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Evidence for the MENA Countries

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The transmission of oil and food prices to consumer prices Evidence for the MENA countries

Ansgar Belke, Christian Dreger[1]

Abstract. This paper investigates the effects of global oil and food price shocks to consumer prices in Middle East-North African (MENA) countries using threshold cointegration methods. Oil and food price shocks increase domestic prices in the long run, whereby the impact of food prices dominates. While global prices are weakly exogenous, consumer prices respond to deviations from the equilibrium relationship. The short run adjustment pattern exhibits asymmetries and is particularly strong after positive shocks. Downward rigidities on wages may play a crucial role in this regard, as the relatively weak reactions of consumer prices after negative shocks are related to labour market institutions and public subsidies. The more rigid the regulations the more pronounced are the asymmetries. Robustness checks show that international price shocks do not affect GDP growth.

Keywords: Oil and food price transmission, asymmetric error correction, MENA region

JEL: C22, E31, Q02

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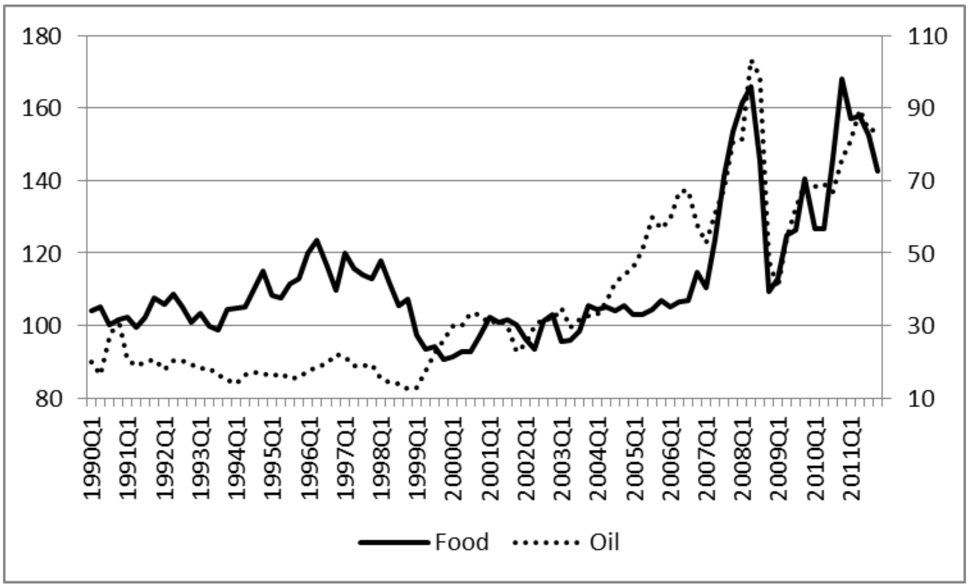
1 Introduction

In the pre-crisis period of globalization, the rapid integration of huge emerging market countries such as China and India into the world economy led to high demand in global food and energy markets (IMF, 2008). The depreciation of the US-dollar caused further upward pressure: While international prices are often denominated in dollar, many producers calculate the price in their own currency. Oil and food prices have moved in parallel in recent years (Figure 1). This pattern is probably also driven by legislative mandates to use cropland for the production of biofuels and the increasing role of commodities in international asset portfolios (Bakhat and Wuerzburg, 2013, Zilberman et al., 2013). While the global financial crisis led to a decline in the world demand for commodities, causing oil and food prices to fall, they started to rise again thereafter.

Figure 1: Oil and food prices



Note: IHS Global Insight (oil, dashed line, right axis), Food and Agriculture Organization of the United Nations (food, solid line, left axis).

Rocketing oil and food prices can affect the real side of the economy, depending on the degree of their transmission to the domestic price level. Price increases may depress the purchasing power of private households and can trigger production losses, as firms will choose labour and capital input to match the shifts in relative prices. In the case of price decreases, a reversal is expected, given that the adjustment pattern is symmetric. The effects should be especially visible in low-income net importing countries. As food represents a relatively large share of the consumption baskets of private households, accelerating prices can lead to increasing poverty and political instability. For instance, high and volatile food prices have contributed to social unrest in the eve of the Arab Spring (Breisinger, Ecker and Al Riffai, 2011). By exploring the causes and consequences of high food prices, especially in developing countries, Dewbre, Giner, Thompson and von Lampe (2008) have highlighted the importance of price transmission which is at the centre of our paper.

The remainder of the paper is organized as follows. Section 2 reviews the policy reactions to oil and food price shocks that have been implemented in the countries considered in the analysis. Section 3 provides a discussion the econometric methodology. Moreover, it presents the data and the results. In section 4, we deliver the outcome of some robustness checks. Among others, in turns out that international prices do not affect GDP growth. Finally, Section 5 concludes with some policy recommendations.

2 Policy reactions to oil and food price shocks –quantifying the pass-through

The degree of price transmission can differ across countries, depending on whether own resources can be mobilized to mitigate the effects. Policy responses may also shape the outcome (Timmer, 2008). In case of price hikes, governments can react by rising subsidies or improved safety nets to protect poor households. Export restrictions might be implemented to stimulate supply at domestic markets. Wage-price spirals may occur in countries with wage and price indexation. To combat the rising inflation pressure, central banks may tighten their monetary policy stance, but with adverse effects on the real economy. Countries with international reserves may react by appreciating their currencies. However, an appreciation hurts firms engaged in export-oriented activities and hampers the build-up of import-competing industries. While such policies could dampen the adverse effects of food and oil price shocks, they can contribute to higher instability in international markets and decrease the incentives of domestic farmers to respond with higher production. In addition, policies are not sustainable, if they imply a deterioration of public budgets.

This paper investigates the impacts of global food and oil prices on consumer prices for a sample of MENA countries: Algeria, Egypt, Jordan, Libya, Morocco, Syria and Tunisia. The selection is motivated by data availability. All countries considered are net food importers. Due to strong population growth, the vulnerabilities will likely increase in the future. The region is the most food import dependent region in the world. Food dependency ratios, i.e. net imports over private consumption exceed 50 percent on average, with substantial variation across countries (Ianchovichina, Loening and Wood, 2012). Moreover, Algeria is blessed with natural resources. Therefore, the impacts can be studied for resource abundant and resource scarce economies. Among the developing world, the MENA region is outstanding for its extensive use of price subsidies and controls. Hence, insights into the effectiveness of these measures can be obtained.

Previous studies looked at the impact of commodity prices, mostly from the perspective of industrial (Kilian (2008a, 2008b) or oil exporting countries (Esfahani, Mohaddes and Pesaran, 2012). Few results are available for non-oil exporting emerging countries. In a mixed sample of ten countries, De Gregorio, Landerretche and Neilson (2007) found a decline in the pass through from oil price inflation to consumer price inflation. The decrease is smaller than in industrial countries, probably due to wage price spirals or a less efficient use of energy. In contrast to oil prices, food prices did not receive much attention until the price hikes of 2007/08.

Based on reduced form VARs, Ferrucci, Jiménez-Rodríguez and Onorante (2010) concluded that international commodity price inflation is the main determinant of producer and consumer food price inflation in the euro area, with a pass-through coefficient of 0.3. According to the IMF (2008) study, the impact of oil price inflation exceeds its counterpart from food price inflation for advanced economies. For emerging markets, the ordering is reversed, i.e. food price inflation becomes more important due to different second round effects. The evidence is scarce for MENA countries. Following Ianchovichina, Loening and Wood (2012) a one percent increase of global food prices raises domestic food prices by 0.2 to 0.4 percent. For some countries like Egypt and Morocco, the price transmission exhibits significant asymmetries, as price increases have stronger absolute effects on domestic inflation than price decreases. Similar to the IMF (2008), the authors fit autoregressive models to inflation rates. Therefore, the results are potentially biased, as they ignore cointegration relationships between international and domestic price levels.

Therefore, the focus of this paper is on cointegration between international and domestic prices. To account for the previous finding of asymmetries, a nonlinear adjustment pattern towards the long run is considered.[2] According to our results, both oil and food price shocks increase domestic prices in the long run, and the elasticity of food prices is larger. While global prices are shown to be weakly exogenous, consumer prices respond to deviations from the long run. Hence, conditional error correction equations can be specified to determine domestic consumer price inflation. The adjustment pattern towards equilibrium is characterized by asymmetries and particularly strong after positive shocks. The feedback coefficients are related to labour market institutions. The more rigid the institutions the more pronounced the asymmetries. The effects are similar for resource abundant and resource scarce economies. This may be seen as an indication of the relevance of the resource curse hypothesis for Algeria (Sachs and Warner, 1999).

3 Data, econometrics and empirical results

We start with cointegration and weak exogeneity tests (Johansen 1988, 1991, Kremers, Ericsson and Dolado, 1992, Urbain, 1992). Based on this information, we estimate conditional error-correction models (ECMs) in the second step. By estimating symmetric and asymmetric variants of ECMs we acknowledge that transaction costs, trading rules, or policy changes may invalidate the linearity assumption. Although the linearity restriction should not have an impact on the long run in infinite samples, it could produce misleading inference over a finite time span.[3]

3.1 Data

Our data source is IHS Global Insight and The World Bank. The data used in the empirical model include

- Seasonally adjusted quarterly consumer price index data measured by local currencies and base year 2005=100, IHS.

[2] We finally decided to set the threshold equal to zero in order to be able to differentiate between positive and negative shocks. A value of zero would approximately also result from the application of the Hansen-Seo testing procedure for two-regime threshold cointegration in vector error-correction models (Hansen and Seo, 2002). The results are available on request from the authors.

[3] Several approaches take non-linearities into account. See Enders (2001), Enders and Granger (1998), Enders and Siklos (2001) and Hansen and Seo (2002). For a deeper discussion of these asymmetry issues in error-correction models see Belke, Beckmann and Verheyen (2013).

- Quarterly oil price data per barrel (Brent) in USD, base year 2005=100, IHS.
- Quarterly World Bank food price data based on nominal USD and 2005=100
- Bilateral exchange rates (Local currency per USD), IHS.

Following the results of standard unit root tests and also the consensus established in the literature, we consider all variables used in our investigation as integrated of order 1. The sample ranges from the first quarter of 1990 to the fourth quarter of 2011. We investigate five countries: Algeria, Egypt, Jordan, Morocco and Tunisia.

3.2 Results

3.2.1 Cointegration analysis (Johansen method), impacts on prices

The bivariate case – consumer prices and food versus oil prices

We begin with the presentation and discussion of the empirical results gained from *bivariate* cointegration exercises based on the Johansen method (Johansen, 1988, 1991). We display the results of our bivariate cointegration analysis in Tables 1 and 2. Table 1 examines the relationship among consumer prices (CPI) and food prices expressed in national currency, whereas Table 2 assesses the relation between CPI and oil prices in national currency.

As a main result, cointegration is usually detected and the long run impact of food prices turns out to be stronger than that of oil prices. The estimated food price elasticities are about twice as large as oil price elasticities. The consumer price index (CPI) reacts with the correct sign to restore deviations from equilibrium. Moreover, international prices are weakly exogeneous, except of Egypt and Tunisia. This does, however, not imply that Egypt and Tunisia affect global market prices, as international prices are measured in local currency. Hence, evidence based on inflation models is likely biased, as the cointegrating relationship is ignored.

Table 1: Cointegration analysis (Johansen method) - CPI and food prices (in national currency)

	Lag	Trace	B(Food)	F(CPI)	F(Food)
Algeria	2	38.04 (0.000)	0.546 (0.034)	-0.084 (0.015)	0.097 (0.086)
Egypt	2	22.33 (0.004)	1.037 (0.084)	-0.017 (0.007)	0.128 (0.050)
Jordan	1	15.51 (0.050)	0.886 (0.143)	-0.027 (0.009)	0.053 (0.045)
Morocco	1	25.55 (0.001)	0.250 (0.127)	-0.034 (0.007)	0.050 (0.053)
Tunisia	2	18.48 (0.017)	0.516 (0.053)	-0.014 (0.005)	0.239 (0.083)

Table 2: Cointegration analysis (Johansen method) - CPI and oil prices (in national currency)

	Lag	Trace	B(Oil)	F(CPI)	F(Oil)
Algeria	2	20.07 (0.010)	0.166 (0.076)	-0.029 (0.007)	0.017 (0.069)
Egypt	2	14.04 (0.082)	0.555 (0.064)	-0.018 (0.007)	0.184 (0.090)
Jordan	1	22.76 (0.003)	0.377 (0.038)	-0.045 (0.011)	0.228 (0.135)
Morocco	1	29.72 (0.000)	0.129 (0.032)	-0.040 (0.008)	0.170 (0.147)
Tunisia	2	14.91 (0.061)	0.257 (0.030)	-0.015 (0.005)	0.402 (0.182)

Note: Bilateral models, variables in logs. International prices transformed into domestic currency by spot exchange rates to the US-dollar (average of period). B(Food) and B(Oil) are long-run elasticities. F(CPI) is the feedback coefficient in the error correction equation for CPI inflation, F(Food), F(Oil) the corresponding parameter in the error correction equation for international price inflation. Trace statistic for null of no cointegration. Figures in parentheses are *p*-values for the trace statistic and standard errors otherwise. The lag length for the underlying VAR in levels is determined by the SBC. VAR includes a trend not restricted to cointegration relationship.

The trivariate case – decomposing international prices

We continue with the presentation and discussion of the empirical results gained from *trivariate* cointegration exercises, i.e. by decomposing the international price measured in domestic currency into the nominal exchange rate and the international price in US-dollar. Hence, we now deal with the long-run relation between three variables in which no variable is exogenous a priori.

We display the results of our trivariate cointegration analysis in Tables 3 and 4. Table 3 examines the relationship among consumer prices (CPI), the exchange rate (local currency per USD) and food prices in USD, whereas Table 4 assesses the relation between consumer prices (CPI), the exchange rate (local currency per USD) and oil prices in USD.

Table 3: Cointegration analysis (Johansen method) - CPI, exchange rate (LC per USD) and food prices (USD)

	Lag	Trace	B(ExRate)	B(Food)	F(CPI)
Algeria	1	37.75 (0.011)	-0.019 (0.007)	0.641 (0.326)	-0.018 (0.003)
Egypt	2	30.83 (0.038)	0.158 (0.036)	1.238 (0.174)	-0.032 (0.007)
Jordan	1	26.90 (0.104)	5.661 (4.404)	0.986 (0.201)	-0.019 (0.006)
Morocco	1	32.50 (0.011)	-0.003 (0.036)	0.181 (0.126)	-0.031 (0.006)
Tunisia	2	29.84 (0.050)	0.625 (0.090)	0.429 (0.054)	-0.016 (0.007)
		F(ExRate)	F(Food)		
Algeria		0.481 (0.488)	0.010 (0.015)		
Egypt		0.079 (0.087)	-0.018 (0.016)		
Jordan		-0.003 (0.002)	0.036 (0.032)		
Morocco		-0.343 (0.257)	0.072 (0.054)		
Tunisia		0.106 (0.072)	0.208 (0.112)		

Table 4: Cointegration analysis (Johansen method) - CPI, exchange rate (LC per USD) and oil prices (USD)

	Lag	Trace	B(ExRate)	B(Oil)	F(CPI)
Algeria	1	32.18 (0.026)	0.201 (0.038)	0.110 (0.879)	0.003 (0.001)
Egypt	2	30.46 (0.042)	-0.233 (0.091)	1.063 (0.181)	-0.008 (0.004)
Jordan	1	34.81 (0.012)	4.304 (1.450)	0.331 (0.029)	-0.063 (0.015)
Morocco	1	33.57 (0.018)	-0.003 (0.023)	0.120 (0.034)	-0.039 (0.007)
Tunisia	2	27.45 (0.091)	-0.181 (0.202)	0.319 (0.052)	-0.014 (0.004)
		F(ExRate)	F(Oil)		
Algeria		0.164 (0.094)	-0.002 (0.007)		
Egypt		-0.183 (0.051)	0.130 (0.047)		
Jordan		-0.002 (0.005)	0.294 (0.188)		
Morocco		-0.420 (0.307)	0.202 (0.151)		
Tunisia		-0.051 (0.040)	0.365 (0.132)		

Note: Empirical models are trivariate, as they also include the nominal exchange rates (ExRate), measured as units of local currency per US dollar (average of period). International price denominated in USD. B(…) denotes the long-run parameters in the cointegrating relationship, F(…) the feedback coefficients.

Basically, the results of the bivariate models displayed in Tables 1 and 2 are confirmed by the results displayed in Tables 3 and 4. One arrives nearly at the same conclusions if the international price in local currency is decomposed into its two ingredients. Especially in the food price model (Table 3), only the consumer price index (CPI) adjusts, while nominal exchange rates and the international price are weakly exogenous in all cases. The only exceptions from this rule can be found in the oil price model for Egypt and Tunisia.

This leads us to the same interpretation as in Tables 1 and 2. The differences between the food price and the oil price model seem to decrease slightly if the nominal exchange rate is included in the cointegrating relationship. The corresponding parameter often enters with a positive sign in the food price model (except Algeria and Morocco), which indicates a long-run depreciation in response to food price shocks. In contrast, it enters with a negative sign in the oil price model (except Algeria and Jordan), which in turn suggests an appreciation. At the same time, our empirical evidence reveals that exchange rate movements do not serve as complete shock absorbers. Oil prices are not weakly exogenous in the case of Tunisia.[4]

3.2.2 Estimating error-correction models – symmetric versus asymmetric adjustment

Based on the information gained in section 3.2.1, we proceed with estimating error-correction models. Given the results on weak exogeneity, we focus on conditional single equation models. Besides the models with a symmetric adjustment process (Table 5), asymmetries in the feedback mechanism are allowed (Table 6), depending on whether the (mean adjusted) error correction term is positive (EC>0) or negative (EC<=0). The motivation of this setup is the finding of nonlinearities in some papers of the related literature such as International Monetary Fund (2008) and Ianchovichina et al. (2012).

We start with the discussion of the results from the estimation of the symmetric error correction models displayed in Table 5 below. The endogenous variable is domestic CPI inflation. The parameter EC represents the (mean adjusted) error correction term which has been calculated from the cointegrating relationships in Tables 1 and 2. According to the usual test statistics autocorrelation, and some other issues are not a problem at all. However, some less unambiguous results from the Cusum of Squares test or the Ramsey test really speak in favour of adopting an asymmetric ECM as the next step.

[4] We also experimented with the real exchange rate instead of the nominal rate and gained overall similar results.

Table 5: Symmetric error correction models – estimation results

Food price model – ECM regression of local consumer prices on world food prices

	Algeria	Egypt	Jordan	Morocco	Tunisia
Constant	0.015 (0.003)	0.012 (0.002)	0.012 (0.002)	0.009 (0.001)	0.009 (0.001)
Δp_{t-1}	0.323 (0.095)	0.626 (0.095)			0.373 (0.092)
Δp_{t-2}		-0.306 (0.090)			
Δp_{t-4}			-0.316 (0.092)	-0.327 (0.097)	-0.338 (0.093)
$\Delta food_t$	0.051 (0.019)	0.072 (0.015)	0.057 (0.018)	0.024 (0.013)	0.011 (0.006)
$\Delta food_{t-1}$	-0.034 (0.020)		0.051 (0.020)		
EC_{t-1}	-0.085 (0.015)	-0.026 (0.006)	-0.025 (0.008)	-0.052 (0.008)	-0.024 (0.006)
R2	0.703	0.606	0.403	0.349	0.414
QM (1)	0.775	0.981	0.330	0.847	0.468
QM (4)	0.291	0.622	0.845	0.945	0.589

Oil price model – ECM regression of local consumer prices on world oil prices

	Algeria	Egypt	Jordan	Morocco	Tunisia
Constant	0.011 (0.003)	0.013 (0.002)	0.011 (0.002)	0.009 (0.001)	0.007 (0.001)
Δp_{t-1}	0.380 (0.103)	0.723 (0.103)	0.126 (0.101)		0.477 (0.092)
Δp_{t-2}	0.153 (0.100)	-0.349 (0.101)			
Δp_{t-4}			-0.298 (0.094)	-0.306 (0.091)	-0.233 (0.089)
Δoil_t			0.025 (0.009)	0.010 (0.006)	
EC_{t-1}	-0.029 (0.007)	-0.019 (0.006)	-0.043 (0.012)	-0.067 (0.009)	-0.014 (0.006)
R2	0.689	0.476	0.290	0.372	0.340
QM (1)	0.861	0.925	0.363	0.797	0.716
QM (4)	0.284	0.962	0.550	0.976	0.552

Note: The endogenous variable is domestic CPI inflation. All variables are specified in logs, p is CPI, and food and oil are international food and oil prices, both expressed in national currency. The parameter EC represents the (mean adjusted) error correction term which has been calculated from the cointegrating relationships in Tables 1 and 2. R^2 is the modified R-squared, and QM stands for the modified Portmanteau statistic for autocorrelation in the residuals up to the specified lag length. The figures in parentheses after the regression coefficients denote standard errors; the entries for QM are p-values..

The error correction terms displayed in Table 5 almost always turn out to be highly significant with the correct sign. The food price models often have a better fit. The contemporaneous impact of international inflation on domestic inflation is higher in case of food prices.

We are able to fit conditional single equation conditional error correction models because of the results on weak exogeneity. There are a few exceptions, particularly for Egypt and Tunisia, where international prices seem to be not weakly exogenous. This does not necessarily imply, however, that these countries can affect world prices, as international prices are denoted in domestic currency. In principle, the exchange rate may react to deviations from the long run, causing a rejection of the assumption on exogeneity. Moreover, we could argue that a bivariate error correction model for Egypt and Tunisia does not lead to different conclusions with respect to domestic inflation.

Let us now turn to the estimation results for asymmetric ECM specifications displayed in Table 6. The empirical evidence conveyed in this table does not indicate substantial improvement over Table 5. Nonetheless, the response to negative error-correction terms, seems to be higher, with the exception of Algeria, a MENA country with less rigid labour markets (Angel-Urdinola and Arvo Kuddo, 2010, Campos and Nugent, 2011). A negative error correction term implies that the CPI is below its long run equilibrium value. Such a constellation can occur after positive shocks in international prices. Instead, the response to positive error correction terms is often insignificant as for instance for Egypt. Here, the international price has declined, but the CPI did not adjust accordingly. Hence, this finding might indicate among others rigidities to downward price adjustments, probably driven by wage rigidities.

Table 6: Asymmetric error correction models – estimation results

Food price model - ECM regression of local consumer prices on world food prices

	Algeria	Egypt	Jordan	Morocco	Tunisia
Constant	0.017 (0.004)	0.010 (0.003)	0.011 (0.003)	0.007 (0.002)	0.008 (0.002)
Δp_{t-1}	0.319 (0.096)	0.591 (0.097)			0.359 (0.092)
Δp_{t-2}		-0.298 (0.089)			
Δp_{t-4}			-0.314 (0.092)	-0.344 (0.096)	-0.354 (0.093)
$\Delta food_t$	0.052 (0.019)	0.076 (0.015)	0.059 (0.018)	0.019 (0.013)	0.013 (0.006)
$\Delta food_{t-1}$	-0.035 (0.020)		0.050 (0.020)		
$EC>0_{t-1}$	-0.105 (0.031)	-0.016 (0.008)	-0.020 (0.016)	-0.017 (0.022)	-0.010 (0.011)
$EC<0_{t-1}$	-0.077 (0.019)	-0.043 (0.014)	-0.032 (0.019)	-0.075 (0.016)	-0.042 (0.013)
R2	0.701	0.611	0.397	0.365	0.423
QM (1)	0.791	0.823	0.310	0.793	0.508
QM (4)	0.341	0.637	0.857	0.916	0.526

Oil price model - ECM regression of local consumer prices on world oil prices

	Algeria	Egypt	Jordan	Morocco	Tunisia
Constant	0.017 (0.005)	0.012 (0.003)	0.008 (0.002)	0.010 (0.001)	0.007 (0.001)
Δp_{t-1}	0.361 (0.103)	0.718 (0.104)	0.054 (0.101)		0.463 (0.096)
Δp_{t-2}	0.126 (0.101)	-0.346 (0.101)			
Δp_{t-4}			-0.375 (0.095)	-0.304 (0.092)	-0.248 (0.094)
Δoil_t			0.023 (0.009)	0.011 (0.006)	
$EC>0_{t-1}$	-0.060 (0.024)	-0.015 (0.012)	-0.006 (0.018)	-0.072 (0.023)	-0.010 (0.009)
$EC<0_{t-1}$	-0.023 (0.008)	-0.024 (0.012)	-0.109 (0.028)	-0.065 (0.015)	-0.019 (0.012)
R2	0.692	0.476	0.341	0.365	0.334
QM (1)	0.793	0.925	0.252	0.788	0.632
QM (4)	0.327	0.962	0.668	0.975	0.650

Note: See Table 5. Asymmetric adjustment to the long run is allowed, depending on whether the (mean adjusted) error correction term is positive (EC>0) or negative (EC<=0).

This view is underlined by the observation that the non-GCC MENA countries investigated by us, on average, display a high realization of the Employing Workers index (EWI) from the World Bank Doing Business dataset, compared with international standards This strictness of employment regulation index represents the only source of consolidated data available on labor regulation in MENA countries. A higher value of this index indicates more rigidity in the labor law (Angel-Urdinola and Arvo Kuddo, 2010).

Nevertheless, one must take into account that employment laws in MENA remain subject to evasion, weak enforcement, and in many cases do not affect the large informal sector. Informality, defined as the share of employment not contributing to a pension scheme, is lowest among the MENA countries for Egypt – a country for which we identified a clear asymmetric error correction in the wake of price shocks.

Another piece of evidence supporting our view is that in Egypt labor regulation is perceived by firms as a major constraint while this is to a lesser extent true for other MENA countries like Jordan, Algeria and Morocco (Angel-Urdinola and Arvo Kuddo, 2010, Campos and Nugent, 2011). Finally, countries like Egypt rank highest in the LAMRIG ranking developed by Campos and Nugent (2011) using a de jure index of MENA labour market rigidity.

The evidence gained by us is, thus, overall consistent with the rare results on asymmetries in the pass-through of international price shocks in MENA countries, especially Egypt, in the literature summarized in section 2.

4 Robustness checks

4.1 Adapting the sample period: excluding the Arab Spring

With an eye on the potential incidence of the Arab Spring, the revolutionary wave of demonstrations and protests, riots, and civil wars in the Arab world which began on 18 December 2010, on our results, we also check whether our cointegration results hold for a shorter sample ranging from 1990Q1 to 2010Q4. We do not feel in need to include Jordan in this exercise, because the impacts of the Arab spring appear to be more indirect yet. We display the results of cointegration tests for the bivariate case and the limited sample in Tables 7 and 8 below.

Table 7: Cointegration tests shortened sample - CPI and food prices, national currency

	Lag	Trace	B(Food)	F(CPI)	F(Food)
Algeria	2	26.17 (0.001)	0.427 (0.060)	-0.058 (0.013)	-0.082 (0.073)
Egypt	2	16.05 (0.026)	0.919 (0.091)	-0.031 (0.009)	-0.008 (0.053)
Morocco	1	30.85 (0.000)	0.360 (0.104)	-0.043 (0.008)	0.102 (0.066)
Tunisia	2	15.92 (0.043)	0.491 (0.063)	-0.015 (0.006)	0.223 (0.091)

Table 8: Cointegration tests shortened sample - CPI and oil prices, national currency

	Lag	Trace	B(Oil)	F(CPI)	F(Oil)
Algeria	2	20.04 (0.001)	0.142 (0.084)	-0.029 (0.007)	0.010 (0.068)
Egypt	2	11.10 (0.205)	0.472 (0.065)	-0.025 (0.008)	0.036 (0.081)
Morocco	1	32.00 (0.000)	0.145 (0.029)	-0.051 (0.009)	-0.010 (0.179)
Tunisia	2	17.27 (0.027)	0.238 (0.028)	-0.016 (0.005)	0.480 (0.180)

Note: Bilateral models, variables in logs. International prices transformed into domestic currency by current exchange rates. B(Food) and B(Oil) are the long-run parameters. F(CPI) is the feedback coefficient in the error correction equation for the CPI change, F(Food), F(Oil) the corresponding parameter in the error correction equation for the change in the international price. Trace statistic for the null of no cointegration. Figures in parentheses are *p*-values for the trace statistic and standard errors otherwise. The lag length for the underlying VAR (in levels) is determined by the SB criterion. VAR includes a trend not restricted to cointegration relationship.

As for the complete sample period, there is usually evidence of cointegration and the impact of food prices is stronger than that of oil prices. The national consumer price index always reacts with the theoretically expected sign to restore deviations from equilibrium. World prices such as food and oil prices turn out to be weakly exogeneous, except of Tunisia.

The results of the trivariate models lead us to the same conclusions as in Tables 7 and 8. They just corroborate our analysis based on the full sample period. Again, differences between the food price and the oil price model tend to decrease slightly if the nominal exchange rate appears in the cointegrating relationship. The corresponding parameter often enters with a positive sign in the food price model, again indicating a long-run depreciation in response to food price shocks. In contrast, it enters with a negative sign in the oil price model (except Algeria), which suggests an appreciation. Oil again does not appear to be weakly exogeneous in the Egypt and Tunisian case.

Table 9 - Cointegration tests shortened sample - CPI, exchange rate (LC per USD) and food prices (USD)

	Lag	Trace	B(ExRate)	B(Food)	F(CPI)
Algeria	1	52.34 (0.000)	1.013 (0.049)	0.427 (0.071)	0.046 (0.018)
Egypt	2	30.02 (0.047)	0.154 (0.038)	1.345 (0.218)	-0.032 (0.007)
Morocco	1	36.70 (0.007)	-0.224 (0.321)	0.123 (0.136)	-0.041 (0.008)
Tunisia	2	27.92 (0.081)	0.682 (0.101)	0.448 (0.058)	-0.020 (0.008)
		F(ExRate)	F(Food)		
Algeria		0.036 (0.061)	-0.040 (0.072)		
Egypt		0.032 (0.087)	-0.015 (0.038)		
Morocco		-0.075 (0.034)	0.094 (0.067)		
Tunisia		0.063 (0.074)	0.255 (0.128)		

Table 10 - Cointegration tests shortened sample - CPI, exchange rate (LC per USD) and oil prices (USD)

	Lag	Trace	B(ExRate)	B(Oil)	F(CPI)
Algeria	1	37.46 (0.005)	1.763 (0.201)	0.247 (0.142)	0.015 (0.004)
Egypt	2	28.16 (0.076)	-2.002 (0.593)	1.553 (0.272)	-0.008 (0.004)
Morocco	1	39.78 (0.003)	-0.108 (0.192)	0.122 (0.033)	-0.041 (0.008)
Tunisia	2	27.30 (0.095)	-0.227 (0.237)	0.314 (0.056)	-0.013 (0.004)
		F(ExRate)	F(Oil)		
Algeria		0.065 (0.017)	0.025 (0.044)		
Egypt		-0.022 (0.009)	0.105 (0.036)		
Morocco		-0.079 (0.037)	0.031 (0.174)		
Tunisia		-0.049 (0.034)	0.354 (0.133)		

Note: See Tables 7 and 8. Models are trivariate, as they also include nominal exchange rates (ExRate), measured as units of local currency per US dollar. International prices are denominated in USD.

4.2 Impacts of international price shocks on GDP growth?

We now check whether there is an impact of international price shocks on real GDP in MENA countries and, if it exists, whether is more pronounced than that on domestic consumer prices. In other words, we assess whether real GDP is a significant transmission channel of foreign price shocks on domestic "politics". Our motivation is that the presumed effect of the global oil and food prices on the local inflation is at least partly driven by the assumption that the global prices fluctuations of those two commodities are widely affecting the business cycles of the local markets in the region. Oil and food price fluctuations may affect the local markets cycles via three channels: the significant importance of oil incomes in Algeria, the significant cost of the intervention policies (subsidies and strategic food reserves) in the region to insulate the local markets and the effects of the inter-region linkages and the outer-world linkages on the region's business cycles. To be conservative and consistent with the previous robustness check, we continue to use the limited sample period up to 2010Q4 and leave out Jordan.

Cointegration tests

As in the preceding sections, we start with a battery of cointegration tests to empirically investigate the impact of changes in international prices on local real GDP in a couple of selected MENA countries (Tables 11 and 12). We then change our focus from level to growth relationships and come up with an analysis of Granger Causality (Tables 13 and 14).

Table 11: Cointegration tests - real GDP and food prices, national currency

	Lag	Trace	B(Food)	F(YR)	F(Food)
Algeria	2	13.05 (0.113)	0.540 (0.098)	-0.005 (0.002)	0.145 (0.052)
Egypt	2	7.12 (0.563)	0.489 (0.142)	-0.002 (0.002)	0.129 (0.063)
Morocco	6	9.94 (0.285)	0.550 (0.371)	0.012 (0.007)	0.096 (0.048)
Tunisia	2	4.83 (0.826)	0.515 (0.253)	-0.003 (0.003)	0.085 (0.048)

Table 12: Cointegration tests - real GDP and oil prices, national currency

	Lag	Trace	B(Oil)	F(YR)	F(Oil)
Algeria	2	10.63 (0.234)	0.234 (0.025)	-0.010 (0.005)	0.610 (0.227)
Egypt	2	5.25 (0.782)	0.298 (0.066)	-0.002 (0.002)	0.282 (0.137)
Morocco	1	15.75 (0.046)	0.362 (0.039)	0.018 (0.016)	0.679 (0.242)
Tunisia	2	11.55 (0.180)	0.346 (0.028)	-0.002 (0.004)	0.454 (0.140)

Note: See Tables 7 and 8. Instead of the CPI, real GDP (in domestic currency is used (YR).

Cointegration is not detected in Tables 11 and 12, especially not for food prices. Nor is there a long-run impact of international price shocks on real output, even not for Algeria, although this country is blessed with natural resources. As the cointegration tests fail, the other parameters are irrelevant.[5] These effects also hold if international prices are measured in US-dollar and the nominal exchange rate enters the long-run relationship.[6]

Granger Causality tests

The lack of a long run impact of international prices on real GDP does not imply that there is no short-run response. The latter can be determined by Granger Causality tests (Granger 1969). The null hypothesis of no causality is tested between the *growth rates* of real GDP and the corresponding *change* in international prices. Year-on-year rates are considered in Tables 13 and 14, and quarter-on-quarter rates in Tables 15 and 16.

[5] In principle, we could have substituted the relevant entries by an NA (not available).
[6] This table is available on request.

Table 13: Granger Causality tests - food model (yoy)

Direction of causality	Lag length	Food prices to real GDP	Real GDP to food prices
Algeria	6	1.369 (0.242)	1.792 (0.116)
Egypt	6	0.540 (0.776)	0.459 (0.836)
Morocco	6	0.559 (0.762)	0.641 (0.697)
Tunisia	6	1.586 (0.167)	0.935 (0.477)

Table 14: Granger Causality tests - oil model (yoy)

Direction of causality	Lag length	Oil prices to real GDP	Real GDP to oil prices
Algeria	6	0.620 (0.713)	0.580 (0.745)
Egypt	6	1.846 (0.105)	0.351 (0.907)
Morocco	6	2.054 (0.072)	0.458 (0.837)
Tunisia	6	1.644 (0.151)	0.603 (0.727)

Table 15: Granger Causality tests - food model (qoq)

Direction of causality	Lag length	Food prices to real GDP	Real GDP to food prices
Algeria	1	5.143 (0.026)	5.415 (0.023)
Egypt	1	0.116 (0.891)	1.625 (0.204)
Morocco	5	0.467 (0.799)	0.979 (0.437)
Tunisia	5	1.124 (0.356)	1.031 (0.407)

Table 16: Granger Causality tests - oil model (qoq)

Direction of causality	Lag length	Oil prices to real GDP	Real GDP to oil prices
Algeria	1	0.509 (0.478)	0.753 (0.388)
Egypt	1	0.368 (0.546)	0.503 (0.481)
Morocco	5	1.950 (0.098)	0.479 (0.791)
Tunisia	1	0.227 (0.635)	0.673 (0.415)

Note: Granger F statistic is displayed, *p*-values are put in parentheses. The lag length is determined by the SB criterion.

Again, we do not find any impact of nominal prices on real GDP, even not in the short run.[7]

5 Conclusions and policy recommendations

Seen on the whole, we would like to stress the policy relevance merging from our empirical results.

The asymmetric error-correction identified in the paper, i.e. the lower reaction of domestic consumer prices after negative shocks in international prices, points to rigidities to downward price adjustments. From this perspective, extended price subsidies are the consequence which may lead to fiscal problems in the respective MENA countries. They can also contribute to higher instability in international markets due to biased incentives to food producers. What is more, exchange rate movements do not serve as complete shock absorbers in MENA countries. Finally, the estimated food price elasticities are about twice as large as oil price elasticities. This implies that the impact of food prices dominates.

The result of asymmetric error correction, i.e. the lower reaction of domestic consumer prices after negative shocks in international prices, deserves special attention. The reason for the high policy relevance of this result is illustrated in the following. Intervention policies in the MENA region countries are very common and include subsidies and

[7] It may be argued that real prices might be a better choice. The results are available on request, but with an eye on the lack of a long-run relation, we feel legitimized to concentrate on the inflation reaction.

food strategic reserves. Energy and food subsidies have been used to be for decades, the major part of the social security safety net in the region (Albers and Peeters, 2011). According to IMF data, food subsidies have been estimated about 0.7 percent of GDP of the MENA countries in 2011. Energy subsidies have cost about $240 billion in 2011, which is equal to about 8.5 percent of the regional GDP or 22 percent of the government revenue and account for about 50 percent of the global energy subsidies.

Other intervention tools are the food strategic reserves. The MENA region countries now hold more than 13 percent of global wheat stocks and 15 percent of global wheat trade. It is suggested that this strategy can reduce the variability of domestic wheat prices and, despite some failures, can insulate the region countries from off-shore price disturbances (Larson et al., 2012). By comparing the adjustment pattern across countries, our analysis provides an indirect evaluation of the success of policies implemented to cushion the domestic economies from global price shocks.

In this vein, we feel legitimized to consider government interventions to be just another economic characteristic affecting pass-through to the local inflation. In some definition, for a country to be considered as food secure, it is supposed to generate sufficient foreign exchange from exports to finance food imports (Breisinger et al. 2010). However, keeping domestic prices and imports of food as stable as possible is not just about importing enough food, but also using interventions based on food stocks and price subsidies on imported food. Those massive interventions will cost even more in case of global price fluctuations. For instance, the government will have to double the subsidy paid per unit of imported food in case of a shock doubling the world food price in order to keep imports at levels prevailing at the old international prices (Ianchovichina et al. 2012).

Regardless of the assumption that food and oil prices fluctuating simultaneously, MENA oil-exporting countries, such as Algeria and the Gulf Council countries not considered in our study, should benefit on the macro level in case of rising oil prices, having more fiscal space to cover the food imports and the costs of interventions. The situation in the MENA oil-importing countries will differ and its fiscal space will depend also on other factors including its relations with the region and the outer world through remittances and trade.

We conclude with some final remarks about the identification of further research areas. In spite of the legitimized focus on the Arab Spring since turn-of-year 2010/11, one should not forget the Union for the Mediterranean partnership, which was initiated with the Barcelona process in 1995. It aims at the establishment of free trade agreements in the area and tries to promote regional interdependences (Canova and Cicarelli, 2011). Consequently, an interesting question in the context of this paper is whether an increase in trade and regional interdependencies would change the nature and features of the pass-through of international price movements to the Mediterranean. Moreover, the high linkage between the GCC countries and the other countries in the MENA region through the financial flows and remittances should have a bearing on the degree of the pass-through of international price shocks on domestic prices and GDP (Ilahi and Shendy, 2008). We leave these questions to further research.

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