Budova, Jana; Sulikova, Veronika; Sinicakova, Marianna

Article

When Inflation Again Matters: Do Domestic and Global Output Gaps Determine Inflation in the EU?

Amfiteatru Economic

Provided in Cooperation with:
The Bucharest University of Economic Studies

Suggested Citation: Budova, Jana; Sulikova, Veronika; Sinicakova, Marianna (2023) : When Inflation Again Matters: Do Domestic and Global Output Gaps Determine Inflation in the EU?, Amfiteatru Economic, ISSN 2247-9104, The Bucharest University of Economic Studies, Bucharest, Vol. 25, Iss. 63, pp. 575-592, https://doi.org/10.24818/EA/2023/63/575

This Version is available at:
https://hdl.handle.net/10419/281719

WHEN INFLATION AGAIN MATTERS: DO DOMESTIC AND GLOBAL OUTPUT GAPS DETERMINE INFLATION IN THE EU?

Jana Budová[1*], Veronika Šuliková[2] and Marianna Siničáková[3]
[1)2)3)] *Technical University of Košice, Košice, Slovakia*

Please cite this article as:
Budová, J., Šuliková, V. and Siničáková, M., 2023. When Inflation Again Matters: Do Domestic and Global Output Gaps Determine Inflation in the EU?. *Amfiteatru Economic*, 25(63), pp. 575-592.

DOI: 10.24818/EA/2023/63/575

Article History:
Received: 25 November 2022
Revised: 6 March 2023
Accepted: 3 April 2023

Abstract
In this paper, we examine whether domestic or global output gap affects inflation in three panels: the European Union, the peripheral countries of the European Union, and the Eurozone. We have also analysed the impact of these variables on inflation in individual countries of the European Union. To find the determinants of inflation, we employ the Granger causality test and panel regression. The first examined period is from 1Q 1997 to 3Q 2020. The period between 1999 and 2020 is divided into two shorter periods – the precrisis (1999 – 2008) and postcrisis (2009-2020) period. The results of the study show that after the crisis the global output gap predicts the evolution of inflation in the Eurozone panel. On the other hand, the domestic output gap predicts inflation in the European Union. In the precrisis period, the determinant of inflation is the domestic output gap, specifically in the Eurozone panel. In the European Union panel and its peripheral economies, the global output gap determines inflation. In Italy, Lithuania, Estonia, Finland, Latvia, and the Netherlands, the domestic output gap determines inflation. The global output gap determines inflation in the Netherlands, Slovenia, Estonia, and Latvia. We demonstrated that there are two ways dependency among the variables.

Keywords: domestic output gap, global output gap, inflation, the Granger causality test, panel data model.

JEL Classification: E31, E32, E58.

[*] Corresponding author, **Marianna Siničáková** – e-mail: marianna.sinicakova@tuke.sk

Introduction

After a decade of exceptionally low inflation in the Eurozone well below the ECB (European central bank) target (according to Eurostat, the average inflation rate was 1.2% from 2012 to 2021), inflation issues reappeared at the end of 2021 and accelerated in 2022 (8.1% in May 2022). The situation is similar beyond the Eurozone. Numerous reports from other countries warn against the negative effects of price jumps, e.g., the inflation rate in the US hit 8.6% in May 2022, which is the highest rate among G7 countries (Sherman, 2022). Reasons for these inflation pressures stem from slow central bank responses; too long-lasting practise of quantitative easing; release of pandemic measures; lack of certain resources, raw materials, and stocks; business cycles, the war in Ukraine; deglobalization changes in the world, etc. It will be crucial to identify crucial inflation determinants to curb inflation pressures.

An essential indicator that helps policy makers to predict the behaviour of inflation is the output gap. This indicator is not easily observable, it must be estimated (for example, by means of a Hodrick-Prescott (HP) filter, a multivariate HP filter, a production function approach, a DSGE model, etc.). The formation of the relationship between these two variables dates to the middle of the 20th century; at present, the basis of this relationship is the New Keynesian Phillips curve (NKPC). The global output gap (GOG) appears to be a very important variable that can explain inflationary behaviour. The significant relationship between these variables may be mainly due to the integration of world markets that has taken place in recent years. This raises the question for many authors whether the determinant of inflation is the global output gap, the domestic output gap (DOG), or both.

The impact of both output gaps on inflation was analysed in an article by Jašová et al. (2020). The authors examined the impact of these two variables on inflation in two different groups of countries. The first group consisted of advanced countries, while the second group consisted of emerging economies. Several authors have dealt with the same issue, for example Çiçek (2012), Bianchi and Civelli (2015), Łyziak (2019), Busetti et al. (2021) and many others. The aim of the paper is to fill in the gap in existing research by estimating panel models that also include the global output gap and to compare the results of different methods. To our best knowledge, only five papers consider global output gaps in their models (Çiçek, 2012; Bianchi & Civelli, 2015; Łyziak, 2019; Jašová et al., 2020; Busetti et al., 2021) and other authors consider only domestic output gaps (Assenmacher-Wesche et al., 2008; Kendera, 2015).

This paper includes three objectives. First, we want to determine whether, in the current globalised world, inflation is influenced by the global rather than the domestic output gap. Subsequently, we want to identify other determinants of inflation. The final objective is to determine whether the impact of output gaps on inflation has changed in the post-crisis period (i.e. after 2008).

In this paper, we analyse whether inflation is determined by output gaps not only in specific countries of the European Union (EU), but also in selected panels. The paper analyses whether there is not only one-way but also two-way dependence between the variables. As inflation is currently in the centre of discussion, we are also trying to identify other determinants. The paper deals with the identification of inflation determinants in selected panels before the crisis in 2008 and in the post-crisis period.

1. Review of the scientific literature

There are currently many studies that examine the determinants of various macroeconomic variables. The interest in research in the field of driving forces of inflation is growing over time; the authors are trying to use various methods to determine its determinants. The subject of the research of most authors is one specific country or Eurozone; a small part of the contributions is focused on groups of countries including developed and emerging economies or the Visegrad group of countries. In most studies, the global output gap, the domestic output gap, the exchange rate, as well as interest rates appear to be important indicators of inflation.

The euro area countries were already researched by Gerlach & Svensson in 2003. The data on the indicators date back to 1980 when the Eurozone was not yet established. In 2018, Jarociński and Lenza (2018) dealt with inflation indicators in the Eurozone. The authors Busetti et al. (2021) used various methods to conclude that the output gap is the driving force behind inflation in the Eurozone. In addition to other variables that enter the econometric model, the authors mentioned above used the output gap as another variable. To avoid biasing the results, the econometric model must include control variables (Busetti et al., 2021).

The determinants of Chinese inflation, and specifically the impact of the output gap on this inflation, have been addressed in studies by the following groups of authors: Gerlach and Peng (2006), Zhang and Murasawa (2011), Zhang et al. (2017), Wang et al. (2022). Zhang et al. (2017) choose the global output gap as a potential determinant of inflation in China. The global output gap was measured by the weighted output gap of the 18 best Chinese trading partners. The authors recommend that the Bank of China address the impact of this global output gap because inflation would be easier to predict. The exchange rate was the indicator used in addition to the global output gap and the M2 monetary aggregate by the authors. Gerlach and Peng (2006) used this indicator only as an unobserved variable due to the difficult measurement of the impact on inflation.

Valadkhani (2014) and Tiwari et al. (2014) focused on advanced economies such as France and a group of countries: the United Kingdom, the US, and Canada. The period examined was rather the same. The authors chose the output gap as a variable that could be a determinant of inflation. Valadkhani (2014) also used the following indicators: wage rate, oil prices, and the nominal effective exchange rate (NEER). The authors of both studies pointed to the same result; the output gap determined inflation. Kendera (2015) focused on the determinants of inflation in the Visegrad Four countries. Łyziak (2019) focused on one of these countries - Poland. Kendera (2015) used a vector autoregressive model and the Granger causality test. The aim of both authors was to find out whether the output gap indicates inflation. Łyziak (2019) used both output gaps as determinants, i.e., the DOG and the GOG. Macroeconomic variables such as the interest rate and the exchange rate were included in the model by Kendera (2015), and in addition to these two variables, the author added the domestic output gap to his analysis. The global output gap loses its relevance in a model in which inflation is specified as core, i.e. it excludes food and energy (Łyziak, 2019).

Assenmacher-Wesche & Gerlach (2008), Bjørnland et al. (2008), and Çiçek (2012) dealt with the impact of output gaps on inflation in European countries, which are not members of the European Union. Island states with a high human development index were dealt with by Assenmacher-Wesche, Gerlach and Sekine (2008) and Abbas and Sgro (2011). Michaelides and Millos (2009) and Mohanty and John (2015) focused on two Asian countries, Russia, and India. In addition to the output gap, these authors also included oil prices and the fiscal

deficit in the model. The determinants of Russian inflation are high oil prices, but also the output gap (Michaelides and Millos, 2009). Andrei et al. (2022) enriched the existing literature by highlighting the importance of input price indices in the agricultural sector.

According to Kohlscheen and Moessner (2022), the output gap positively affects inflation in a panel that includes 35 countries. Similarly, to the authors mentioned, Jašová et al. (2020) examined the relationship between inflation and the output gap in a panel of countries. Jašová et al. (2020) focused on two panels. The first group consisted of emerging countries, and the second included advanced countries. In addition to the domestic output gap, the authors also included the global output gap in the model, with both output gaps representing the determinant of inflation. The panel consisting of emerging countries was characterised by the fact that after the crisis the impact of the global output gap on inflation declined and the impact of the domestic output gap on inflation remained stable. Exactly the opposite is true for the panel that includes advanced economies. The study by Manopimoke (2015) also looked at the impact of output gaps on inflation in emerging and advanced economies. In both panels, the determinant of inflation is the global output gap. The relationship between this gap and inflation is related to the degree of trade openness (TO). Finally, Szafranek (2021) pointed out that increased business cycle synchronisation explained strengthen price co-movements within EU economies.

2. Data

Firstly, we applied the Granger causality test, which includes 24 EU countries (the EU-27 except for Malta, Croatia, and Bulgaria, which have been excluded from our sample due to missing data). We used quarterly data from 1997 to 2020. The paper deals with the causality between these pairs of variables: DOG and GOG, DOG and inflation, GOG and inflation, NEER and inflation. Data are retrieved databases from Eurostat (2022a; 2022b; 2022c; 2022d; 2022e), the International Monetary Fund (2022a; 2022b; 2022c), and the World Bank (2022a; 2022b; 2022c). Each time series is tested for stationarity using the Augmented Dickey-Fuller (ADF) test, the Phillips-Perron (PP) test, and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test, similarly to the paper by Vyrostková and Mirdala (2022).

We used quarterly real gross domestic product (GDP) data to calculate the quarterly domestic output gap. The real GDP was seasonally adjusted, we computed potential GDP using the HP filter with smoothing parameter λ =1600, and the difference between real and potential GDP represented the domestic output gap. In order to calculate the global output gap, we first had to identify the main trading partners of the selected country. The main trading partners are economies, whose export or import accounts for at least 2% of the total volume of export or import (as Łyziak, 2019). We identified business partners based on data available from the World Integrated Trade Solution (2022) (indicators: export partner share in % and import partner share in %). Whereas the export or import of some economies did not account for at least 2% of the total volume of the export or import each year, we calculated the arithmetic average and identified all countries with an average of at least 2% as the main trading partners of the analysed country.

According to Łyziak (2019) we calculated the global output gap using the following formula:

$$\hat{y}_t^{gl} = \sum_{n=1}^{k} w^n \hat{y}_t^n \quad (1)$$

where:

k – the number of trading partners;

w^n – the weight of trading partner *n*;

$\hat{y}_t^n$ – the output gap in country *n*.

According to Borio and Filardo (2007), we calculated the weight of the trading partner *n* as the sum of exports and imports of the trading partner to country *j* divided by the total sum of exports and imports to country *j*.

In the second part of the paper, we estimate the panel data model for the EU-27. The annual data cover the time period from 1999 to 2020. This period was divided into two shorter periods: precrisis from 1999 to 2008 and postcrisis from 2009 to 2020.

Before analysing the determinants of inflation, we calculated the annual domestic and global output gap. Real GDP per capita data (i.e., GDP data at constant prices) were used to calculate the annual domestic output gap. The value of the smoothing parameter is $\lambda = 100$. The annual global output gap was calculated in the same way as the quarterly global output gap. We calculated trade openness as the sum of exports and imports in % of GDP. The annual nominal effective exchange rate is retrieved database from the Eurostat and unemployment (U) from the International Monetary Fund. We verified the stationarity of the dependent variable using unit root tests; data was stationary.

3. Research methodology

Using the Granger causality test and panel regression, we examined whether there is a statistically significant relationship between the global output gap and inflation and between the domestic output gap and inflation. The Granger causality test showed whether given output gaps determine inflation with a lag. The determinants of inflation in the pre-crisis and post-crisis periods were examined using panel regressions.

3.1. Granger causality testing

We were able to determine the direction of causality between variables using the Granger causality test. We looked at the relationship between the DOG and inflation and the GOG and inflation. The disadvantage of the Granger causality test is that it can only provide us with information on the one-way or two-way relationship between variables, but it cannot evaluate whether there is a positive or negative relationship between the variables.

The null hypothesis assumed that the variable "x" did not affect "y". The alternative hypothesis assumed that the variable "x" affects "y". We also tested the opposite direction. The null hypothesis assumed that the variable "y" did not affect "x". The alternative hypothesis assumed that the variable "y" affects "x". If we do not reject the null hypotheses at the chosen level of significance $\alpha = 0.05$ in both equations, then the variables will be independent (Baumöhl, 2009).

3.2. Panel data model

Using the panel data model, we examined the impact of selected variables on inflation within the following groups of countries: European Union (27), Eurozone (19), and rather peripheral countries of the EU (Greece, Cyprus, Lithuania, Latvia, Poland, Bulgaria, Croatia, Hungary, Romania, Czech Republic, Estonia). A total of 12 models were created. We analyse the impact of variables on inflation using adjusted equations:

Fixed effect model (FEM):

$$\pi_{it} = (\beta_0 + u_i) + \beta_1 DOG_{it} + \beta_2 NEER_t + \beta_3 U_{it} + \beta_4 TO_{it} + \varepsilon_{it} \quad (2)$$

$$\pi_{it} = (\beta_0 + u_i) + \beta_1 GOG_{it} + \beta_2 NEER_t + \beta_3 U_{it} + \beta_4 TO_{it} + \varepsilon_{it} \quad (3)$$

Random effect model (REM):

$$\pi_{it} = \beta_0 + \beta_1 DOG_{it} + \beta_2 NEER_t + \beta_3 U_{it} + \beta_4 TO_{it} + (u_i + \varepsilon_{it}) \quad (4)$$

$$\pi_{it} = \beta_0 + \beta_1 GOG_{it} + \beta_2 NEER_t + \beta_3 U_{it} + \beta_4 TO_{it} + (u_i + \varepsilon_{it}) \quad (5)$$

where:

π_{it} – inflation in country *i* at time *t*;

u_i – a fixed or random effect for countries or time periods;

DOG_{it} – the domestic output gap in country *i* at time *t*;

GOG_t – the global output gap in country *i* at time *t*;

$NEER_{it}$ – the nominal effective exchange rate in country *i* at time *t*;

U_{it} – an unemployment in country *i* at time *t*;

TO_{it} – a trade openness in country *i* at time *t*.

We created a correlation matrix to find out if any of the variables should be excluded from the model (if the correlation value was > 0.8) to avoid multicollinearity in these models.

The following tests are used to select the right type of panel model: the F-test or the Chow test, the LM test and the Hausman test (see Table no.1). The resulting model must meet certain assumptions. If any of the assumptions were not met, we solved this problem using the variation-covariance matrix using the Arellano method.

Table no. 1. Choosing the right type of panel model

Test	Null hypothesis	Model selection after H_0 rejection
F-test or Chow test	Pooled OLS is more convenient than the Fixed effects model (FEM)	FEM
Lagrange multiplier test	Pooled OLS is more convenient than the Random effects model (REM)	REM
Hausman test	The REM is more convenient than the FEM	FEM

Source: Own representation according to Park, 2011.

4. Research results and discussion

As stated previously, we dealt with causality between variables within 24 European countries (EU-27, except for Malta, Croatia, and Bulgaria). The analysis of inflation determinants performed by panel regression included countries, which were divided into three groups: i) members of the EU, ii) members of the Eurozone, and iii) peripheral countries of the EU.

The results of the Granger causality test, which includes the impact of output gaps on inflation in the countries of the European Union, are presented in (Table no. 2.). Inflation was determined by the domestic output gap in only six EU countries, namely Lithuania, Estonia, Latvia, Finland, Italy, the Netherlands, and Lithuania. In Estonia and Lithuania, the domestic output gap affected inflation with a lag of one, two, and three quarters. In the Netherlands, inflation was influenced by the domestic output gap with lags of one, two, three, and four quarters, in Finland and Latvia with lag of one quarter only, and in Italy with lag of three quarters. The causality from the domestic output gap to inflation has been demonstrated in more countries using one lag than using two or four lags. In Lithuania, the Netherlands, and Estonia, inflation is determined by the domestic output gap at the 0.05 significance level using a lag of one quarter.

The causality from the global output gap to inflation has not been confirmed in many EU countries. In the Netherlands and Latvia, the global output gap influenced inflation with lag of one, two, three, and four quarters. When we used a lag of two quarters, the number of countries where inflation was affected by the global output gap increased. These countries were Slovenia and Estonia.

Table no. 2. Granger causality testing: domestic output gap → inflation; global output gap → inflation

Country	Causality	p-value			
		1 Lag	2 Lags	3 Lags	4 Lags
Estonia	DOG → HICP	0.0009 ***	0.0196 *	0.0871 .	0.2704
	GOG → HICP	0.101	0.0413 *	0.8931	0.3568
Finland	DOG → HICP	0.0566 .	0.1878	0.228	0.6119
	GOG → HICP	0.4444	0.2208	0.5375	0.913
Netherlands	DOG → HICP	0.0002 ***	0.0015 **	0.005 **	0.0192 *
	GOG → HICP	0.0005 ***	0.0027 **	0.0075 **	0.04791 *
Italy	DOG → HICP	0.1511	0.1726	0.0357 *	0.2409
	GOG → HICP	0.1732	0.2855	0.2647	0.6136
Latvia	DOG → HICP	0.0974 .	0.1675	0.7259	0.9687
	GOG → HICP	0.0049 **	0.0064**	0.0427 *	0.0594 .
Lithuania	DOG → HICP	0.0127 *	0.0162 *	0.0211 *	0.1558
	GOG → HICP	0.5115	0.4306	0.6622	0.7878
Slovenia	DOG → HICP	0.5196	0.1637	0.1701	0.4624
	GOG → HICP	0.3351	0.0746 .	0.2752	0.5997

Note: ***=0.001, **=0.01, *=0.05, .=0,1 indicate 0.1%, 1%, 5%, 10% significance level; DOG: domestic output gap; GOG: global output gap; values are rounded to 4 decimal places.

We report the results of the Granger causality test, which includes the impact of inflation on output gaps in the European Union countries, in (Table no. 3.). In Slovakia, the domestic output gap is affected by inflation with a lag of four quarters, Germany is the only country where the domestic output gap is affected by inflation with lags of one, two, three, and four quarters. In Cyprus, Lithuania, Estonia, Germany, Slovakia, and the Netherlands, inflation influences the domestic output gap using a lag by four quarters at the 0.05 significance level.

The causality in the direction from inflation to the global output gap has been confirmed in many EU countries using larger lags. In eight EU countries, using a lag of three quarters, we confirmed the impact of the global output gap on inflation. Inflation was influenced by the global output gap in Estonia, Latvia, Hungary, Ireland, Spain, Germany, Greece, the Netherlands, Lithuania, and Portugal.

Table no. 3. Granger causality testing: inflation → domestic output gap; inflation→ global output gap

Country	Causality	p-value			
		1 Lag	2 Lags	3 Lags	4 Lags
Austria	HICP → DOG	0.6395	0.9973	0.0321 *	0.0952 .
	HICP → GOG	0.2699	0.7486	0.6057	0.8317
Cyprus	HICP → DOG	0.5153	0.1598	0.0618 .	0.04 *
	HICP → GOG	0.4032	0.4655	0.2542	0.3709
Germany	HICP → DOG	0.0064 **	0.0038 **	0.0055 **	0.0246 *
	HICP → GOG	0.0035 **	0.0041 **	0.0021 **	0.0072**
Greece	HICP → DOG	0.0582 .	0.1761	0.1184	0.1728
	HICP → GOG	0.9058	0.0074 **	0.0167 *	0.0255 *
Portugal	HICP → DOG	0.5902	0.564	0.1434	0.298
	HICP → GOG	0.741	0.1063	0.0828 .	0.1494
Slovakia	HICP → DOG	0.2468	0.515	0.3201	0.0105 *
	HICP → GOG	0.9817	0.5932	0.6149	0.8987
Belgium	HICP → DOG	0.0873 .	0.592	0.5836	0.3542
	HICP → GOG	0.1488	0.4754	0.2947	0.4618
Hungary	HICP → DOG	0.1557	0.2067	0.1222	0.1848
	HICP → GOG	0.0766 .	0.1942	0.3189	0.495
Ireland	HICP → DOG	0.2306	0.1696	0.3224	0.1596
	HICP → GOG	0.9595	0.0425 *	0.0019 **	0.0088 **
Luxembourg	HICP → DOG	0.0836 .	0.5017	0.6132	0.3082
	HICP → GOG	0.898	0.1227	0.1776	0.3044
Spain	HICP → DOG	0.5555	0.4377	0.7537	0.7844
	HICP → GOG	0.4183	0.0743 .	0.1354	0.2081
Estonia	HICP → DOG	0.6319	0.0008 ***	0.0010 **	0.0233 *
	HICP → GOG	0.0921 .	0.0151 *	0.0491 *	0.0906 .
Netherlands	HICP → DOG	0.0573 .	0.2473	0.0102 *	0.0317 *
	HICP → GOG	0.1705	0.6246	0.0144 *	0.0479 *
Latvia	HICP → DOG	0.2782	0.0859 .	0.1797	0.1046
	HICP → GOG	0.0824 .	0.0918 .	0.0101 *	0.03 *
Lithuania	HICP → DOG	0.5204	0.0016 **	0.0024 **	0.0134 *
	HICP → GOG	0.3555	0.4078	0.0003 ***	0.0057 **
Slovenia	HICP → DOG	0.9917	0.0995 .	0.2339	0.5631
	HICP → GOG	0.5646	0.119	0.2596	0.8855

Note: ***=0.001, **=0.01, *=0.05, .=0,1 indicate 0.1%, 1%, 5%, 10% significance level; DOG: domestic output gap; GOG: global output gap; values are rounded to 4 decimal places.

The results of the estimated panel models are displayed in (Table no. 4.). Panel 1 and Panel 2 cover the 27 countries of the European Union in the pre-crisis period i.e., from 1999 to 2008. The domestic output gap is added to the equation of the model Panel 1 as an independent variable, while the global output gap is also included as an explanatory variable but in the model Panel 2. The equations for Panel 3 and Panel 4 are different from Panel 1

and Panel 2 only by the selection of periods, which in these cases is the post-crisis period, i.e., 2009-2020. Inflation is determined as an explanatory variable in each model, and inflation is expressed by the consumer price index (CPI). All four models are balanced and have been adjusted using a variation-covariance matrix, due to unfulfilled assumptions. The tables display the values of estimates considering individual and time effects. A random-effects model was chosen for Panel 1 based on the Hausman test. In the pre-crisis period, the domestic output gap does not affect inflation. On the other hand, the NEER is a variable that has a significant impact on inflation. For Panel 2, a fixed effects model was chosen, and as in the previous case, the NEER affects inflation. In the precrisis period, inflation in this panel was determined by the global output gap, and its impact was positive.

For panels that consisted of EU countries but included the post-crisis period, a fixed-effects model was chosen. The results differ from the previous two panels. In Panel 3, inflation is determined by the domestic output gap, not by the NEER, and the effect of the output gap on inflation is positive. Panel 4 is characterised by the fact that inflation is not determined by any variable.

Table no. 4. Panel regression estimations: members of the European Union

	Y = CPI			
	Pre-crisis period (1999-2008) EU27		**Post-crisis period (2009-2020) EU27**	
Name of panel	**PANEL 1**	**PANEL 2**	**PANEL 3**	**PANEL 4**
Model Type	*REM*	*FEM*	*FEM*	*FEM*
Sample size	n=27, T=10, N=270		n=27, T=12, N=324	
	Estimate			
Intercept	-19.6866904 ***	-	-	-
NEER	0.221946 ***	0.225073***	-0.0017910	-0.0045703
U	-0.242561	-0.053919	-0.0298181	-0.0571298
TO	-0.036479	-0.032753	-0.0061736	-0.0056583
DOG	-0.079492	does not enter the model	0.1261731 .	does not enter the model
GOG	does not enter the model	0.028061*	does not enter the model	0.0042038

Note: ***=0.001, **=0.01, *=0.05, .=0,1 indicate 0.1%, 1%, 5%, 10% significance level; p-value of assumption tests (before modifying models): Breusch-Godfrey – Panel 1: < 2.2e-16, Panel 2: < 2.2e-16, Panel 3: 5.174e-06, Panel 4: 4.967e-06, Pesaran CD test – Panel 1: 0.3181, Panel 2: 0.1143, Panel 3: 0.2215, Panel 4: 0.2295, Breusch-Pagan – Panel 1: 1.704e-07, Panel 2: 5.755e-07, Panel 3: 0.0006397, Panel 4: 0.001098; DOG: domestic output gap; GOG: global output gap; NEER: nominal effective exchange rate; U: unemployment; TO: trade openness; REM: Random Effect Model; FEM: Fixed Effect Model.

Secondly, we estimated for the Eurozone countries (Panel 5, Panel 6, Panel 7, and Panel 8) and divided the time series into precrisis and postcrisis periods so that we could compare the

determinants of inflation in different time laps (see Table no. 5.). Panel 5 and Panel 6 contain 190 observations, and Panel 7 and Panel 8 include 228 observations. According to Hausman's test, a fixed-effects model was selected for each of the panels. All models are balanced. As in the previous cases, inflation is the explanatory variable and is expressed through the CPI. The domestic output gap was chosen as the independent variable for Panel 5 and Panel 7, and the global output gap for Panel 6 and Panel 8. Panel 5 is characterised by the fact that inflation in the precrisis period was determined by the domestic output gap and unemployment. A negative statistically significant relationship, respectively, Phillips curve was confirmed between unemployment and inflation. Inflation is positively influenced by the domestic output gap. In the precrisis period, specifically in Panel 6, inflation in countries using the euro is not affected by the global output gap. In the postcrisis period, the model results are consistent in confirming the Phillips curve. In Panel 7, inflation was not affected by the domestic output gap. In this panel, the only determinant of inflation is unemployment. We confirmed the impact of the global output gap on inflation using a fixed-effects model in Panel 8 (positive relationship). In this panel, the Phillips curve was also confirmed, i.e. inflation is determined by unemployment (negative relationship).

Table no. 5. Panel regression estimations: members of the Eurozone

	Y = CPI			
	Pre-crisis period (1999-2008) Eurozone		**Post-crisis period (2009-2020) Eurozone**	
Name of panel	**PANEL 5**	**PANEL 6**	**PANEL 7**	**PANEL 8**
Model Type	*FEM*	*FEM*	*FEM*	*FEM*
Sample size	n=19, T=10, N=190		n=19, T=12, N=228	
	Estimate			
Intercept	-	-	-	-
NEER	-0.110020	-0.1215409	0.10420627	0.1286238
U	-0.194136 .	-0.2812193 *	-0.09019873 .	-0.0830031 .
TO	-0.027074	-0.0245223	-0.00181307	-0.0022815
DOG	0.277703 .	does not enter the model	0.00091931	does not enter the model
GOG	does not enter the model	0.0126005	does not enter the model	0.0036462 .

Note: ***=0.001, **=0.01, *=0.05, .=0,1 indicate 0.1%, 1%, 5%, 10% significance level; p- value of assumption tests (before modifying models): Breusch-Godfrey – Panel 5: 4.124e-07, Panel 6: 2.618e-07, Panel 7: 0.0008463, Panel 8: 0.0004075, Pesaran CD test – Panel 5: 0.4705, Panel 6: 0.4236, Panel 7: 0.1901, Panel 8: 0.1805, Breusch-Pagan – Panel 5: 0.0272, Panel 6: 0.01873, Panel 7: 0.0007275, Panel 8: 0.0005572; DOG: domestic output gap; GOG: global output gap; NEER: nominal effective exchange rate; U: unemployment; TO: trade openness; FEM: Fixed Effect Model.

We have chosen the following countries as peripheral countries of the EU: Greece, Cyprus, Lithuania, Latvia, Poland, Belgium, Croatia, Hungary, Romania, the Czech Republic, and Estonia. Using the Hausman test, we choose a random effects model for Panel 9 and Panel

10 (precrisis period) and a fixed effects model for Panel 10 and Panel 11 (postcrisis period). Panel 9 and Panel 11 included the domestic output gap. The global output gap was chosen as the independent variable in Panel 10 and Panel 12. The other independent variables were the same as in the previous models. All models were balanced and modified by the variation-covariance matrix, due to the non-fulfilment of some assumptions. The number of observations in both periods is lower than for panels covering the EU-27 or the Eurozone, as this group of countries consists of only 11 countries. Panel 9 is in line with the result of Panel 1 (EU-27), i.e., in the pre-crisis period in Panel 9, only the NEER determines inflation, which affects it positively. The Phillips curve is not confirmed in Panel 1 and in Panel 9. In this period, inflation is also not affected by the domestic output gap. Panel 10 contains the largest number of statistically significant variables, implying that we have confirmed the Phillips curve for the peripheral EU countries in the precrisis period. In Panel 10, inflation is positively affected by NEER and the global output gap, and inflation is negatively influenced by unemployment (see Table no. 6.).

Table no. 6. Panel regression: The EU peripheral countries

	Y = CPI			
	Pre-crisis period (1999-2008) Peripheral countries of the EU		**Post-crisis period (2009-2020) Peripheral countries of the EU**	
Name of panel	**PANEL 9**	**PANEL 10**	**PANEL 11**	**PANEL 12**
Model Type	*REM*	*REM*	*FEM*	*FEM*
Sample size	n=11, T=10, N=110		n = 11, T = 12, N = 132	
	Estimate			
Intercept	-15.762817 ***	-16.266718 ***	-	-
NEER	0.241407 ***	0.225786 ***	-0.0220084	-0.0240888
U	-0.463266	-0.357233 .	-0.0799858 *	-0.0894396 **
TO	-0.038014	-0.017890	-0.0088467	-0.0090380
DOG	0.502940	does not enter the model	0.0434610	does not enter the model
GOG	does not enter the model	0.047585 **	does not enter the model	0.0012092.

Note: ***=0.001, **=0.01, *=0.05, .=0,1 indicate 0.1%, 1%, 5%, 10% significance level; p-value of assumption tests (before modifying models): Breusch-Godfrey – Panel 9: 7.273e-07, Panel 10: 2.276e-06, Panel 11: 0.08176, Panel 12: 0.07494, Pesaran CD test – Panel 9: 0.07908, Panel 10: 0.04949, Panel 11: 0.01244, Panel12: 0.01285, Breusch-Pagan – Panel 9: 7.1e-05, Panel 10: 3.792e-05, Panel 11: 0.07317, Panel 12: 0.5669; DOG: domestic output gap; GOG: global output gap; NEER: nominal effective exchange rate; U: unemployment; TO: trade openness; REM: Random Effect Model; FEM: Fixed Effect Model.

We also confirmed similar findings by using cross-correlations and Vector Autoregressive (VAR) models (see Table no. 7. to compare the results of different methods). The impact of other determinants of inflation is shown in (Table no. 8.).

Using the Granger causality test, we find that inflation is determined by the domestic output gap rather than the global output gap in a larger number of countries. In the Netherlands, Latvia, and Estonia, inflation is affected by both gaps. The VAR model was used to further identify the relationships, again concluding that the domestic output gap is the determinant of inflation in a large number of countries. In each of the countries studied, we confirmed a positive relationship between DOG and inflation and a negative relationship between GOG and inflation. The Portuguese and Estonian inflation is affected by both output gaps. The global output gap has the highest ability to explain the variability of inflation in a larger number of countries than the domestic output gap and affects inflation in the precrisis period in two groups of countries: the EU and the EU peripheral countries. In the pre-crisis period, the panel consisting of the peripheral countries of the European Union is characterised only by the impact of the GOG on inflation. The DOG is the driving force behind inflation in the Eurozone before the crisis and in the European Union after the crisis (see Table no.7.).

Table no. 7. Comparison of results of different methods

Method	The results
Granger causality test	**Determinant of inflation:** • **DOG:** Estonia, Finland, the Netherlands, Lithuania, Latvia, Italy • **GOG:** Latvia, the Netherlands, Estonia, Slovenia • **DOG+GOG:** Estonia, the Netherlands, Latvia
VAR models	**Determinant of inflation:** • **DOG:** Luxembourg* (+), Greece* (+), Portugal* (+), Italy **.** (+), Estonia **.** (+) • **GOG:** Portugal* (-), Estonia* (-) • **DOG+GOG:** Estonia **.** and Portugal*
Decomposition of variability and IRF	**Determinant of inflation:** (we consider the tenth quarter) • **DOG** has the highest ability to explain inflation variability in: Greece and *Luxembourg.* • **GOG** has the highest ability to explain inflation variability in: *Estonia, Italy, and Portugal.* In Greece and Luxembourg, inflation is responding *positively* to the DOG shock. In Estonia, the inflation response to the impulse of the GOG is *negative.* In Portugal, the inflation response to the shock is *positive.*
Cross correlations	**Correlation between:** • **DOG and inflation:** a slight correlation between DOG and inflation was confirmed in Germany. • **GOG and inflation:** a slight correlation between GOG and inflation was confirmed in Germany and Latvia.
Panel regression	**Determinant of inflation in the pre-crisis period:** • **DOG:** Eurozone **.** (+) • **GOG:** European Union* (+), the EU peripheral countries** (+) **Determinant of inflation in the post-crisis period:** • **DOG:** European Union **.** (+) • **GOG:** Eurozone **.** (+)

Note: (+): positive relationship; (-): negative relationship; DOG: domestic output gap; GOG: global output gap; IRF: Impulse response function, ***=0.001, **=0.01, *=0.05, **.**=0,1 indicate 0.1%, 1%, 5%, 10% significance level.

Using the Granger causality test, we find that NEER is a determinant of inflation in 10 EU countries, and, on the other hand, using VAR models in 11 EU countries. The result matched the results of the Granger causality test in Belgium, the Czech Republic, Estonia, Finland, and Romania. Trade openness does not determine inflation in any panel in the pre-crisis or post-crisis period. In the precrisis period, the NEER is a determinant of inflation in peripheral EU countries and in the panel consisting of EU countries. In the post-crisis period, it has no effect on inflation in any panel. In the EU countries, unemployment does not affect inflation in either period but is a determinant of inflation in the Eurozone and the peripheral EU countries (see Table no. 8.).

Table no. 8. Other determinants of inflation

Method	The results
Granger causality test	**Determinant of inflation:** • **NEER:** Lithuania, Belgium, Hungary, Slovakia, Czech Republic, Estonia, Finland, Italy, Ireland, Romania
VAR models	**Determinant of inflation:** • **NEER:** France **(-), Belgium* (-), Spain* (-), Romania** (+), Austria*** (-), Germany* (-), Denmark **.** (-), Finland** (-), Czech Republic** (-), Poland*** (-), Estonia **.** (-)
Decomposition of variability and IRF	**Determinant of inflation:** (we consider the second quarter) • **NEER** has the highest ability to explain inflation variability in *Estonia*. Inflation responds negatively to the nominal effective exchange rate shock in Estonia.
Panel regression	**Determinant of inflation in the pre-crisis period:** • **NEER:** European Union *******(+), the EU peripheral countries***(+) • **U:** Eurozone **.** (PANEL 5) *(PANEL 6) (-), the EU peripheral countries **.** (-) **Determinant of inflation in the post-crisis period:** • **NEER:** is not the driving force behind inflation in any panel • **U:** Eurozone **.** (-), Peripheral countries of the EU *(PANEL 11), **(PANEL 12) (-) **TO:** is not the driving force behind inflation in any panel

Note: (+): positive relationship; (-): negative relationship; * → Panel 10; NEER: nominal effective exchange rate; U: unemployment; TO: trade openness; IRF: Impulse response function, ***=0.001, **=0.01, *=0.05, **.**=0,1 indicate 0.1%, 1%, 5%, 10% significance level.

A comparison of the results with other studies is shown in (Table no. 9.). Busetti et al. (2021) included NEER, GOG, and DOG (and other variables) in the model, which we also employed in our research. The results of our study show that before the crisis the domestic output gap affects inflation and after the crisis the global output gap. Unlike Busetti et al. (2021), we did not define the NEER as a determinant of inflation. Jarociński and Lenza (2018) argue that in countries that use the euro, DOG affects inflation after 2012 (the period analysed is from 3Q 2002 to 4Q 2015). Based on the results of our study, we argue that post-crisis GOG is a determinant of inflation. Kendera (2015) confirmed the impact of DOG on inflation in Slovakia using the VAR model, but we did not confirm this relationship. Using the Granger causality test, the author demonstrated a statistically significant relationship between inflation and DOG in other V4 countries. Tiwari, Oros and Albulescu (2014) examined the impact of DOG on French inflation, and the results of their study show that there is a significant relationship between these variables. Our results do not match because we only

defined NEER as a determinant of French inflation. Similarly, to our study, the paper by Gerlach and Svensson (2003) examined the impact of the output gap on inflation in the Eurozone countries. According to our results, before the crisis, inflation was determined by the output gap. According to the authors, it is appropriate to consider output gap when judging price pressures. The results may be different due to the use of different econometric methods, time periods, and the addition of other variables to the model.

Table no. 9. Confrontation of results

Author	Variable	Country	The impact of the variable	Our results
Busetti et al. (2021)	NEER	Eurozone	confirmed	unconfirmed
	DOG		confirmed	confirmed (pre-crisis period)
	GOG		confirmed	confirmed (post-crisis period)
Jarociński, Lenza (2018)	DOG	Eurozone	confirmed	unconfirmed (post-crisis period)
Kendera (2015)	DOG	Slovakia	confirmed	unconfirmed
		Czech Republic	confirmed	unconfirmed
		Hungary	confirmed	unconfirmed
		Poland	confirmed	unconfirmed
Tiwari, Oros, Albulescu (2014)	DOG	France	confirmed	unconfirmed
Gerlach, Svensson (2003)	DOG	Eurozone	confirmed	confirmed (pre-crisis period)

Note: other authors, such as Assenmacher-Wesche and Gerlach (2008), Michaelides and Millos (2009), Abbas and Sgro (2011), Zhang and Murasawa (2011), Çiçek (2012), Valadkhani (2014), Mohanty and John (2015), Jašová, et al. (2020) dealt with other countries (for instance: Australia, China, USA, Canada, United Kingdom, Turkey, Russia, Switzerland); NEER: nominal effective exchange rate, DOG: domestic output gap, GOG: global output gap.

Conclusions

The main aim of the contribution was to analyse the impact of domestic and global output gaps on inflation. We used quarterly data from 1Q 1997 to 3Q 2020 and annual data divided into two periods - precrisis from 1999 to 2008 and the postcrisis period from 2009 to 2020. Annual data was used in panel regression models; quarterly data were used in the Granger causality test. Before our analysis, we estimated the quarterly and annual domestic output gap via the HP filter, and we calculated the quarterly and annual global output gap.

The results of our analysis, conducted via the Granger causality test, show that in Lithuania, Estonia, the Netherlands, Finland, and Latvia, inflation is affected by the domestic output gap with a lag by one quarter. In the Netherlands and Latvia, inflation is influenced by the global output gap with a lag of one quarter. Both gaps are determinants of inflation with a lag of one quarter only in the Netherlands and Latvia.

Through panel regressions, we find that precrisis inflation is affected by unemployment and the domestic output gap, specifically in the panel that includes Eurozone countries. In the EU, the global output gap and the NEER are determinants of inflation, and in the peripheral EU countries, inflation is determined by the global output gap, unemployment, and the NEER. After the crisis, variables such as trade openness and the nominal effective exchange rate did not determine inflation in any group of countries. The global output gap and unemployment were determinants of inflation in the group of countries using the euro. In the EU countries, the domestic output gap influenced inflation, and in the peripheral EU countries, unemployment affected inflation. Trade openness has not determined inflation in any period. The impact of the domestic output gap on inflation strengthened in the EU countries after the crisis, while it weakened in the euro area countries. The reverse was true for the global output gap, but a weakening of the impact is also observed in the EU periphery countries.

Regarding policy implications, the results of our study show that, contrary to common practise, economic policy makers should take into account not only the domestic output gap but also the global output gap in inflation forecasting models. According to our results, inflation is affected by the global output gap in the Eurozone (post-crisis period) and in individual EU countries. It seems that the current inflation crisis starting in 2022 is even more sensitive to global effects, therefore, the global output gap cannot be neglected neither in forecasting or policy decision process. A limitation of our study is the lack of focus on energy shocks and oil prices. We did not deal with the topic of energy shock and oil price, because of the current turbulent fluctuations in the markets. For this reason, the research results would not be relevant. If longer time series are available, the topic will be suitable for future research. In addition, it would be appropriate to examine determinants of inflation in Estonia and other rather small EU countries, as their inflation (fragility of the country and sensitivity to external shocks) is currently remarkably high.

References

Abbas, S.K. and Sgro, P.M., 2011. New Keynesian Phillips Curve and Inflation Dynamics in Australia. *Economic Modelling*, 28(4), article no. 2022-2033. https://doi.org/10.1016/j.econmod.2011.04.002

Andrei, J.V., Rădulescu, I. D., Erokhin, L.C.V., Nancu, D., Gao, T. and Vasić, M., 2022. A short descriptive analysis of the European evolutions of input price indices of agricultural products between 2008-2017: patterns, trends and implications. *Strategic Management*, 27(3), pp.039-047. https://doi.org/10.5937/StraMan2200018A

Assenmacher-Wesche, K. and Gerlach, S., 2008. Money Growth, Output Gaps and Inflation at Low and High Frequency: Spectral Estimates for Switzerland. *Journal of Economic Dynamics and Control*, 32(2), pp.411-435. https://doi.org/10.1016/j.jedc.2007.02.002

Assenmacher-Wesche, K., Gerlach, S. and Sekine, T., 2008. Monetary Factors and Inflation in Japan. *Journal of the Japanese and International Economies*, 22(3), pp.343-363. https://doi.org/10.1016/j.jjie.2007.09.00

Baumöhl, E., 2009. Analýza vzájomného vzťahu akciových trhov a HDP - Grangerov test kauzality. *Národohospodářský obzor*, [e-journal] 9(1), pp.5-20. Available at: <http://nho.econ.muni.cz/> [Accessed 13 May 2022].

Bianchi, F. and Civelli, A., 2015. Globalization and Inflation: Evidence from a Time-varying VAR. *Review of Economic Dynamics*, 18(2), pp.406-433. https://doi.org/10.1016/j.red.2014.07.004

Bjørnland, H.C., Brubakk, L. and Jore, A.S., 2008. Forecasting Inflation with an Uncertain Output Gap. *Empirical Economics*, [35(3), pp. 413-436. https://doi.org/10.1007/s00181-007-0165-y

Borio, C. and Filardo, A., 2007. Globalisation and Inflation: *New Cross-country Evidence on the Global Determinants of Domestic Inflation.* [pdf] Available at: <https://eml.berkeley.edu/~webfac/eichengreen/e183_sp07/global_infla.pdf> [Accessed 13 May 2022].

Busetti, F., Caivano, M .and Delle Monache, D., 2021. Domestic and Global Determinants of Inflation: Evidence from Expectile Regression. *Oxford Bulletin of Economics and Statistics*, 83(4), pp.982-1001. https://doi.org/10.1111/obes.12428

Çiçek, S., 2012. Globalization and Flattening of Phillips Curve in Turkey between 1987 and 2007. *Economic Modelling*, 29(5), pp.1655-1661. https://doi.org/10.1016/j.econmod.2011.12.019

Eurostat, 2022a. *GDP and Main Components (Output, Expenditure, and Income)*. [online] Eurostat. Available at: <https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=namq_10_gdp&lang=en> [Accessed 24 January 2022].

Eurostat, 2022b. *HICP – Inflation Rate*. [online] Eurostat. Available at: <https://ec.europa.eu/eurostat/databrowser/view/tec00118/default/table?lang=en&fbclid=IwAR3iXtvQnt_nYYDX9pFhKg2rD3vCfrwQOcv1HBKXSwWQq35VyMwwBwwh8us> [Accessed 21 June 2022].

Eurostat, 2022c. *HICP – Monthly Data (annual rate of change).* [online] Eurostat. Available at: <https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_hicp_manr&lang=en> [Accessed 24 January 24 2022].

Eurostat, 2022d. *Industrial Countries' Effective Exchange Rates - Quarterly Data.* [online] Eurostat. Available at: <http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_eff_ic_q&lang=EN> [Accessed 24 January 2022].

Eurostat, 2022e. *Industrial Countries' Effective Exchange Rates - Annual.* [online] Eurostat. Available at: <https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_eff_ic_a&lang=en> [Accessed 24 January 2022].

Gerlach, S. and Svensson, L., 2003. Money and inflation in the euro area: a case for monetary indicators? *Journal of Monetary Economics*, 50(8), pp.1649-1672. https://doi.org/10.1016/j.jmoneco.2003.02.002

Gerlach, S. and Wensheng, P.E.N.G., 2006. Output Gaps and Inflation in Mainland China. *China Economic Review*, 17(2), pp.210-225. https://doi.org/10.1016/j.chieco.2005.09.002

International Monetary Fund, 2022a. *Exports, FOB to Partner Countries*. [online] International Monetary Fund. Available at: <https://data.imf.org/regular.aspx?key=61013712&fbclid=IwAR3aaGAWUmVnmb82ert3CvFlJYSDuMLvCKBSu2Snuf-ecYMDz_hZPPDx6rQ> [Accessed 24 January 2022].

International Monetary Fund, 2022b. *Gross Domestic Product Per Capita, Constant Prices.* [online] International Monetary Fund. Available at: <https://www.imf.org/en/

Publications/WEO/weo-database/2021/October/select-country-group> [Accessed 24 January 2022].

International Monetary Fund, 2022c. *Unemployment.* [online] International Monetary Fund. Available at: <https://www.imf.org/en/Publications/WEO/weo-database/2021/October/select-country-group>[Accessed 24 January 2022].

Jarociński, M. and Lenza, M., 2018. An Inflation- predicting Measure of the Output Gap in the Euro Erea. *Journal of Money, Credit and Banking,* 50(6), pp.1189-1224. https://doi.org/10.1111/jmcb.12496

Jašová, M., Moessner, R. and Takáts, E., 2020. Domestic and Global Output Gaps as Inflation Drivers: What Does the Phillips Curve Tell? *Economic Modelling,* 87(1), pp.238-253. https://doi.org/10.1016/j.econmod.2019.07.025

Kendera, T., 2015. Reakcia inflácie na zmenu makroekonomického prostredia v čase krízy v krajinách V4. *Finančné trhy,* 105(2), pp.1-16.

Kohlscheen, E. and Moessner, R., 2022. Globalisation and the Slope of the Phillips Curve. *Economics Letters,* 216, pp.110587. https://doi.org/10.1016/j.econlet.2022.110587

Łyziak, T., 2019. Do Global Output Gaps Help Forecast Domestic Inflation? Evidence from Phillips Curves for Poland. *International Journal of Forecasting,* 35(3), pp.1032-1041. https://doi.org/10.1016/j.ijforecast.2019.03.006

Manopimoke, P., 2015. *Globalization and international inflation dynamics: the role of the global output gap*. [pdf] Available at: <https://www.pier.or.th/files/dp/pier_dp_008.pdf> [Accessed 24 January 2022].

Michaelides, P. and Milios, J., 2009. TFP Change, Output Gap and Inflation in the Russian Federation (1994-2006). *Journal of Economics and Business,* 61(4), pp.339-352. https://doi.org/10.1016/j.jeconbus.2008.10.001

Mohanty, D. and John, J., 2015. Determinants of Inflation in India. *Journal of Asian Economics,* 36, pp.86-96. https://doi.org/10.1016/j.asieco.2014.08.002

Park, H.M., 2011. Practical Guides to Panel Data Modeling: a Step-by-step Analysis Using Stata. *Public Management and Policy Analysis Program, Graduate School of International Relations, International University of Japan*, 12, pp.1-52.

Szafranek, K., 2021. Disentangling the Sources of Inflation Synchronization. Evidence from a Large Panel Dataset. *International Review of Economics & Finance,* 76(1), pp.229-245. https://doi.org/10.1016/j.iref.2021.05.002

Sherman, N., 2022. Why is Inflation in the US so High? [online] BBC News Available at: <https://www.bbc.com/news/business-61569559> [Accessed 14 June 2022].

The World Bank, 2022a. *Export of Goods and Services (% of GDP).* [online] The World Bank. Available at: <https://databank.worldbank.org/reports.aspx?source=2&series=NE.EXP.GNFS.ZS&country=> [Accessed 24 January 2022].

The World Bank, 2022b. *Import of Goods and Services (% of GDP).* [online] The World Bank. Available at: <https://databank.worldbank.org/reports.aspx?source=2&series=NE.EXP.GNFS.ZS&country=#> [Accessed 24 January 2022].

The World Bank, 2022c. *Inflation, Consumer Prices (annual %).* [online] The World Bank. Available at: <https://data.worldbank.org/indicator/FP.CPI.TOTL.ZG?end=2020&name_desc=false&start=1995&view=chart> [Accessed 24 January 2022].

Tiwari, A.K., Oros, C. and Albulescu, C.T., 2014. Revisiting the Inflation–output Gap Relationship for France Using a Wavelet Transform approach. *Economic Modelling*, 37, pp.464-475. https://doi.org/10.1016/j.econmod.2013.11.03

Valadkhani, A., 2014. Switching Impacts of the Output Gap on Inflation: Evidence from Canada, the UK and the US. *International Review of Economics & Finance*, 33(1), pp. 270-285. https://doi.org/10.1016/j.iref.2014.06.001

Vyrostková, L. and Mirdala, R., 2022. Inflation Persistence and Unit Root Tests in the Euro Area Countries. *E&M Economics and Management*, 25(4), pp.4-19. https://doi.org/10.15240/tul/001/2022-4-001

Wang, X.T., Shen, P.L. and Palečková, I., 2022. Research on the Macro Net Financial Assets Value Effect of Monetary Policy. *E&M Economics and Management*, 25(1), pp.161-176. https://doi.org/10.15240/tul/001/2022-1-010

World Integrated Trade Solution, 2022. *Trade Statistics by Country/Region.* [online] World Integrated Trade Solution. Available at: <https://wits.worldbank.org/countrystats.aspx?lang=en> [Accessed 24 January 24 2022].

Zhang, C. and Murasawa, Y., 2011. Output Gap Measurement and the New Keynesian Phillips Curve for China. *Economic Modelling*, 28(6), pp.2462-2468. https://doi.org/10.1016/j.econmod.2011.07.00

Zhang, C., Ji, X. and Dai, W., 2017. Global Output Gap and Domestic Inflation in China. *Panoeconomicus*, 64(1), pp.17-30. https://doi.org/10.2298/PAN150402034Z