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Fuel to Food: Evidence of Price Pass-through in Kyrgyzstan

SAMARKAND Conference
Samarkand, Uzbekistan
2 - 4 November, 2015

Motivation

International price shocks/food crises →

Effects of commodity prices on food security:

- Trade and development policy effects - e.g. trade bans/restrictions, energy resources and biofuels, etc. (Goetz, Glauben and Brummer 2013, Serra and Zilberman 2013, etc.)
- Different aspects of price transmission – horizontal/vertical price transmission (Frey and Manera 2007, Listorti and Esposti 2011, etc.)

Role of oil prices on food price hikes (Headey and Fan 2008, Baffes and Dennis 2013, etc.):

- However, rigorous evidence on oil price impact on food prices is scarce and particularly in developing countries (Dillon and Barrett 2015)

Focus on different geographical areas particularly on developing countries:

- Mostly in Africa, South America, East and South Asia and transitional countries in eastern Europe
- Studies on Central Asian food security from market price relationships and integration is limited

Objectives

- Contribute to the understanding of oil price impact on food prices particularly in Central Asia
 - Role of oil prices in determining local wheat prices (main staple food)
 - How fast international price shocks are transmitted to local fuel and wheat prices and how local prices adjust to international prices
- Contribute to the understanding of wheat markets in Central Asia through market integration and price transmission perspective
- Literature suggest that fuel prices are believed to affect food prices through three main channels (farm inputs, biofuels, and transportation costs). We use oil and wheat prices at international, national and regional reference level and focus on the third channel. We estimate:
 - Price pass-through from International Oil Prices to major domestic market(s) (or point of entry (POE))
 - Price transmission from regional wheat price (Kazakhstan export price) to POE and determine the role of international oil price in the process
 - Finally, we estimate within country price pass-through for both products → from POE to local markets

Kyrgyzstan

Food deficit country in Central Asia according to WFP definition:

- About 12% of the population are chronically food insecure (WFP 2014)
- Restricted production resources: arable land is about 8%, and 44% is mountainous pastures (Tilekeyev 2013)
- Highly reliant on fuel (>95% of fuel products) and food imports (except for dairy products) (FAOSTAT, 2012, 2015; and IEA, 2013)
- Vulnerable to international price shocks.

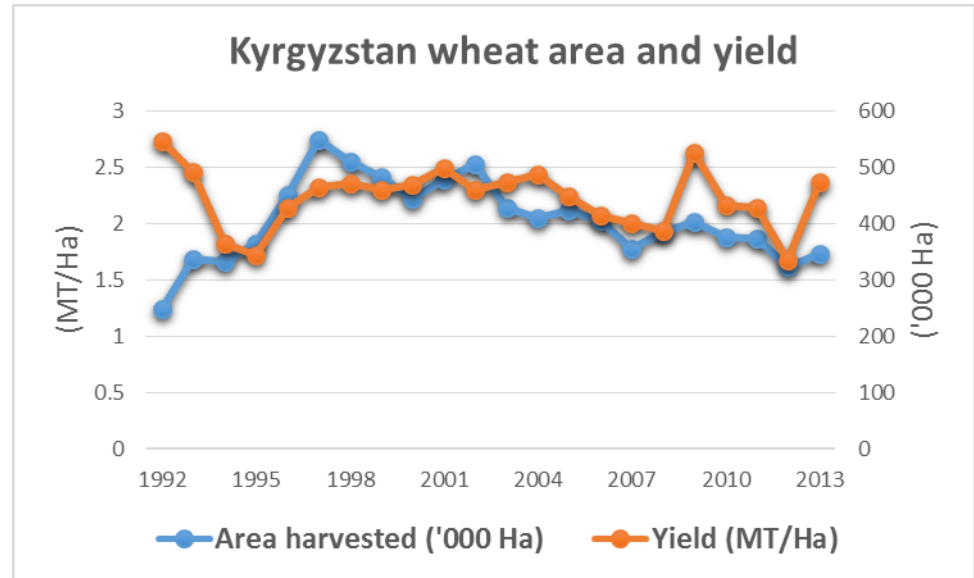
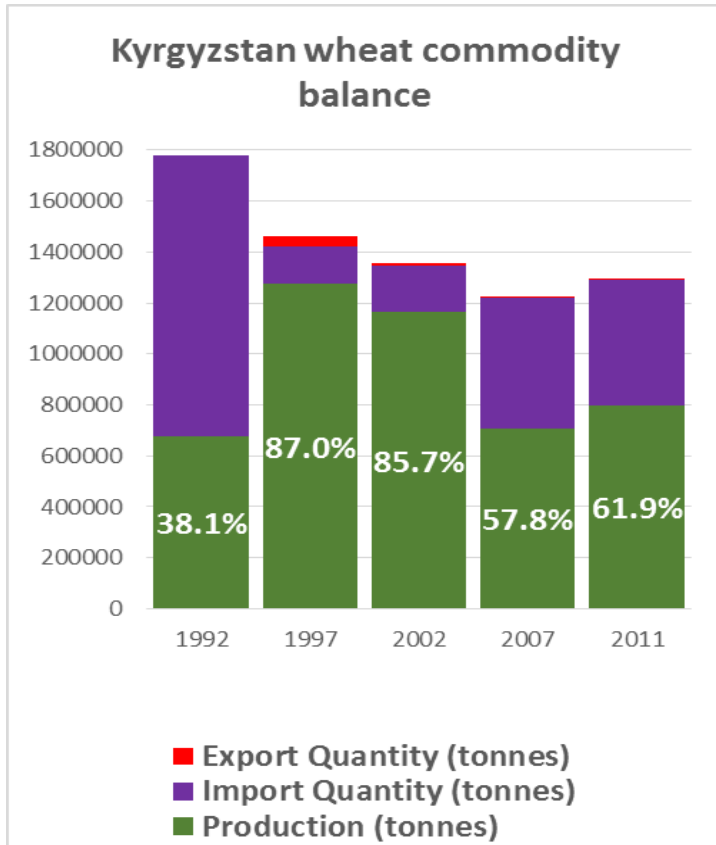
Wheat and wheat products are the most important source of food and calorie intake (FAO 2012, 2014):

- They account for more than 36% of household expenditure on food
- Constitute about 20% of total food imports
- Domestic wheat production meets about 40-50% of domestic consumption requirements



Kyrgyzstan's mountain pastures. Photo: ALAMY

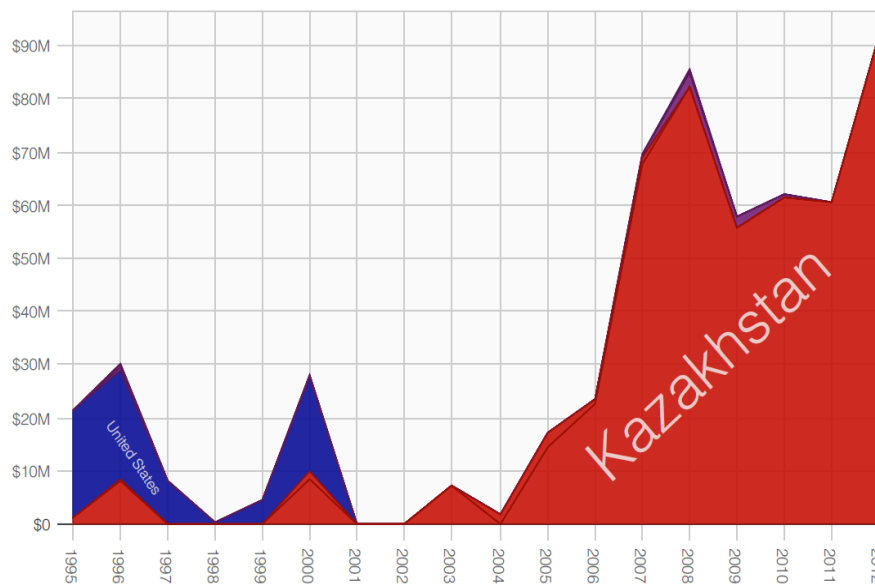
Kyrgyzstan wheat markets and trade



- Wheat production increased until early 2000s and since then declined
- This is partly explained by decreasing area harvested
- Weather seem to have substantial effect on wheat yield → Good (e.g. 2009) and bad (e.g. 2008 & 2012) farming seasons associated with high and low wheat yield
- Current National Food Security Program targets to increase wheat self-sufficiency to about 90-95% by 2017
 - Achievable? How to achieve?
- Overall, trade and access to reliable market(s) for imports is essential

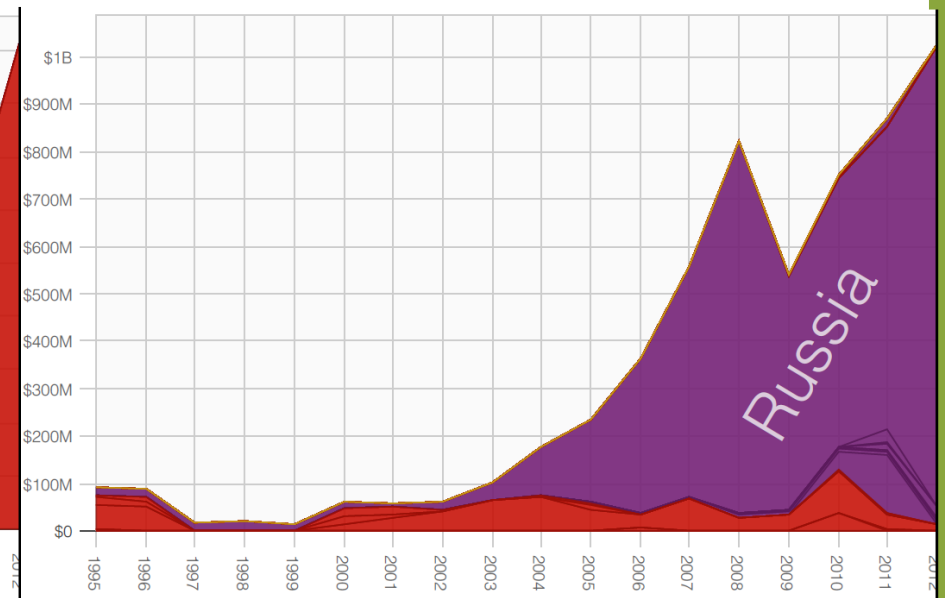
EAEU (namely Kazakhstan and Russia) is an important source of wheat and fuel imports

Kyrgyzstan's Wheat Imports (1995-2012)



Source: The Observatory of Economic Complexity, MIT.

Kyrgyzstan's Refined Petroleum Imports (1995-2012)



Source: The Observatory of Economic Complexity, MIT

- Almost all wheat imports come from Kazakhstan (red area)
 - Share of other countries, mainly US, is small and were delivered in the form of food aid until early 2000s (blue area)
- Similarly, almost all refined petroleum come from Russia (violet area)

Theoretical framework and method:

- Spatial price transmission approach (Fackler and Goodwin, 2001)
 - “Weak” Law of One Price (LOP) with relaxed assumptions

$$p_t^D - p_t^E \leq \text{Transaction Cost}_{ij}$$

p_t^D and p_t^E are wheat prices in two (e.g. domestic and export respectively) markets

- Co-integration analysis (Johansen 1991, 1995, and Engle and Granger 1987, 1989) and (Asymmetric) Error correction model (ECM) (Engle and Granger, 1987, Meyer and von Cramon-Taubadel, 2004)

Two-step Spatial Price Transmission Analysis approach:

1st Step: Long-run spatial price relationship (degree of elasticity or **price pass-through coefficient**):

$$p_t^D = \beta_0 + \beta_1 p_t^E + \beta_2 ER_t + \varepsilon_t$$

β_i = degree of elasticity; ER_t is an exchange rate; ε_t = error term

2nd Step: Dynamic price relationships (*speed of adjustment* to discrepancy in the equilibrium):

$$\Delta p_t^D = a_0 + p_1 ECT^{neg} + p_2 ECT^{pos} + \sum_{i=1}^p f_i \Delta p_{t-i}^D + \sum_{j=1}^n g_j \Delta p_{t-j}^E + \sum_{k=1}^n h_k \Delta ER_{t-k} + u_{it}$$

p_1 and p_2 = speed of adjustment

ECT is an error correction term is a lagged residual from long-run equation ($\bar{\varepsilon}_{t-1}$);

$$ECT^{neg} < 0;$$

$$ECT^{pos} \geq 0$$

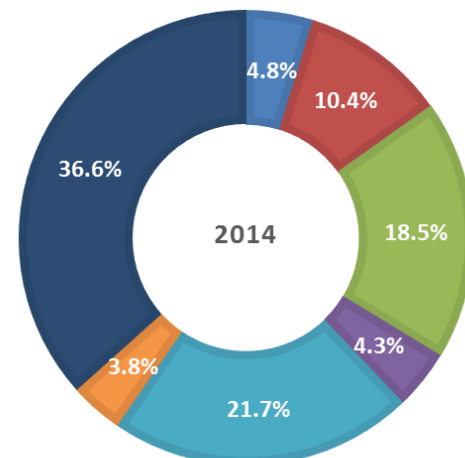
NB: We omit exchange rate when analyzing local price relationships

Data:

- Monthly data from January 2004 until June 2015 (n=138)
 - Local wheat and diesel prices → National Statistical Committee of the Kyrgyz Republic
 - Southern Kazakhstan Wheat Export Prices → KazakhZerno and Margin.kz (food market information agencies)
 - International Oil (Brent) Prices → International Energy Agency (IEA)

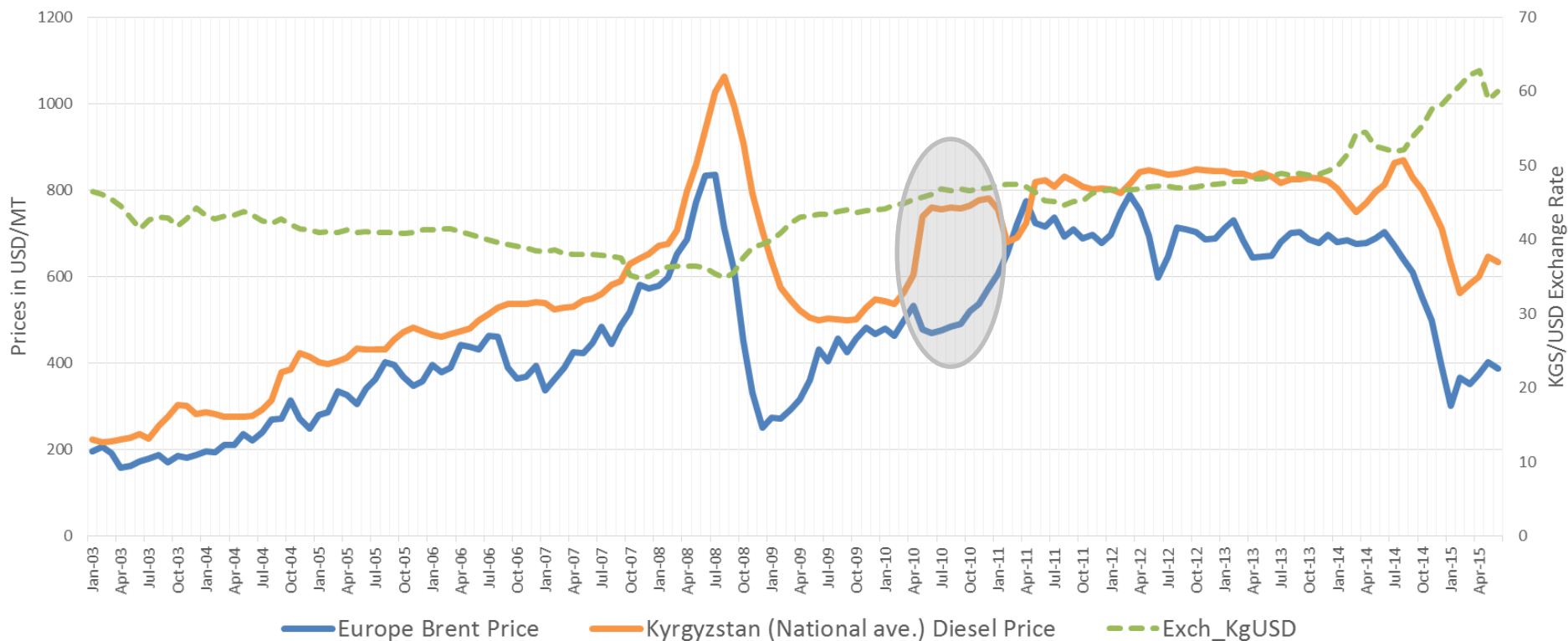


Wheat production by region in Kyrgyzstan in 2014



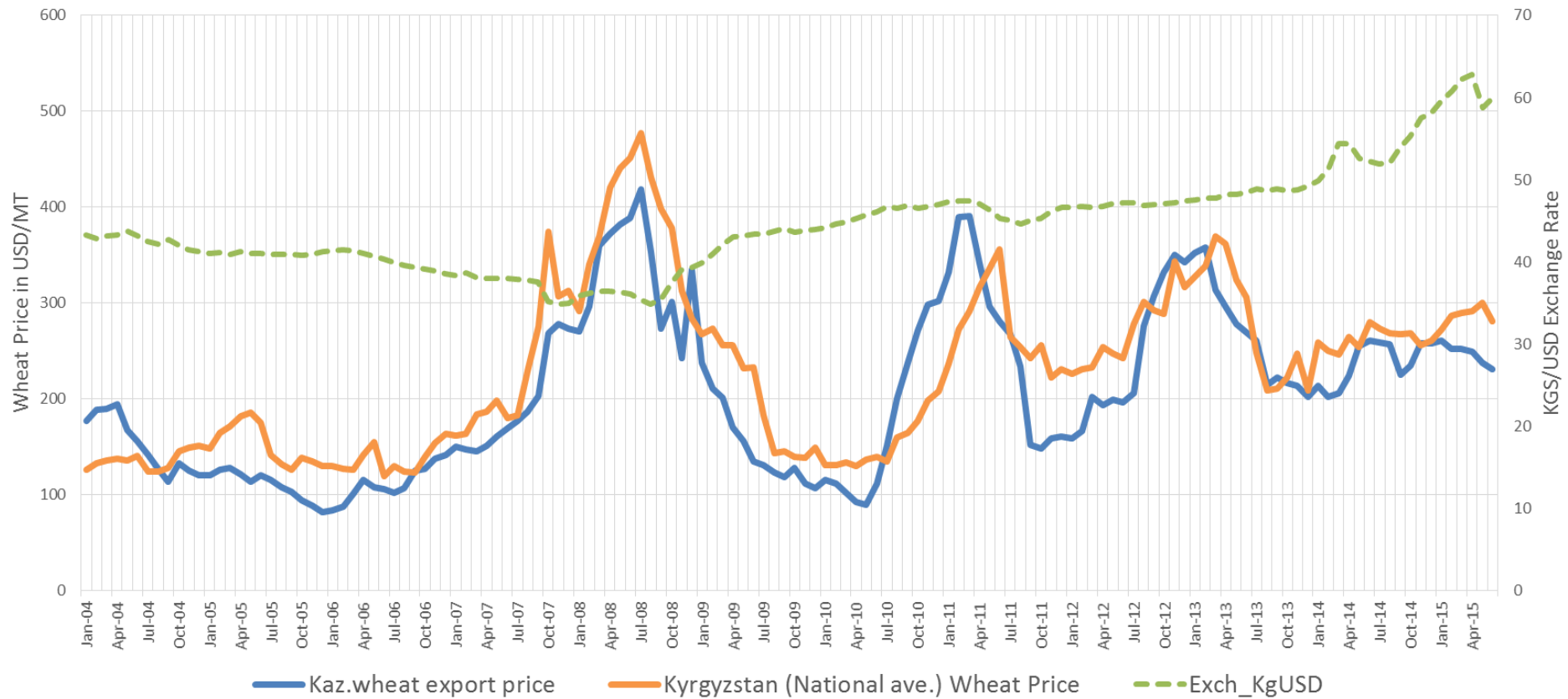
- Batken oblast
- Jalal Abad oblast
- Issyk-kul oblast
- Naryn oblast
- Osh oblast
- Talas oblast
- Chuy oblast

International Oil price and average Diesel price in Kyrgyzstan (nominal), 2003 - 2015



In average, domestic price move closely to international oil prices, except when Russia introduced export levy (shaded area) in May 2010 and until governments agreed on quota of oil product supply exempt of export tax.

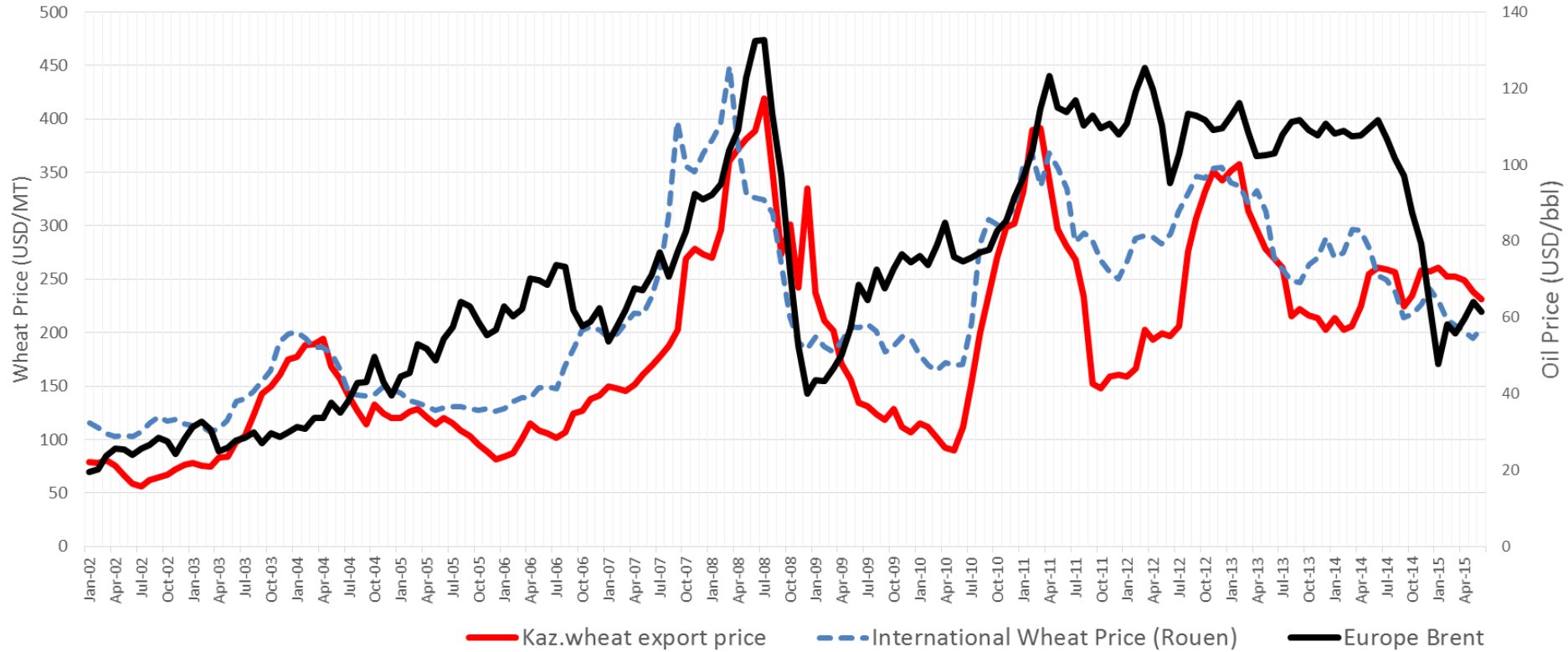
Kazakhstan wheat export price and average producer price in Kyrgyzstan (nominal), 2004 - 2015



In general, wheat prices co-move, more or less, and average producer price in Kyrgyzstan is higher than Kazakh export price

Also, important assumption that exchange rate (ER) are weakly exogenous holds true – i.e. exchange rate is important in determining local wheat prices but wheat prices do not have significant power to determine the exchange rate

Kazakhstan wheat export price, International Oil price and International wheat price, 2002 - 2015



Literature suggests that global oil price affects international wheat prices, *not vice-versa*

ECM model estimates: Price pass-through from Global/Regional markets to Local markets

	From Global Oil		From Kazakhstan Wheat Export and Global Oil	
	To Bishkek Diesel	To Osh Diesel	To Bishkek Wheat	To Osh Wheat
First stage: Pass-through elasticity				
Global Oil	.729***	.723***	.225***	.233***
Kazakhstan Wheat Export	–	–	.660***	.667***
Second stage: Speed of adjustment				
ECT	–	–	-.486***	-.218***
ECT ^{pos}	-.043	-.0329	–	–
ECT ^{neg}	-.159***	-.200***	–	–
F-test: ECM asymmetry (p-value)	0.07	0.04	0.42	0.59
Full-life (months required to complete pass-through)	10.6	7.2	1.1	6.2

Notes: Number of lags selected according to the BIC, AIC and significance of parameters in the regression with respective lags, as well as ensuring that there is no serial autocorrelation.

The Ljung-Box (LM) statistics was conducted to test that the first p number of the residual autocorrelations are jointly equal to 0.

ECM model estimates: Price pass-through from Global/Regional markets to Local markets

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- Average price pass through from crude oil to gasoline is about 50% for the World and highest estimated price pass-through is in Europe with 80%, (Husain et.al. 2015. IMF Working Paper)
- 72 -73% in Kyrgyzstan is close to Europe estimates
- However, asymmetry suggests prices adjust faster when prices rise... Asymmetry is slightly higher in Osh.

ECM model estimates: Price pass-through from Global/Regional markets to Local markets

	From Kazakhstan Wheat Export and Global Oil	
	To Bishkek Wheat	To Osh Wheat
First stage: Pass-through elasticity		
Global Oil	.225***	.233***
Kazakhstan Wheat Export	.660***	.667***
Second stage: Speed of adjustment		
ECT	-.486***	-.218***
ECT ^{pos}	—	—
ECT ^{neg}	—	—
F-test: ECM asymmetry (p-value)	0.42	0.59
Full-life (months required to complete pass-through)	1.1	6.2

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- 22 -23% price pass-through from global oil to local wheat prices is in line with about 20% in the World (Baffes 2007, Baffes and Dennis 2015)
- About 66% elasticity between Kazakhstan export and Kyrgyzstan producer prices partly indicates that wheat price co-movement is far from perfect
- Symmetric and fast adjustment especially in Bishkek (about 49%) adjusts local wheat prices to equilibrium in little over 1 months

ECM model estimates: Within-country diesel price transmission

	Issyk-Kul	Naryn	Jalal-Abad	Osh	Batken	Talas
First stage: Pass-through elasticity						
Bishkek Oil	.955***	.982***	1.076***	1.016***	1.075***	.980***
Second stage: Speed of adjustment						
ECT	-.096	-.249***	-.209**	-.180**	-.141**	—
ECT ^{pos}	—	—	—	—	—	-.611***
ECT ^{neg}	—	—	—	—	—	.0381
F-test: ECM asymmetry (p-value)	0.46	0.34	0.40	0.17	0.70	0.02
Full-life (months required to complete pass-through)	—	4.9	6.7	8.6	12.9	0.5

- Close to 100% price elasticity shows LOP holds true for within country diesel price transmission (1.0 would indicate perfect degree of co-movement of prices)
- Except for Talas, the further the market from Bishkek, the slower seem to be the adjustment
- Talas diesel price seem to principally adjust to price decreases in Bishkek → Could access to Kazakh fuel sources have played a role in softening price hikes?

	Issyk-Kul	Naryn	Jalal-Abad	Osh	Batken	Talas
First stage: Pass-through elasticity						
Own Diesel	.256***	.231***	.238***	.266***	.464***	.427***
Bishkek Wheat	.809***	.663***	.622***	.670***	.497***	.676***
Second stage: Speed of adjustment						
ECT	-.291***	-.504***	-.371***	-.142**	-.225***	-.217***
ECT ^{pos}	—	—	—	—	—	—
ECT ^{neg}	—	—	—	—	—	—
F-test: ECM asymmetry (p-value)	0.35	0.58	0.61	0.48	0.26	0.90
Full-life (months required to complete pass-through)	3.6	1.0	2.2	12.7	5.9	6.2

- Own diesel price effect on Batken and Talas wheat prices is substantially higher compare to in other regions. Long distance and remoteness incurs additional transportation cost.
- IssykKul wheat price cointegration with Bishkek wheat prices seem to be highest and Batken has the lowest cointegration. Location and distance seem to have a role in wheat cointegration as well.
- In dynamic relationship, the further (or the more isolated) the market from Bishkek, the slower seem to be the adjustment to equilibrium

Discussions and Conclusion

- We find that both global oil and regional wheat prices exert considerable influence on wheat prices in Kyrgyzstan.
- Global oil and regional wheat price shocks transmit quickly to local wheat prices. Adjustment to new equilibrium can take only few months. On the contrary, local fuel prices tend to adjust to global oil prices much slowly.
- We find no substantial difference between cross-border (e.g. from Kazakhstan export price to Bishkek price) and within country (e.g. Bishkek to Local) wheat price transmission. On the contrary, cross-border oil price transmission is less complete than within country fuel price transmission. The latter is being very close to perfect co-movement.

Some useful policy implication could be:

- Fuel price impacts vary with travel distance. Therefore, policymakers concerned with food security, especially in remote areas, should pay at least as much attention to fuel and other transportation related costs as they do to wheat and other food prices.
- New national food security strategy seems to focus on more productivity growth, which is highly relevant, however, post-harvest efficiency including transportation and delivery of food from production zones to food deficit zones and fast urbanizing areas is essential.

A close-up photograph of a wheat field. The wheat stalks are golden-brown and have long, thin awns. The field extends to the horizon under a bright blue sky with scattered white clouds. The text "Thank you!" is centered in the middle of the image.

Thank you!

Photo by M.DeFreese, CIMMYT, 2012.