, 1956- 1969; 1986-2020.

Contrasting the estimates of the inflation equation using recent data in Table 8 with those using the historical data in Table 5, it is notable that the international inflation is significant in all countries, except Australia (t = 1.71). Interestingly, the parameters on the lagged domestic and international inflation rates are generally insignificant, suggesting simpler inflation dynamics. The error-correction terms are significant in 11 cases, the exceptions being Canada (t = 1.89), Denmark (t = 0.91), Iceland (t = 1.85) and the US (t = 1.31). However, the average parameter on the error-correction term in -0.17, exactly half of the average parameter in the historical data (-0.34). It seems plausible that this much slower convergence of price level is due to the much greater importance of services, which in many cases are not traded internationally and whose prices move more sluggishly than goods prices, in CPIs.

Overall, while there are important differences in the behaviour of the domestic inflation rates before World War 1 and during the low-inflation period after 1956 (that is, 1956-69; 1986-2020) there are also obvious similarities. In particular, international inflation plays an important role in domestic inflation process, as demonstrated by Ciccarelli and Mojon (2010).

9. Conclusions

In this paper we have studied co-movements of inflation among a sample of 15 relatively developed economies over the period 1851-1913. While measurement problems are likely to affect domestic inflation rates, we argue that such errors are likely to be uncorrelated across countries and therefore are unlikely to significantly impact our results. Subject to the measurement issues, there are several interesting findings.

First, there are strong correlations of inflation in different countries, suggesting the existence of a common international component of inflation. There are also idiosyncratic shocks to inflation that are more marked in some countries than in others, implying that the relative importance of the international component varies across countries. As evidenced by the correlation between domestic and international inflation, it appears particularly important in the UK but particularly low in the US. That latter finding appears largely a consequence of the idiosyncratic behaviour of US inflation during and immediately after the Civil War.

Second, the cross-sectional dispersion of inflation declines gradually throughout the sample period. This finding is compatible with the idea that inflation became more stable over time, but it may also be due to improved measurement of inflation and structural changes to the economy, such as the growing importance of services.

Third, estimated reduced-form inflation equations of the type pioneered by Ciccarelli and Mojon (2010) suggest that the international inflation rate functions as an "attractor" for domestic inflation rates.

Fourth, Bai-Perron tests for structural breaks at unknown points in time indicate that six of the reduced-form inflation equations undergo a structural break in the period 1867-77. However, sub-sample estimates indicate that there is no clear pattern of changes in the parameters as a result of these breaks, and the main conclusion that international inflation was an important driver of domestic inflation rates in all the countries in our sample during the period is unchanged.

Fifth, a comparison with more recent data suggests that the key role of international inflation in the domestic inflation process is unchanged.

References

Abildgren, Kim (2009) "Consumer Prices in Denmark, 1502-2007," Working paper 60, Danmarks Nationalbank.

Barro, Robert J. (1979) "Money and the Price Level Under the Gold Standard," *The Economic Journal*, 89(353), 123-33.

Barro, Robert J. (1982) "United States Inflation and the Choice of Monetary Standard," in Robert E. Hall, ed. Inflation: Causes and Effects, University of Chicago Press, 99-110.

Barsky, Robert B. (1987), "The Fisher Hypothesis and the Forecastability and Persistence of Inflation," Journal of Monetary Economics, 19, 3-24.

Bekaert, G. and A. Mehl (2019), "On the global financial market integration "swoosh" and the trilemma," *Journal of International Money and Finance*, 94, 227-245.

Benati, Luca (2008) "Investigating Inflation Persistence Across Monetary Regimes," The Quarterly Journal of Economics, 123(3), 1005-1060.

Bordo, Michael D. and Andrew Filardo (2005), "Deflation in a historical perspective," BIS Working Papers No 186, November.

Bordo, Michael D. and Joseph G. Haubrich (2004), "The yield curve, recessions and the credibility of the monetary regime: Long run evidence 1875-1997," NBER Working Paper 10431, April.

Ciccarelli, Matteo and Benoît Mojon (2010), "Global Inflation," *Review of Economics and Statistics*, 92, 524-535.

Cogley, Timothy and Thomas J. Sargent (2015), "Measuring price-level uncertainty and instability in the United States, 1850-2012", *The Review of Economics and Statistics*, 97(4), 827-838.

Cogley, Timothy, Thomas J. Sargent and Paolo Surico, (2015), "Price-level uncertainty and instability in the United Kingdom", *Journal of Economic Dynamics and Control*, 52, 1-16.

Edvinsson, Rodey and Johan Söderberg (2010), "The evolution of Swedish consumer prices 1290–2008," in Historical Monetary and Financial Statistics for Sweden: Exchange rates, prices, and wages, 1277–2008, edited by Edvinsson, Tor Jacobson, and Daniel Waldenström, Sveriges Riksbank.

Eichengreen, Barry and Ian W. McLean (1994), "The supply of gold under the pre-1914 gold standard," Economic History Review, XLVII, 2(1994), 288-309.

Esmeralda Ballesteros (1997), "Una estimación del coste de la vida en España. 1861-1936 Revista de Historia Económica," XV, 2: 363-95 Downloaded from http://www.iisg.nl/hpw/barquin1.php.

Estevadeordal, Antoni, Brian Frantz and Alan M. Taylor (2003), "The Rise and Fall of World Trade, 1870–1939," *The Quarterly Journal of Economics*, 118(2) 359–407.

Federal Reserve Economic Data (FRED), "Consumer Price Index in the United Kingdom," https://fred.stlouisfed.org/series/CPIUKA

Findlay, Ronald and Kevin H. O'Rourke (2001), "Commodity market integration, 1500–2000", NBER Working Paper 8579.

Grytten, Ola H. "A Consumer Price Index for Norway, 1516-2003," in Historical Monetary Statistics for Norway 1819–2003," in Eitrheim, Øyvind , Jan T. Klovland and Jan F. Qvigstad (eds.), Historical Monetary Statistics for Norway 1819–2003, Occasional Papers 35, Norges Bank. Downloaded from https://static.norges-bank.no/contentassets/de6b294d63d94b1a859408c33c1b3b5a/hele.pdf?v=03/09/2017122252&ft=.pdf

Heikkinen, Sakari (1997), "Labour and the Market. Workers, Wages and Living Standards in Finland, 1850-1913". Commentationes Scientiarium Socialium 51, Helsinki.

Historical Statistics of Switzerland HSSO, 2012. Table H.17. hsso.ch/2012/h/17

Hughes, J. R. T. (1956), "The Commercial Crisis of 1857," *Oxford Economic Papers*, 8(2), 194-222.

Jacks, David (2005), "Intra- and international commodity market integration in the Atlantic economy, 1800–1913', *Explorations in Economic History*, 42, 381-413.

Jobst, Clemens and Thomas Scheiber (2014), Austria-Hungary: from 1863 to 1914, in South-Eastern European Monetary and Economic Statistics from the Nineteenth Century to World War II, Bank of Greece, Bulgarian National Bank, National Bank of Romania, Oesterreichische Nationalbank, 2014, Athens, Sofia, Bucharest, Vienna.

Kaufmann, Daniel (2020), "Is deflation costly after all? The perils of erroneous historical classifications," *Journal of Applied Econometrics*, 35, 614-628.

Kaufmann, Daniel (2019), "Nominal stability over two centuries", Swiss Journal of Economics and Statistics, 155, 1-23.

Klovland, Jan Tore (2005), "Commodity market integration: Evidence from Britain and Germany", *European Review of Economic History*, 9, 163-197.

Maddock, Rodney and Ian McLean (1984), "Supply-Side Shocks: The Case of Australian Gold," *The Journal of Economic History*, 44(4), 1047-1067.

Mardia, K. V., J. T. Kent and J. M. Libby (2003), Multivariate Analysis, Academic Press, San Diego.

McLean, Ian W. (1997), "Consumer prices and expenditure patterns in Australia 1850-1914", *Australian Economic History Review*, 39, 1-28.

Mishkin, Frederic S. (1992), "Is the Fisher effect for real? A reexamination of the relationship between inflation and interest rates," Journal of Monetary Economics, 30(2), 195-215.

Mitchell, B. R. (2003), International Historical Statistics: Europe 1750 – 2000, Palgrave Macmillan, 5TH ed.

Obstfeld, Maurice and Alan M. Taylor (2005), Global Capital Markets: Integration, Crisis, and Growth, Cambridge University Press, Cambridge.

Rockoff, Hugh (1984), "Some Evidence on the Real Price of Gold, Its Costs of Production, and Commodity Prices," in Michael D. Bordo and Anna Schwartz, eds., A Retrospective on the Classical Gold Standard, 1821-1931, p. 613 – 650, University of Chicago Press.

Studer, Roman and Pascal Schuppli (2008), "Deflating Swiss Prices over the Past Five Centuries", *Historical Methods*, Summer 2008, 41(3), 137-153.

Summers, Larry (1983), "The nonadjustment of nominal interest rates: A study of the Fisher effect.", in James Tobin, ed., Macroeconomic prices and quantities: Essays in memory of Arthu Okun, Brookings Institution, Washington, DC.

Volosovych, Vadym (2011), "Measuring financial market integration over the long run: Is there a U-shape?," Journal of International Money and Finance, 30(7), 1535-1561.

Wonnacott, Thomas H., and Ronald J. Wonnacott (1977), Introductory Statistics for Business and Economics, Second ed., John Wiley & Sons, New York.

Table 1: Data sources

Country	Source
Australia	McLean (1999), W6-series used
Austria	Jobst and Scheiber (2014)
Belgium	Mitchell (2003)
Denmark	Abildgren (2009)
Finland	Heikkinen (work in progress)
	Heikkinen (1997)
France	Mitchell (2003)
Germany	Mitchell (2003)
Iceland	BIS , www.bis.org
Netherlands	Arthur van Riel, http://iisg.nl/hpw/brannex.php
Norway	Grytten (2004)
Spain	Ballesteros (1997)
Sweden	Edvinsson and Söderberg (2010)
Switzerland	Studer and Schuppli (2008)
	Historical Statistics of Switzerland (2012)
UK	FRED, fred.stlouisfed.org
US	www.measuringworth.com/datasets/uscpi/result.php

Table 2: Descriptive statistics of inflation, 1851-1913

	Median	Mean	Interquartile range	Standard deviation	R^2
Australia	1.29	1.31	5.05	4.91	0.17
Austria	0.00	0.18	6.78	4.68	0.16
Belgium	0.00	0.33	1.10	1.40	0.45
Canada	0.00	0.19	2.55	2.64	0.35
Denmark	0.72	0.67	6.07	6.64	0.59
Finland	0.00	0.47	3.41	5.22	0.36
France	0.54	0.67	5.79	4.25	0.40
Germany	0.80	0.55	5.09	3.23	0.47
Iceland	1.07	0.73	2.92	3.49	0.27
Netherlands	1.07	0.73	2.92	3.49	0.64
Norway	0.56	0.55	7.85	5.83	0.58
Sweden	0.72	0.20	3.23	2.37	0.53
Switzerland	-0.08	0.12	4.63	3.19	0.50
UK	0.12	-0.31	6.74	5.69	0.77
US	0.56	0.49	3.38	3.07	0.02

Table 3: Correlation coefficients of international inflation measures, 1851-1913

	Cross-sectional average	Cross-sectional median	First principal component	Single factor
Cross-sectional average	1.00	0.95	0.98	0.88
Cross-sectional median	0.95	1.00	0.97	0.93
First principal component	0.98	0.97	1.00	0.95
Single factor	0.88	0.93	0.95	1.00

Table 4: p-Values for ADF tests for a unit root, 1851 - 1913

	Without time trend	With time trend
Australia	0.190	0.249
Austria	0.001	0.000
Belgium	0.072	0.001
Canada	0.636	0.886
Denmark	0.073	0.017
Finland	0.002	0.007
France	0.134	0.705
Germany	0.979	0.082
Iceland	0.179	0.215
Netherlands	0.202	0.214
Norway	0.034	0.001
Sweden	0.193	0.026
Switzerland	0.358	0.392
UK	0.632	0.026
US	0.008	0.018

Table 5: Estimated inflation equations

1853-1913, 62 observations

$$\pi_{i,t} = \alpha + \beta\pi_t^* + \gamma\pi_{i,t-1} + \delta\pi_{t-1}^* + \lambda ec_{i,t-1} + \varepsilon_{i,t}$$

	Australia	Austria	Belgium	Canada	Denmark	Finland	France	Germany	Iceland	Nether-lands	Norway	Sweden	Switzer-land	UK	US
α	-0.169	0.203	-0.345	-0.541	-0.142	-0.025	0.269	0.468	0.392	-0.371	0.077	0.051	-0.120	-0.172	0.079
	(0.768)	(0.310)	(0.422)	(0.643)	(0.221)	(0.546)	(0.155)	(0.622)	(0.381)	(0.318)	(0.260)	(0.346)	(0.652)	(0.190)	(0.481)
	[-0.220]	[0.653]	[-0.817]	[-0.842]	[-0.642]	[-0.045]	[1.740]	[0.753]	[1.029]	[-1.165]	[0.297]	[0.148]	[-0.184]	[-0.904]	[0.163]
β	1.309	0.781	0.929	1.751	0.679	0.959	0.375	1.148	0.857	1.128	0.811	0.957	2.525	1.113	0.370
	(0.707)	(0.146)	(0.129)	(0.501)	(0.121)	(0.189)	(0.051)	(0.203)	(0.210)	(0.111)	(0.138)	(0.300)	(0.378)	(0.091)	(0.257)
	[1.851]	[5.336]**	[7.200]**	[3.495]**	[5.615]**	[5.080]**	[7.295]**	[5.659]**	[4.085]**	[10.122]**	[5.883]**	[3.190]**	[6.686]**	[12.172]**	[1.440]
γ	0.260	0.381	0.143	0.158	0.335	0.188	-0.129	0.229	-0.019	-0.011	0.234	0.158	0.092	-0.026	0.693
	(0.118)	(0.098)	(0.117)	(0.113)	(0.084)	(0.106)	(0.082)	(0.098)	(0.108)	(0.120)	(0.139)	(0.099)	(0.112)	(0.112)	(0.189)
	[2.198]*	[3.886]**	[1.229]	[1.406]	[3.990]**	[1.772]	[-1.569]	[2.339]*	[-0.175]	[-0.095]	[1.684]	[1.591]	[0.825]	[-0.236]	[3.669]**
δ	-0.060	-0.475	0.067	-0.499	-0.115	0.463	-0.043	0.180	-0.368	0.237	-0.023	0.303	-1.056	-0.014	-0.347
	(0.338)	(0.217)	(0.203)	(0.332)	(0.099)	(0.260)	(0.072)	(0.211)	(0.211)	(0.203)	(0.232)	(0.220)	(0.197)	(0.128)	(0.170)
	[-0.178]	[-2.185]*	[0.329]	[-1.505]	[-1.169]	[1.784]	[-0.594]	[0.851]	[-1.743]	[1.167]	[-0.100]	[1.377]	[-5.368]**	[-0.113]	[-2.039]*
λ	-0.296	-0.482	-0.689	-0.077	-0.300	-0.428	-0.123	-0.342	-0.310	-0.276	-0.532	-0.444	-0.285	-0.386	-0.117
	(0.109)	(0.078)	(0.124)	(0.047)	(0.064)	(0.097)	(0.048)	(0.124)	(0.094)	(0.106)	(0.104)	(0.096)	(0.093)	(0.119)	(0.044)
	[-2.713]**	[-6.181]**	[-5.541]**	[-1.638]	[-4.664]**	[-4.422]**	[-2.541]*	[-2.758]**	[-3.286]**	[-2.598]*	[-5.136]**	[-4.624]**	[-3.084]**	[-3.239]**	[-2.655]*
R-squared:	0.329	0.407	0.643	0.407	0.716	0.561	0.469	0.635	0.435	0.706	0.728	0.688	0.650	0.837	0.553

Notes: robust standard errors in parenthesis, (); and t-statistics in bracket, []. */** denotes significance ant the 5%/1% level.

Table 6: Results for a Bai-Perron tests of potentially multiple breaks at unknown points in time (25 % trimming)

	Test statistic
Australia	4.71
Austria	14.25
Belgium	23.89
Canada	10.91
Denmark	29.1
Finland	15.04
France	14.98
Germany	21.65
Iceland	16.70
Netherlands	7.93
Norway	11.24
Sweden	3.99
Switzerland	60.37
UK	38.87
US	6.67

Note: The critical value for a test at the 5% significance level is 17.12

Table 7: Estimated inflation equations with breaks

	Belgium		Denmark		Germany			Switzerland		UK	
	1852 - 1875	**1876 - 1913**	**1852 - 1869**	**1870 - 1913**	**1852 - 1866**	**1867 - 1895**	**1896 - 1913**	**1852 - 1868**	**1869 - 1913**	**1852 - 1877**	**1878- 1913**
α	-1.371	0.000	-0.074	-0.064	-2.217	3.561	-0.189	-3.986	0.113	-0.185	-0.326
	(0.450)	(0.559)	(0.513)	(0.185)	(1.778)	(0.448)	(0.649)	(2.408)	(0.662)	(0.328)	(0.198)
	[-3.045]**	[0.000]	[-0.143]	[-0.346]	[-1.247]	[7.953]**	[-0.292]	[-1.655]	[0.171]	[-0.565]	[-1.646]
β	0.822	1.277	0.962	0.208	1.126	1.199	0.729	3.070	1.984	1.300	0.663
	0.087	0.422	0.114	0.146	0.396	0.247	0.395	0.453	0.302	0.095	0.110
	[9.496]**	[3.023]**	[8.467]**	[1.422]	[2.842]*	[4.860]**	[1.845]	[6.770]**	[6.575]**	[13.687]**	[6.051]**
γ	0.145	0.277	0.036	0.363	0.301	-0.003	0.182	0.222	0.291	-0.205	-0.428
	0.116	0.160	0.270	0.075	0.246	0.129	0.257	0.109	0.160	0.163	0.185
	[1.257]	[1.732]	[0.135]	[4.816]**	[1.226]	[-0.027]	[0.710]	[2.041]	[1.815]	[-1.258]	[-2.312]*
δ	0.178	-0.614	0.050	0.129	0.492	0.700	-0.102	-1.145	-0.838	0.151	0.476
	0.233	0.316	0.259	0.114	0.418	0.266	0.351	0.441	0.270	0.128	0.282
	[0.762]	[-1.940]	[0.194]	[1.136]	[1.176]	[2.634]*	[-0.291]	[-2.599]*	[-3.101]**	[1.182]	[1.688]
λ	-1.164	-0.638	-0.205	-0.251	-0.426	-0.633	-0.588	-0.934	-0.210	-0.344	-0.085
	0.156	0.138	0.226	0.062	0.166	0.099	0.272	0.107	0.101	0.163	0.108
	[-7.461]**	[-4.639]**	[-0.907]	[-4.029]**	[-2.562]*	[-6.375]**	[-2.160]*	[-8.760]**	[-2.078]*	[-2.105]*	[-0.788]
Observations:	24	38	18	44	15	29	18	17	45	26	36
R-squared:	0.875	0.539	0.868	0.643	0.749	0.806	0.508	0.824	0.595	0.899	0.743

Notes: robust standard errors in parenthesis, (); and t-statistics in bracket, []. */** denotes significance ant the 5%/1% level.

Table 8: Estimated inflation equations
1956-1969; 1986-2020, 47 observations

$$\pi_{i,t} = \alpha + \beta\pi_t^* + \gamma\pi_{i,t-1} + \delta\pi_{t-1}^* + \lambda ec_{i,t-1} + \varepsilon_{i,t}$$

	Australia	Austria	Belgium	Canada	Denmark	Finland	France	Germany	Iceland	Nether-lands	Norway	Sweden	Switzer-land	UK	US
α	1.382	-0.228	0.022	0.344	-0.356	-2.261	-1.317	-0.121	0.478	-1.439	-0.124	-0.917	-0.766	-0.247	0.493
	(0.448)	(0.183)	(0.269)	(0.273)	(0.704)	(0.509)	(0.549)	(0.219)	(1.569)	(0.505)	(0.567)	(0.501)	(0.341)	(0.346)	(0.281)
	[3.083]**	[-1.245]	[0.082]	[1.263]	[-0.506]	[-4.447]**	[-2.397]*	[-0.552]	[0.304]	[-2.850]**	[-0.219]	[-1.831]	[-2.248]*	[-0.713]	[1.753]
β	0.503	0.757	0.737	0.594	0.895	1.617	1.016	0.476	1.894	0.553	0.811	1.403	0.986	0.896	0.839
	(0.295)	(0.105)	(0.221)	(0.174)	(0.182)	(0.192)	(0.218)	(0.122)	(0.642)	(0.106)	(0.217)	(0.128)	(0.107)	(0.101)	(0.227)
	[1.707]	[7.243]**	[3.331]**	[3.425]**	[4.917]**	[8.406]**	[4.664]**	[3.916]**	[2.950]**	[5.236]**	[3.729]**	[10.925]**	[9.186]**	[8.855]**	[3.699]**
γ	0.663	0.456	0.345	0.376	0.707	0.353	0.396	0.765	0.601	0.489	0.521	0.310	0.640	0.499	0.671
	(0.088)	(0.187)	(0.068)	(0.176)	(0.174)	(0.072)	(0.097)	(0.110)	(0.099)	(0.198)	(0.181)	(0.109)	(0.120)	(0.125)	(0.116)
	[7.571]**	[2.436]*	[5.099]**	[2.133]*	[4.056]**	[4.912]**	[4.083]**	[6.960]**	[6.039]**	[2.474]*	[2.871]**	[2.834]**	[5.312]**	[4.003]**	[5.792]**
δ	-0.456	-0.337	-0.314	-0.098	-0.545	-0.261	-0.029	-0.364	-0.162	0.039	-0.192	-0.268	-0.506	-0.346	-0.648
	(0.212)	(0.134)	(0.211)	(0.157)	(0.116)	(0.172)	(0.234)	(0.157)	(0.837)	(0.147)	(0.167)	(0.223)	(0.207)	(0.172)	(0.203)
	[-2.148]*	[-2.526]*	[-1.486]	[-0.622]	[-4.719]**	[-1.517]	[-0.124]	[-2.320]*	[-0.194]	[0.264]	[-1.148]	[-1.199]	[-2.442]*	[-2.009]	[-3.188]**
λ	-0.206	-0.192	-0.228	-0.137	-0.066	-0.195	-0.265	-0.202	-0.130	-0.225	-0.283	-0.112	-0.050	-0.152	-0.096
	(0.058)	(0.039)	(0.044)	(0.073)	(0.072)	(0.045)	(0.098)	(0.064)	(0.070)	(0.080)	(0.085)	(0.041)	(0.019)	(0.053)	(0.073)
	[-3.531]**	[-4.900]**	[-5.179]**	[-1.886]	[-0.906]	[-4.336]**	[-2.714]**	[-3.146]**	[-1.846]	[-2.802]**	[-3.334]**	[-2.731]**	[-2.611]*	[-2.847]**	[-1.308]
R-squared:	0.703	0.661	0.633	0.675	0.720	0.749	0.526	0.726	0.688	0.467	0.572	0.774	0.809	0.798	0.722

Notes: robust standard errors in parenthesis, (); and t-statistics in bracket, []. */** denotes significance ant the 5%/1% level.

Figure 1: Alternative measures of international inflation

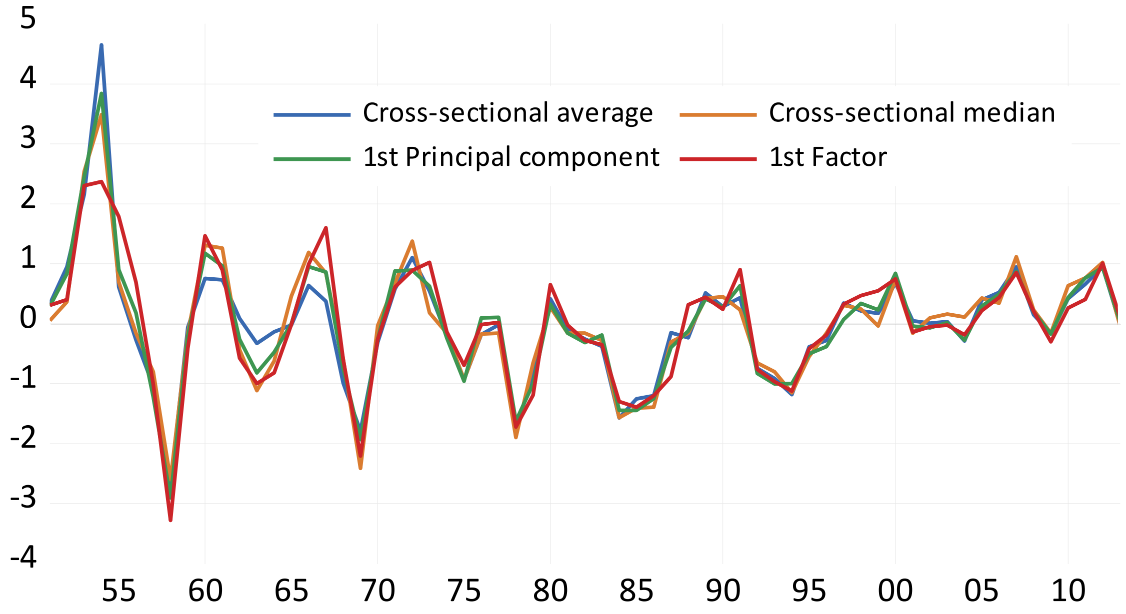
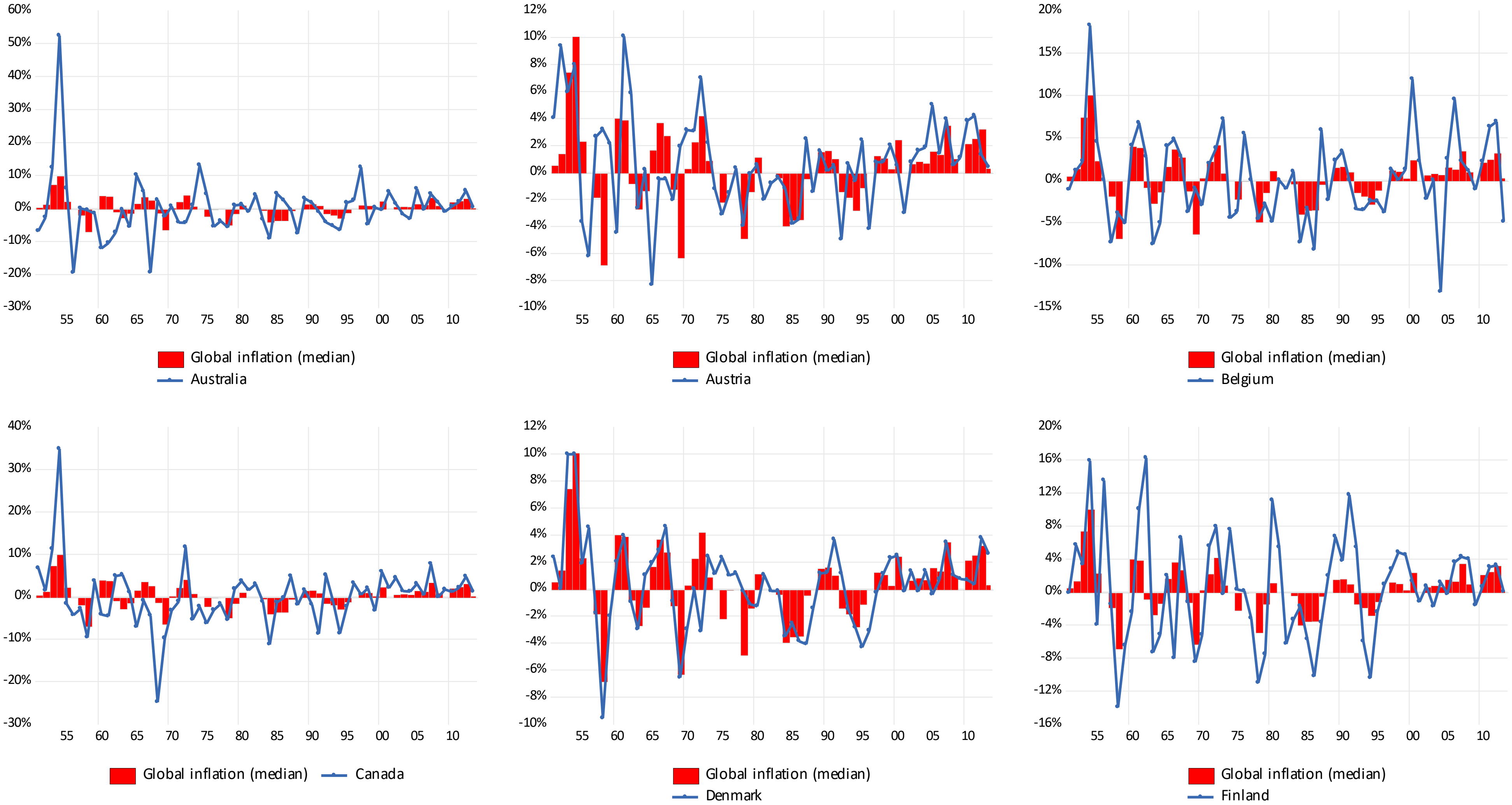
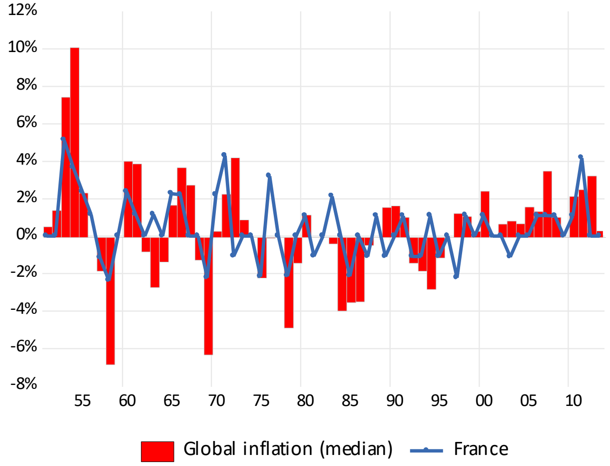
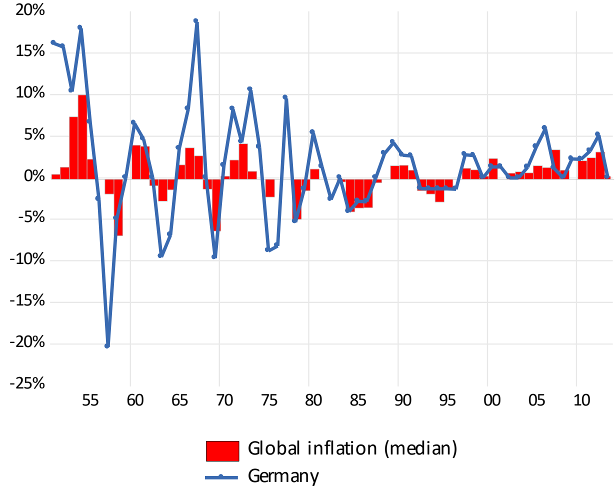
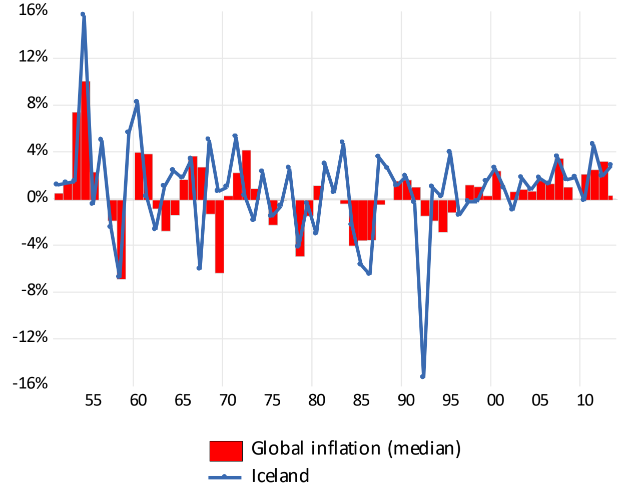


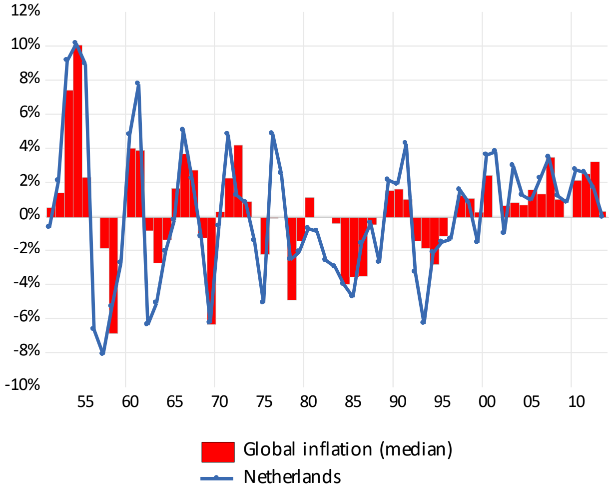
Figure 2: Domestic and international inflation

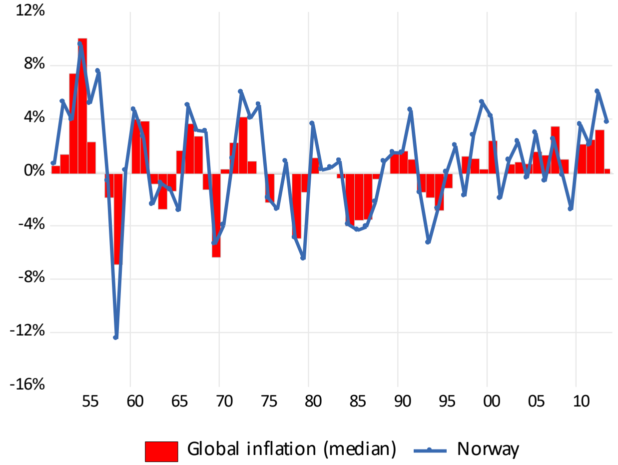


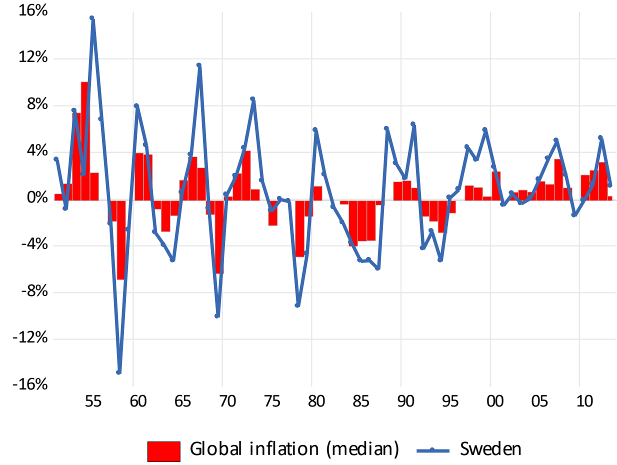

12%
10%
8%
6%
4%
2%
0%
-2%
-4%
-6%
-8%
55 60 65 70 75 80 85 90 95 00 05 10
Global inflation (median)
France

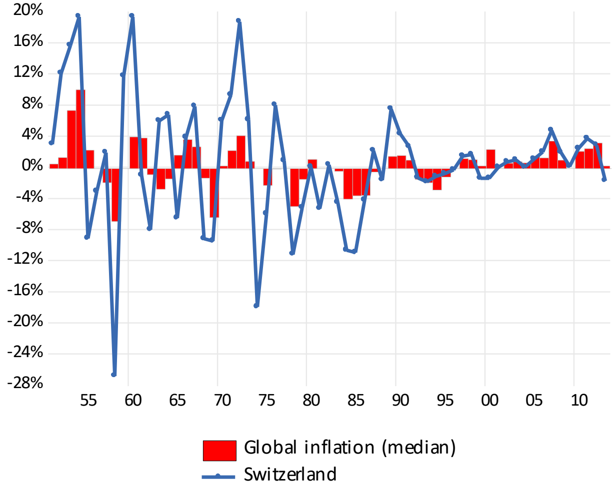

20%
15%
10%
5%
0%
-5%
-10%
-15%
-20%
-25%
55 60 65 70 75 80 85 90 95 00 05 10
Global inflation (median)
Germany

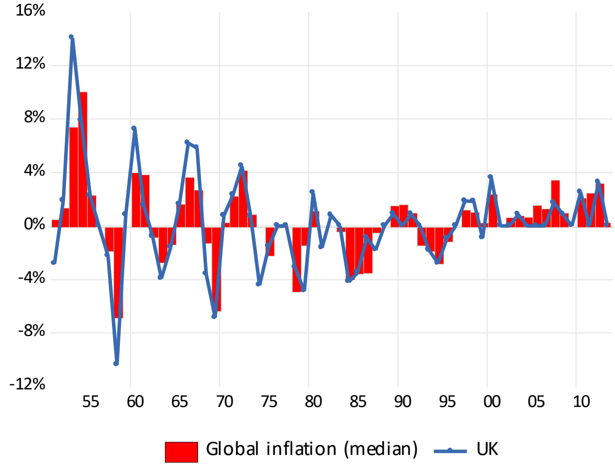

16%
12%
8%
4%
0%
-4%
-8%
-12%
-16%
55 60 65 70 75 80 85 90 95 00 05 10
Global inflation (median)
Iceland


12%
10%
8%
6%
4%
2%
0%
-2%
-4%
-6%
-8%
-10%
55 60 65 70 75 80 85 90 95 00 05 10
Global inflation (median)
Netherlands


12%
8%
4%
0%
-4%
-8%
-12%
-16%
55 60 65 70 75 80 85 90 95 00 05 10
Global inflation (median)
Norway


16%
12%
8%
4%
0%
-4%
-8%
-12%
-16%
55 60 65 70 75 80 85 90 95 00 05 10
Global inflation (median)
Sweden


20%
16%
12%
8%
4%
0%
-4%
-8%
-12%
-16%
-20%
-24%
-28%
55
60
65
70
75
80
85
90
95
00
05
10
Global inflation (median)
Switzerland


16%
12%
8%
4%
0%
-4%
-8%
-12%
55
60
65
70
75
80
85
90
95
00
05
10
Global inflation (median)
UK

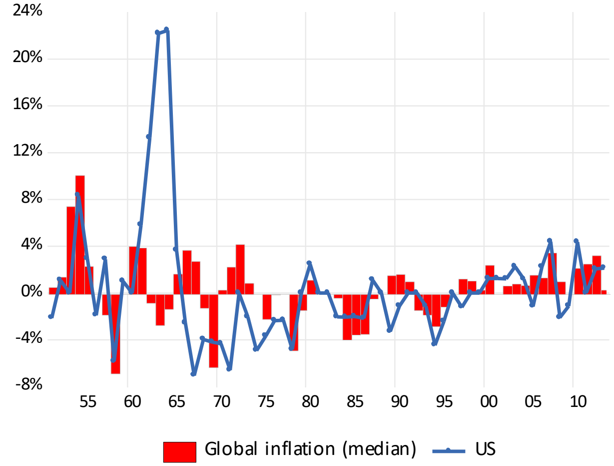

24%
20%
16%
12%
8%
4%
0%
-4%
-8%
55
60
65
70
75
80
85
90
95
00
05
10
Global inflation (median)
US

Figure 3: Cross-sectional standard deviation of inflation

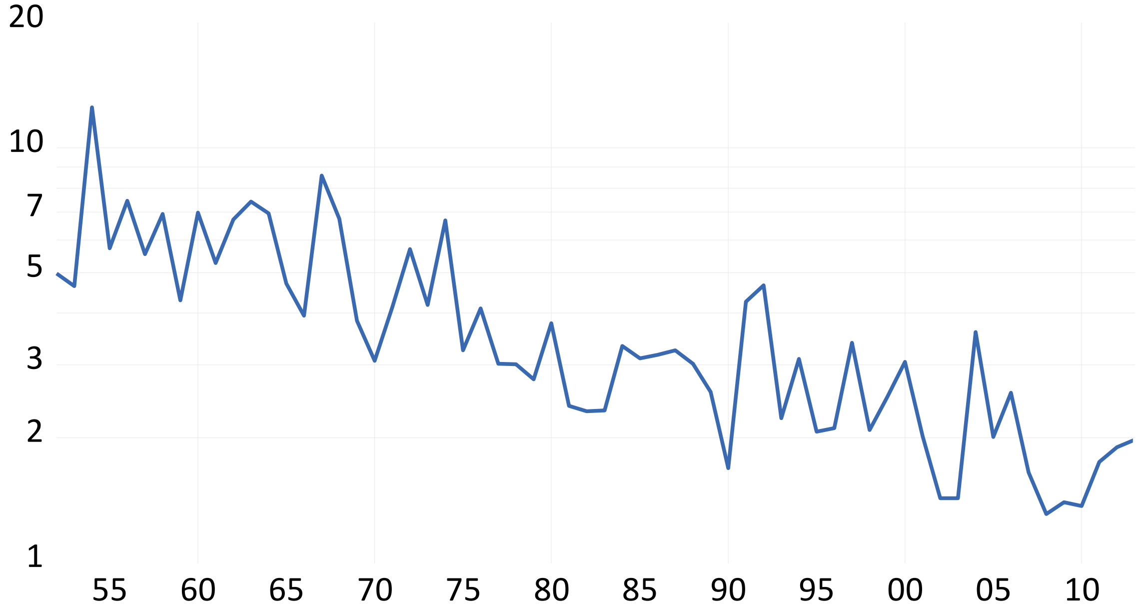


Figure 4: International inflation, 1956-2020