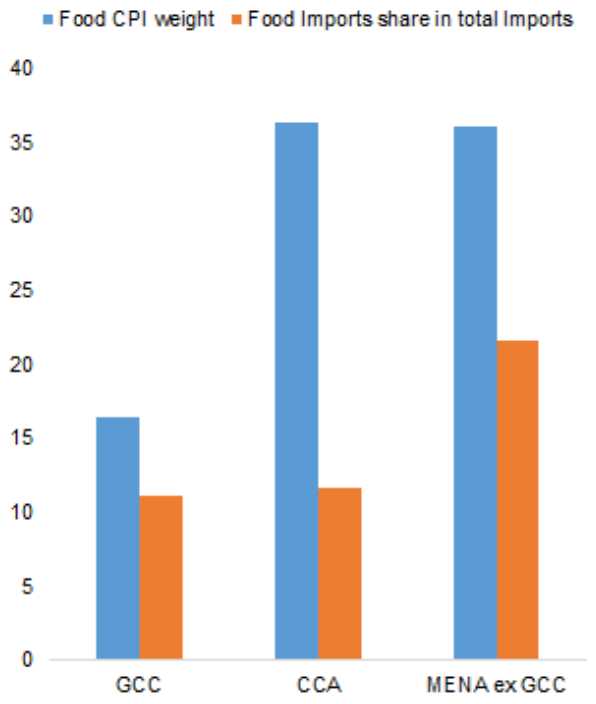
Online Annexes. Here Today, Where Tomorrow? A Deep Dive into Inflation Dynamics and Drivers in the Middle East and Central Asia

Online Annex 1.1

As discussed in the Inflation Deep Dive and shown in Figure 1.1.1 below, GCC countries have, on average, lower shares of food in the CPI and of food imports in total imports compared to both MENA (excluding the GCC countries) and the CCA.

Figure 1.1.1. Food CPI Weight and Food Imports Share of Total Imports
(Percent)



Sources: IMF staff calculations based on data from Haver Analytics, country authorities, and the United Nations Conference on Trade and Development. UNCTADstat database.
Note: CCA = Caucasus and Central Asia; CPI = consumer price index; GCC = Gulf Cooperation Council; MENA = Middle East and North Africa. Food weight in the CPI includes nonalcoholic beverages and is unweighted average, latest year available. The Food CPI weight corresponds to the latest year available. The Food Imports share in total imports correspond to the average for 2016-2020.

Core vs Non-core Inflation Approximations

The remainder of this Annex examines the decomposition of Consumer Price Index (CPI) inflation used in Section 2.1, looking at three components: 1) Food; 2) Energy; and 3) Headline inflation, excluding Food and Energy, labeled Other. The results of this decomposition are summarized in the following table:

Table 1.1.1. Contributions to CPI Inflation

(Year-over-year, percent)

Subregion	Component	2020	2021	Change 2020-21	Contribution to change (percent)
MENA excluding GCC	Food	1.2	3.2	2.1	59.5
	Energy	0.1	0.3	0.2	5.9
	Other	4.2	5.4	1.2	34.6
	Headline	5.5	8.9	3.5	100.0
GCC	Food	0.6	0.5	-0.1	-4.8
	Energy	-0.5	-0.5	0.0	1.7
	Other	-0.6	1.6	2.1	103.4
	Headline	-0.4	1.7	2.1	100.0
CCA	Food	2.5	4.1	1.6	41.8
	Energy	-0.1	1.3	1.4	35.8
	Other	2.0	3.5	1.5	37.7
	Headline	4.5	8.3	3.9	100.0

Source: IMF staff calculations based on data from Haver Analytics and country authorities.

For some countries, CPI data are not available at the disaggregation level that allows the exclusion of the most volatile items of CPI inflation, which are generally a subset of food items plus energy-related items (that is, electricity, gas and other fuels, gasoline, etc.). An approximation to core inflation can still be obtained by excluding from the CPI the two broad categories, or divisions in the terminology of the Classification of Individual Consumption by Purpose (COICOP), which contain these volatile items—namely, Food and Non-Alcoholic Beverages as a proxy for Food, and Housing, Water, Electricity, Gas and Other Fuels as a proxy for Energy.

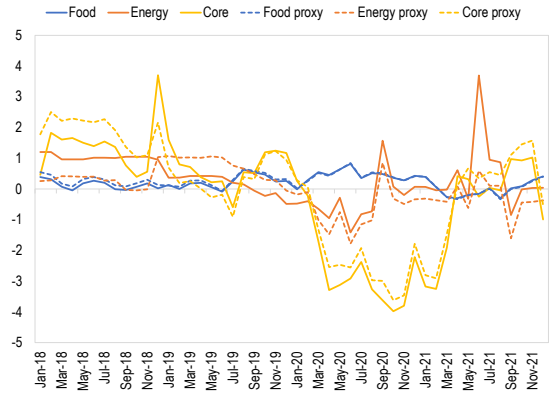
This approximation to core inflation (that is, Headline excluding Food and Non-Alcoholic Beverages and Housing, Water, Electricity, Gas and Other Fuels) implies that the measure for Food contains non-volatile components, namely, beverages and processed food items whose price is generally not as volatile as produce and other perishable food items, as well as food items whose price is regulated. It also implies that the measure for Housing contains non-volatile components, namely Housing Cost (both actual rentals and imputed rentals for owner-occupied housing), Maintenance and Repair of Dwelling, and Water Supply and Miscellaneous Services.

Given that the weight of Housing, Water, Electricity, Gas and Other Fuels in the total CPI is high (typically the second highest category after Food and Non-Alcoholic Beverages), this implies that the approximation error could also be high. To the extent that the non-fuel components of Housing are not volatile, their exclusion from the core approximation may affect the level but not the trend. This approximation also does not include fuels used in transport (that is, gasoline, diesel, gas, etc.), which are included as Operation of Personal Transport under the broad category of Transport. To the extent that gasoline prices, along with those of other fuels, have increased significantly over the past year or so, this implies the approximation to the core component will be higher in both levels and trends than if these items were excluded from the core. The net effect of the two measurement errors is uncertain, as the higher weight allocated to fuels by using the weight of the whole Housing category is offset by the fact that fuels from the Transport category are excluded.

For countries for which more disaggregated CPI data are available (Table 1.1.2 below has the level of disaggregation at which CPI data are available), this approximation can be compared with a more granular definition of the core and non-core components of inflation which excludes non-fuel components from Energy and in turn includes fuel used in transport. The examples below for three countries from the various subregions in ME&CA show that the approximation is reasonable, as evidenced by the fact that all components have the same trend and the differences between the series are relatively small.

Figure 1.1.2a. Bahrain: Contributions to CPI Inflation

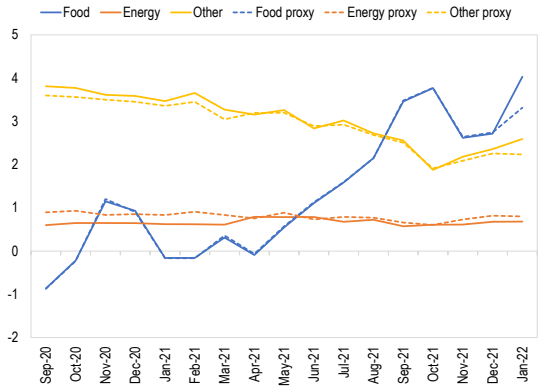
(Year-over-year, percent)



Source: IMF staff calculations based on data from Haver Analytics and country authorities.

Figure 1.1.2b. Egypt: Contributions to Urban CPI Inflation

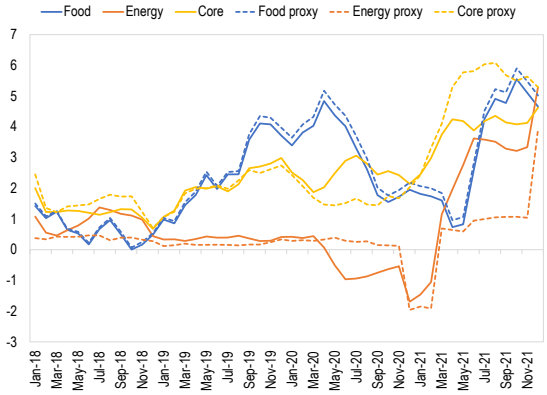
(Year-over-year, percent)



Source: IMF staff calculations based on data from Haver Analytics and country authorities.

Figure 1.1.2c. Georgia: Contributions to CPI Inflation

(Year-over-year, percent)



Source: IMF staff calculations based on data from Haver Analytics and country authorities.

Table 1.1.2. Consumer Price Indices in ME&CA Countries by Level of Disaggregation

Country	Base period	Disaggregation level	Notes
Afghanistan	March 2004 = 100	1	
Algeria	2001=100	1	ONS data outdated (latest is November 2019)
Armenia	2015=100	1	3-digit COICOP classification available at the annual frequency
Azerbaijan	2005=100	0	A breakdown is available between three broad groups: food products, nonfood products, and services
Bahrain	April 2019=100	2-3	The CPI has disaggregated data at the level of 54 groups of products
Djibouti	2013=100	2	Individual price indices for 41 groups of products are available through July 2021
Egypt	2018-2019=100	2	The CAPMAS National CPI has a greater level of disaggregation (54 groups of products) in Haver than the CBE Urban Areas CPI
Georgia	2010=100	3-4	The NSO has available detailed price indices for 41 groups of products
Iran	April 2016-March 2017=100	1+	The CPI has disaggregated data at the level of 23 groups of products
Iraq	2012=100	1+	The CPI has disaggregated data at the level of 29 groups of products
Jordan	2018=100	1+	The CPI has disaggregated data at the level of 35 groups of products
Kazakhstan	December 2015=100	4	The CPI has disaggregated data at the level of 24 groups of products
Kuwait	2012=100	4	The CPI has disaggregated data at the level of 200+ groups of products
Kyrgyz Republic	2005=100	2-3	The CPI has disaggregated data at the level of 55 groups of products
Lebanon	December 2013=100	1	The CPI has disaggregated data at the level of 16 groups of products in Haver
Libya	2008=100	1	
Mauritania	2014=100	1+	The CPI has disaggregated data at the level of 19 groups of products
Morocco	2017=100	2	The CPI has disaggregated annual data at the level of 41 groups of products.
Oman	2012=100	4	The CPI has disaggregated data at the level of 200+ groups of products
Pakistan	July 2015- June 2016=100	4	The National CPI is computed using the weighted average of Urban and Rural CPIs
Qatar	2018=100	1	
Saudi Arabia	2018=100	4	The CPI has disaggregated data at the level of 101 groups of products
Somalia	2018=100	1	
Sudan	2007=100	1	
Syrian Arab Republic	2010=100	1+	Only available through Central Bureau of Statistics website and only up to end-2019
Tajikistan	2010=100	1	A breakdown is available between food products and nonfood products
Tunisia	2015=100	1	The CPI has disaggregated data at the level of 51 groups of products
Turkmenistan	2010=100	NA	A breakdown is available between three broad groups: food products, nonfood products, and services
United Arab Emirates	2014=100	2-3	The CPI has disaggregated data at the level of 76 groups of products
Uzbekistan	2010=100	1+	The CPI has disaggregated data at the level of 24 groups of products up to December 2020.
West Bank and Gaza	2018=100	1	
Yemen	NA	NA	

Online Annex 1.2

The empirical analysis to uncover the role of domestic and external factors in driving inflation consists of estimating an augmented Phillips curve using quarterly data for 10 countries from the first quarter of 2014 to the last quarter of 2021. We augment the Phillips Curve (Gali and Gertler, 1999; Gali, Gertler, and Lopez-Salido, 2001, 2003) with open economy variables that proxy for macroeconomic developments in the rest of the world (Auer, Borio, and Filardo 2017; Bems, Caselli, Grigoli, Gruss, Lian, 2018).

This Online Annex describes the reduced form estimation of the relationship between global/domestic slack and inflation. Specifically, section 2.2 of the main text starts with an estimate of the following baseline specification:

$$\pi_{i,t} = \alpha + \beta_1 \pi^e_{i,t} + \beta_2 \pi_{i,t-1} + \beta_3 y^{domestic}_{i,t} + \beta_4 y^{foreign}_{i,t} + \beta_5 \Delta P_{i,t-1} + \beta_6 Z_{i,t-1} + FE + \varepsilon_{i,t}$$

where *i* indexes the country, *t* the quarterly time period. Quarter-over-quarter core or headline inflation $\pi_{i,t}$ is regressed on the following covariates: $\pi^e_{i,t}$ is inflation expectations, measured by the five-year ahead forecast for CPI inflation from the IMF's World Economic Outlook, $\pi_{i,t-1}$ is lagged core or headline inflation, $y^{domestic}_{i,t}$ is the domestic output gap, $y^{foreign}_{i,t}$ is the foreign output gap, $\Delta P_{i,t-1}$ captures a measure of external price pressures[1] in the previous period, $Z_{i,t-1}$ is the lag of energy and food price inflation, and FE captures both country and time fixed effects.

The domestic and foreign output gaps are estimated as the difference between the respective actual and potential output in percent of potential output, where potential is estimated as a HP-filtered underlying trend of output. For oil exporters, the estimations use non-oil GDP. Inflation expectations, a key variable in the analysis, are from IMF desk projections due to the limited availability of data from Consensus Economics. We use the average of the biannual WEO forecasts to obtain a proxy with quarterly frequency. We estimate the baseline specification employing linear regression with country and time fixed effects.

Table 1.2.1 presents estimation results for the baseline specification. These indicate that external price pressures—based on trading partners' producer price indexes—and inflation expectations have a highly statistically significant effect on domestic core and headline inflation. Lagged inflation loses significance once external price pressures are controlled for. Other variables, including the domestic output gap, are imprecisely estimated.

[1] Two measures of external price pressures are used: i) the percent change in import-weighted trading partners' producer price indexes (converted to local currency using the nominal effective exchange rate) and relative to the percent change in the GDP deflator, following the October 2021 *World Economic Outlook, Chapter 2;* and ii) the lagged quarter-over-quarter percentage change in the import price index.

Table 1.2.1. Phillips Curve Estimation, Baseline Specification Augmented for External Factors

	Core inflation	Core inflation	Headline Inflation	Headline Inflation
Inflation expectations 5 year ahead	0.228***	0.209***	0.273***	0.215***
	(0.061)	(0.078)	(0.062)	(0.065)
Lag of core (headline) price inflation	0.270**	0.0574	0.226***	-0.0515
	(0.113)	(0.087)	(0.079)	(0.173)
Output Gap	-0.000383	0.00717	-0.000481	-0.0448
	(0.001)	(0.032)	(0.001)	(0.038)
Lag of external price pressure		0.0320***		0.0307***
		(0.009)		(0.006)
Foreign Output Gap		-0.448		-0.357
		(0.423)		(0.578)
Lag of energy inflation				0.099
				(0.084)
Lag of food inflation				0.0804
				(0.084)
Observations	348	189	409	189
R-Squared overall	0.53	0.58	0.53	0.68
R-Squared Adjusted	0.46	0.48	0.46	0.59
R-Squared within	0.24	0.29	0.22	0.31

Notes: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regression include country and time fixed effects. Countries include: Egypt, Georgia, Iran, Jordan, Kazakhstan, Kuwait, Morocco, Qatar, Tunisia, Saudi Arabia.

Sources: IMF, World Economic Outlook (2021), Haver; and IMF Staff estimations.

Robustness Tests

Inflation expectations in the baseline specification correspond to five-year-ahead inflation forecasts, which is regarded as a sufficiently long horizon to capture beliefs about inflation in the long term rather than the effect of transitory shocks and the response of monetary policy. The empirical literature distinguishes between long-term inflation expectations (five-year-ahead inflation forecasts) and medium-run (two and three-year ahead) inflation expectations. As a robustness test, three-year-ahead inflation forecasts are included and the findings from Table 1.2.1 remain robust (Table 1.2.2).

Table 1.2.2. Phillips Curve Estimation

(3-year inflation forecast)

	Core inflation	Headline inflation
Inflation expectations 3 year ahead	0.260**	0.276**
	(0.106)	(0.106)
Lag of core/headline price inflation	0.0568	-0.0552
	(0.0869)	(0.177)
Output Gap	0.01	-0.0378
	(0.0313)	(0.0329)
Lag of external price pressure	0.0312***	0.0300***
	(0.0091)	(0.00618)
Foreign Output Gap	-0.364	-0.359
	(0.4)	(0.566)
Lag of energy inflation		0.105
		(0.0839)
Lag of food inflation		0.078
		(0.0841)
Observations	189	189
R-Squared overall	0.60	0.70

Notes: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regression include country and time fixed effects.

Sources: IMF, World Economic Outlook (2021), Haver; and IMF Staff estimations.

Our analysis suggests that external price pressures are a strong and robust determinant of inflation. When using import prices instead of the measure based on trading partners' producer price indexes to proxy for such pressures, the key results are broadly unchanged—most notably, import prices and inflation expectations remain statistically significant (Table 11.2.3).

Table 1.2.3. Phillips Curve Estimation
(Import prices)

	Core inflation	Headline Inflation
Inflation expectations 5 year ahead	0.265***	0.322***
	(0.076)	(0.076)
Lag of core (headline) price inflation	0.275**	0.0708
	(0.127)	(0.278)
Output Gap	0.000424	0.00106
	(0.003)	(0.0029)
Lag import price	0.211**	0.215**
	(0.092)	(0.104)
Foreign Output Gap	0.365	0.717
	(0.351)	(0.548)
Lag of energy inflation		0.131
		(0.115)
Lag of food inflation		0.0532
		(0.128)
Observations	244	226
R-Squared overall	0.547	0.618

Notes: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regression include country and time fixed effects.

Sources: IMF, World Economic Outlook (2021), Haver; and IMF Staff estimations.

Measuring output gaps for the region's countries is subject to high uncertainty and measurement errors.[2] Albuquerque and Baumann (2017) and Hong et al. (2018) demonstrated the importance of considering alternative measures of economic slack, other than the deviation of unemployment from a hard-to-estimate NAIRU and the output gap. As shown in the October 2021 *Regional Economic Outlook* (REO)*: Middle East and Central Asia*, the unemployment rate, if analyzed in isolation, can mask the full impact of the pandemic shock because it does not consider that many workers might exit the labor force in response to the shock. We therefore use the employment gap as an alternative measure of slack, with the caveat that data are not widely available on a comparable basis across all countries. Results reported in Table 1.2.4 suggest that external factors continue to play an important role, but inflation expectations remain statistically significant only in the headline inflation specification (column 2). Other alternative measures, such as money supply in excess of GDP or the credit-to-GDP gap, do not seem to explain domestic inflation dynamics for the limited country sample used in the estimation (Table 1.2.5 and A.1.2.6).[3] Likewise, following Albuquerque and Baumann (2017), a principal component of three widely measures of slack (unemployment gap, employment gap, and output gap) does not explain domestic inflation dynamics.

[2] See Orphanides and van Norden (2005); Coibon (2018); Barkema et al. (2020).

[3] These results remain unchanged when using the primary balance as percent of GDP (non-oil primary balances for oil-exporters) as a gauge of domestic factors.

Table 1.2.4. Phillips Curve Estimation
(Employment gap)

	Core inflation	Headline Inflation
Inflation expectations 5 year ahead	0.185	0.345*
	(0.217)	(0.198)
Lag of core (headline) price inflation	0.0732	0.122
	(0.117)	(0.161)
Employment Gap	0.0285	0.095
	(0.067)	(0.078)
Lag of external price pressure	0.0304**	0.0252***
	(0.012)	(0.007)
Foreign Output Gap	-0.0959	-0.528
	(0.562)	(0.693)
Lag of energy inflation		-0.0349
		(0.080)
Lag of food inflation		-0.0174
		(0.095)
Observations	101	101
R-Squared overall	0.63	0.70

Notes: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regression include country and time fixed effects.

Sources: IMF, World Economic Outlook (2021), Haver; and IMF Staff estimations.

Table 1.2.5. Phillips Curve Estimation
(Money supply)

	Core inflation	Headline Inflation
Inflation expectations 5 year ahead	0.191	0.186
	(0.198)	(0.177)
Lag of core (headline) price inflation	0.0465	-0.0791
	(0.087)	(0.181)
Money supply in excess of GDP	0.0000194	0.0000078
	(0.00001)	(0.00001)
Lag of external price pressure	0.0304***	0.0275***
	(0.0092)	(0.01)
Foreign Output Gap	-0.108	-0.0218
	(0.391)	(0.533)
Lag of energy inflation		0.116
		(0.088)
Lag of food inflation		0.0871
		(0.092)
Observations	189	189
R-Squared overall	0.58	0.66

Notes: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regression include country and time fixed effects.

Sources: IMF, World Economic Outlook (2021), Haver; and IMF Staff estimations.

Table 1.2.6. Phillips Curve Estimation
(Credit growth)

	Core inflation	Headline Inflation
Inflation expectations 5 year ahead	0.232	0.268
	(0.206)	(0.183)
Lag of core (headline) price inflation	0.101	0.0531
	(0.094)	(0.17)
Lag credit to GDP gap	-1.002	0.657
	(0.8)	(1.917)
Lag of external price pressure	0.0287***	0.0243***
	(0.01)	(0.01)
Foreign Output Gap	-0.105	-0.271
	(0.32)	(0.471)
Lag of energy inflation		0.0557
		(0.089)
Lag of food inflation		0.0514
		(0.087)
Observations	145	124
R-Squared overall	0.75	0.77

Notes: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regression include country and time fixed effects.

Sources: IMF, World Economic Outlook (2021), Haver; and IMF Staff estimations.

Table 1.2.7. Phillips Curve Estimation
(Trading partners' producer price index)

	Core inflation	Core inflation
Inflation expectations 5 year ahead	0.235***	0.266***
	(0.0721)	(0.0812)
Lag of core (headline) price inflation	0.329**	0.165
	(0.138)	(0.168)
Output Gap	-0.0171	-0.0385
	(0.0146)	(0.0282)
Lag of producer price index	0.0507*	0.0491*
	(0.0279)	(0.0282)
Foreign Output Gap	0.421	0.551
	(0.302)	(0.425)
Lag NEER		-0.0283
		(0.0384)
Observations	246	161
R-Squared overall	0.61	0.70

Notes: Robust standard errors in parentheses *** p<0.01, ** p<0.05, * p<0.1. All regression include country and time fixed effects.

Sources: IMF, World Economic Outlook (2021), Haver; and IMF Staff estimations.

Finally, we estimate an alternative specification to confirm that previous results are not affected by using the nominal effective exchange rate in the construction of the external price pressure measure used in the baseline specification. For this purpose, we include separately the nominal effective exchange rate and the trading partners' producer price index in the specification for core inflation (Table 1.2.7). Results indicate that global price shocks remain statistically significant.

Focusing on recent periods, rather than longer-term dynamics, and a wider sample coverage, domestic factors, such as expansionary fiscal and monetary policies, and exchange rate depreciation, appear to play a role in driving inflation (Figures 1.2.8-1.2.10).

Figure 1.2.8. Change in Primary Fiscal Balance as a Percent of GDP (2019-2021) and Core Inflation
(Year-over-year, percent)

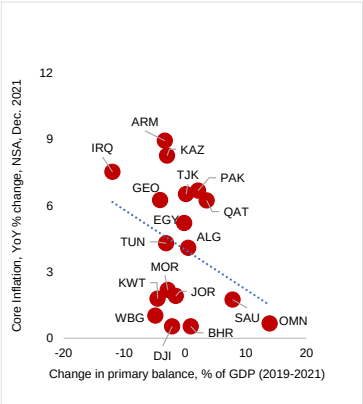


Figure 1.2.9. Change in Broad Money Supply as a Percent of GDP (2019-2021) and Core Inflation
(Year-over-year, percent)

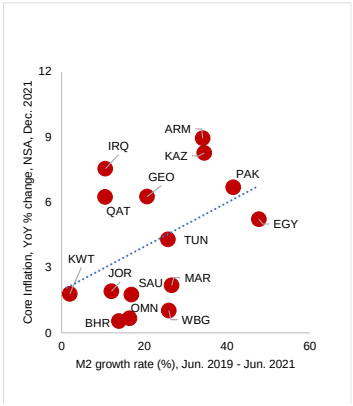
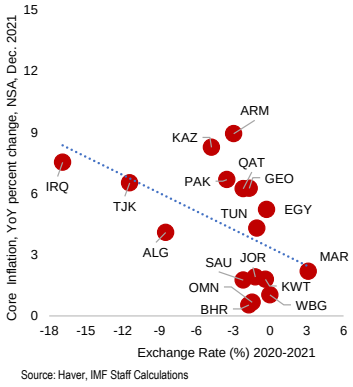


Figure 1.2.10. Change in the Nominal Effective Exchange Rate (2020-2021) and Core Inflation
(Year-over-year, percent)

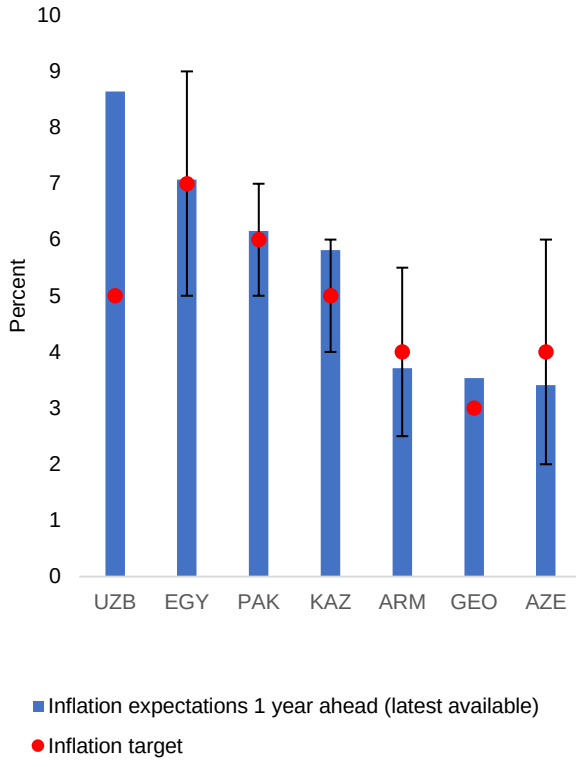


Source: WEO, Haver; and IMF staff calculations.

Since inflation expectations seem to be an important driver of inflation dynamics, it is crucial to investigate whether expectations have been affected by the recent surge in prices in the region, which in turn may feed into higher current and future inflation. Indeed short-term expectations have risen above the inflation target for countries where data are available (for example, in Georgia and Uzbekistan). For Kazakhstan short-term inflation expectation is above the inflation target but below the upper inflation target range. For a small subset of counries, where long-term inflation expectations and inflation target are available, long-term inflation expectations have remained broadly anchored (with the exception of Uzbekistan) at levels compatible with the targets and inflation target ranges as of February 2022 (Tables 1.2.11-1.2.12).[4] If inflation expectations become de-anchored, this could lead to longer-lasting inflationary pressures, as indicated by Phillips curve estimations.

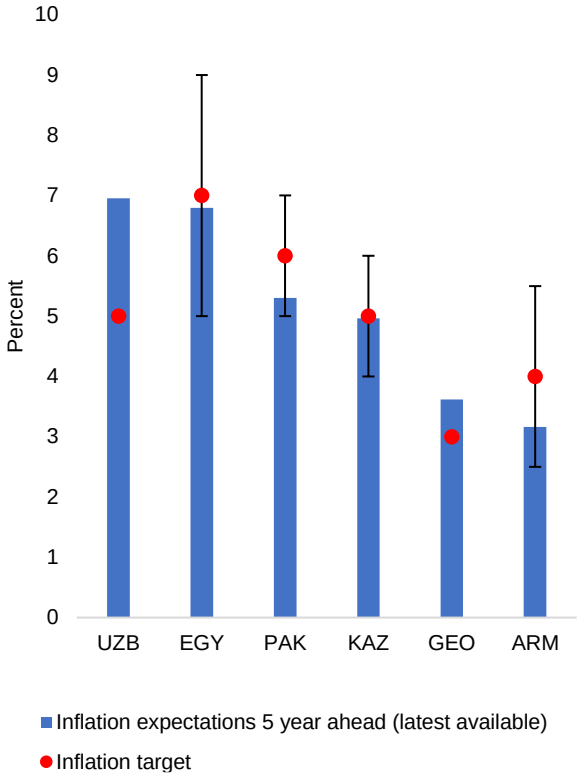
[4] Inflation expectations are measured using Consensus Surveys and are available for nine countries (Armenia, Azerbaijan, Egypt, Georgia, Kazakhstan, Pakistan, Saudi Arabia, Turkmenistan, Uzbekistan) for 1-, 3-, 5-, and 10-year horizons.

Table 1.2.11. Short-term Inflation Expectations (1-year ahead) and Inflation Target



Source: Haver, National Statistical Offices, Consensus Surveys
Note: The latest available data refers to Februrary 2022. Uzbekistan and Georgia have a point target and not an inflation target range.

Table 1.2.12. Long-term Inflation Expectations (5-year ahead) and Inflation Target



Source: Haver, National Statistical Offices, Consensus Surveys
Note: The latest available data refers to January 2022. Uzbekistan and Georgia have a point target and not an inflation target range. 5 year ahead inflation expectation is not available for Azerbaijan.

Online Annex 1.3

This Online Annex documents the methodology employed for estimating the pass-through of international food and oil prices and global supply-chain constraints to domestic price dynamics. Estimation is performed on an unbalanced panel of 23 countries.[5] The sample is restricted to countries for which CPI inflation is available on monthly frequencies. The estimation period ranges from January 2014 to December 2021.

To estimate the impact of global factors on domestic inflation, we follow the methodology proposed by Jordà (2005), which consists of estimating impulse response functions directly from local projections. This approach has been advocated by, among others, Stock and Watson (2007) and Auerbach and Gorodnichenko (2013) as a flexible alternative that does not impose the dynamic restrictions embedded in vector autoregressive (autoregressive distributed lag) specifications.

Specifically, for each period *k*, the following reduced-form equation is estimated:

$$\pi_{i,t+k} = \alpha_i^k + \sum_{j=1}^{l} \gamma_j \pi_{i,t-j} + \beta_k x_t + \sum_{j=1}^{k} \theta_j x_{i,t+j} + \sum_{j=1}^{l} \vartheta_j x_{i,t-j} + \delta z_{i,t} + \varepsilon_{i,t} \quad (1)$$

where π represents domestic CPI inflation of country *i* at time *t.* Inflation is defined as the month-over-month (log) change in the price index; x_t is the change the global factor in month *t.* Three global factors are considered: oil prices, international food prices, and global supply chain constraints. Each of these factors is shocked in isolation but controlling for the effect of the others. α_i are country-fixed effects while β_k measures the impact of changes in the (shocked) global factor on domestic inflation for each future period *k*. γ_{jk} captures the persistence of domestic CPI inflation. The term $z_{i,t}$ contains a list of control variables including month-fixed effects (to account for seasonality in the dependent variable), the world output gap to control for global demand pressures, the exchange rate of the domestic currency against the US dollar, and global factors not included in x_t. The specification also includes the forward leads of the of global factors between time 0 (the date of the shock) and the end of the forecast horizon (*k*) to correct the bias in the impulse response inherent in local projection methods (Teulings and Zubanov, 2014). The number of lags (*l*) included in the model is 1, but the results are robust to different lag length. Since fixed effects are included in the regression, the dynamic impact on inflation should be interpreted as relative to a country-specific trend.

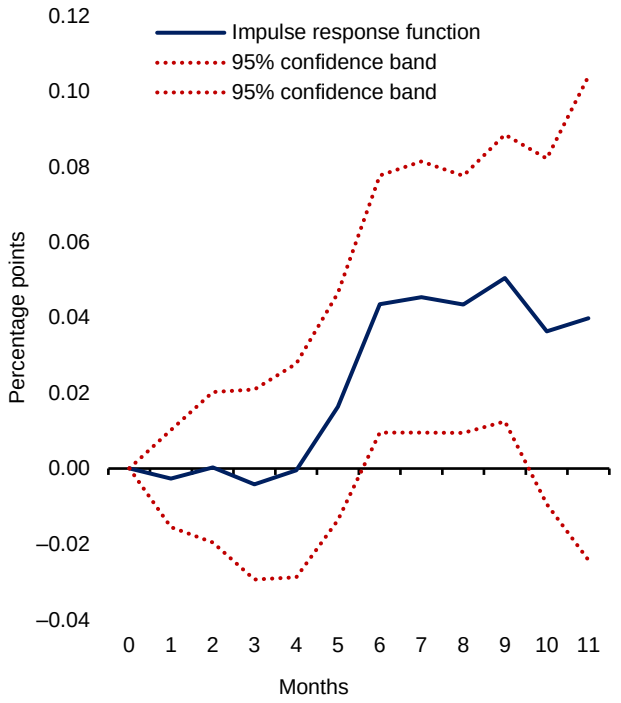
Global factors are measured as follows: the oil price is the (log difference of the) Brent spot market price in USD (month average); international food prices are measured as the (log difference of the) IMF Primary Commodities Food Price Index (2016 = 100). The index includes Cereal, Vegetable Oils, Meat, Seafood, Sugar, and Other Food (Apple (non-citrus fruit), Bananas, Chana (legumes), Fishmeal, Groundnuts, Milk (dairy), Tomato (vegetables)) Price Indices. We measure global supply chains disruptions with (changes in) the Global Supply Chain Pressure Index (GSCPI) proposed by G. Benigno, J. di Giovanni, J. Groen, and A. Noble (2022). The index is constructed by extracting co-movements in a set of indicators covering cross-border transportation costs (the Baltic Dry Index (BDI), the Harpex index, the U.S. Bureau of Labor Statistics (BLS) measures of air transportation of freight to and from the U.S.)

[5] Algeria, Armenia, Azerbaijan, Bahrain, Egypt, Georgia, Iran, Iraq, Jordan, Kazakhstan, Kuwait, Kyrgyz Republic, Morocco, Oman , Pakistan, Qatar, Saudi Arabia, Somalia, Tajikistan, Tunisia, United Arab Emirates, Uzbekistan, and West Bank and Gaza.

and country level data from the Institute of Supply Management (ISM) Manufacturing Purchasing Managers Index (PMI) surveys. Country-specific PMI components as well as in the transportation cost series are corrected for demand factors.

The estimated pass-through for food prices shows that a 1-percent rise in food prices translates on average into an increase in domestic inflation of about 0.05 percentage point within five months of the initial shock while disappearing after 10 months (Figure 1.3.1).

Figure 1.3.1. Response of CPI to Percent Shock in International Food Prices



Source: IMF staff calculations.
Note: The chart shows the cumulative Impulse Response Function (IRFs) for domestic inflation and 95% confidence interval bands following a 1 percent increase in international food prices. CPI = consumer price index.

To explain the cross-sectional variation in the dynamic response of domestic inflation to a shock in international food prices, we estimate country-specific equations starting from Model (1) and use the same set of controls. We then regress the impulse response functions obtained from these models on a set of determinants for international food price pass-through, estimating the following equation:

$$\Psi_i = b\Gamma_i + \mu_i \quad (2)$$

where for each country *i*, Ψ_i is the maximum of the impulse response function measuring the impact of a 1 percent increase in international food prices on domestic CPI, over a period of 18 months. If this impulse response function is not significant at the 5-percent significance level in any of the 18 months following the shock, Ψ_i is set equal to zero. Γ_i is a vector of explanatory variables of international food price pass-through, including the food import share (food imports as a share of total imports) and the

weight of food products in the CPI basket. Model (2) is estimated using standard OLS. Measurement error in the dependent variable (as Ψ_i is the result from a previous estimation) reduces the power of statistical tests on the significance of *b,* but does not create bias. Estimation results are reported in Table 1.3.1.

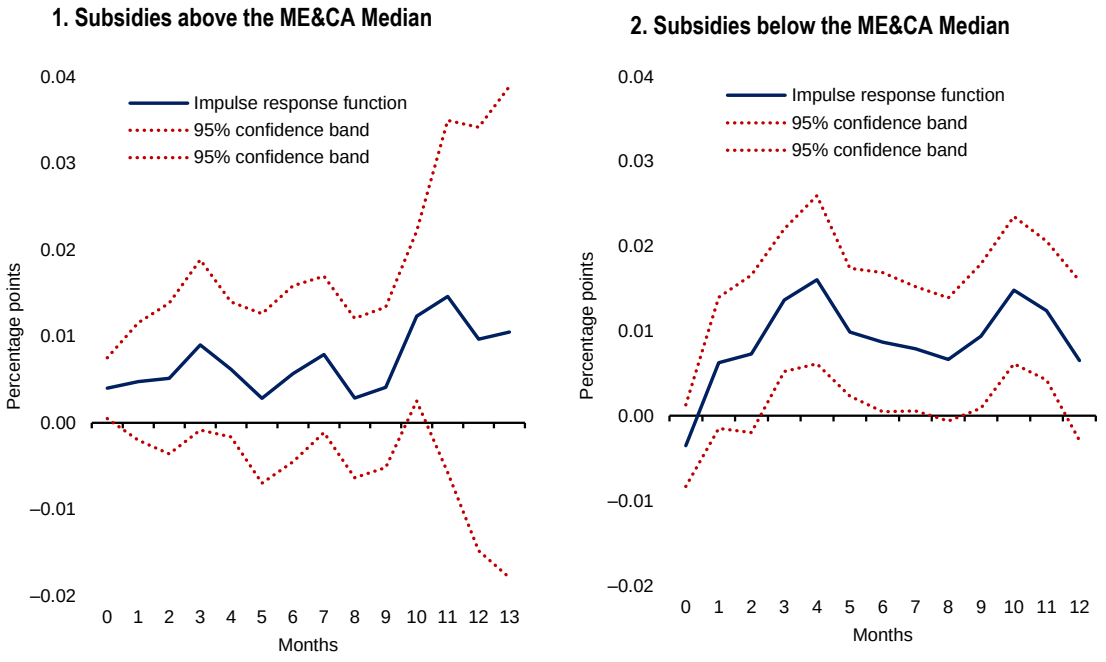
Table 1.3.1. Determinants of International Food Prices Pass-through to CPI

	(1) Int. food prices pass-through	(2) Int. food prices pass-through
Share of food in CPI	0.219**	
	(0.0699)	
Food import share		0.00614
		(0.0038)
Observations	17	21
R-squared	0.386	0.177

Robust standard errors in parentheses. * p<0.10, ** p<0.05

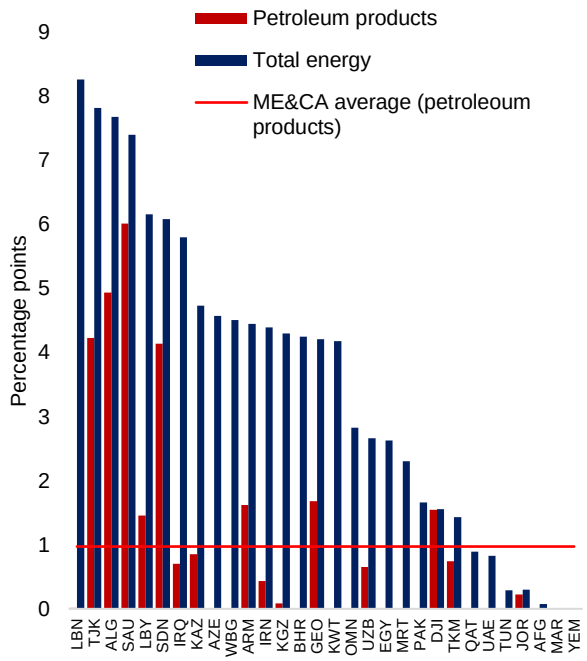
Looking at oil price pass-through, a 1-percent increase in oil prices translates into an increase in domestic inflation of about 0.01 percentage point, but only for those countries in which petroleum product-related subsidies, as a share of GDP, are below the median across ME&CA (Figure 1.3.2-1.3.3).

Figure 1.3.2. Pass-through of Oil Prices to Domestic Inflation
(Response of CPI to percent shock)



Source: IMF staff calculations.
Note: The charts show the cumulative Impulse Response Function (IRFs) for domestic inflation and 95% confidence interval bands following a 1 pecent increase in oil prices. CPI = consumer price index; ME&CA = Middle East and Central Asia

Figure 1.3.3. Fossil Fuel Subsidies, 2020
(Percent of GDP)

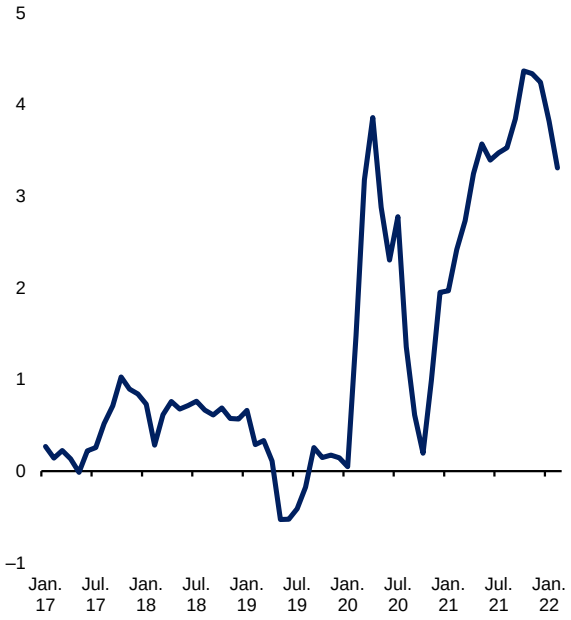


Source: Fossil Fuel Subsidy Tracker and IMF staff calculations.
Note: Country abbreviations are International Organization for Standardization country codes. ME&CA = Middle East and Central Asia. Explicit subsidies as a percentage of Gross Domestic Product (GDP). Syria and Lebanon excluded because of data limitations.

Finally, the estimation of the dynamic impact of supply-chain constraints (proxied by the GSCPI) on domestic inflation for ME&CA shows a positive and significant pass-through about 12 months after the shock (Figures 1.3.4 and 1.3.5).[6] The persistency of domestic inflation pressures associated with shocks to the GSCPI suggests that supply chain constraints could affect domestic price dynamics until the end of 2022 and beyond.

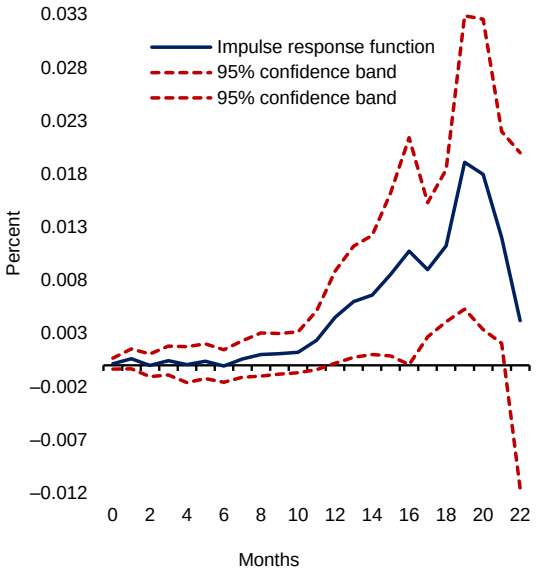
[6] The relatively long lag in which supply chain disruptions appear to affect domestic inflation may be affected by the pandemic period, where a significant recession may have delayed the impact of supply shocks on inflation.

Figure 1.3.4. Global Supply Chain Pressure Index



Source: Beningno et al. 2022

Figure 1.3.5. Response of CPI to a one Standard Deviation Shock in the GSCPI



Source: IMF staff calculations
Note: CPI = consumer price index; GSCPI = Global Supply Chain Pressure Index. The chart shows the cumulative Impulse Response Function (IRF) for domestic inflation and 95% confidence bands following a 1 standard deviation in the GSCPI.

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