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EXOGENOUS SHOCKS AND
TIME-VARYING PRICE PERSISTENCE IN THE EU27

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Abstract

This paper analyses monthly price persistence in the EU27 countries over the period 2010-2022 using a fractional integration framework, where the measure of persistence is the fractional differencing parameter d. In addition to full sample estimates, subsample and recursive ones are obtained to examine time variation. On the whole, the results provide clear evidence that both the exogenous shocks considered have generally increased price persistence in the EU27 (despite their heterogeneity), although the recursive estimates suggest that their impact might have peaked and might now be decreasing. Therefore, any policies adopted to counteract those shocks should be gradually phased out. The exceptions are the Southern European countries, where price persistence appears to have decreased, though in Italy the recursive analysis indicates that it is now rising sharply.

Keywords: Price persistence; fractional integration; Covid-19 pandemic; Russia-Ukraine war; recursive estimation; time variation

JEL Classification: C22; E31

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1. Introduction

The world economy has recently been hit by two exogenous shocks with global consequences, namely the Covid-19 pandemic and the energy crisis resulting from the Russian invasion of Ukraine. Both of them have had repercussions not only on the real economy, but also on prices, which have risen sharply in countries throughout the globe. An interesting issue is whether or not the effects of those shocks on prices will be long-lived in order to be able to adopt appropriate policy responses. This is the focus of the present study, which provides evidence on the degree of price persistence in each of the 27 European Union member states (EU27) over a sample period including both the Covid-19 pandemic and the Russia-Ukraine war. More specifically, the aim of the analysis is to establish whether there has been any time variation in the degree of persistence as a result of those two shocks. For this purpose, a fractional integration model for monthly log-prices is estimated over the full sample going from January 2010 to December 2022 as well as for two subsamples (the first of which includes only the first shock, whilst the second includes both); in addition, recursive analysis is carried out to shed further light on the possible presence of time variation.

The adopted framework is more general than the standard one based on the dichotomy between I(0) stationarity and the I(1) non-stationarity since it allows for fractional as well as integer degrees of differentiation; it produces a direct measure of persistence in the form of the estimated fractional differencing parameter d, and is informative on whether the effects of shocks are transitory or permanent and the nature of the dynamic adjustment process, which is essential for policy makers to know to take appropriate actions. In contrast to most existing studies, our focus is on log-prices rather than the inflation rate, and thus provides evidence on the degree of persistence of a possibly nonstationary series such as prices rather than taking first differences to make it stationary. Studies analysing instead the properties of the inflation rate include Franta et al. (2010) on the EU new member states, Caporale and Gil-Alana (2011) on a wider set of European economies, Gil-Alana et al. (2016) on the G7 countries, Cuestas et al. (2016) on European countries both within and outside the eurozone, and Fuhrer and Moore (1995) on the US. Also, Marques (2004) found higher persistence in the 60s and 70s in the US but not in Europe; Cogley et al. (2010) reported that in the US the inflation gap, defined as the difference between inflation and trend inflation, increased during the 1980s; Pivetta and Reis (2007) did not find significant changes in inflation persistence in the US over various decades; Mayoral (2007) reported temporary increases in persistence in various OECD countries; Caporale et al. (2020) provided evidence of generally steady inflation persistence in the UK and the US over the time period 1660-2016; Caporale and Gil-Alana (2020) analysed UK data for 1216-2010 and found an increase in the degree of persistence in the 16th century and more recently after WWI and in the last quarter of the 20th century; finally, Caporale et al. (2022) concluded that inflation was very persistent in the G7 countries over the period January 1973-March 2020. An important issue not often considered by those studies is the possibility of time variation. Most recently, Caporale et al. (2023) analyse time-varying inflation persistence for both EU27 and euro zone aggregates. By contrast, the present study provides evidence on time variation in price persistence in each of the 27 EU member states.

The rest of the paper is structured as follows: Section 2 outlines the methodology; Section 3 describes the data and discusses the empirical findings; Section 4 offers some concluding remarks.

2. Methodology

Different measures of persistence have been used in the literature. A simple one is given by the autoregressive coefficient in an AR(1) model (or the sum of the coefficients in an

AR(p) one), with higher values corresponding to higher degrees of persistence. However, a serious limitation of this approach is that it imposes an exponential rate of decay on the autocorrelation values; moreover, it assumes stationarity I(0) of the series of interest. By contrast, in the present study we adopt a more general framework allowing for fractional orders of integration and a (much lower) hyperbolic rate of decay in the estimated differencing parameter d, which measures the degree of persistence. This type of model encompasses the standard AR(p) ones, which are a special case of the I(d) specification with d-differenced series.

More precisely, we estimate the following model:

$$y_t = \beta_0 + \beta_1 t + x_t, \qquad (1 - L)^d x_t = u_t, \qquad t = 1, 2, \ldots, \qquad (1)$$

where y_t is the observed time series, in our case the (logged) Harmonized Index of Consumer Prices (HICP); β_0 and β_1 are respectively the intercept and the coefficient on a linear time trend; L is the lag operator, i.e., $L^k x_t = x_{t-k}$, and x_t is assumed to be I(d), where d is the degree of differentiation. As for the error term u_t, we assume (weak) autocorrelation; however, instead of imposing a specific ARMA model, we use a non-parametric method due to Bloomfield (1973) that approximates ARMA structures with very few parameters and is very suitable in the context of fractional integration, as shown by Gil-Alana (2004).

For the estimation we use a simple version of a testing procedure developed in Robinson (1994) that is very suitable for our purposes, since: (i) it allows us to estimate d, the degree of persistence, for any real value d, including possibly nonstationary processes ($d \geq 0.5$) without the need for taking first differences as instead required by standard procedures based on unit (or fractional) roots; (ii) it has an asymptotic normal distribution; (iii) it is the most efficient test in the Pitman sense (Pitman, 1948) against local departures. A full description of this method can be found in Gil-Alana and Robinson (1997).

3. Empirical Results

For the analysis we use the log transformation of seasonally unadjusted monthly data for the Harmonized Index of Consumer Prices (HICP) in each of the 27 European Union (EU) member states; these series have been obtained from Eurostat (the statistical office of the European Union) and are available on the Bloomberg platform, with the sample period going from January 2010 to December 2022. Figure 1 displays the HICP series for each of the EU27. An upward trend in the most recent years is immediately noticeable.

FIGURE 1 ABOUT HERE

Table 1 displays the estimates of the differencing parameter d in Equation (1) and their associated 95% confidence intervals for each series and under three different specifications, namely: (i) setting $\beta_0 = \beta_1 = 0$, i.e. assuming that there are no deterministic terms in the model (column 2); (ii) setting $\beta_1 = 0$, i.e. including only an intercept in the model (column 3); (iii) allowing for both an intercept and a linear time trend (column 4). The coefficients in bold are those from the selected specification on the basis of the t-statistics. The sample period for these results ends in December 2019, i.e. before the onset of the Covid-19 pandemic.

TABLES 1 AND 2 ABOUT HERE

Table 2 reports the estimated model coefficients for each series. It can be seen that the time trend is significant in all cases except that of Slovakia; more specifically, it is positive and ranges from 0.028 in Greece to 0.210 in Estonia. Further, the estimated values of d are positive in all cases, which implies the presence of long memory ($d > 0$) in all countries except Malta, where the I(0) hypothesis cannot be rejected given the wide confidence interval. Evidence of mean reversion (d significantly below 1) is found for the following countries: Italy (d = 0.21); Spain (0.24); Portugal (0.35); Austria (0.38), Greece (0.43); Slovenia (0.50); Ireland (0.62); Lithuania (0.72); Belgium (0.75) and Denmark (0.79). In all these cases, the effects of shocks will be transitory and disappear in the long run. The unit root null hypothesis (i.e., d = 1) cannot be rejected for another group of twelve countries (Germany, Cyprus, Latvia, Croatia, France, Sweden, Check Republic, Finland, Hungary, Estonia, Bulgaria, Poland and Romania), while for Slovakia it is rejected in favor of values of d significantly higher than 1. Thus, there is a large degree of heterogeneity across the countries in the sample.

Next, we re-estimate the model by extending the sample to January 2022, thus incorporating the Covid-19 period but only before the Russian invasion to Ukraine. These results are reported in Table 3. It can be seen that the time trend coefficient is now insignificant in the cases of Cyprus and Belgium in addition to that of Slovakia, and mean reversion is found only for a few countries, namely Italy (d = 0.18), Spain (0.23), Greece (0.38), Portugal (0.38), Austria (0.42) and Slovakia (0.59); in most cases the estimated value of d is now higher (see Table 5 for a direct comparison of the results for the different sample periods). The only exceptions are three Southern European countries: Italy (where d decreases from 0.21 for the sample ending in December 2019 to 0.18 for the extended one ending in January 2022); Spain (from 0.24 to 0.23) and Greece (from 0.43 to 0.38). Thus, the obtained evidence suggests that the Covid-19 pandemic increased the degree of persistence in the vast majority of EU countries.

TABLES 3, 4 AND 5 ABOUT HERE

In the following step, we obtain estimates based on the full sample ending in December 2022. These results are reported in Table 4. The time trend coefficient is now insignificant in a higher number of cases, and the estimates for the degree of inflation persistence are higher in all cases compared to those for the sample ending in January 2022 (see Table 5 for a direct comparison), with Italy (d = 0.50), Spain (0.69), Portugal (0.77) and Greece (0.82) now being the only countries displaying mean-reverting behaviour.

Finally, we estimate the model recursively to analyse time variation in the degree of persistence as measured by d; specifically, we add three observations at a time to the sample ending in December 2019 (which includes 120 observations) to obtain the corresponding estimates up until December 2022, namely for a period which includes both the Covid-19 pandemic and the Russia-Ukraine war. As can be seen, after an initial increase across the board, in the most recent period price persistence appears to have subsided in the vast majority of the EU27, with the exception of the Czech Republic, Hungary, Latvia, Malta and Slovenia, where there has been a slight increase, and most notably Italy, the only case where it has risen sharply after a period of relative stability.

FIGURE 2 ABOUT HERE

4. Conclusions

This paper analyses monthly price persistence in the EU27 countries over the period 2010-2022 using a fractional integration framework which encompasses a wide range of stochastic processes, where the measure of persistence is the estimated value of the fractional differencing parameter d. A related study had previously been carried out by Caporale et al. (2023), but for inflation as opposed to price persistence, and at the aggregate level (for the EU27 and the euro zone countries respectively), while the present contribution focuses on the individual EU member states. The model is initially estimated over the period from January 2010 to December 2019, which produces evidence of heterogeneity across the EU27. The sample is then extended to January 2022, with the aim of examining the possible effects of the Covid-19 pandemic prior to the outbreak of the Russia-Ukraine war; this exogenous shock appears to have increased price persistence everywhere except in three countries from Southern Europe, namely Italy, Spain and Greece.

Extending the sample period further, i.e. to the end of December 2022 (to include the Russia-Ukraine conflict as well) results in higher estimates of d, with the same countries from Southern Europe as well as an additional one (i.e. Portugal) from the same region being the only ones to exhibit mean reversion. Finally, the recursive estimates suggest that price persistence has subsided in most cases (and increased very slightly in a few ones) in the most recent period, the only outlier being Italy, where a sharp increase appears to have occurred most recently.

On the whole, our analysis provides clear evidence that both the exogenous shocks considered have generally increased price persistence in the EU27 (despite their heterogeneity), although the recursive results suggest that their impact might have peaked and might now be decreasing, which is consistent with the aggregate findings of Caporale et al. (2023) for both the EU27 and the euro zone. Therefore, any policies adopted to counteract those shocks should be gradually phased out. The interesting exceptions are the Southern European countries, where if anything price persistence appears to have decreased as a result of the Covid-19 pandemic and the Russia-Ukraine war, though in Italy the recursive analysis indicates that it is now rising sharply.

A limitation of the present study is its univariate nature, which does not allow us to investigate the possible factors affecting the degree of persistence and thus to provide an explanation for the presence of outliers such Italy. Future work should adopt a multivariate framework to investigate these issues in the context of fractional cointegration, using frameworks such as the fractional CVAR (i.e., FCVAR) model proposed by Johansen and Nielsen (2010, 2012). Further possible extensions could consider non-linear structures in the deterministic part of the model, such Chebyshev polynomials in time (as in Cuestas and Gil-Alana, 2016), Fourier functions (Gil-Alana and Yaya, 2021) or neural networks (Yaya et al., 2021) within a fractional integration framework.

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TABLE 1: Estimates of the differencing parameter. Sample ending in December 2019

Country	No terms	An intercept	An intercept and a linear time trend
AUSTRIA	0.93 (0.73, 1.21)	0.59 (0.53, 0.65)	**0.38 (0.23, 0.57)**
BELGIUM	0.92 (0.73, 1.19)	0.68 (0.61, 0.88)	**0.75 (0.59, 0.96)**
BULGARIA	0.94 (0.77, 1.22)	1.05 (0.91, 1.22)	**1.05 (0.92, 1.21)**
CROATIA	0.92 (0.74, 1.19)	0.82 (0.61, 1.23)	**0.87 (0.68, 1.20)**
CYPRUS	0.93 (0.76, 1.20)	0.75 (0.42, 1.26)	**0.80 (0.57, 1.27)**
CZECK REP.	0.92 (0.74, 1.21)	0.93 (0.74, 1.24)	**0.94 (0.77, 1.20)**
DENMARK	0.94 (0.74, 1.18)	0.62 (0.52, 0.95)	**0.79 (0.65, 0.97)**
ESTONIIA	0.94 (0.76, 1.19)	1.04 (0.73, 1.41)	**1.03 (0.84, 1.40)**
FINLAND	0.93 (0.75, 1.19)	1.01 (0.81, 1.25)	**1.00 (0.89, 1.16)**
FRANCE	0.91 (0.74, 1.20)	0.81 (0.61, 1.14)	**0.88 (0.72, 1.12)**
GERMANY	0.93 (0.72, 1.18)	0.79 (0.64, 1.42)	**0.80 (0.57, 1.36)**
GREECE	0.95 (0.78, 1.23)	0.28 (0.11, 0.55)	**0.43 (0.19, 0.70)**
HUNGARY	0.95 (0.76, 1.21)	1.02 (0.77, 1.31)	**1.02 (0.85, 1.28)**
IRELAND	0.92 (0.72, 1.19)	0.58 (0.46, 0.86)	**0.62 (0.45, 0.88)**
ITALY	0.93 (0.75, 1.21)	0.37 (0.28, 0.46)	**0.21 (0.07, 0.38)**
LITHUANIA	0.93 (0.75, 1.20)	0.70 (0.59, 0.86)	**0.72 (0.58, 0.88)**
LUXEMBOURG	0.92 (0.74, 1.20)	0.63 (0.53, 0.91)	**0.79 (0.65, 0.95)**
LATVIA	0.94 (0.74, 1.19)	0.81 (0.63, 1.07)	**0.83 (0.66, 1.09)**
MALTA	0.91 (0.72, 1.15)	0.68 (0.40, 1.47)	**0.68 (-0.08, 1.52)**
NETHERLANDS	0.92 (0.74, 1.19)	0.61 (0.51, 0.82)	**0.65 (0.49, 0.85)**
POLAND	0.93 (0.75, 1.20)	1.16 (0.99, 1.43)	**1.13 (0.99, 1.36)**
PORTUGAL	0.91 (0.74, 1.18)	0.46 (0.37, 0.55)	**0.35 (0.17, 0.58)**
ROMANIA	0.95 (0.77, 1.20)	1.11 (0.91, 1.36)	**1.10 (0.95, 1.32)**
SLOVAKIA	0.94 (0.74, 1.18)	**1.28 (1.10, 1.54)**	1.27 (1.09, 1.55)
SLOVENIA	0.94 (0.76, 1.24)	0.51 (0.43, 0.62)	**0.50 (0.37, 0.69)**
SPAIN	0.94 (0.76, 1.22)	0.36 (0.27, 0.46)	**0.24 (0.08, 0.44)**
SWEDEN	0.92 (0.73, 1.20)	0.89 (0.79, 1.04)	**0.88 (0.76, 1.04)**

The values in parenthesis are the 95% confidence bands of the estimates of d. In bold, the selected specification for each series on the basis of the statistical significance of the deterministic terms.

TABLE 2: Estimated coefficients in selected models. Sample ending in December 2019

Country	d	Intercept (tvalue)	Time trend (tvalue)
AUSTRIA	0.38 (0.23, 0.57)*	89.85 (136.43)	0.151 (15.81)
BELGIUM	0.75 (0.59, 0.96)*	89.77 (123.12)	0.152 (6.33)
BULGARIA	1.05 (0.92, 1.21)	94.81 (220.44)	0.101 (2.07)
CROATIA	0.87 (0.68, 1.20)	91.59 (262.58)	0.097 (5.30)
CYPRUS	0.80 (0.57, 1.27)	93.23 (116.31)	0.058 (1.81)
CZECK REP.	0.94 (0.77, 1.20)	91.86 (277.10)	0.139 (5.99)
DENMARK	0.79 (0.65, 0.97)*	92.79 (272.63)	0.080 (6.16)
ESTONIA	1.03 (0.84, 1.40)	85.42 (197.49)	0.210 (4.66)
FINLAND	1.00 (0.89, 1.16)	89.59 (299.99)	0.121 (4.43)
FRANCE	0.88 (0.72, 1.12)	92.78 (245.10)	0.105 (5.08)
GERMANY	0.80 (0.57, 1.36)	91.69 (194.51)	0.118 (6.30)
GREECE	0.43 (0.19, 0.70)*	98.98 (141.25)	0.028 (2.61)
HUNGARY	1.02 (0.85, 1.28)	87.57 (231.25)	0.196 (5.19)
IRELAND	0.62 (0.45, 0.88)*	96.02 (285.13)	0.048 (6.56)
ITALY	0.21 (0.07, 0.38)*	93.67 (186.50)	0.088 (12.81)
LITHUANIA	0.72 (0.58, 0.88)*	91.54 (209.81)	0.152 (11.74)
LUXEMBOURG	0.79 (0.65, 0.95)*	89.58 (139.49)	0.139 (5.65)
LATVIA	0.83 (0.66, 1.09)	91.73 (209.53)	0.137 (7.04)
MALTA	0.68 (-0.08, 1.52)	88.99 (83.56)	0.135 (4.87)
NETHERLANDS	0.65 (0.49, 0.85)*	90.90 (161.44)	0.125 (9.35)
POLAND	1.13 (0.99, 1.36)	91.32 (342.21)	0.134 (3.17)
PORTUGAL	0.35 (0.17, 0.58)*	93.74 (179.17)	0.092 (12.30)
ROMANIA	1.10 (0.95, 1.32)	85.21 (185.44)	0.210 (3.20)
SLOVAKIA	1.28 (1.10, 1.54)	91.16 (306.88)	-----
SLOVENIA	0.50 (0.37, 0.69)*	93.15 (189.36)	0.101 (12.34)
SPAIN	0.24 (0.08, 0.44)*	94.87 (202.44)	0.082 (12.79)
SWEDEN	0.88 (0.76, 1.04)	95.47 (245.74)	0.102 (4.80)

In parenthesis in the third and fourth columns the associated t-values.

TABLE 3: Estimated coefficients in selected models. Sample ending in January 2022

Country	D	Intercept (tvalue)	Time trend (tvalue)
AUSTRIA	0.42 (0.21, 0.65)*	89.63 (132.43)	0.156 (18.35)
BELGIUM	1.17 (0.62, 1.39)	88.82 (106.94)	-----
BULGARIA	1.16 (1.00, 1.34)	94.73 (207.85)	0.166 (2.10)
CROATIA	0.95 (0.75, 1.24)	91.51 (256.59)	0.115 (4.90)
CYPRUS	0.85 (0.37, 1.27)	93.25 (119.07)	-----
CZECK REP.	1.08 (0.86, 1.62)	91.79 (161.41)	0.228 (3.34)
DENMARK	1.05 (0.90, 1.26)	92.33 (236.28)	0.113 (2.77)
ESTONIIA	1.25 (1.03, 1.47)	85.30 (153.99)	0.304 (2.09)
FINLAND	1.14 (0.99, 1.36)	89.51 (283.12)	0.149 (2.98)
FRANCE	0.97 (0.79, 1.19)	92.69 (247.82)	0.114 (4.23)
GERMANY	1.06 (0.77, 1.54)	91.53 (181.47)	0.147 (2.67)
GREECE	0.38 (0.11, 0.73)*	99.48 (164.64)	0.020 (2.76)
HUNGARY	1.15 (0.98, 1.36)	87.49 (210.96)	0.274 (3.99)
IRELAND	0.87 (0.65, 1.16)	95.75 (241.35)	0.065 (3.55)
ITALY	0.18 (0.03, 0.34)*	93.79 (200.91)	0.082 (15.37)
LITHUANIA	1.03 (0.82, 1.24)	91.35 (185.86)	0.235 (5.02)
LUXEMBOURG	0.90 (0.76, 1.08)	89.31 (130.44)	0.152 (4.19)
LATVIA	0.97 (0.78, 1.21)	91.61 (205.66)	0.168 (5.23)
MALTA	0.91 (-0.07, 2.58)	88.10 (72.71)	0.126 (1.87)
NETHERLANDS	0.88 (0.67, 1.16)	90.28 (140.61)	0.157 (5.03)
POLAND	1.33 (1.17, 1.56)	91.23 (321.91)	0.258 (2.45)
PORTUGAL	0.38 (0.21, 0.62)*	93.83 (169.88)	0.083 (12.50)
ROMANIA	1.18 (1.03, 1.40)	85.17 (187.14)	0.271 (3.14)
SLOVAKIA	0.59 (0.41, 0.81)*	92.72 (180.54)	0.106 (12.10)
SLOVENIA	1.53 (1.23, 2.21)	91.18 (258.60)	-----
SPAIN	0.23 (0.03, 0.54)*	94.78 (195.97)	0.084 (15.34)
SWEDEN	0.97 (0.83, 1.15)	95.42 (222.67)	0.119 (3.86)

The values in parenthesis are the 95% confidence bands of the estimates of d. In bold, the selected specification for each series on the basis of the statistical significance of the deterministic terms.

TABLE 4: Estimated coefficients in selected models. Sample ending in December 2022

Country	d	Intercept (tvalue)	Time trend (tvalue)
AUSTRIA	0.96 (0.82, 1.10)	88.74 (141.98)	0.234 (5.62)
BELGIUM	1.21 (1.10, 1.34)	88.75 (99.47)	---
BULGARIA	1.35 (1.23, 1.49)	94.65 (210.26)	---
CROATIA	1.22 (1.07, 1.43)	91.39 (222.16)	0.221 (2.40)
CYPRUS	1.02 (0.83, 1.33)	92.71 (109.05)	0.125 (1.67)
CZECK REP.	1.42 (1.26, 1.74)	91.13 (165.31)	---
DENMARK	1.16 (1.03, 1.34)	92.21 (196.58)	0.172 (2.17)
ESTONIIA	1.40 (1.23, 1.65)	85.46 (122.19)	---
FINLAND	1.30 (1.17, 1.46)	89.46 (254.88.)	0.209 (1.85)
FRANCE	1.21 (1.08, 1.40)	92.53 (226.13)	0.174 (1.99)
GERMANY	1.18 (1.04, 1.43)	91.59 (157.00)	---
GREECE	0.82 (0.67, 0.97)*	96.12 (85.27)	0.089 (2.31)
HUNGARY	1.63 (1.49, 1.82)	87.64 (209.62)	---
IRELAND	1.17 (1.03, 1.35)	95.66 (211.71)	0.137 (1.71)
ITALY	0.50 (0.37, 0.77)*	93.57 (100.88)	---
LITHUANIA	1.30 (1.17, 1.43)	91.33 (164.27)	0.379 (2.12)
LUXEMBOURG	1.00 (0.88, 1.15)	89.13 (112.84)	0.192 (3.03)
LATVIA	1.42 (1.27, 1.69)	91.56 (159.41)	---
MALTA	0.95 (0.28, 2.88)	87.96 (70.51)	0.165 (2.08)
NETHERLANDS	0.96 (0.84, 1.11)	90.09 (94.95)	0.229 (3.61)
POLAND	1.43 (1.33, 1.58)	94.36 (241.10)	---
PORTUGAL	0.77 (0.60, 0.95)*	91.59 (120.29)	0.139 (6.24)
ROMANIA	1.31 (1.18, 1.48)	85.14 (178.01)	0.366 (2.28)
SLOVAKIA	0.94 (0.80, 1.10)	91.78 (155.03)	0.183 (5.09)
SLOVENIA	1.57 (1.42, 1.79)	91.18 (260.62)	---
SPAIN	0.69 (0.55, 0.83)*	92.14 (109.06)	0.140 (7.62)
SWEDEN	1.43 (1.28, 1.61)	95.19 (190.68)	---

In parenthesis in the third and fourth columns the associated t-values.

Table 5: Summary of the estimates of d

Country	December 2019	January 2022	December 2022
AUSTRIA	0.38 (0.23, 0.57)	0.42 (0.21, 0.65)	0.96 (0.82, 1.10)
BELGIUM	0.75 (0.59, 0.96)	1.17 (0.62, 1.39)	1.21 (1.10, 1.34)
BULGARIA	1.05 (0.92, 1.21)	1.16 (1.00, 1.34)	1.35 (1.23, 1.49)
CROATIA	0.87 (0.68, 1.20)	0.95 (0.75, 1.24)	1.22 (1.07, 1.43)
CYPRUS	0.80 (0.57, 1.27)	0.85 (0.37, 1.27)	1.02 (0.83, 1.33)
CZECK REP.	0.94 (0.77, 1.20)	1.08 (0.86, 1.62)	1.42 (1.26, 1.74)
DENMARK	0.79 (0.65, 0.97)	1.05 (0.90, 0.26)	1.16 (1.03, 1.34)
ESTONIIA	1.03 (0.84, 1.40)	1.25 (1.03, 1.47)	1.40 (1.23, 1.65)
FINLAND	1.00 (0.89, 1.16)	1.14 (0.99, 1.36)	1.30 (1.17, 1.46)
FRANCE	0.88 (0.72, 1.12)	0.97 (0.79, 1.19)	1.21 (1.08, 1.40)
GERMANY	0.80 (0.57, 1.36)	1.06 (0.77, 1.54)	1.18 (1.04, 1.43)
GREECE	0.43 (0.19, 0.70)	0.38 (0.11, 0.73)	0.82 (0.67, 0.97)
HUNGARY	1.02 (0.85, 1.28)	1.15 (0.98, 1.36)	1.63 (1.49, 1.82)
IRELAND	0.62 (0.45, 0.88)	0.87 (0.65, 1.16)	1.17 (1.03, 1.35)
ITALY	0.21 (0.07, 0.38)	0.18 (0.03, 0.34)	0.50 (0.37, 0.77)
LITHUANIA	0.72 (0.58, 0.88)	1.03 (0.82, 1.24)	1.30 (1.17, 1.43)
LUXEMBOURG	0.79 (0.65, 0.95)	0.90 (0.76, 1.08)	1.00 (0.88, 1.15)
LATVIA	0.83 (0.66, 1.09)	0.97 (0.78, 1.21)	1.42 (1.27, 1.69)
MALTA	0.68 (-0.08, 1.52)	0.91 (-0.07, 2.58)	0.95 (0.28, 2.88)
NETHERLANDS	0.65 (0.49, 0.85)	0.88 (0.67, 1.16)	0.96 (0.84, 1.11)
POLAND	1.13 (0.99, 1.36)	1.33 (1.17, 1.56)	1.43 (1.33, 1.58)
PORTUGAL	0.35 (0.17, 0.58)	0.38 (0.21, 0.62)	0.77 (0.60, 0.95)
ROMANIA	1.10 (0.95, 1.32)	1.18 (1.03, 1.40)	1.31 (1.18, 1.48)
SLOVAKIA	0.50 (0.37, 0.69)	0.59 (0.41, 0.81)	0.94 (0.80, 1.10)
SLOVENIA	1.28 (1.10, 1.54)	1.53 (1.23, 2.21)	1.57 (1.42, 1.79)
SPAIN	0.24 (0.08, 0.44)	0.23 (0.03, 0.54)	0.69 (0.55, 0.83)
SWEDEN	0.88 (0.76, 1.04)	0.97 (0.83, 1.15)	1.43 (1.28, 1.61)

FIGURE 1: Time series plots of the HICP series in the EU27 countries (2015=100)

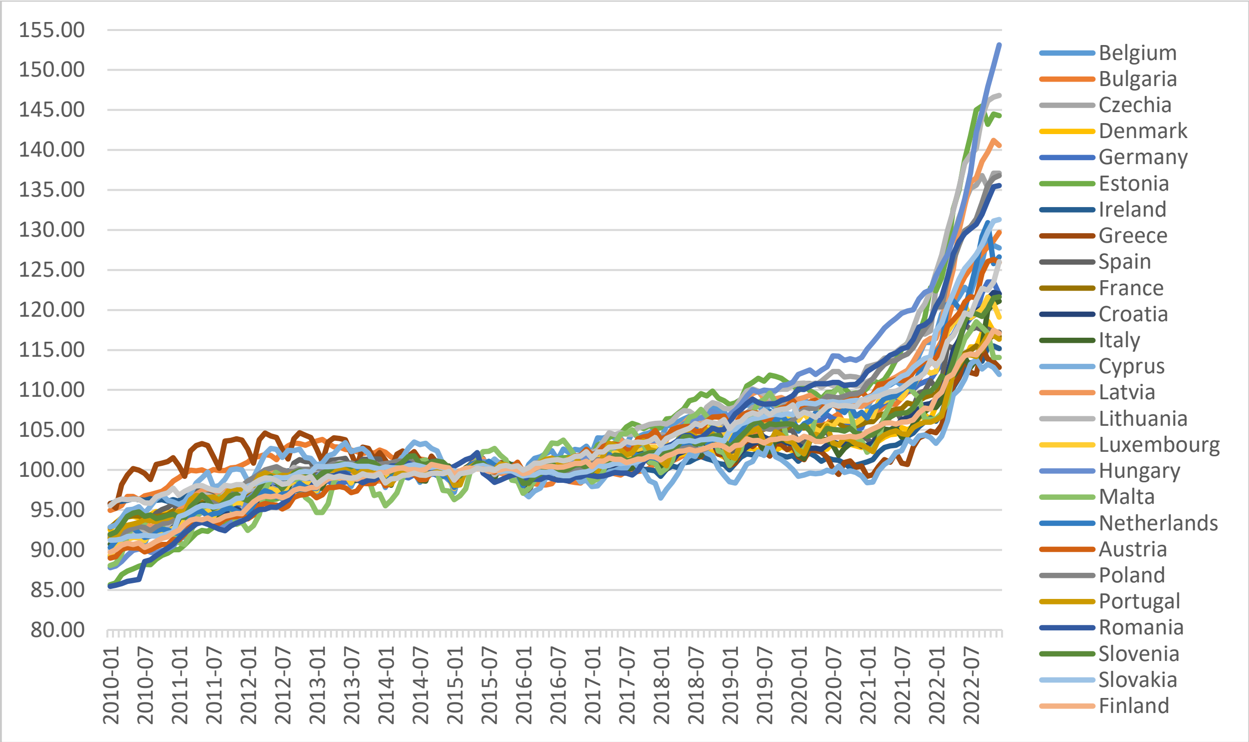
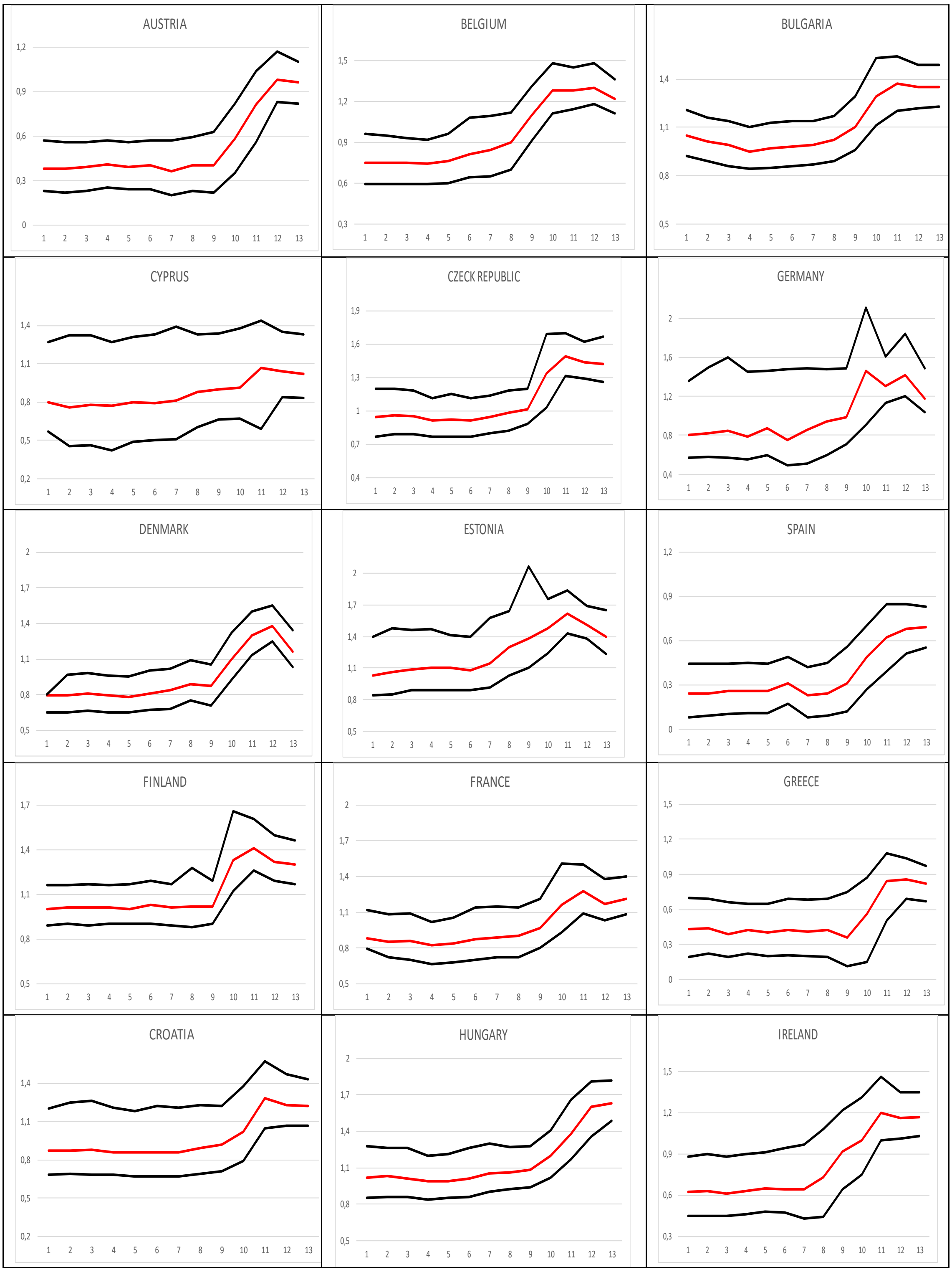
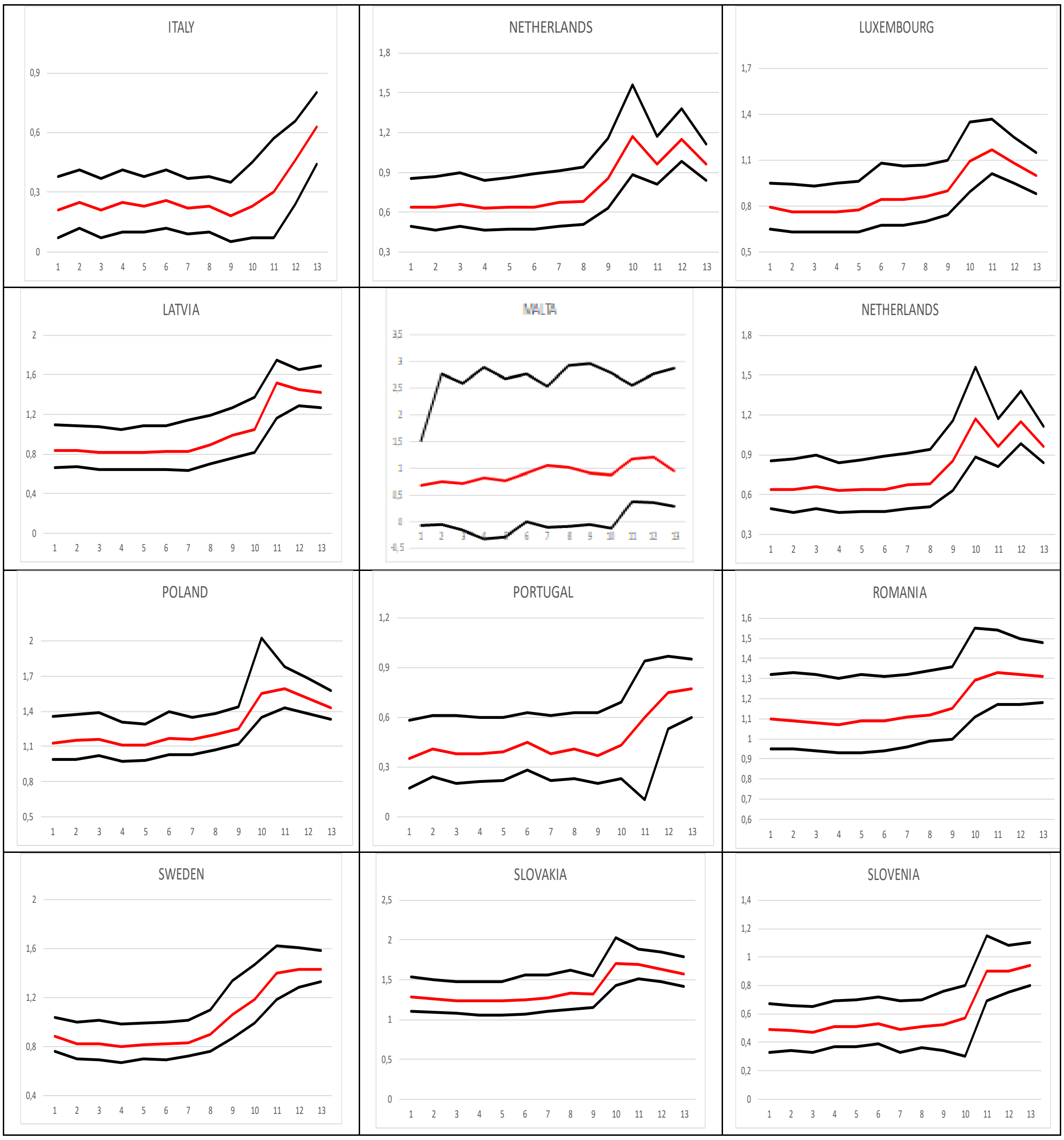


FIGURE 2: Price persistence




ITALY
NETHERLANDS
LUXEMBOURG
LATVIA
MALTA
NETHERLANDS
POLAND
PORTUGAL
ROMANIA
SWEDEN
SLOVAKIA
SLOVENIA