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SPATIAL PRICE TRANSMISSION AND FOOD SECURITY: THE CASE OF KOSOVO

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Introduction

- Global food commodity markets exhibited **significant vulnerability and high price volatility since 2007**. A range of casual factors has been identified to explain sudden emergence of high food prices.

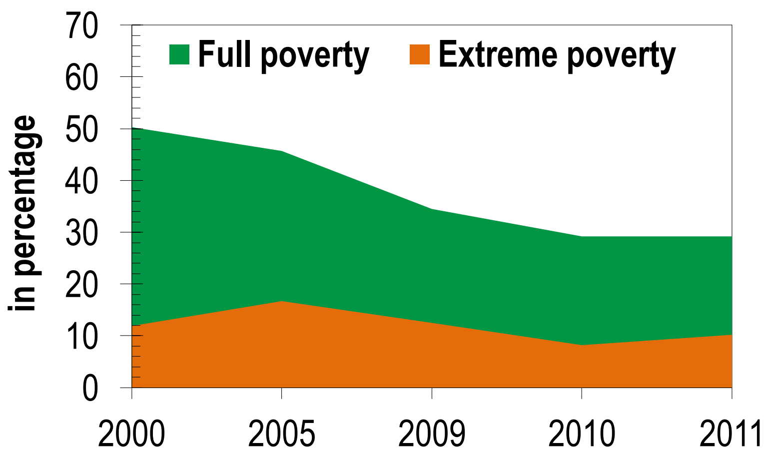
- Main drivers of the recent price volatility are **short and long term factors** such as *increased demand from the emerging economies, speculation in financial markets, increasing use of biofuels, decline in investment in agriculture* (McDonald, 2010; Mittal, 2009; Ruby, 2012).

- In this context, the main objective is evaluation of the extent to which price signals are transmitted from world markets into Kosovo agricultural commodities (wheat, maize, barley, beef, chicken).

Introduction

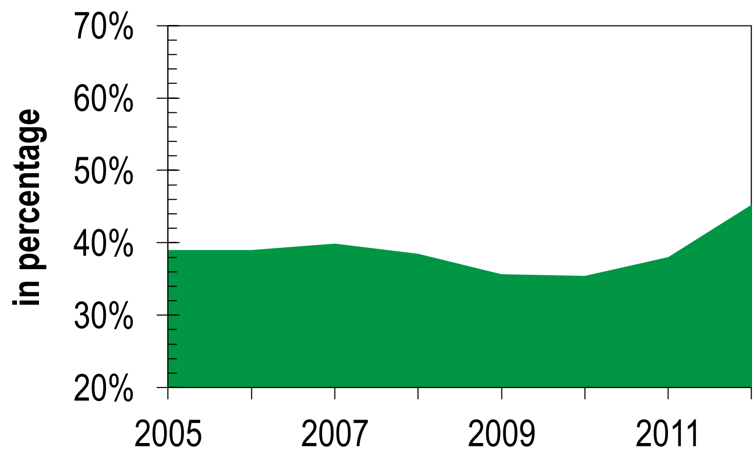
- Kosovo went out from the war (end 1990s) with the significant share of poor population. Poverty data from 2011 show that a third of total population (29.2%) lives with less than 2$ per day, while more than 10% cope with the extreme poverty line (1.2$ per day).

- Food consumption marks the highest proportion on the total share of expenditures in Kosovo (40%).



Poverty prevalence in Kosovo

Source: Own elaboration based on the data of KAS

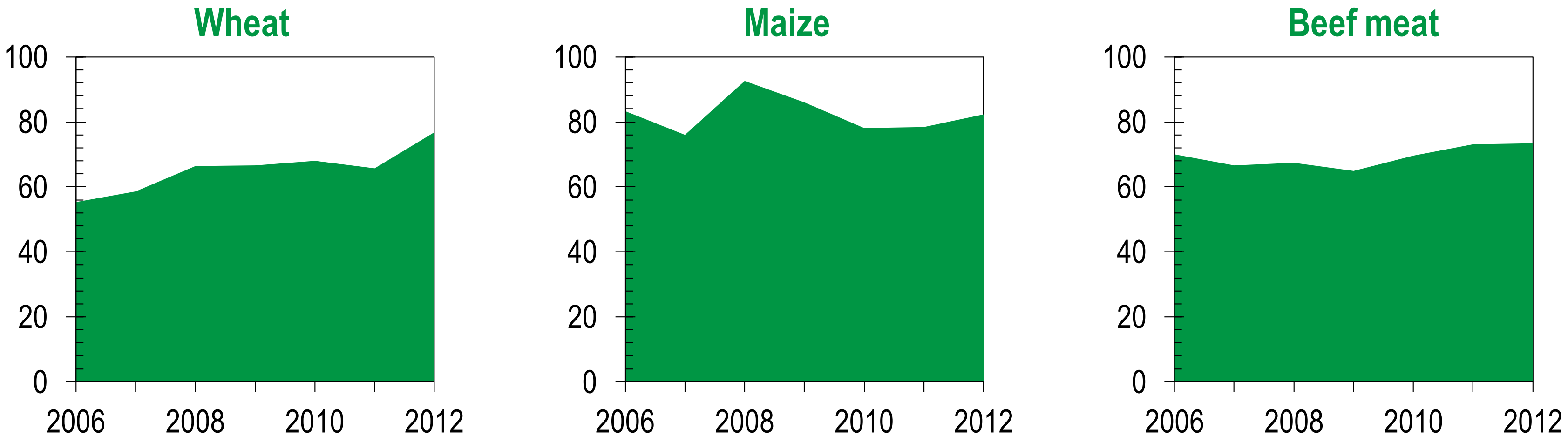


Food share in total consumption

Introduction

- Agricultural sector has indispensible role on ensuring food security, in particular related to the food availability. This is particularly important in the case of Kosovo as a "***bread-eating country***" (Lingard, 2003), where wheat is the main food staple.

- Kosovo satisfies **76% of demand for wheat**, **82% for maize** and **70% for meat**, signaling the problem of self-insufficiency.



Self-sufficiency ratio of selected food commodities

Own elaboration based on the data of MAFRD (Green report, 2013)

Introduction

Price transmission and Food security

- Large price increases over a short time period were aggravating situation of food security, particularly in developing countries (Brown *et al*, 2012; Minot, 2011).

- World price transmission shocks into domestic markets were **distressing consumers' real income**, bringing many households into poverty and driving poorer households into hunger and malnutrition (Baquedano and Liefert, 2014).

- Therefore it is relevant to understand the degree to which vulnerability of the food prices within developing countries is driven by the world price fluctuations.

Methods and materials

Theoretical framework (2/2)

■ Price transmission studies are considered to have theoretical and applied value. ***Theoretical relevance*** lays on its strength to drive resource allocation and market integration, while the ***applied value*** is based on the achieving distributional balance between food deficit and surplus regions (Amikuzuno and Ogundari, 2012).

■ Literature on spatial price transmission (Sexton *et al*, 1991; Conforti, 2004) guides on the group of factors affecting the price transmission process, such as: <u>transport costs</u>, <u>transactions costs</u>, <u>market power</u>, <u>exchange rates</u>, <u>trade barriers</u>, and <u>domestic policies</u>.

Methods and materials

- As the first step, we *test the stationarity* of time series using two unit root tests: the **Augmented Dickey-Fuller (ADF) test** and the **Phillips-Perron (PP) test**.

  - The number of lags of a dependent variable is determined by the Akaike Information Criterion (AIC). If both time series are not stationary, they are suitable to test for cointegration relationship between them.

- **Johansen approach** is employed to *test for cointegration*:

$$Z_t = A_1 Z_{t-1} + \ldots + A_k Z_{t-k} + \varepsilon_t \tag{1}$$

$$\Delta Z_t = \sum_{i=1}^{k-1} \Gamma_i \Delta Z_{t-i} + \Pi Z_{t-k} + \varepsilon_t \tag{2}$$

where:

Z_t - vector of non-stationary variables
A - different matrices of parameters,
t - time subscript,
k - number of lags,
ε_t - the error term,
Γ_i - the short-run adjustment to changes in the endogenous variables,
Π - long-run cointegrating relationships between variables in the model.

Methods and materials

- In order to capture asymmetric movements in the residuals, Enders and Granger (1998) and Enders and Siklos (2001) propose to use **threshold cointegration approach**. Assuming the long run relationship between two nonstationary variables *X* and *Y*

$$Y_t = \lambda_0 + \lambda_1 X_t + \mu_t \tag{3}$$

where: μ is the error term

Engle and Granger (1987) show that cointegration exists if the null hypothesis $\rho=0$ is rejected in:

$$\Delta\mu_t = \rho\mu_{t-1} + \xi_t \tag{4}$$

where: ξ is the error term for the residuals

Methods and materials

To capture the assymetry in adjustment process, a **two-regime threshold cointegration approach** is adopted:

$$\Delta\mu_t = I_t\rho_1\mu_{t-1} + (1 - I_t)\rho_2\mu_{t-1} + \xi_t \qquad (5)$$

where: I_t is the Heaviside indicator I_t=1 if $\mu_{t-1} \geq \tau$ or I_t=0 if $\mu_{t-1} < \tau$.
If μ_{t-1} is bigger than the threshold τ, then adjustment is at the rate ρ_1
If μ_{t-1} is smaller than the threshold τ, then adjustment is shown in ρ_2.
When $\rho_1=\rho_2$, then the adjustment process is symmetric.

If the null hypothesis $\rho_1=\rho_2=0$ is rejected, then *X* and *Y* are cointegrated and the following **TAR model** is estimated:

$$\Delta Y_t = \theta_Y + \delta_Y^+ E_{t-1}^+ + \delta_Y^- E_{t-1}^- + \sum_{j=1}^{J} \alpha_{Yj}^+ \Delta Y_{t-j}^+ + \sum_{j=1}^{J} \alpha_{Yj}^- \Delta Y_{t-j}^- + \sum_{j=1}^{J} \beta_{Yj}^+ \Delta X_{t-j}^+ + \sum_{j=1}^{J} \beta_{Yj}^- \Delta X_{t-j}^- + \upsilon_{Yt} \qquad (6)$$

where: ΔY_T and ΔX_T are dependent and independent variables in their first differences,
E - error correction term,
δ - speed of adjustment coefficients of ΔY_T if Y_{T-1} is above and below its long-run equilibrium,
θ, δ, α and *β* are coefficients and υ is the error term, t is time subscript and j is the number of lags.

Methods and materials

- Four (4) asymmetric models are considered in this study:

1. Threshold autoregression model with threshold value equal to zero;
2. Threshold autoregression model with threshold value estimated (consistent threshold autoregression model);
3. Momentum threshold autoregression model with threshold value equal to zero; and
4. Consistent momentum threshold autoregression model with threshold value estimated.

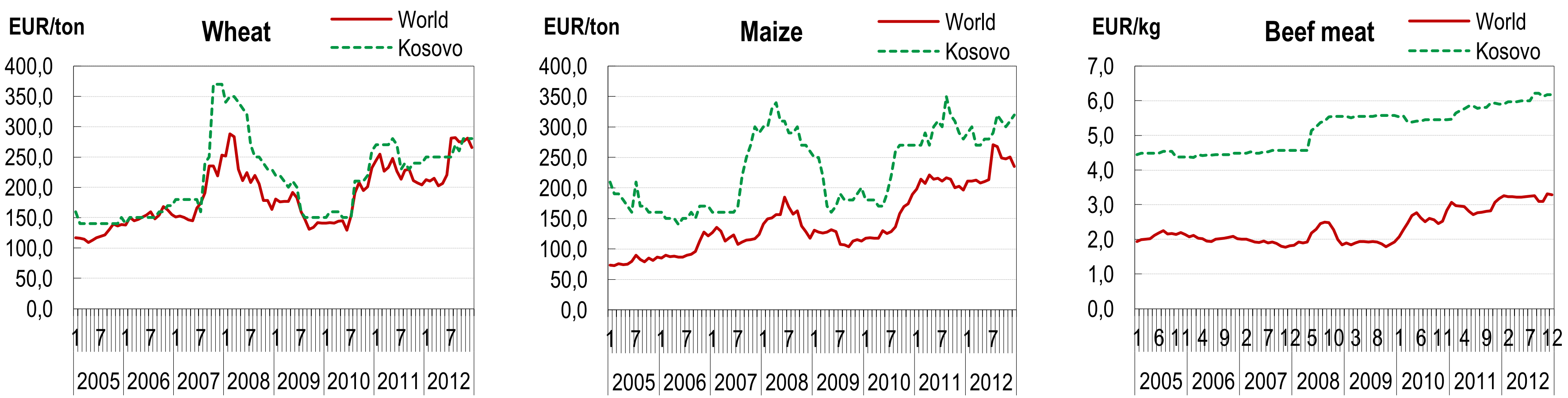
- A model with the lowest AIC and BIC is used.

Results

■ Strong price fluctuations and high volatility in two waves evidenced.

● The first wave of price volatility took place at the end of 2007. Such price development can be attributed to the impact of the global crisis.

● The second wave of the price volatility is recorded in the mid-2010. This is particularly true for the cereal commodities (wheat and maize).



Price development for selected agricultural commodities (World and Kosovo)

Source: Own elaboration based on the data of KAS and World Bank (GEM)

Results

Stationarity of time series: ADF test and Phillips Perron test

- Results of the tests confirm that time series are non-stationary. We stationarized them by taking first differences.
- The tests indicate that all variables are stationary in first differences. The lags of the dependent variable in the tests were determined by Akaike Information Criterion (AIC).

Augmented Dickey Fuller test results

	Level		*1st Diff*	
	ADF_c	*ADF_t*	*ADF_c*	*ADF_t*
World				
Wheat	-1.586	-2.243	-7.171***	-7.141***
Maize	-1.405	-2.437	-5.790***	-5.770***
Barley	-1.543	-1.985	-7.085***	-7.076***
Beef	-1.043	-2.379	-5.735***	-5.745***
Chicken	-1.735	-2.857	-5.630***	-5.610***
Kosovo				
Wheat	-1.965	-2.275	-5.453***	-5.425***
Maize	-1.619	-2.230	-9.682***	-9.637***
Barley	-0.625	-2.244	-10.120***	-10.219***
Beef	-0.310	-2.212	-8.633***	-8.610***
Chicken	-0.529	-2.527	-4.331***	-4.366***

Note: ADF_c is the ADF with an intercept and ADF_t with an intercept and a deterministic trend.
*,**,*** denote significance at the 1%, 5% and 10% significance levels.

Results

Threshold cointegration

- There is relatively strong evidence of cointegration relationship between world and local prices.

- The pairs of prices that have not proved to be cointegrated with the Johansen test were cointegrated with threshold adjustment. It means that Enders&Granger model with threshold fits data better.

Threshold cointegration test results

	Model	*Threshold*	*Lags*	ρ_1	ρ_2	$\Phi(H_0{:}\rho_1=\rho_2=0)$	$F(H_0{:}\ \rho_1=\rho_2)$
Wheat	cMTAR	-1.067	0	-0.250***	-0.585***	12.886*** [0.001]	4.154** [0.048]
Maize	cMTAR	0.538	0	-0.299***	-0143*	7.030*** [0.009]	1.646 [0.086]
Barley	cMTAR	0.311	0	-0.195***	-0.033	3.668** [0.029]	3.153* [0. 079]
Beef	cMTAR	-1.603	2	-0.027	-0.185***	4.509** [0.014]	4.795** [0.031]
Chicken	cMTAR	-4.872	2	-0.037	-0.194***	4.428** [0.015]	3.929* [0. 051]

Note: *,**,*** denote significance at the 1%, 5% and 10% significance levels, with P values in the brackets

Results

Error correction models

- Because of an evidence of cointegration relationship between world and local prices we have estimated error correction models.

Results of the asymmetric error correction model with threshold cointegration

	Wheat		*Maize*		*Barley*		*Beef*		*Chicken*	
	World	*Kosovo*	*World*	*Kosovo*	*World*	*Kosovo*	*World*	*Kosovo*	*World*	*Kosovo*
(Intercept)	-0.674	-0.323	5.043**	0.227	0.720	0.200	2.249	0.608	-2.013	1.971*
X.diff.world.t_1.pos	0.100	0.030	-0.197	0.044	0.043	-0.004	0.015	-0.006	0.595***	0.042
X.diff.world.t_2.pos	-0.145	0.007	-0.397**	-0.031	-	-	0.245	-0.028	0.121	0.182
X.diff.world.t_3.pos	0.043	-0.010	-0.011	-0.031	-	-	-	-	0.337*	-0.077
X.diff.world.t_4.pos	0.279	0.064**	-	-	-	-	-	-	-	-
X.diff.world.t_1.neg	-0.202	0.040	-0.101	-0.024	0.109	-0.041	0.387*	0.026	0.169	0.129
X.diff.world.t_2.neg	-0.278	-0.033	0.095	0.040	-	-	-0.132	0.015	-0.367**	0.001
X.diff.world.t_3.neg	-0.171	0.030	-0.188	-0.013	-	-	-	-	-0.185	0.108
X.diff.world.t_4.neg	-0.183	0.040	-	-	-	-	-	-	-	-
X.diff.domestic.t_1.pos	1.793*	0.105	0.071	0.027	-0.315	0.075	-1.539**	-0.080	0.140	0.487***
X.diff.domestic.t_2.pos	-0.562	0.107	-1.049	0.121	-	-	-1.475**	-0.016	-0.197	-0.081
X.diff.domestic.t_3.pos	-2.308**	-0.149	-0.615	0.249	-	-	-	-	-0.251	-0.620***
X.diff.domestic.t_4.pos	1.370	0.250*	-	-	-	-	-	-	-	-
X.diff.domestic.t_1.neg	1.138	-0.075	-0.133	0.101	-0.819	0.260	-0.977	0.019	0.600**	0.640***
X.diff.domestic.t_2.neg	1.575	0.207	1.799*	0.236	-	-	0.126	0.002	0.275	-0.274
X.diff.domestic.t_3.neg	3.639**	0.042	2.019**	0.128	-	-	-	-	0.056	-0.060
X.diff.domestic.t_4.neg	0.739	-0.241	-	-	-	-	-	-	-	-
X.ECT.t_1.pos	0.752	-0.074	0.233	-0.270**	0.284	-0.240	0.110	0.000	0.106*	0.032
X.ECT.t_1.neg	-0.746	-0.679***	0.626	-0.088	-0.059	-0.021	0.320	-0.100*	0.276***	0.070
R-squared	0.288	0.473	0.216	0.161	0.025	0.112	0.221	0.064	0.464	0.478
Adj-R2	0.113	0.343	0.075	0.011	-0.041	0.052	0.127	-0.049	0.368	0.384

Policy implications

- There are 3 categories of policy actions in mitigating problems arising from higher food prices (Benson *et al*, 2013):

- **Short terms actions** (such as reduction of consumption taxes, food price controls, export bans or release of food reserve stocks) aiming to *reduce domestic food prices*.

- **Long term policy actions** targeting *increase of the domestic food production and supply* (such as input subsidies or price support for domestic farmers).

- **Social protection programs** for the vulnerable social groups (such as food rations, food or cash for work, and cash transfer programs).

Conclusion

- Kosovo as a small country is ***a "price taker"*** in the global trade, therefore it is very difficult to policy-respond under the current conditions of the liberalized trade regime. It is a part of EU ATMs and CEFTA and most of the Kosovo imports origin from these countries.

- Empirical estimates found that Kosovo is vulnerable to the price transmitting signals from the world market. Proved existence of **asymmetry** for world and local prices of *wheat* and *beef* and **weak evidence of asymmetry** for *barley* and *chicken*.

- Kosovo has **limited budgetary resources** to undertake robust socially driven policies. Policy driven on achieving long run objectives in **incentivizing farmers and consumers** to respond to market signals.

THANK YOU FOR YOUR ATTENTION!

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