PERSISTENCE IN THE UNEMPLOYMENT AND INFLATION RELATIONSHIP. EVIDENCE FROM 38 OECD COUNTRIES

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ABSTRACT

This paper focuses on the analysis of persistence in the unemployment and inflation rates in a group of 38 OECD countries as well as the relationship between the two variables. For this purpose, fractional integration is used. The results indicate that the two individual variables are highly persistence, especially the unemployment rate, and evidence of mean reversion is only found in the cases of Colombia and Costa Rica for unemployment and in Norway for inflation. Conducting the analysis on the difference between the two variables, the order of integration is significantly smaller in a number of cases, and reversion to the mean takes place in the cases of Austria, Switzerland, Costa Rica, Israel and Turkey. Policy recommendations derived from the results are presented in the conclusion section of the manuscript.

Keywords: Unemployment; inflation; persistence; fractional integration

JEL Classification: C12

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1. Introduction

Unemployment and inflation are major targets of macroeconomic policies. These variables have an adverse effect on the welfare of individuals. (Blanchflower et al., 2014; Keshab, 2016). Studies like Krugman (1994) showed that OECD countries have experienced very different long-term trends in unemployment with high unemployment since the mid-1970s. Causes of unemployment include excessive levels of real wages, institutional arrangements in the labour market, inefficient job searches, structural change, technological change, demographic change, and inadequate aggregate demand (Mitchell, 2000). On the other hand, the two large oil price shocks in the 1970s created surges in inflation (Walsh, 2022). As Central Banks took up the fight against spiralling inflation in the late 1970s and early 1980s, they brought down and stabilised inflation expectations (Schanbel, 2022). Inflation has followed a downward trend since the 1980s for advanced economies and since the mid-1990s in emerging and developing economies. By the year 2000, inflation had stabilized at low levels (Ha et al., 2019). Factors such as globalization, deregulation, technological advances and improved fiscal policy relatively have influenced the low inflation (Rogoff, 2003). This thirty-year long of moderate inflation, apparently independent of fluctuations in the labour market, was interpreted as a weakening of the relationship between unemployment and inflation (Crump et al., 2022)

In recent years, the impacts of the Russia-Ukraine war and the impact of COVID-19 in some parts of the world have impaired growth and put more pressure on prices (OECD, 2022). The inflation has increased above target in most countries due to key factors: supply chain bottlenecks, a shift in demand toward durable goods and away from services, fiscal and monetary stimulus and post-pandemic recovery, employment shortfall and supply shocks to energy and food. (Agarwal and Kimball, 2022). These events have

brought discussions of a changing unemployment-inflation trade-off back to the fore (Crump et al., 2022).

This paper analyses the extent of persistence of the unemployment and inflation rates for 38 OECD countries during the period 1970-2021 and examines whether there is a trade-off between unemployment and inflation. The difference between the current paper and the previous ones is the use of fractional integration approaches. The use of fractional integration techniques provides more flexibility in the examination of the degree of persistence of both unemployment and inflation rates than the traditional methods used in estimating persistence. Using fractional integration methods, this study identifies the countries where unemployment and inflation rate are stationarity and those where the series are non-stationary. Another contribution of this study is that we have not only considered persistence of inflation and unemployment but the relationship between the two. Hence, this paper is likely to produce more useful results relative to studies that have either focussed on the persistence of the series or only the relationship between the two series. Moreover, we have also included dataset covering the covid-19 period.

From a policy perspective, this study produces results that can provide valuable inputs to policymakers on how to tackle inflation and unemployment rates. For example, knowing the dynamics and nature of the persistence of inflation in a country is important for effective monetary policy decisions towards maintaining price stability (Oloko et al., 2021). In addition, knowing the persistence of unemployment will provide information on the series, the degree of shocks it spreads to the country and an economy´s responsiveness to unemployment risk (Godday et al., 2022).

This paper presents the following structure: Section 2 describes the literature review; Section 3 presents the methodology and the dataset; Section 4 shows the empirical results, and Section 6 provides some concluding remarks.

2. Literature review

The relationship between unemployment and inflation was popularised by Phillips (1958) who argued that there is a negative relationship between the series and an implication of the work is that expansionary monetary policy might lead to more inflation but less unemployment. Following his work, much additional research has been done on the interrelationship between these two economic variables (Santomero and Seater, 1978).

There are two possible explanations of this relationship, one in the short-run and another in the long-run (Yelwa et al., 2015). In the short run, for traditional Keynesians like Lipsey (1960) and Samuelson and Solow (1960), there is an inverse relationship between the unemployment and inflation. While that, in the long run, for monetarists like Friedman (1968) and Phelps (1967) and neoclassical like Lucas (1973) the concepts of unemployment and inflation are not related due to the hypotheses of adaptive and rational expectations (Alisa, 2015).

The extensive literature on unemployment persistence highlights two fundamental theories of unemployment: the hysteresis theory of unemployment (Blanchard and Summers, 1986) and the classical 'natural' rate theory of Friedman (1968) and Phelps (1967). According to the hysteresis theory, the unemployment rate does not return to an equilibrium level and the shocks are not transitory. In contrast, the theory of the natural rate of unemployment assumes that the unemployment rate is subject to temporary fluctuations around this natural rate in accordance with inflationary expectations (Fosten and Ghoshray, 2011). Therefore, the rate of unemployment that will tend to revert to its equilibrium in the long run (Omay et al., 2020). Several studies conducted for Asian countries (Lee et al., 2010), for Latin Amerian countries (Ayala et al., 2012), for European

countries (Cuestas et al. (2011), Bolat et al. (2014), for Unites States (Romero-Avila and Usabiaga, 2007), for OECD countries (Omay et al., 2021; Cheng, 2022; Bermejo et al., 2022), for Canada, France and UK (Yilanci et al, 2020) showed evidence of unemployment hysteresis hypothesis. However, studies such as Song et al (1998), Camarero and Tamarit (2004), León-Ledesma (2002), Lee et al (2009), Furuoka (2014), Yilanci (2008) among others, supported the natural rate hypothesis.

From a policy perspective, if the hysteresis hypothesis is valid, monetary and fiscal policies can be employed to decrease unemployment rates. By the contrast, if the natural rate hypothesis is valid, an activist policy will not be effective and can be destabilizing (Omay et al., 2021). Other factors influencing the persistence of unemployment such as high real wages, unemployment protection schemes, powerful labour unions, and the stigma connected with being jobless for a long time (Godday et al., 2022)

In relation to the persistence of unemployment, the dynamics of inflation is essential because it has vital policy implications (Gadea and Mayoral, 2006). Several studies found that inflation persistence has fallen. For example, Kumar and Okimoto (2007) investigated the dynamics of inflation persistence using fractionally integrated processes. These authors found a decline in inflation persistence in the United States since the 1980s. These results are similar to the study by Carlstrom et al (2009). These authors showed evidence of a change in the persistence of inflation in the United States since the 1980s.

On the other hand, various studies have presented evidence that inflation persistence seems to be high. For instance, Gadea and Mayoral (2006) considered the inflation rates of 21 OECD countries which were modelled as fractionally integrated processes. The results showed that inflation persistence is very high although non-

permanent in several nations. Likewise, Pivetta and Reis (2007) used non-linear Bayesian methods to estimate the persistence of inflation in the United States for the period 1965-2001. The results showed that inflation persistence has been high and unchanged for the estimation period. In the same vein, Caporale et al. (2022a) persistence in the inflation rates of the G7 nations by investigating their order of integration. The empirical findings indicated that the series are very persistent. However, other studies like Caporale et al. (2022b) for UK, Altissimo et al. (2006) for Euro area have concluded that inflation persistence had remained stable.

Understanding the inflation persistence is very important for policymakers because it has immediate consequences on the conduct of monetary policy (Marques, 2004). Studies like Mester (2022) indicate that better economic outputs were obtained under the assumption that the inflation rate is persistent. In this case, policymakers will choose monetary policy that are characterized by a relatively aggressive response to the evolution of inflation (Coenen, 2007; Schnabel, 2022)

3. Methodology

We use techniques based on fractional integration and cointegration. Thus, the number of differences to be adopted in a time series to render it stationary I(0) may be a fractional value. This modelling approach belongs to the category of long memory or long-range dependence process, which is characterized because a strong degree of dependence in the data that implies that the infinite sum of its autocovariances is infinite.

A time series process is said to be integrated of order d, and denoted by I(d) for any real value d, if it can be represented as:

$$(1 - L)^d x_t = u_t, \qquad t = 1, 2, \dots,$$

(1)

where L refers to the lag operator and u_t is I(0) or short memory, which is defined as a process where the infinite sum of its autocovariances is finite, and include for example the stationary and invertible AutoRegressive Moving Average-class of models. T the polynomial in L in the right-hand side of (1) can be expanded in terms of its Binomial representation such that

$$(1-L)^d = \sum_{j=0}^{\infty} \binom{d}{j} (-1)^j L^j = 1 - dL + \frac{d(d-1)}{2} L^2 - \ldots \qquad (2)$$

implying that equation (1) can be writing as:

$$x_t = d x_{t-1} - \frac{d(d-1)}{2} x_{t-2} + \ldots + u_t. \qquad (3)$$

In this context, for fractional values of d, x_t will depend on all its past history and higher the d is, higher the association between the values is. Remember that long memory occurs as long as d is positive; stationarity asymptotically holds if d is smaller than 0.5, and mean reversion takes place if d is strictly smaller than 1, lower the value of d, faster the convergence process.

Fractional integration is extended to the multivariate case throughout cointegration. According to Engle and Granger (1987), two series cointegrates if they individually display the same degree of integration, say d, that there exists a linear combination of the two which is integrated of a smaller order. They propose a two-step strategy, testing in the first step the value of d in the individual series, and then testing the order of integration in the estimated residuals from the regression of one variable against the order. Nevertheless, if cointegration does not hold the regression produces spurious estimates invalidating the analysis. In the empirical application conducted in this work, rather than making a regression of unemployment on inflation (or vice versa) we simply look at the difference between the two series, avoiding thus the problem of estimation and directly working with observed data.

4. Data

The data for inflation rate (which is defined as the annual growth rate of the consumer price index with 2015 base year) ~~the total number of unemployed as a percentage of labour force)~~ and unemployment rate (which is defined as the total number of unemployed as a percentage of labour force) for the 38 OECD countries analysed have been obtained from *OECD Statistics*. The consumer price index used in the computation of inflation rate involves the prices of a fixed set of consumer goods and services of constant and characteristics and quantity paid for or obtained by the residents of the countries under observation. The selection of these countries is due to data limitations. The length of the series is different for each of them. Table 1 shows all countries, the start of the series and sample size.

INSERT TABLES 1 AND 2 ABOUT HERE

Table 2 shows the descriptive statistics of the inflation and unemployment series of the 38 OECD countries considered. It is observed that the average unemployment rate takes values between 2.75 (the minimum value that corresponds to Japan) and 16.72 (maximum value that corresponds to Spain). Although not only Spain has double-digit unemployment rates, this also happens with Colombia, Costa Rica, Greece, Ireland, Lithuania, Latvia, Poland, Slovak Republic and Turkey. These large differences in the unemployment rate between countries can be explained on the one hand by the different way of calculating the unemployment rate, and on the other hand because the natural unemployment rate (NAIRU) is not the same in all countries since this rate corresponds to the potential output of an economy. Moreover, according to the Phillips curve between unemployment and inflation, an attempt to reduce the unemployment rate could lead to high inflation. In general terms, most countries have average unemployment rates higher

than their average inflation rates. In terms of average rates, only Mexico has an average inflation rate much higher than the average unemployment rate. This low unemployment rate is because it tends to concentrate only frictional employment and part of cyclical unemployment (Banco de Mexico, 2017). Everything means that the difference between unemployment and inflation is positive, on average, for all countries except Mexico (Figure 1). Also, Figure 2 shows the evolution of this difference during the periods considered for each country. There is an increasing trend and a value greater than 0 that is common, in general, to all countries, except for the case of Mexico with an increasing trend, but value less than 0.

INSERT FIGURES 1 AND 2 ABOUT HERE

5. Empirical results

Based on the monthly nature of the series under examination, the model of interest is the following one,

$$y_t = \alpha + \beta t + x_t, \quad (1-L)^d x_t = u_t, \quad t = 1, 2, ..., \tag{3}$$

where u_t is supposed to follow a seasonal AR(1) process of the form:

$$u_t = \rho u_{t-12} + \varepsilon_t, \quad t = 1, 2, \ldots . \tag{4}$$

We estimate d in (3) and (4) under the three classical specifications in the unit roots literature:

1) with no deterministic terms, i.e. imposing $\alpha = \beta = 0$ a priori in (3),

2) including only an intercept, i.e., with $\beta = 0$, and

3) with an intercept and a linear time trend as in equation (3).

We start with 3) and if the two coefficients α and β are significant we choose that model. However, if β is insignificant, we move to the model in 2) with an intercept. Finally, if α is also found to be insignificant, we choose model 1) with no terms.

Tables 3 and 4 refers to unemployment while Tables 5 and 6 to inflation. In Tables 3 and 5 we report the estimates of d for the three selected cases, marking in bold the selected model for each country. Tables 4 and 6 reports the estimated coefficients on these selected models.

Starting with the results for unemployment, we observe in Table 3 that the time trend coefficient is found to be statistically insignificant in all countries, with an intercept being sufficient for the description of the deterministic part of the model. Looking at the estimated coefficients, in Table 4, the values of d are very heterogeneous across countries: thus, evidence of mean reversion is found in two cases: Colombia (d = 0.74) and Costa Rica (0.75); evidence of unit roots in a group of seven countries (Austria, Belgium, Canada, Switzerland, Israel, Japan and United States, while in the remaining 28 countries, the unit root hypothesis is rejected in favour of values of d above 1, the highest one corresponding to Germany with an estimated d of 1.91. Looking at the seasonal coefficient, the values are relatively low in all cases, the highest values corresponding to Luxembourg (ρ = -0.316), Austria (-0.234) and Finland (-0.227).

INSERT TABLES 3 - 6 ABOUT HERE

Next, we look at inflation. Table 5 indicates that the time trend is also insignificant in all countries for these variables, and even the intercept is unrequired in the cases of Canada, Iceland, Japan and United States. Focussing on d, apart from the case of Norway, the countries can be grouped in two categories: those where the unit root null hypothesis cannot be rejected (Australia, Austria, Switzerland, Costa Rica, Germany, Denmark, Spain, Greece, Israel, Republic Korea, Netherlands, New Zealand, Republic

Slovak, Slovenia and Turkey) and those where this hypothesis is rejected in favour of values of d > 1 (Belgium, Canada, Republic Czech, Chile, Colombia, Estonia, Finland, France, United Kingdom, Hungary, Ireland, Iceland, Italy, Japan, Lithuania, Luxembourg, Latvia, Mexico, Poland, Portugal, Sweden, and United States. The seasonal coefficient is once more small with three main exceptions: Canada (ρ = -0.470), Japan (-0.446) and United States (-0.444).

INSERT TABLE 7 ABOUT HERE

Table 7 resumes the selected estimate of d for each country and we have marked in bold the countries where we cannot reject the null that the two orders of integration are equal. For this purpose, we have used the homogeneity test developed in Robinson and Yajima (2002). It tests the null hypothesis:

$$H_0 : d_{y1} = d_{y2}, \tag{5}$$

where the orders of integration of the individual series are represented by d_{y1} and d_{y2}. The test statistic is:

$$\hat{T}_{xy} = \frac{m^{1/2}\left(\hat{d}_{y1} - \hat{d}_{y2}\right)}{\left\{\frac{1}{2}\left[1 - \hat{G}^2_{y1.y2} \Big/ \left(\hat{G}_{y1}\hat{G}_{y1.y2}\right)\right]\right\}^{1/2}} + h(T) \tag{6}$$

where $h(T) > 0$ and $\hat{G}_{y1.y2}$ denote the (y1.y2)th element of $\hat{\Lambda}\left(\lambda_j\right)^{-1} I\left(\lambda_j\right)\hat{\Lambda}\left(\lambda_j\right)$ with $\hat{\Lambda}\left(\lambda_j\right) = diag\left\{e^{i\pi\hat{d}_{y1}/2}\lambda^{-\hat{d}_{y1}},\ e^{i\pi\hat{d}_{y2}/2}\lambda^{-\hat{d}_{y2}}\right\}$.

Check Gil-Alana and Hualde (2009) for proof on the small sample performance of this procedure. The empirical findings using this approach are displayed in bold in Table 7.

We observe that only for eleven countries we have divergence in the degree of integration. These countries are Australia, Colombia, Germany, Denmark, Spain, Japan, Korea Republic, Netherlands, Norway and Sweden. For the rest of the countries, we cannot reject the null of equal degrees of differentiation so we can go ahead and test for cointegration in the relationship between unemployment and inflation. However, as earlier argued, testing the residuals of a regression of unemployment and inflation may produce spurious results if cointegration is not satisfied and inconsistent estimates of the coefficients in the model (see Robinson and Hidalgo, 1997). However, though there exist some consistnet methods of estimation based on narrow bandwidths in the frequency domain (Robinson, 1994, and more recently, Christensen and Nielsen, 2006), a much simpler approach is to directly work with the observed differenced data, and this is approach employed as follows. Thus, we estimate once more the model given by equation (3) but this time on the difference between unemployment and inflation. Results of the estimated parameters are displayed across Table 8.

INSERT TABLE 8 ABOUT HERE

We first observe in this table a positive time trend in a number of cases: Austria ($\beta = 0.107$), Chile (0.107), Costa Rica (0.278), Hungary (0.156), Israel (0.076) and Luxembourg (0.060) and a negative one in case of Turkey (-0.058). More importantly, if we look at the orders of integration, evidence of mean reversion is found in the cases of Austria (0.53), Switzerland (0.27), Costa Rica (0.32), Israel (0.67) and Turkey (0.11). For the rest of the countries, though most of the estimates of d are below 1, the confidence bands are so wide that the unit root null cannot be rejected. Thus, only for this group of 5 countries we find evidence of a long run equilibrium relationship.

6. Concluding comments

The aim of this paper is to evaluate the analysis of persistence of both unemployment rate and inflation rate in 38 OECD countries. The long run equilibrium relationship between the two series have also been examined. A major difference between the current paper and the previous works is that data used in this paper covers the CVID-19 period. Besides, we have also used fractional integration approaches, which allow for more flexibility in the examination of the degree of persistence of the series, in the analysis. The results suggest that unemployment rate is highly persistent series (in line with the hysteresis hypothesis) as 36 countries or 95% of the countries have persistent unemployment series. Moreover, the results indicate that inflation rate is also a highly persistent series as 37 countries or 97% of the countries have persistent inflation series. The results further suggest that long run equilibrium relationship exist between the series only in 5 countries or 13% of the countries under observation.

An implication of the results is that high unemployment rates will persist in the long-run if adequate policies are not introduced to tame unemployment in these OECD countries. It also implies that robust combination of policies is needed to sufficiently address high unemployment rates whenever they arise. Hence, in addition to fiscal policies, there is a need to expand the currently available job retention schemes in these countries, sustaining, and where feasible increasing, cost-effective active labour market measures; while decreasing labour market duality; and reinforcing and increasing quality apprenticeship measures as well as other work experience programmes. Some of these policies have been introduced occasionally to tackle unemployment in these countries. For instance, expansion of eligibility for job retention schemes to include temporary workers was introduced to further benefited many young workers in OECD countries, especially during the COVID-19 period (OECD, 2021).

Another implication of the results is inflation will persist in the long run, if adequate policies are not introduced to address rising inflation in the OECD nations. Active monetary policies such as relevant open-market operations, wide interest rate corridor as well as other reforms are needed to address high inflation, whenever they occur in OECD countries. Supply side measures should be implemented to improve innovation, competition and productivity – all of which have the potential tame inflation. Some forms of these measures have been introduced in the past in the OECD countries. For instance, market-oriented reforms launched under the structural program "A New Start for Sweden" was introduced in Sweden after the economy experienced high inflation economy in the 1980s.

Since, the two series are not cointegrated in many cases, this implies that that comprehensive measures are needed to reduce incidence of stagflation. The elimination of barriers to work via mitigating work disincentives in tax and occupational licensing reforms should enhance labour force participation and simultaneously reduce the cost of production for companies. Furthermore, deregulation of housing, energy and other markets would lessen the regulatory burden on firms, depressing the cost of national production.

Decreasing supervisory uncertainty for firms should cause improvement in business activities. There are few examples of countries implementing these measures. The EU Commission has launched a number of initiatives over the last decade to improve the quality of legislation aimed at decreasing the total administrative burden imposed on firms. (OECD, 2015).

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Table 1: Countries and sample size

Country	Code(ISO 3)	Starting date	Ending date	Number of observations
Australia	AUS	1966-Q3	2021-Q3	121
Austria	AUT	1993-Q1	2021-Q3	115
Belgium	BEL	1983-Q1	2021-Q3	155
Canada	CAN	1955-Q1	2021-Q3	267
Switzerland	CHE	2010-Q1	2021-Q3	47
Chile	CHL	1986-Q1	2021-Q3	143
Colombia	COL	2007-Q1	2021-Q3	59
Costa Rica	CRI	2010-Q3	2021-Q3	45
Czech Republic	CZE	1993-Q1	2021-Q3	115
Germany	DEU	1991-Q1	2021-Q3	123
Denmark	DNK	1983-Q1	2021-Q3	155
Spain	ESP	1986-Q2	2021-Q3	142
Estonia	EST	1998-Q1	2021-Q3	95
Finland	FIN	1988-Q1	2021-Q3	135
France	FRA	1983-Q1	2021-Q3	155
United Kingdom	GRB	1983-Q1	2021-Q3	155
Greece	GRC	1998-Q2	2021-Q3	94
Hungary	HUN	1996-Q1	2021-Q3	103
Ireland	IRL	1983-Q1	2021-Q3	155
Iceland	ISL	2003-Q1	2021-Q3	75
Israel	ISR	1995-Q1	2021-Q3	107
Italy	ITA	1983-Q1	2021-Q3	155

Japan	JPN	1956-Q1	2021-Q3	263
Korea, Republic	KOR	1990-Q1	2021-Q3	127
Lithuania	LTU	1998-Q2	2021-Q3	94
Luxembourg	LUX	1983-Q1	2021-Q3	155
Latvia	LVA	1998-Q2	2021-Q3	94
Mexico	MEX	1987-Q1	2021-Q3	139
Netherlands	NLD	1983-Q1	2021-Q3	155
Norway	NOR	1989-Q1	2021-Q3	131
New Zealand	NZL	1986-Q1	2021-Q3	143
Poland	POL	1997-Q1	2021-Q3	99
Portugal	PRT	1983-Q1	2021-Q3	155
Slovak Republic	SVK	1998-Q1	2021-Q3	95
Slovenia	SVN	1996-Q2	2021-Q3	103
Sweden	SWE	1983-Q1	2021-Q3	155
Turkey	TUR	2005-Q1	2021-Q3	67
United States	USA	1956-Q1	2021-Q3	263

Table 2: Descriptive statistics

Countries	Unemployment				Inflation			
	Mean	Sd	Min	Max	Mean	Sd	Min	Max
AUS	5.96	2.30	1.60	11.15	4.95	3.92	-0.45	17.69
AUT	5.11	0.84	3.63	7.00	1.92	0.85	0.03	3.88
BEL	8.11	1.40	5.03	10.97	2.29	1.58	-1.22	8.68

CAN	7.29	2.06	3.03	1 3.10	3.54	2.98	-0.86	1 2.70
CHE	4.73	0.30	4.06	5.42	-0.02	0.69	-1.37	1.13
CHL	8.16	1.67	5.54	1 3.88	7.23	6.80	-3.03	2 9.02
COL	1 0.92	2.07	8.76	2 0.13	3.99	1.75	1.56	8.24
CRI	1 1.27	3.56	8.33	2 3.82	2.70	2.03	-0.96	6.15
CZE	5.68	2.05	1.87	9.27	4.19	4.43	-0.39	2 1.87
DEU	7.03	2.27	3.10	1 1.20	1.77	1.19	-0.25	6.09
DNK	6.12	1.47	3.23	9.90	2.34	1.56	0.10	8.52
ESP	1 6.72	4.73	7.97	2 6.33	3.07	2.18	-1.07	9.47
EST	8.92	3.39	4.03	1 8.23	3.39	2.88	-1.96	1 1.73
FIN	9.05	3.18	2.90	1 7.53	1.93	1.73	-1.04	7.22
FRA	9.83	1.32	7.27	1 2.50	2.16	1.89	-0.42	9.83
GRB	7.07	2.22	3.77	1 1.30	2.88	1.79	0.30	9.20
GRC	1 5.39	6.36	7.60	2 7.80	1.85	2.09	-2.38	5.53
HUN	7.08	2.29	3.30	1 1.03	6.18	5.52	-1.06	2 7.56
IRL	1 0.47	4.58	3.90	1 7.00	2.55	2.66	-6.13	1 2.41
ISL	4.82	1.84	2.60	8.47	4.43	3.36	1.07	1 7.08
ISR	7.02	2.01	3.54	1 0.92	2.70	3.40	-2.52	1 3.15
ITA	9.52	1.64	6.03	1 2.93	3.45	3.09	-0.48	1 6.14
JPN	2.75	1.23	1.07	5.43	2.83	4.05	-2.20	2 3.43
KOR	3.51	1.07	1.93	8.13	3.40	2.32	-0.09	9.74
LTU	1 0.77	4.06	4.07	1 8.20	2.40	2.70	-1.67	1 2.06
LUX	3.83	1.55	1.50	7.57	2.28	1.71	-1.20	9.74
LVA	1 1.31	3.70	5.47	2 0.57	3.43	3.79	-3.75	1 7.70
MEX	3.86	0.98	2.20	7.03	1 6.64	2 9.75	2.27	1 77.44

NLD	5.81	1.71	2.93	9.50	1.91	1.02	-1.20	4.39
NOR	4.24	1.09	2.47	6.73	2.28	1.07	-1.43	4.70
NZL	5.92	1.86	3.40	11.20	3.05	3.35	-0.51	18.94
POL	10.70	5.29	2.97	2.47	3.70	3.82	-1.50	17.23
PRT	8.75	3.07	4.80	18.10	5.60	6.74	-1.51	30.64
SVK	12.97	4.16	5.70	19.53	3.84	3.51	-0.75	15.80
SVN	6.79	1.58	4.17	10.63	3.67	3.21	-0.92	10.94
SWE	6.35	2.40	1.43	10.30	2.73	2.90	-1.42	11.30
TUR	10.60	1.63	8.23	14.00	9.97	3.62	4.34	22.37
USA	5.95	1.64	3.40	12.97	3.59	2.75	-1.62	14.51

Figure 1: Difference between average unemployment rate and average inflation rate

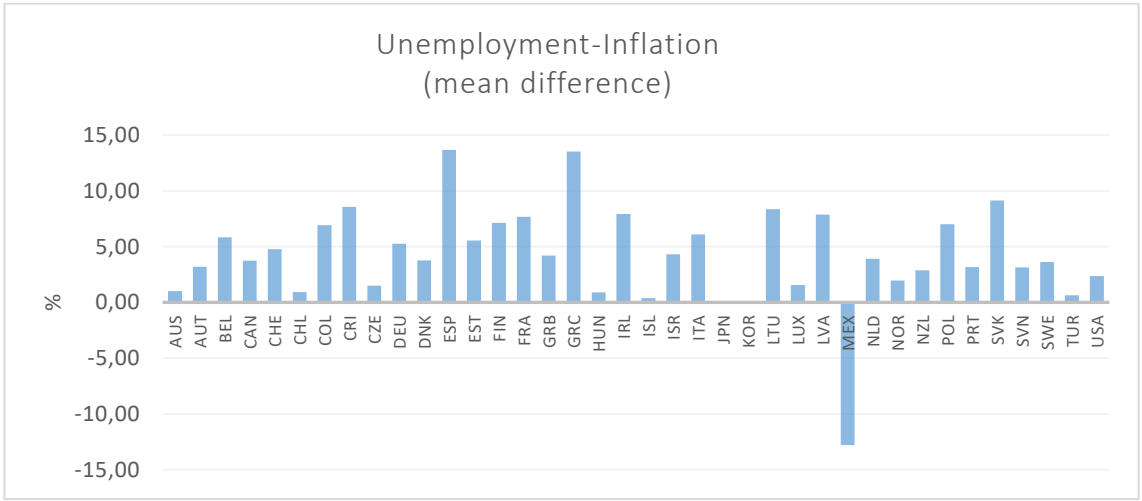

Figure 2: Evolution of the difference between the average unemployment rate and the average inflation rate

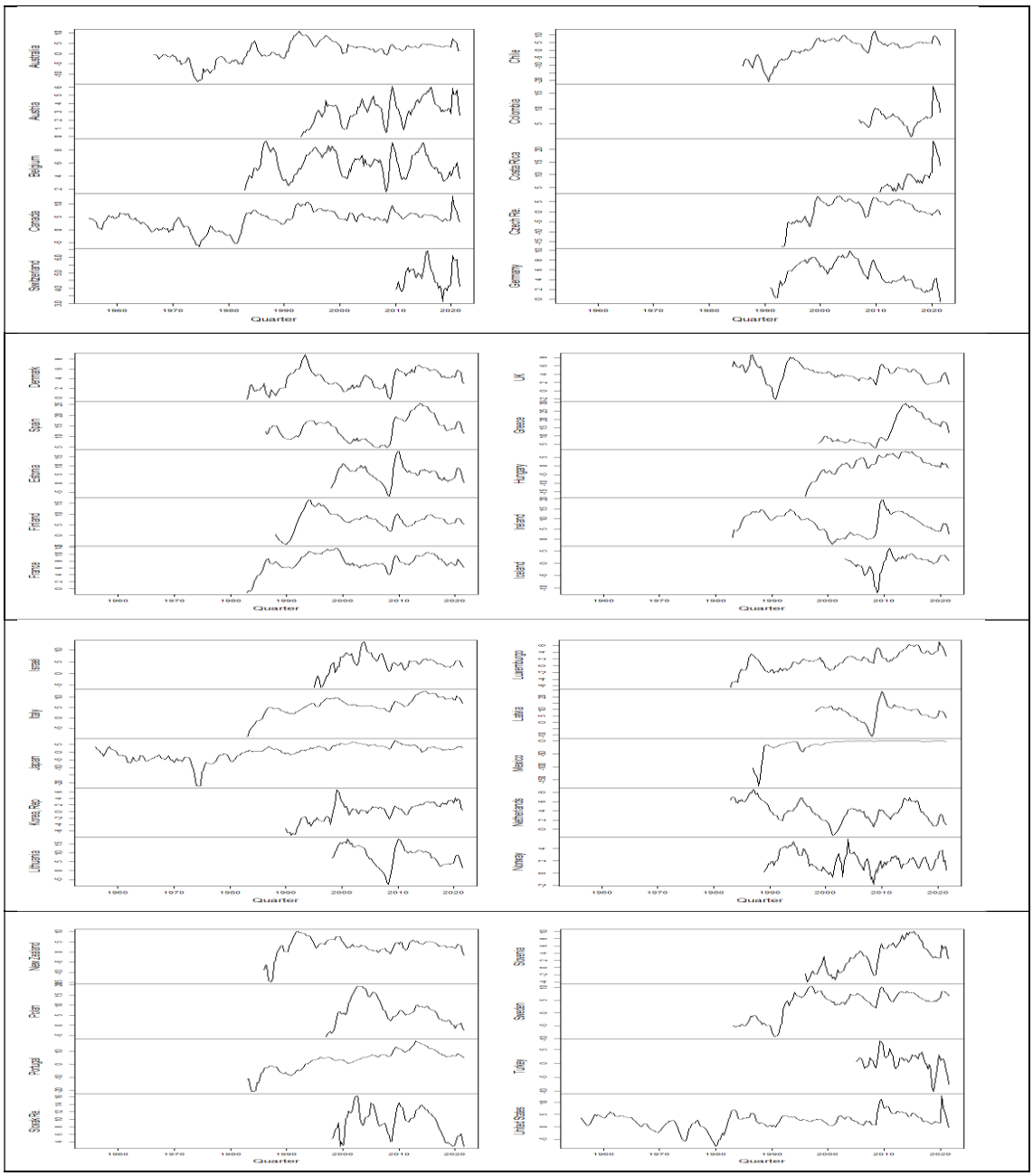

Table 3: Estimates of d for UNEMPLOYMENT

Country	No deterministic terms	With an intercept	With an intercept and a linear time trend
AUS	1.31 (1.19,	**1.41 (1.29,**	1.41 (1.29,

AUT	0.88 (0.75,	**0.83 (0.68,**	0.83 (0.67,
BEL	1.00 (0.90,	**1.04 (0.95,**	1.04 (0.95,
CAN	0.97 (0.89,	**1.04 (0.94,**	1.04 (0.94,
CHE	0.83 (0.67,	**0.74 (0.43,**	0.73 (0.38,
CHL	0.84 (0.74,	**1.22 (1.04,**	1.21 (1.04,
COL	0.80 (0.66,	**0.74 (0.59,**	0.74 (0.58,
CRI	0.80 (0.66,	**0.75 (0.58,**	0.72 (0.55,
CZE	1.15 (1.05,	**1.57 (1.42,**	1.57 (1.42,
DEU	1.12 (1.03,	**1.94 (1.73,**	1.94 (1.72,
DNK	1.02 (0.91,	**1.44 (1.32,**	1.44 (1.32,
ESP	1.04 (0.94,	**1.74 (1.60,**	1.74 (1.60,
EST	1.15 (1.02,	**1.39 (1.23,**	1.39 (1.23,
FIN	1.27 (1.17,	**1.52 (1.41,**	1.52 (1.41,
FRA	1.06 (0.97,	**1.24 (1.14,**	1.24 (1.14,
GBR	1.02 (0.93,	**1.60 (1.47,**	1.60 (1.46,
GRC	1.08 (0.98,	**1.56 (1.45,**	1.56 (1.45,
HUN	0.99 (0.87,	**1.32 (1.22,**	1.32 (1.22,
IRL	1.08 (1.00,	**1.38 (1.29,**	1.38 (1.29,
ISL	1.18 (1.04,	**1.78 (1.59,**	1.77 (1.59,
ISR	0.99 (0.88,	**1.15 (1.00,**	1.15 (1.00,
ITA	1.02 (0.94,	**1.23 (1.13,**	1.22 (1.13,
JPN	1.04 (0.95,	**1.27 (1.18,**	1.27 (1.18,
KOR	1.21 (1.04,	**1.47 (1.26,**	1.47 (1.26,
LTU	1.08 (0.96,	**1.44 (1.29,**	1.44 (1.29,
LUX	0.95 (0.83,	**1.16 (1.05,**	1.16 (1.05,
LVA	1.05 (0.93,	**1.37 (1.22,**	1.37 (1.22,
MEX	0.98 (0.85,	**1.24 (1.09,**	1.24 (1.09,
NLD	1.00 (0.90,	**1.60 (1.47,**	1.59 (1.46,
NOR	1.01 (0.92,	**1.19 (1.06,**	1.19 (1.06,
NZL	1.07 (0.98,	**1.19 (1.10,**	1.19 (1.10,
POL	1.07 (0.97,	**1.61 (1.48,**	1.62 (1.48,
PRT	1.15 (1.05,	**1.43 (1.33,**	1.43 (1.33,
SVK	1.12 (1.01,	**1.74 (1.55,**	1.73 (1.54,
SVN	0.99 (0.87,	**1.12 (1.01,**	1.12 (1.01,
SWE	1.24 (1.14,	**1.47 (1.36,**	1.47 (1.36,
TUR	0.98 (0.81,	**1.50 (1.20,**	1.49 (1.20,
USA	0.90 (0.81,	**0.90 (0.81,**	0.90 (0.81,

In parenthesis, 95% bands for the estimates of d. In bold, the selected specification for each series.

Table 4: Estimated coefficients for each selected model. UNEMPLOYMENT

Country	d (95 band)	Intercept (tvalue)	Seasonal coefficient
AUS	1.41 (1.29,	1.816 (6.56)	-0.051

AUT	0.83 (0.68,	3.898 (11.21)	-0.234
BEL	1.04 (0.95,	10.496	-0.095
CAN	0.97 (0.89,	4.8175	-0.054
CHE	0.74 (0.43,	4.937 (22.45)	0.124
CHL	1.22 (1.04,	14.275	-0.001
COL	0.74 (0.59,	11.490 (9.88)	-0.132
CRI	0.75 (0.58,	9.358 (5.56)	-0.139
CZE	1.57 (1.42,	4.441 (20.24)	-0.077
DEU	1.94 (1.73,	5.177 (57.51)	-0.106
DNK	1.44 (1.32,	8.144 (34.08)	0.031
ESP	1.74 (1.60,	20.583	0.016
EST	1.39 (1.23,	9.178 (12.30)	-0.095
FIN	1.52 (1.41,	4.758 (14.34)	-0.227
FRA	1.24 (1.14,	7.955 (33.41)	0.140
GBR	1.60 (1.47,	10.764 (65.75	-0.140
GRC	1.56 (1.45,	10.849	-0.166
HUN	0.32 (1.22,	10.207	0.075
IRL	1.38 (1.29,	12.957	-0.116
ISL	1.78 (1.59,	3.656 (7.30)	0.080
ISR	1.15 (1.00,	7.297 (19.96)	-0.011
ITA	1.23 (1.13,	7.001 (25.03)	0.186
JPN	1.04 (0.95,	2.6793 (24.10)	-0.067
KOR	1.47 (1.26,	2.456 (8.05)	0.045
LTU	1.44 (1.29,	13.834	-0.088
LUX	1.16 (1.05,	3.252 (14.88)	-0.316
LVA	1.37 (1.22,	14.467	-0.163
MEX	1.24 (1.09,	4.585 (15.39)	-0.039
NLD	1.60 (1.47,	9.505 (62.85)	-0.140
NOR	1.19 (1.06,	4.851 (21.26)	-0.067
NZL	1.19 (1.10,	4.186 (12.05)	-0.101
POL	1.61 (1.48,	11.762	-0.066
PRT	1.43 (1.33,	7.949 (26.07)	0.001
SVK	1.74 (1.55,	12.048	-0.218
SVN	1.12 (1.01,	7.120 (18.32)	-0.085
SWE	1.47 (1.36,	3.581 (13.99)	-0.059
TUR	1.50 (1.20,	9.114 (21.69)	-0.211
USA	0.90 (0.81,	4.0831 (5.73)	-0.016

In parenthesis, 95% bands for the estimates of d in column 2. T-values in column 3. Column 4 reports the seasonal AR. ** means evidence of persistence.

Table 5: Estimates of d for INFLATION

Country	No deterministic terms	With an intercept	With an intercept and a linear time trend
AUS	1.09 (0.98,	**1.09 (0.98,**	1.09 (0.98,
AUT	1.14 (0.97,	**1.16 (0.96,**	1.16 (0.96,
BEL	1.06 (0.90,	**1.29 (1.09,**	1.28 (1.09,
CAN	**1.33 (1.22,**	1.33 (1.22,	1.32 (1.22,
CHE	1.15 (0.89,	**1.15 (0.89,**	1.15 (0.89,
CHL	0.98 (0.86,	**1.40 (1.19,**	1.40 (1.19,
COL	1.44 (1.17,	**1.65 (1.30,**	1.65 (1.30,
CRI	1.11 (0.84,	**1.14 (0.79,**	1.14 (0.77,
CZE	1.02 (0.83,	**1.23 (1.04,**	1.22 (1.04,
DEU	1.26 (1.10,	**1.18 (0.97,**	1.18 (0.97,
DNK	0.92 (0.80,	**1.00 (0.84,**	1.00 (0.86,
ESP	1.17 (1.00,	**1.16 (0.95,**	1.16 (0.95,
EST	1.18 (0.97,	**1.46 (1.21,**	1.46 (1.21,
FIN	1.28 (1.14,	**1.34 (1.16,**	1.34 (1.16,
FRA	1.01 (0.88,	**1.23 (1.07,**	1.22 (1.07,
GBR	1.15 (1.01,	**1.29 (1.10,**	1.29 (1.10,
GRC	1.21 (0.98,	**1.19 (0.92,**	1.19 (0.92,
HUN	0.90 (0.77,	**1.30 (1.12,**	1.27 (1.12,
IRL	1.08 (0.94,	**1.48 (1.25,**	1.50 (1.25,
ISL	**1.35 (1.08,**	1.35 (1.09,	1.35 (1.09,
ISR	1.00 (0.83,	**1.22 (0.92,**	1.22 (0.92,
ITA	1.00 (0.86,	**1.48 (1.30,**	1.46 (1.28,
JPN	**1.28 (1.17,**	1.29 (1.18,	1.29 (1.18,
KOR	1.08 (0.93,	**0.99 (0.78,**	0.98 (0.77,
LTU	1.27 (1.06,	**1.40 (1.18,**	1.41 (1.18,
LUX	0.96 (0.81,	**1.21 (1.07,**	1.21 (1.06,
LVA	1.46 (1.26,	**1.71 (1.45,**	1.73 (1.46,
MEX	1.27 (1.11,	**1.73 (1.48,**	1.76 (1.49,
NLD	1.01 (0.88,	**1.06 (0.92,**	1.06 (0.92,
NOR	0.89 (0.72,	**0.78 (0.60,**	0.78 (0.61,
NZL	1.06 (0.93,	**1.06 (0.90,**	1.06 (0.90,
POL	0.98 (0.83,	**1.28 (1.10,**	1.27 (1.10,
PRT	1.12 (1.01,	**1.24 (1.10,**	1.24 (1.09,
SVK	1.09 (0.92,	**1.06 (0.84,**	1.06 (0.84,
SVN	1.15 (0.99,	**1.07 (0.87,**	1.07 (0.86,
SWE	1.10 (0.97,	**1.20 (1.04,**	1.20 (1.04,
TUR	1.14 (0.88,	**1.13 (0.77,**	1.13 (0.78,
USA.	**1.45 (1.33,**	1.45 (1.33,	1.44 (1.33,

In parenthesis, 95% bands for the estimates of d. In bold, the selected specification for each series.

Table 6: Estimated coefficients for each selected model. INFLATION

Country	d (95 band)	Intercept (tvalue)	Seasonal coefficient
AUS	1.09 (0.98,	2.344 (2.31)	0.064
AUT	1.16 (0.96,	3.936 (9.11)	0.153
BEL	1.29 (1.09,	8.979 (16.01)	0.194
CAN	1.33 (1.22,	---	-0.470
CHE	1.15 (0.89,	1.175 (3.25)	0.068
CHL	1.40 (1.19,	25.860	0.165
COL	1.65 (1.30,	4.936 (9.02)	0.169
CRI	1.14 (0.79,	5.304 (6.27)	0.109
CZE	1.23 (1.04,	21.923	-0.025
DEU	1.18 (0.97,	2.688 (5.20)	0.105
DNK	1.00 (0.84,	8.520 (17.56)	0.027
ESP	1.16 (0.95,	8.123 (11.90)	0.117
EST	1.46 (1.21,	12.656	0.040
FIN	1.34 (1.16,	3.850 (8.15)	0.007
FRA	1.23 (1.07,	9.347 (23.02)	-0.038
GBR	1.29 (1.10,	5.150 (10.68)	0.152
GRC	1.19 (0.92,	5.398 (7.54)	0.074
HUN	1.30 (1.12,	28.662	0.208
IRL	1.48 (1.25,	3.454 (20.60)	-0.047
ISL	1.35 (1.08,	---	0.116
ISR	1.22 (0.92,	13.745	-0.035
ITA	1.48 (1.30,	16.406	-0.026
JPN	1.28 (1.17,	---	-0.446
KOR	0.99 (0.78,	7.654 (8.67)	0.121
LTU	1.40 (1.18,	7.314 (8.13)	0.089
LUX	1.21 (1.07,	10.029	0.032
LVA	1.71 (1.45,	6.511 (7.79)	0.189
MEX	1.73 (1.48,	10.263	0.061
NLD	1.06 (0.92,	31.93 (7.35)	-0.112
NOR	0.78 (0.60,	4.467 (6.47)	-0.005
NZL	1.06 (0.90,	13.050	0.193
POL	1.28 (1.10,	17.842	0.116
PRT	1.24 (1.10,	19.516	-0.166
SVK	1.06 (0.84,	7.352 (5.24)	0.054
SVN	1.07 (0.87,	8.656 (10.34)	-0.202
SWE	1.20 (1.04,	8.731 (11.32)	0.004
TUR	1.13 (0.77,	8.624 (4.85)	0.097
USA	1.45 (1.33,	---	-0.444

In parenthesis, 95% bands for the estimates of d in column 2. T-values in column 3. Column 4 reports the seasonal AR. ** means evidence of persistence.

Table 7: Comparison of persistence between unemployment and inflation

Countries	Unemployment (d)	Inflation (d)
AUS	1.41 (1.29, 1.57)	1.09 (0.98, 1.22)
AUT	**0.83 (0.68, 1.04)**	**1.16 (0.96, 1.41)**
BEL	**1.04 (0.95, 1.15)**	**1.29 (1.09, 1.53)**
CAN	**04 (0.94, 1.16)**	**1.33 (1.22, 1.46)**
CHE	**0.74 (0.43, 1.19)**	**1.15 (0.89, 1.47)**
CHL	**1.22 (1.04, 1.45)**	**1.40 (1.19, 1.65)**
COL	0.74 (0.59, 0.99)	1.65 (1.30, 2.06)
CRI	**0.75 (0.58, 0.99)**	**1.14 (0.79, 1.62)**
CZE	**1.57 (1.42, 1.77)**	**1.23 (1.04, 1.51)**
DEU	1.94 (1.73, 2.23)	1.18 (0.97, 1.41)
DNK	1.44 (1.32, 1.60)	1.00 (0.84, 1.21)
ESP	1.74 (1.60, 1.93)	1.16 (0.95, 1.41)
EST	**1.39 (1.23, 1.58)**	**1.46 (1.21, 1.73)**
FIN	**1.52 (1.41, 1.65)**	**1.34 (1.16, 1.54)**
FRA	**1.24 (1.14, 1.35)**	**1.23 (1.07, 1.46)**
GBR	**1.60 (1.47, 1.77)**	**1.29 (1.10, 1.51)**
GRC	**1.56 (1.45, 1.71)**	**1.19 (0.92, 1.52)**
HUN	**0.32 (1.22, 1.47)**	**1.30 (1.12, 1.57)**
IRL	**1.38 (1.29, 1.49)**	**1.48 (1.25, 1.76)**
ISL	**1.78 (1.59, 2.00)**	**1.35 (1.08, 1.68)**
ISR	**1.15 (1.00, 1.37)**	**1.22 (0.92, 1.64)**
ITA	**1.23 (1.13, 1.35)**	**1.48 (1.30, 1.72)**
JPN	**1.27 (1.18, 1.38)**	**1.28 (1.17, 1.40)**
KOR	1.47 (1.26, 1.73)	0.99 (0.78, 1.23)
LTU	**1.44 (1.29, 1.63)**	**1.40 (1.18, 1.68)**
LUX	**1.16 (1.05, 1.32)**	**1.21 (1.07, 1.41)**
LVA	**1.37 (1.22, 1.54)**	**1.71 (1.45, 2.00)**
MEX	1.24 (1.09, 1.44)	1.73 (1.48, 2.01)
NLD	1.60 (1.47, 1.77)	1.06 (0.92, 1.23)
NOR	1.19 (1.06, 1.38)	0.78 (0.60, 1.01)
NZL	**1.19 (1.10, 1.31)**	**1.06 (0.90, 1.29)**
POL	**1.61 (1.48, 1.81)**	**1.28 (1.10, 1.53)**
PRT	**1.43 (1.33, 1.56)**	**1.24 (1.10, 1.41)**
SVK	1.74 (1.55, 2.00)	1.06 (0.84, 1.33)
SVN	**1.12 (1.01, 1.26)**	**1.07 (0.87, 1.33)**
SWE	**1.47 (1.36, 1.62)**	**1.20 (1.04, 1.40)**
TUR	**1.50 (1.20, 1.86)**	**1.13 (0.77, 1.61)**
USA	**0.90 (0.81, 1.02)**	**1.45 (1.33, 1.58)**

In bold, evidence of homogeneity in the orders of integration of the two series.

Table 8: Estimated coefficients for the difference between UNEMPLOYMENT and INFLATION

Country	d (95 band)	Intercept (tvalue)	Time trend (tvalue)
AUT	0.53 (0.10,	0.791 (1.91)	0.030 (3.33)
BEL	0.93 (0.60,	1.957 (2.90)	---
CAN	0.89 (0.70,	4.438 (4.59)	---
CHE	0.27 (-0.26,	4.627 (25.51)	---
CHL	0.79 (0.58,	-9.943 (-7.48)	0.107 (2.38)
CRI	0.32 (-0.18,	2.531 (1.76)	0.278 (5.27)
CZE	0.90 (0.56,	-16.791 (-	---
EST	0.97 (0.46,	---	---
FIN	1.35 (1.07,	---	---
FRA	1.01 (0.84,	-1.188 (-2.44)	---
GBR	0.88 (0.54,	5.887 (11.07)	--
GRC	1.31 (1.04,	5.455 (5.67)	---
HUN	0.96 (0.79,	-17.366 (-	0.156 (1.94)
IRL	1.02 (0.82,	---	---
ISL	0.78 (0.41,	---	---
ISR	0.67 (0.49,	-4.062 (-3.74)	0.076 (2.52)
ITA	1.15 (0.93,	-9.331 (-	---
JPN	0.95 (0.74,	3.223 (2.81)	---
LTU	1.31 (0.81,	6.532 (5.43)	---
LUX	0.85 (0.55,	-6.124 (-9.73)	0.060 (2.33)
LVA	1.35 (0.75,	8.111 (6.00)	---
NZL	0.86 (0.63,	-8.636 (-6.83)	---
POL	1.14 (0.95,	-6.036 (-5.96)	---
PRT	1.08 (0.72,	-11.636 (-	---
SVN	0.91 (0.63,	-1.736 (-	---
SWE	1.15 (0.86,	-5.136 (-5.99)	---
TUR	0.11 (-0.21,	2.504 (4.00)	-0.058 (-3.78)
USA	0.85 (0.61,	3.449 (3.13)	---

In parenthesis, 95% bands for the estimates of d in column 2. T-values in column 3. Column 4 reports the seasonal AR. ** means evidence of persistence.