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Eurozone inflation: fresh projections from global factors

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Abstract

This study identifies the contributions of global factors in determining eurozone inflation. The analysis makes use of an augmented Phillips curve model of inflation, as well as panel data estimates. The findings document the importance of such factors in forecasting inflation, thus, confirming the substantial role of external factors in eurozone inflation. The findings survived certain model specifications. Therefore, monetary, and fiscal policymakers should explicitly consider both domestic and global conditions to anchor inflation expectations in forming specific strategies for taming inflation expectations.

Keywords: inflation, global factors, eurozone countries
JEL Classification Codes: C33, E31, E37

1. Introduction

The globalisation of the inflation hypothesis supports that the factors influencing inflation dynamics are turning increasingly global. This suggests that as countries integrate into a higher level of global markets, a downward pressure on prices occurs due to a rising competition environment. Researchers have reassessed the predictive power of standard inflation models and increasingly look at global factors as a potential explanation behind the reduced sensitivity of inflation to domestic determinants (Ciccarelli and Mojon, 2010). Accordingly, models of inflation should account for global factors beyond their impact via import prices (Bianchi and Civelli, 2015; Kamber and Wong, 2020). In other words, inflation turns more 'global-centric' if global factors gradually develop into dominant ones, shaping inflation dynamics. This search also gets relevant for monetary policy. Where the impact of global factors is only transitory,

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central banks should ‘look through’ it. In contrast, when they entail changes in a price- and wage-setting behaviour characterized as persistent, this has direct implications for monetary policy.

The goal here is to provide fresh evidence on analysing the determinants of eurozone inflation by emphasizing the role of global factors in inflation measured by different definitions. For the euro area, Fischer et al. (2009) highlight the good inflation forecasting performance of the random walk model. Banbura and Mirza (2013) show that only a few studies focus on the out-of-sample inflation forecasting performance in the euro area. Our work offers new evidence on the role global factors generate accurate eurozone inflation forecasts.

2. Data

Global factors are described by the NY Fed’s Global Supply Chain Pressure Index, which captures supply chain disruptions using a range of indicators (transportation cost and manufacturing). Global transportation costs are measured from the Baltic Dry Index and the Harpex Index, as well as airfreight cost indices. It uses several supply chain-related components from Purchasing Managers’ Index surveys, focusing on manufacturing firms across seven interconnected economies: China, Eurozone, Japan, Korea, Taiwan, UK, and US. The index comes from the FRBNY. They are also proxied by global GDP, global energy prices (Brent prices), and global non-energy prices (the non-energy commodity index on food, raw materials, and metals prices).

The dataset is also composed of the eurozone HICP index, HICP excluding food and energy (core), unit labour cost, the unemployment rate, producer prices, real GDP, the real effective exchange rate, trade openness (the ratio of the sum of imports and exports to GDP), and credit (bank corporate credit). The HICP index allows for full comparability across eurozone countries, and it is considered on a quarter-on-quarter basis. All data are retrieved from the Eikon database, are on a quarterly basis, and span the period 2003 to 2022.

3. Empirical results

The analysis is based on an augmented Phillips curve model of inflation in a panel setting by introducing global variables. This inflation model is a key relationship, widely adopted in macroeconomic modelling. The literature, however, has criticized it on the grounds that fails to accommodate instability, such as monetary policy regime changes (Kim et al., 2014; Davig, 2016). Given certain structural changes in the global economies, as well as changing monetary policies, it is very likely that inflation dynamics has experienced major shifts. Other criticisms are related to certain shortcomings of the model associated with mismeasurement of either inflation or economic slack, a flatter price Phillips curve, and a flatter aggregate demand relationship, induced by an improvement in the ability of policy to stabilize inflation (McLeay and Tenreyro, 2019; Faccini and Melosi, 2020).

At the same time, the literature has provided supportive evidence that despite the considerable structural instability observed, the model provides a useful vehicle, which can explain inflation dynamics, and supports the view that it plays a key role in inflation determination, although the inflation dynamics may vary according to the prevailing economic environment and monetary policy in place. In other words, the model provides a coherent characterisation of inflation dynamics in many countries around the globe, often matching regime changes in monetary policy and central banks’ reactions to changing economic environments (Galí and Gertler, 1999; Gordon, 2013; Aristidou, 2018; Del Negro et al., 2020). The empirical analysis employs the following model equation:

$$infl_{it} = a_0 + a_1\, infl_{it-1} + \sum_{i=1}^{p_1} a_{2i}\, GDP_{it-k} + a_3\, GSF_t + a_4\, credit_t + a_5\, energy_t + a_6\, non\text{-}energy_t + a_7\, GGDP_t + a_8\, rer_t + \sum_{i=1}^{p_2} a_{9i}\, open_{it-k} + \sum_{i=1}^{p_3} a_{10i}\, ucl_{it-k} + a_{11i}\, unempl_t + a_{12}\, DUMFIN_t + a_{13}\, DUMCOV_t + a_{14}\, DUMUKR_t + \alpha_i + u_{it} \quad (1)$$

where infl is the inflation rate for country i at time t, GDP is real GDP (Deniz et al., 2016), GSF denotes global supply factors, credit shows domestic liquidity (Cardoso and Vieira, 2016), energy is global oil prices (Bala and Chin, 2018), non-energy indicates commodity prices (Forbes, 2019), GGDP is global GDP (Forbes, 2019), rer denotes the real exchange rate defined as the real effective rate (Sek et al., 2015), open shows trade openness (Deniz et al., 2016), ucl defines unit labor cost (Mohanty and Klau, 2001), and unempl proxies the economic slack (Banbura and Bobeica, 2023). DUMFIN is a global financial crisis dummy (taking one from 2008:3 to 2009:4, and zero otherwise), DUMCOV is a COVID-19 dummy (taking one from 2020:1 to 2022:4, and zero otherwise), and DUMUKR is a Russian-Ukraine conflict dummy (taking one from 2022:1 to 2022:4, and zero otherwise). α_i denotes country fixed effects, while u_{it} is the error term. Global GDP, energy, and non-energy prices. In terms of the three dummy variables, the literature has offered studies that justify the potential influence of these major events in the global inflations process, such as De Santis and Van der Veken (2022) for the effect of global financial crisis on inflation, Brianca et al. (2020) for the effect of the recent pandemic crisis on inflation (due to the simultaneous presence of demand and supply shocks), and Maurya et al. (2023) for the impact of the Russia-Ukraine war conflict on inflation, with the results being dependent on the geographical proximity and trading activity with the countries in conflict.

In the first step of the empirical analysis, a second-generation panel unit root test is employed to determine the degree of integration of the panel variables. More specifically, the Pesaran (2007) panel unit root test is employed that assumes that the null hypothesis supports the presence of a unit root. The results of this test are reported in Table 1 and support the presence of a unit root across all panel variables, except that in the case of inflation. Moreover, Table 1 reports the results of the General Least Squared Dickey-Fuller test recommended by Elliott et al. (1996) for the time series variables. The results also illustrate the presence of a unit root in the levels across these variables.

To avoid potential endogeneity, we estimate Model (1) using the General Method of Moments (GMM) recommended by Arellano and Bover (1995). Table 2 reports the results under certain specifications: column (1) displays the estimates when only domestic controls are included, Column (2) when both domestic and global factors are included (both specifications measure inflation as HICP), Columns (3) and (4) show the results when inflation is measured as HICP core, and Columns (5) and (6) provide the findings when inflation is defined through the production price index. All six specifications document the statistical significance of both domestic and global factors in determining inflation. Global supply factors, global GDP, global energy, and global non-energy prices exert a positive impact on all definitions of eurozone inflation. Economically, the coefficients on global supply factors indicate that a one percentage point increase in them leads to an increase of 0.0341, 0.0319 and 0.0373 percentage points in HICP, HICP core and producer prices, respectively.

The findings also confirm the importance of inflation persistence. In terms of the remaining controls, they show that domestic GDP, openness, and unit labour cost have a positive effect on all inflation measures. In contrast, the real effective exchange rate and unemployment have a negative impact. Relevant diagnostics reject the null hypothesis of difference-in-Hansen tests, thus, supporting the validity of the instruments considered. As instruments lags of the control variables in levels and first differences have been used. The estimates use estimators with Driscoll-Kraay standard errors, which address cross-sectional dependence and serial correlation. Erroneously ignoring potential correlation of regression residuals over time and across subjects offer biased statistical inference, i.e., the estimates are still consistent, but inefficient. To ensure validity of the findings, we need to adjust the standard errors of the estimates for possible dependence in the residuals. The Driscoll and Kraay adjustment uses a nonparametric covariance matrix estimator that produces heteroskedasticity- and autocorrelation-consistent standard errors that are robust to general forms of cross-sectional dependence.

Next, we present the results of out-of-sample forecasting over two different periods: 2017:1-2019:4 and 2020:1-2022:4. The analysis for certain forecasting horizons compares the models without the global factors against the models when the global factors included. The forecasts are aggregated and then evaluated for inflation. To evaluate the forecasts, we use the root mean squared forecasting error (RMSFE) metric. We compare this metric to the benchmark naive model. If the resulting relative ratios are greater than one, then the naive model performs better than the other models in terms of forecasting accuracy. The findings illustrate that over both considered forecasting periods, the forecasts produced from the models where the global factors are included are uniformly more accurate than the models without them (Table 3). Moreover, the model with the overall HICP index performs better.

Table 1. Unit root tests

Panel variables		
CIPS test	Levels	1^{st}Differences
inflation	-5.906***	
GDP	-1.265	-6.593***
open	-1.319	-6.144***
ucl	-1.174	-6.386***
Time-series variables		
GLS test		
GSF	-1.141	-6.517***
credit	-1.119	-6.247***
energy	-1.227	-6.473***
non-energy	-1.138	-6.346***
GGDP	-1.122	-6.498***
unempl	-1.225	-6.327***
rer	-1.228	-6.642***

Note: A constant is included in the Pesaran (2007) tests. The results are reported under the null hypothesis of stationarity. Critical values for the Pesaran (2007) test: -2.40 at 1%, -2.22 at 5%, and -2.14 at 10%. The results are reported at lag = 3. ***: p≤0.01.
Source: own elaboration

Table 2. Eurozone inflation estimates

Variables	**(1)**	**(2)**	**(3)**	**(4)**	**(5)**	**(6)**
Constant	0.039	0.043	0.041	0.047	0.049	0.054
	[0.21]	[0.19]	[0.20]	[0.17]	[0.16]	[0.14]
Inflation(-1)	0.459***	0.496***	0.481***	0.469***	0.508***	0.511***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
GDP	0.0561***	0.0519***	0.0578***	0.0512***	0.0492***	0.0529***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.01]	[0.00]
GDP(-1)	0.0171**	0.0152**	0.0140**	0.0127**	0.0110**	0.0118**
	[0.03]	[0.04]	[0.04]	[0.05]	[0.05]	[0.05]
Global supply factors		0.0341***		0.0319***		0.0323***
		[0.00]		[0.00]		[0.00]
Credit	0.0217***	0.0195***	0.0172***	0.0266***	0.0267***	0,0209***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Energy prices		0.0491***		0.0465***		0.0460***
		[0.00]		[0.00]		[0.00]
Energy prices(-1)		0.0143**		0.0129**		0.0126**
		[0.04]		[0.05]		[0.05]
Non-energy prices		0.0373***		0.0362***		0.0349***
		[0.00]		[0.00]		[0.00]
Global GDP		0.0339***		0.0321***		0.0316***
		[0.00]		[0.00]		[0.00]
Global GDP(-1)		0.0098**		0.0084**		0.0090**
		[0.05]		[0.05]		[0.05]
Real eff, exch, rate	-0.0214***	-0.0211***	-0.0206***	-0.0198***	-0.0223***	-0.0215***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Trade openness	-0.0297***	-0.0283***	-0.0289***	-0.0275***	-0.0294***	-0.0281***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
Unit labor cost	0.0125**	0.0114**	0.0127**	0.0119**	0.0131**	0.0124**
	[0.05]	[0.05]	[0.05]	[0.05]	[0.04]	[0.05]
unempl	-0.0325***	-0.0298***	-0.0331***	-0.0322***	-0.0335***	-0.0329***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
DUMFIN	-0.0054***	-0.0051***	-0.0055***	-0.0052***	-0.060***	-0.054***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]

DUMCOV	0.0101***	0.0095***	0.0109***	0.0102***	0.0118***	0.0112***
	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]	[0.00]
DUMUKR	0.0175**	0.0166**	0.0214***	0.0203***	0.0199**	0.0184**
	[0.03]	[0.03]	[0.01]	[0.01]	[0.02]	[0.02]
Diagnostics						
Country fixed effects	YES	YES	YES	YES	YES	YES
R^2-adjusted	0.72	0.82	0.75	0.83	0.79	0.86
No. of instruments	15	23	16	24	17	27
Number of obs.	1,600	1,600	1,600	1,600	1,600	1,600
AR(2)	[0.42]	[0.44]	[0.48]	[0.47]	[0.56]	[0.59]
Hansen Overidentif,	[0.94]	[0.95]	[0.94]	[0.93]	[0.98]	[0.96]
Difference-in-Hansen	[0.99]	[0.99]	[0.99]	[0.99]	[0.99]	[0.99]

Note: AR(2) is the auto-correlation test of order 2 in first-differenced errors. Difference in Hansen is the test of validity of instruments. The test of overidentification is based on the Hansen J-statistic. The null hypothesis is that the instruments are valid (i.e., uncorrelated with the error term). Figures in brackets denote p-values. Estimates are based on Driscoll-Kraay standard errors. The number of lags was determined through the Akaike criterion, **: p≤0.05, ***: p≤0.01.
Source: own elaboration

Table 3. Root Mean Squared Forecasting Error metric

	HICP			HICP core			PP		
Forecasting horizon (q)	1	4	8	1	4	8	1	4	8
Model									
<u>2017:1-2019:4</u>									
Without global factor	0.79	0.76	0.80	0.79	0.81	0.86	0.81	0.87	0.91
With global factors	0.76	0.72	0.77	0.75	0.78	0.82	0.77	0.83	0.85
<u>2020:1-2022:4</u>									
Without global factor	0.82	0.80	0.85	0.83	0.84	0.90	0.86	0.91	0.95
With global factors	0.78	0.76	0.81	0.80	0.82	0.86	0.82	0.87	0.9

Source: own elaboration

4. Conclusion

Evidence presented in this paper documented that the role of external factors in eurozone inflation had been economically larger. The findings survived certain model specifications. Global factors did appear to be a major force behind euro area inflationary trends. While much of the recent increase in inflation is a direct result of pandemic-related disruptions and the Russia-Ukraine war conflict, pushing international commodity prices higher, the analysis showed that the joint significance of global and domestic factors contributed to inflation dynamics. Policymakers should continue to recalibrate both domestic and global conditions to anchor inflation expectations. In that sense, tight policies are needed to anchor expectations and maintain subdued demand, such that economic agents settle on relative price setting that is consistent with disinflation. The surge of inflation has also enhanced the role of inflation expectations in wage contract negotiations, which will likely make further declines in inflation more challenging. At the same time, the results confront the European monetary policymakers with new challenges, which will require combining day-to-day inflation-fighting with a concern for the eurozone's overall economic strategy. Thus, they need to design instruments that target specific markets, sectors, and interest rates, while explicitly considering the short-, medium- and long-term impacts of such action. The challenge here is that using interest rates to bring down inflation today should not be any success story without considering the expense of future economic stability.

The new inflation needs a more carefully calibrated strategic use of the interest rate mechanism which ensures stable funding conditions for governments and facilitating sufficient funds for firms' long-term investments. Nevertheless, the new changed economic landscape calls for a broader approach to inflation policies. Relying exclusively on monetary controls for an effective demand management is far too passive. Economic policy should also address supply issues, such as providing support for (socioeconomic) measures that motivate increases in labour force participation, intensifying antitrust enforcement to reduce the firms' market power, and increasing the supply of renewable energy and eliminating reliance on fossil fuels to limit any future energy supply shocks.

The analysis can be extended by getting estimates per country groups, per sub-periods, and per alternative variables measures.

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