Monetary Policy's Asymmetric Impact on Food Inflation in Hungary

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This study delves into the intricate relationship between monetary policy and food inflation in Hungary from January 2007 to March 2023, utilizing a nonlinear autoregressive distributed lag (NARDL) model. This model allows for a more nuanced understanding of the asymmetric dynamics between monetary policy and food inflation, as it captures both the short-run and long-run effects.
The empirical findings reveal a long-run asymmetry, suggesting that tighter monetary policy may lead to a subsequent rise in food prices over an extended period. This is because tighter monetary policy can increase the cost of borrowing, which can in turn lead to higher production costs for food producers. As a result, food producers may pass these higher costs on to consumers in the form of higher food prices.
However, in the short run, the impact of monetary policy on food prices remains insignificant. This is likely because food prices are also influenced by other factors, such as supply and demand shocks.
These findings underscore the importance of considering the asymmetric dynamics between monetary policy and food inflation when formulating economic policies. Policymakers should be aware that tighter monetary policy may have unintended consequences for food prices, especially in the long run.

Keywords: Food prices, Inflation, Monetary policy, Nonlinear ARDL, Asymmetry

Jel Code: E31, E52, Q11

I. Introduction

The efficacy of monetary policy in stabilising food prices has been called into question by policymakers in light of the recent high and volatile food inflation in developed and developing countries. Monetary restrictions may not impact food inflation as a result of the Engel law; however, they do have an effect on non-food prices and output. For policymakers, this raises the question of how monetary policy influences food shocks. Uncertainty and inflation expectations are heightened by food inflation. This complicates forecasting and targeting aggregate inflation. Increasing inflation uncertainty complicates producers' investment

decision-making. In impoverished nations, food insecurity contributes to an increase in infant and child mortality as well as malnutrition (de Brauw, 2011; Kidane and Woldemichael, 2020). Recent empirical research provides further evidence that monetary policy has an impact on the markets for agricultural products and food inflation (e.g. Bhattacharya and Jain, 2020; Iddrisu and Alagidede, 2020, 2021; Samal and Goyari, 2022), Samal et al. 2022). According to the majority of studies, monetary policy tightening increases food and agriculture prices. International processes have a fundamental impact on the economies of small, open economies. Existing literature indicates that restrictive monetary policy, which introduces additional uncertainty to already volatile food price markets, is both ineffective and potentially detrimental.

Hungary serves as a case study because within the European Union, food prices in Hungary are also particularly high. For comparison, in June 2023, average inflation in the European Union was 5.5%, food price growth was 11.6%, while the Hungarian data for the same period for the general price level was 19.9%, and food price growth was 29.3% annualised. The current situation is not a temporary shock, with food price growth consistently above 10% since January 2022, and above 20% since June 2022, exceeding 40% for six months. Such a price increase will affect lower-income households much more severely than those on higher incomes.

We investigate whether monetary policy can stabilise food price inflation. From January 2007 to March 2023, we employed the Nonlinear Autoregressive Distributed Lag (NARDL) model to examine the impact of monetary policy shocks on food inflation in Hungary.

II. Data and Methodology

The variables for empirical analysis are based on recent literature (Bhattacharya and Jain, 2020; Iddrisu and Alagidede, 2020, 2021; Samal et al., 2022). We use monthly data from the Hungarian Central Statistical Office and the Hungarian National Bank for the period January 2007 to March 2023. The main variables are the Hungarian food inflation (CPIfood), the Hungarian economic output (GDP), the Hungarian forint/euro exchange rate (Euro), and the monetary policy variable (Policy), which is the three-month Hungarian government bond yield. All variables in the empirical analysis are included in the natural logarithm. Descriptive statistics of variables are shown in Table 1.

Table 1 Descriptive statistics

Variable	Obs	Mean	Std. dev.	Min	Max
lnCPIfood	195	4.668	0.078	4.575	5.006
lnGDP	195	9.062	0.284	8.579	9.648
lnEuro	195	5.723	0.123	5.447	6.037
lnPolicy	195	4.643	0.035	4.605	4.740

To investigate the relationship between food inflation and monetary policy we employ the non-linear ARDL model (NARDL). Using the NARDL model, it is possible to isolate positive and negative effects on the dependent variable (food inflation). The asymmetric long-run equilibrium can be defined as follows:

$$y_t = ß^+ x_t^+ + ß^- x_t^- + \varepsilon_t \tag{1}$$

where y_t is the dependent variable, x_t^+ and x_t^- are the partial cumulative sum processes of positive and negative changes in the dependent variables (x_t), $ß^+$ and $ß^-$ represent the asymmetric long-run parameter, ε_t is the random error term. The NARDL model can be posed as follows when we combine model (1) with the unconstrained linear ARDL (p, q) specification:

$$\Delta y_t = \alpha_0 + r y_{t-1} + \theta^+ x_{t-1}^+ + \theta^- x_{t-1}^- + \sum_{j=1}^{p-1} \tau_j \Delta y_{t-j} + \sum_{j=0}^{q-1} (\pi_j^+ \Delta x_{t-j}^+ + \pi_j^- \Delta x_{t-j}^-) + \varepsilon_t \tag{2}$$

where $\sum_{j=0}^{q-1} \pi_j^+$ and $\sum_{j=0}^{q-1} \pi_j^-$ represent the short-run asymmetry of Δx_t, and the parameterizations of the long-run asymmetry are as follows:

$$ß^+ = -\frac{\theta^+}{r} \text{ és } ß^- = -\frac{\theta^-}{r} \tag{3}$$

III. Results

Unit root tests are the first step in the NARDL analysis process. Financial and macroeconomic variables frequently show non-stationarity or trending behaviour in the mean. Unit root tests are statistically used to test the variables used in this study for (non)stationarity. The various unit root test results for the variables utilised in the analysis, both at the level and at first difference, are shown in Table 2. The Elliott-Rothenberg-Stock unit root test is based on the Akaike information criterion lag. Results show that, the first difference of all variables can be considered as stationary, therefore, we can thoroughly estimate the NARDL model.

Table 2: Unit-root tests

	Elliott-Rothenberg-Stock (AIC)				Phillips-Perron			
	intercept		intercept, trend		intercept		intercept, trend	
	Level	First diff.	Level	First diff.	Level	First diff.	Level	First diff.
lnCPIfood	-1.035	-2.504***	-1.151	-3.953***	-2.031	-8.850***	-2.197	-8.829***
lnGDP	0.753	-0.781	-1.453	-2.420*	-1.213	-5.848***	-4.852***	-5.811***
lnEuro	2.719	-3.382***	-1.539	-6.218***	-9.41	-11.189***	-3.765**	-11.161***
lnPolicy	-1.537*	-1.942**	-1.626	-2.368	0.207	-13.834***	3.565	-14.523***

*** p<0.01; ** p<0.05; * p<0.1

The NARDL short-run coefficients of the inflation equation are presented in Table 3, while the computed long-run coefficients and asymmetric tests are presented in Table 4. The Bounds-test for Nonlinear Cointegration rejects the null hypothesis of no cointegration. In the long run, food prices show a downward trend ($lnCPIfood_{t-1}$), while in the short run, the stickiness of inflation is typical, with positive coefficients ($DlnCPIfood_{t-1}$; $DlnCPIfood_{t-2}$) The fall in GDP in period t-1 ($lnGDP^{-}_{t-1}$) also reduces food prices, here prices are likely to adjust due to falling demand. In contrast, in the short run, GDP growth ($DlnGDP^{+}$) increases food prices. In the case of the HUFEUR exchange rate ($lnEuro^{-}_{t-1}$; $DlnEuro^{-}_{t-2}$), a fall in the exchange rate (strengthening of the forint) increases food prices, an effect that is the same in the short and long run. An increase in the monetary policy variable ($lnPolicy^{+}_{t-1}$) increases food prices in the long run, indicating inefficiency of monetary policy, as prices do not fall during the monetary policy tightening period.

Table 3: Results of NARDL model

	Coefficient
lnCPIfood $_{t-1}$	-0.147***
lnGDP^{+} $_{t-1}$	-0.017
lnGDP^{-} $_{t-1}$	-0.061**
lnEuro^{+} $_{t-1}$	-0.044
lnEuro^{-} $_{t-1}$	0.086*
lnPolicy^{+} $_{t-1}$	0.404***
lnPolicy^{-} $_{t-1}$	0.076

$DlnCPIfood_{t-1}$	0.336***
$DlnCPIfood_{t-2}$	0.178**
$DlnGDP^{+}$	-0.163*
$DlnGDP^{+}_{t-1}$	0.078
$DlnGDP^{+}_{t-2}$	-0.107
$DlnGDP^{+}_{t-3}$	-0.051
$DlnGDP^{-}$	0.043
$DlnGDP^{-}_{t-1}$	0.077
$DlnGDP^{-}_{t-2}$	0.061
$DlnGDP^{-}_{t-3}$	0.046
$DlnEuro^{+}$	-0.013
$DlnEuro^{+}_{t-1}$	-0.084
$DlnEuro^{+}_{t-2}$	-0.030
$DlnEuro^{+}_{t-3}$	-0.002
$DlnEuro^{-}$	-0.114
$DlnEuro^{-}_{t-1}$	0.151
$DlnEuro^{-}_{t-2}$	0.321***
$DlnEuro^{-}_{t-3}$	0.049
$DlnPolicy^{+}$	0.209
$DlnPolicy^{+}_{t-1}$	0.252
$DlnPolicy^{+}_{t-2}$	0.167
$DlnPolicy^{+}_{t-3}$	0.070
$dlnPolicy^{-}$	0.725
$dlnPolicy^{-}_{t-1}$	0.174
$dlnPolicy^{-}_{t-2}$	-0.158
$dlnPolicy^{-}_{t-3}$	0.299
constant	0.702***
N	191
R^2	0.4686
Bounds-test	
F- statistics	3.157**
t-statistics	-4.240***

*** p<0.01; ** p<0.05; * p<0.1

Table 4 displays the outcomes of the short- and long-term asymmetry tests as well as the long-term impacts of the positive and negative shocks. The proxy variable for monetary policy (lnPolicy) is positive and significant for the long-run positive shocks, meaning that tightening monetary policy over time raises food prices which is in line with Samal et al. (2022). Negative shocks do not significantly have the same effect. On the other hand, for the long-run negative shocks, at 90% confidence level, food inflation rises with a decline in GDP and food prices decrease with a strengthening of the Hungarian forint against the euro. In the latter scenario, imports are less expensive due to a stronger home currency, which also applies to finished goods and raw materials. Results on asymmetry imply that over the long term, asymmetry affects all variables; for example, the direction of a shock affects how food prices respond to it. This effect is only seen for economic output (lnGDP) in the short run.

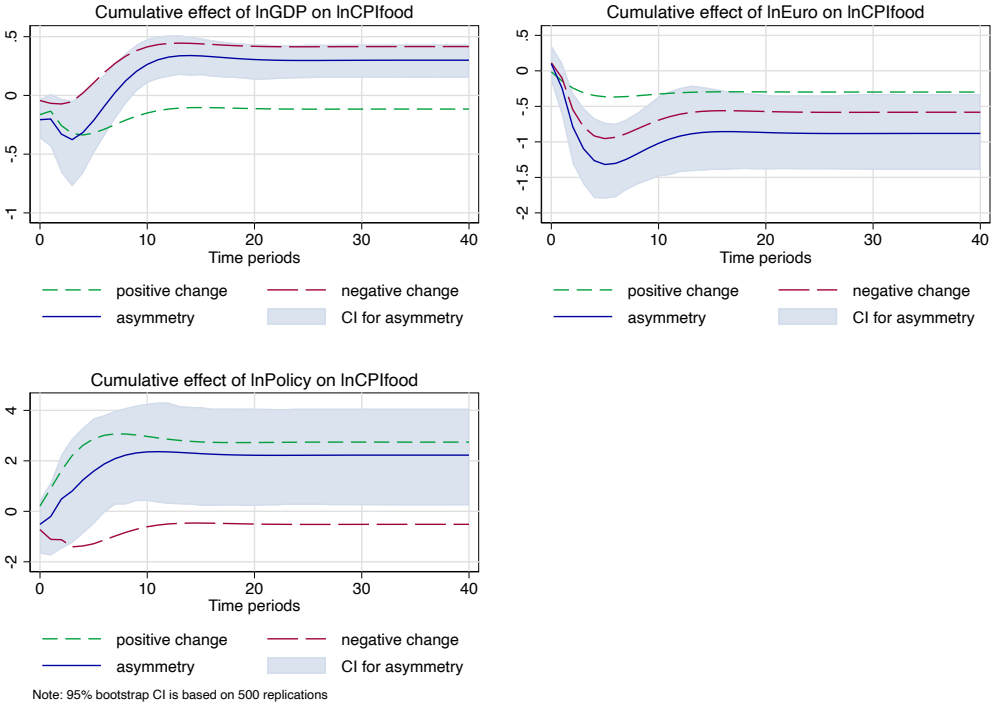
Table 4: Results of asymmetric effects

	Long-run effect [+]			Long-run effect [-]		
	coef.	F-stat	P value	coef.	F-stat	P value
lnGDP	-0.116	0.712	0.400	0.416	3.728	0.055
lnEuro	-0.298	1.587	0.210	-0.583	3.25	0.073
lnPolicy	2.742	35.93	0.000	-0.516	0.310	0.578
		Long-run asymmetry			Short-run asymmetry	
		F-stat	P value		F-stat	P value
lnGDP		11.34	0.001		4.683	0.032
lnEuro		8.293	0.005		2.712	0.102
lnPolicy		4.072	0.045		0.106	0.746

*** p<0.01; ** p<0.05; * p<0.1

The results in Table 4 demonstrate that the asymmetry persists over an extended period of time, as shown the graphs in Figure 2. The asymmetry persists for GDP and monetary policy after month 10, and for the HUFEUR exchange rate after months 14 and 15.

Figure 2: Cumulative effects on food price index



IV. Conclusions

The NARDL model was employed to estimate the variables influencing food prices in Hungary. The findings of our study indicate that, in the short term, monetary policy does not have a significant impact on food prices. However, our analysis suggests that implementing a tighter monetary policy may lead to a subsequent increase in food prices over the long term confirming results by earlier studies (e.g. Battarcharya and Jain 2020; Iddrisu and Alagidede, 2020, 2021). Monetary policy has a limited effect; however, over time, the strengthening of the Hungarian currency can also lower food prices. There is a noticeable asymmetry, particularly in the long-term effects, which makes it more difficult for monetary policy to respond appropriately and effectively to the current record-high prices of food in Hungary. Since that food accounts for a large portion of Hungarian households' disposable income and that inflation indicators reflect spillover effects, monetary policy cannot be limited to addressing core inflation and inflation alone. However, our findings imply that the employment of fiscal policy tools is also necessary because monetary policy might not be sufficient to keep food prices under control.

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