

A Service of

ZBW

Leibniz-Informationszentrum Wirtschaft Leibniz Information Centre for Economics

Moessner, Richhild

Working Paper Effects of Energy Prices on Food Consumer Price Inflation

CESifo Working Paper, No. 11682

Provided in Cooperation with: Ifo Institute – Leibniz Institute for Economic Research at the University of Munich

Suggested Citation: Moessner, Richhild (2025) : Effects of Energy Prices on Food Consumer Price Inflation, CESifo Working Paper, No. 11682, CESifo GmbH, Munich

This Version is available at: https://hdl.handle.net/10419/314721

Standard-Nutzungsbedingungen:

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

Terms of use:

Documents in EconStor may be saved and copied for your personal and scholarly purposes.

You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.

If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.



WWW.ECONSTOR.EU



Effects of Energy Prices on Food Consumer Price Inflation

Richhild Moessner



Impressum:

CESifo Working Papers ISSN 2364-1428 (electronic version) Publisher and distributor: Munich Society for the Promotion of Economic Research - CESifo GmbH The international platform of Ludwigs-Maximilians University's Center for Economic Studies and the ifo Institute Poschingerstr. 5, 81679 Munich, Germany Telephone +49 (0)89 2180-2740, Telefax +49 (0)89 2180-17845, email office@cesifo.de Editor: Clemens Fuest https://www.cesifo.org/en/wp An electronic version of the paper may be downloaded • from the SSRN website: www.SSRN.com

- from the RePEc website: <u>www.RePEc.org</u>
- from the CESifo website: <u>https://www.cesifo.org/en/wp</u>

Effects of Energy Prices on Food Consumer Price Inflation

Abstract

This paper studies the effects of country-specific energy prices on food consumer price inflation (CPI) within a cross-country Phillips curve framework. It considers a panel of 36 OECD member and candidate economies using quarterly data from the start of 1994 to the end of 2021. We find that energy CPI inflation has a significantly positive effect on food CPI inflation, after controlling for the output gap, exchange rate changes and global factors. This result is generally robust to also controlling for inflation expectations, global food commodity prices and core CPI inflation. We also find that the effect of energy CPI inflation on food CPI inflation is significantly larger when energy dependency is higher.

JEL-Codes: E310, E520, E580.

Keywords: inflation, food prices, energy prices.

Richhild Moessner University of Heidelberg Philosophenweg 16 Germany – 69120 Heidelberg richhild.moessner@uni-heidelberg.de

February 2025

1. Introduction

This paper studies the effects of country-specific energy prices on food consumer price inflation (CPI) within a cross-country Phillips curve framework, for advanced economies and emerging economies (EMEs). It considers a panel of 36 OECD member and candidate economies using quarterly data from the start of 1994 to the end of 2021.

Energy prices rose strongly between the start of 2021 and the end of 2022. An important question for monetary policy is whether an increase in energy prices may lead to second-round effects on CPI inflation. Food consumer prices can be affected by energy prices for example due to the use of natural gas in the production of fertiliser, and due to energy needed to heat greenhouses, to transport food and to power tractors (Sands and Westcott, 2011). Farmers and food producers in Europe warned of significant price increases for a wide range of everyday food products in 2022 due to strongly rising energy costs; price rises across a wide range of food products were predicted as output was cut due to surging energy costs (Financial Times, 2022).

The effects of global food commodity prices on food CPI inflation have been studied in De Winne and Peersman (2016), who find for the United States that adverse food commodity market shocks lead to an increase in food commodity prices and food CPI inflation. The effects of global food commodity prices on growth have been studied in De Winne and Peersman, who find for the United States that they lead to a persistent fall in real GDP, and in De Winne and Peersman (2021), who find that increases in global agricultural commodity prices caused by harvest or weather disruptions in other regions of the world significantly reduce economic activity, and that the effect is stronger in advanced economies.

Most of the literature has focussed on the effects of global energy prices on food commodity prices, while there has been much less literature on the effects of energy prices on food CPI inflation. The effects of oil prices on food consumer prices were studied for several Latin American countries by Köse and Ünal (2022), and for Pakistan by Sarwar et al. (2020). Sands and Westcott (2011) performed model simulations for the effects of energy-related cost increases for electricity, diesel fuel and natural gas on food CPI inflation in the United States.¹ The effects of oil prices on food commodity prices have been studied by Baffes and Dennis (2013) from 1960-2012. The recent paper by Kirikkaleli and Darbaz (2021) studied the relationship between energy prices and food commodity prices, where more references on the effects of energy prices on food commodity prices can be found. The recent paper by Avalos and Huang (2022) studied linkages between energy prices and food commodity prices, including via the prices of biofuels, which was also considered in Avalos and Lombardi (2015). Kohlscheen (2022) studied the effects of oil prices on food consumer price inflation, but did not study the effect of country-specific energy prices as we do here. Baumeister and Kilian (2014), Baek and Koo (2014), Lambert and Miljkovic (2010) and Irz et al. (2013) consider the effect of oil prices or energy prices on food consumer prices in a single country (the United States or Finland), rather than across countries.

We add to the literature by studying the effects of country-specific energy prices on the food subcomponent of consumer price inflation within a cross-country Phillips curve framework for a large panel of OECD economies, controlling for cyclical factors via the output gap, for exchange

¹ Cecchetti and Moessner (2008) find that higher commodity prices have generally not led to strong second-round effects on inflation in the period from 2003 to 2008. They also find that past food CPI inflation helps to predict headline CPI inflation, after controlling for the autocorrelation of headline inflation.

rate changes, common global factors, as well as for inflation expectations and global food commodity prices.

We choose cross-country panel estimation of Phillips curves based on Jasova et al. (2019, 2020) in order to capture inflation dynamics well. Phillips curves are the standard way to model inflation dynamics in modern monetary policy analysis (Clarida et al., 1999; Smets, 2003; Woodford, 2003; Levin and Moessner, 2005). This approach allows to exploit cross-country variation to avoid the difficulties of identification present for country-specific estimates, as discussed by Forbes (2019) in the case of the output gap. In this paper we apply this cross-country panel estimation of Phillips curves to quarterly food CPI inflation, based on the approach of Moessner (2022) for annual food CPI inflation.

We find that energy CPI inflation has a significantly positive effect on food CPI inflation, after controlling for cyclical factors via the output gap, for exchange rate changes and common global factors. This result is generally robust to also controlling for inflation expectations, global food commodity prices and core inflation. We also find that the effect of energy CPI inflation on food CPI inflation is significantly larger when energy dependency is higher.

The remainder of the paper is organised as follows. Section 2 summarises the data, and Section 3 presents the method and results. Finally, Section 4 concludes.

2. Data

Data on seasonally adjusted food CPI indices (food and non-alcoholic beverages), energy CPI indices and core CPI indices (headline CPI excluding food and energy) are based on data from the OECD and national data. Brent oil prices (quarterly averages, US dollar per barrel) are from Datastream. The global natural gas price index (quarterly data, 2016 = 100) is from the IMF's Primary Commodity Price System. The global food commodity price index is the United Nation's Food and Agriculture Organization (FAO) food nominal price index (quarterly data, 2015=100). Data on energy dependency, measured as net energy imports as a share of energy use, is from the OECD/International Energy Agency (IEA), and is available up to 2015. Data on food imports as a share of merchandise imports is from the World Bank

Data on output gaps (as a percentage of potential GDP) was obtained from the OECD, and is linearly interpolated from annual data. Nominal effective exchange rate indices (broad indices, quarterly average) are from the BIS, with an increase reflecting an appreciation of the domestic currency. We use data on professionals' survey-based CPI short-term inflation expectations. These are taken from Consensus Economics surveys for next-year CPI inflation expectations.

We consider the following 36 OECD member and candidate economies: the advanced economies Austria, Australia, Belgium, Canada, Denmark, euro area, Finland, France, Germany, Great Britain, Greece, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, the Netherlands, Norway, New Zealand, Portugal, Spain, Sweden, Switzerland and the United States; and the emerging economies Chile, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Mexico, Poland, Slovakia, Slovenia and South Korea. The sample period is from 1994Q1 to 2021Q4 at quarterly frequency.

3. Method and results

To study the effects of energy prices on food CPI inflation, we estimate the following Phillips curves based on Jasova et al. (2019, 2020) and Moessner (2022) for a panel of 36 economies, using the local projections approach of Jordà (2005),

$$\pi_{it;4}^{f} = \rho \,\pi_{it-1}^{f} + \theta \,\pi_{it-1}^{en} + \phi \,outputgap_{it} - \mu \,\Delta NEER_{it} + \beta_t + \alpha_i + \varepsilon_{it.} \tag{1}$$

where πt_{it} denotes food CPI inflation quarter-on-quarter (q/q) seasonally adjusted at annualised rates (saar) in percent, calculated from log differences in quarterly seasonally adjusted food consumer price indices (CPI) in country *i* at time *t*; $\pi t_{it;4}$ denotes the CPI food inflation rate over 4 quarters in country *i* at time *t*, calculated from the log-difference between the food CPI index at time (*t*-1)+4 and the food CPI index at time *t*-1, which corresponds to year-on-year (y/y) food CPI inflation. Moreover, π^{en}_{it} denotes quarter-on-quarter seasonally adjusted energy CPI inflation at annualised rates in percent; *outputgap*_{it} denotes the output gap; and $\Delta NEER_{it}$ is the q/q change in the nominal effective exchange rate in percent, calculated from the log change in the nominal effective exchange rate, with an increase indicating an appreciation of the currency. Finally, α_i are country fixed effects to control for observed and unobserved country heterogeneity, and β_t are time fixed effects in order to control for all observed and unobserved variation in common global factors. Energy CPI inflation is included with a lag in order to address potential endogeneity issues. We use robust standard errors clustered at the country level.

The estimates for equation (1) are shown in column I of Table 1. We find that energy CPI inflation has a positive significant effect on food CPI inflation, after controlling for cyclical factors via the output gap, as well as for exchange rate changes and global factors. An increase in energy CPI inflation in a quarter of 10 percentage points (pp) (q/q, saar) leads to an increase of around 0.2pp in food CPI inflation (y/y) one year ahead. As would be expected, the output gap and exchange rate depreciations have significantly positive effects on food CPI inflation.

Next we estimate equation (1) when adding inflation expectations,

$$\pi_{it;4}^{f} = \rho \pi_{it-1}^{f} + \theta \pi_{it-1}^{en} + \gamma \pi_{it}^{e} + \phi outputgap_{it} - \mu \Delta NEER_{it} + \beta_t + \alpha_i + \varepsilon_{it.}$$
(2)

where $\pi^{e_{it}}$ denotes next-year CPI inflation expectations in country *i* at time *t* from Consensus Economics surveys, year-on-year (y/y) in percent. The estimates for equation (2) are shown in column II of Table 1. When in addition controlling for inflation expectations, which have a significantly positive effect on food CPI inflation, we again find that energy CPI inflation has a positive significant effect on food CPI inflation.

We also estimate a modification of equation (1) when replacing time fixed effects by global food commodity price inflation, $\pi^{f_{c_t}}$,

$$\pi_{it;4}^{f} = \rho \,\pi_{it-1}^{f} + \theta \,\pi_{it-1}^{en} + \phi \,outputgap_{it} - \mu \,\Delta NEER_{it} + \lambda \,\pi_{t-1}^{fc} + \alpha_i + \varepsilon_{it.}$$
(3)

Food commodity price inflation (q/q, saar) is included with a lag in order to address potential endogeneity issues. The estimates for equation (3) are shown in column III of Table 1. Similarly, the results when replacing time fixed effects by food commodity price inflation in equation (2) are shown in column IV of Table 1. When replacing time fixed effects by global food commodity prices, which have a significantly positive effect on food CPI inflation, we again find that energy CPI inflation has a positive significant effect on food CPI inflation. Consequently, we find that the

significantly positive effect of energy CPI inflation on food CPI inflation is robust to in addition controlling for inflation expectations and global food commodity prices.

Moreover, when in addition controlling for core CPI inflation (q/q saar), $\pi^{core_{it}}$, by including its lag in all the regressions shown in Table 1, energy CPI inflation continues to have significantly positive effects in three of the four specifications (see Table 2), so that the result is generally robust to controlling for core inflation.

Next, we study how the effects of energy prices on food CPI inflation depend on energy dependency, by including an interaction term of lagged energy dependency with lagged energy CPI inflation,

$$\pi_{it;4}^{f} = \rho \pi_{it-1}^{f} + \theta \pi_{it-1}^{en} + \gamma \pi_{it-1}^{en} im_{it-1}^{en} + \phi outputgap_{it} - \mu \Delta NEER_{it} + \lambda im_{it-1}^{en} + \beta_t + \alpha_i + \varepsilon_{it.}$$
(4)

where energy dependency is measured as net energy imports as a share of energy use, im^{en}_{it} . The results are shown in column I of Table 3. The effect of energy CPI inflation on food CPI inflation is significantly higher (at the 5% significance level) when energy dependency is larger. The results of equation (4) when also controlling for inflation expectations are shown in column II of Table 3; the interaction term becomes more significant, at the 1% significance level. The results corresponding to columns I and II of Table 3 when in addition controlling for the lagged share of food imports in merchandise imports, im_{it-1} , are shown in columns III and IV of Table 3. The results are robust to this additional control, with the interaction term remaining significant.

4 Conclusions

This paper studies the effects of country-specific energy prices on food consumer price inflation within a cross-country Phillips curve framework. It considers a panel of 36 OECD member and candidate economies using quarterly data from the start of 1994 to the end of 2021. We find that energy CPI inflation has a significant effect on food CPI inflation, after controlling for cyclical factors via the output gap, for exchange rate changes and common global factors. This result is generally robust to also controlling for inflation expectations, global food commodity prices and core inflation. We also find that the effect of energy CPI inflation on food CPI inflation is significantly larger when energy dependency is higher.

References

Avalos, F. and W. Huang (2022), "Commodity markets: shocks and spillovers", Bank for International Settlements Quarterly Review, September, 15-29.

Avalos, F. and M. Lombardi (2015), "The biofuel connection: impact of US regulation on oil and food prices", BIS Working Papers, No 487.

Baek, J. and W. Koo (2014), "On the upsurge of U.S. food prices revisited", Economic Modelling, 42, 272-276.

Baffes, J. and A. Dennis (2013), "Long-Term Drivers of Food Prices", World Bank Policy Research Working Paper No. 6455.

Baumeister, C. and L. Kilian (2014), "Do oil price increases cause higher food prices?", Economic Policy, 29, 691-747.

Cecchetti, S. and R. Moessner (2008), "Commodity prices and inflation dynamics', Bank for International Settlements Quarterly Review, December, 55-66.

Clarida, R., Gali, J. and M. Gertler (1999), "The Science of Monetary Policy: A New Keynesian Perspective", *Journal of Economic Literature*, 37 (4), 1661-1707.

De Winne, J. and G. Peersman (2016), "Macroeconomic Effects of Disruptions in Global Food Commodity Markets: Evidence for the United States", Brookings Papers on Economic Activity, 47, 183-286.

De Winne, J. and G. Peersman (2021), "The adverse consequences of global harvest and weather disruptions on economic activity", Nature Climate Change, 11, 665-672.

Financial Times (2022), "Farmers and producers warn of winter food shortages in Europe", 7 September.

Forbes, K. (2019), "Has globalization changed the inflation process?", BIS Working Paper No. 791.

Galí, J., and M. Gertler (1999), "Inflation Dynamics: A Structural Econometric Analysis", Journal of Monetary Economics, 44(2), 195–222.

Irz, X., Niemi, J. and X. Liu (2013), "Determinants of food price inflation in Finland – the role of energy", Energy Policy, 63, 656-663.

Jasova, M., Moessner, R. and E. Takats (2019), "Exchange rate pass-through: what has changed since the crisis?", *International Journal of Central Banking*, 15(3), 27–58.

Jasova, M., Moessner, R. and E. Takats (2020), "Domestic and global output gaps as inflation drivers: what does the Phillips curve tell?", *Economic Modelling*, 87, 238–253.

Jordà, O. (2005), "Estimation and inference of impulse responses by local projections", American Economic Review, 95(1), 161-182.

Kirikkaleli, D. and I. Darbaz (2021), "The causal linkage between energy price and food price", Energies, 14, 4182.

Kohlscheen, E. (2022), "Understanding the food component of inflation", BIS Working Paper No. 1056.

Köse, N. and E. Ünal (2022), "The effects of the oil price and temperature on food inflation in Latin America", Environment, Development and Sustainability, <u>https://doi.org/10.1007/s10668-022-02817-2</u>.

Lambert, D. and D. Miljkovic (2010), "The sources of variability of U.S. food prices", Journal of Policy Modelling, 32, 210-222.

Levin, A. and R. Moessner (2005), "Inflation persistence and monetary policy design: an overview", ECB Working Paper No. 539.

Moessner, R. (2022), "Effects of carbon pricing on inflation", CESifo Working Paper No. 9563.

Sands, R. and P. Westcott (2011), "Impacts of higher energy prices on agriculture and rural economies", Economic Research Service Report, US Department of Agriculture, August.

Sarwar, M., Hussain, H. and M. Maqbool (2020), "Pass through effects of oil price on food and non-food prices in Pakistan: A nonlinear ARDL approach", Resources Policy, 69, 101876.

Smets, F. (2003), "Maintaining price stability: how long is the medium term?", *Journal of Monetary Economics*, 50, 1293-1309.

Woodford, M. (2003), Interest and prices, Princeton: Princeton University Press.

Tables

Effects on food CPI inflation (y/y)				Table 1
Dependent variable: $\pi^{f}_{it;4}$				
	I	II	III	IV
π^{f}_{it-1}	0.1324***	0.0479**	0.1064***	0.0741***
π^{en}_{it-1}	0.0243***	0.0110**	0.0156***	0.0125***
π^{e}_{it}		0.6393***		0.4414***
outputgap _{it}	0.1564***	0.0349	0.0657*	0.0026
ΔNEER _{it}	0.2628***	0.1755***	0.2209***	0.1621***
π^{fc}_{t-1}			0.0347***	0.0342***
constant	3.4223***	0.9665	1.8342***	0.8935***
observations	3715	3112	1944	1836
number of countries	36	34	36	34
time fixed effects	yes	yes	no	no
R2 within	0.394	0.4333	0.255	0.240
R2 between	0.769	0.853	0.791	0.852

Note: Fixed effects panel estimation; sample period: 1994Q1-2021Q4. ***/**/* denote statistical significance at 1/5/10% confidence level. Robust standard errors clustered at the country level.

Effects on food CPI inflation (y/y): with core inflation				Table 2
Dependent variable: $\pi^{f}_{it;4}$				
	I	II	III	IV
π^{f}_{it-1}	0.1068***	0.0481**	0.1004***	0.0761***
π^{en}_{it-1}	0.0082	0.0111**	0.0146***	0.0131***
π^{core}_{it-1}	0.2455***	-0.0054	0.0645	-0.0658
π^{e}_{it}		0.6450***		0.4989***
outputgap _{it}	0.1073**	0.0354	0.0548*	0.0086
ΔNEER _{it}	0.2628***	0.1755***	0.2201***	0.1619***
π^{fc}_{r-1}			0.0351***	0.0339***
constant	2.6883***	0.9629	1.7284***	0.8865***
observations	3700	3112	1944	1836
number of countries	36	34	36	34
time fixed effects	yes	yes	no	no
R2 within	0.439	0.433	0.256	0.241
R2 between	0.875	0.853	0.838	0.854
Note Fixed effects nanel estimation	sample period 199401-20)2104 ***/**/* denote statis	tical significance at 1/5/10	% confidence level Robust

Note: Fixed effects panel estimation; sample period: 1994Q1-2021Q4. ***/**/* denote statistical significance at 1/5/10% confidence level. Robust standard errors clustered at the country level.

Effects on food C	Table 3					
Dependent variable	$:\pi^{f}_{it;4}$					
	Ι	II	III	IV		
π^{f}_{it-1}	0.1425***	0.0558**	0.1422***	0.0569**		
π ^{en} _{it-1}	0.0286***	0.0158**	0.0285***	0.0155**		
π^{en}_{it-1} im $^{en}_{it-1}$	0.0036**	0.0028***	0.0036**	0.0027***		
π ^e _{it}		0.6445***		0.6402***		
outputgap _{it}	0.1770***	0.0369	0.1663***	0.0281		
ΔNEER _{it}	0.2713***	0.1848***	0.2713***	0.1847***		
im ^{en} _{it-1}	-0.30	0.13	-0.2694	0.1394		
im ^f _{it-1}			-11.0070	-8.6191		
constant	3.5022***	0.8622	4.5265***	1.6650		
observations	2987	2424	2953	2404		
number of countri	36	34	36	34		
time fixed effects	yes	yes	yes	yes		
R2 within	0.416	0.471	0.419	0.472		
R2 between	0.412	0.742	0.383	0.692		
Note: Fixed effects panel estimation; sample period: 1994Q1-2015Q4. ***/**/* denote statistical significance at 1/5/10% confidence						

level. Robust standard errors clustered at the country level.