CENTER FOR AGRI-POLICY ANALYSIS (CAPA

INSTITUTE OF AGRICULTURAL ECONOMICS - SOFIA

PRICE TRANSMISSION IN DAIRY INDUSTRY IN BULGARIA

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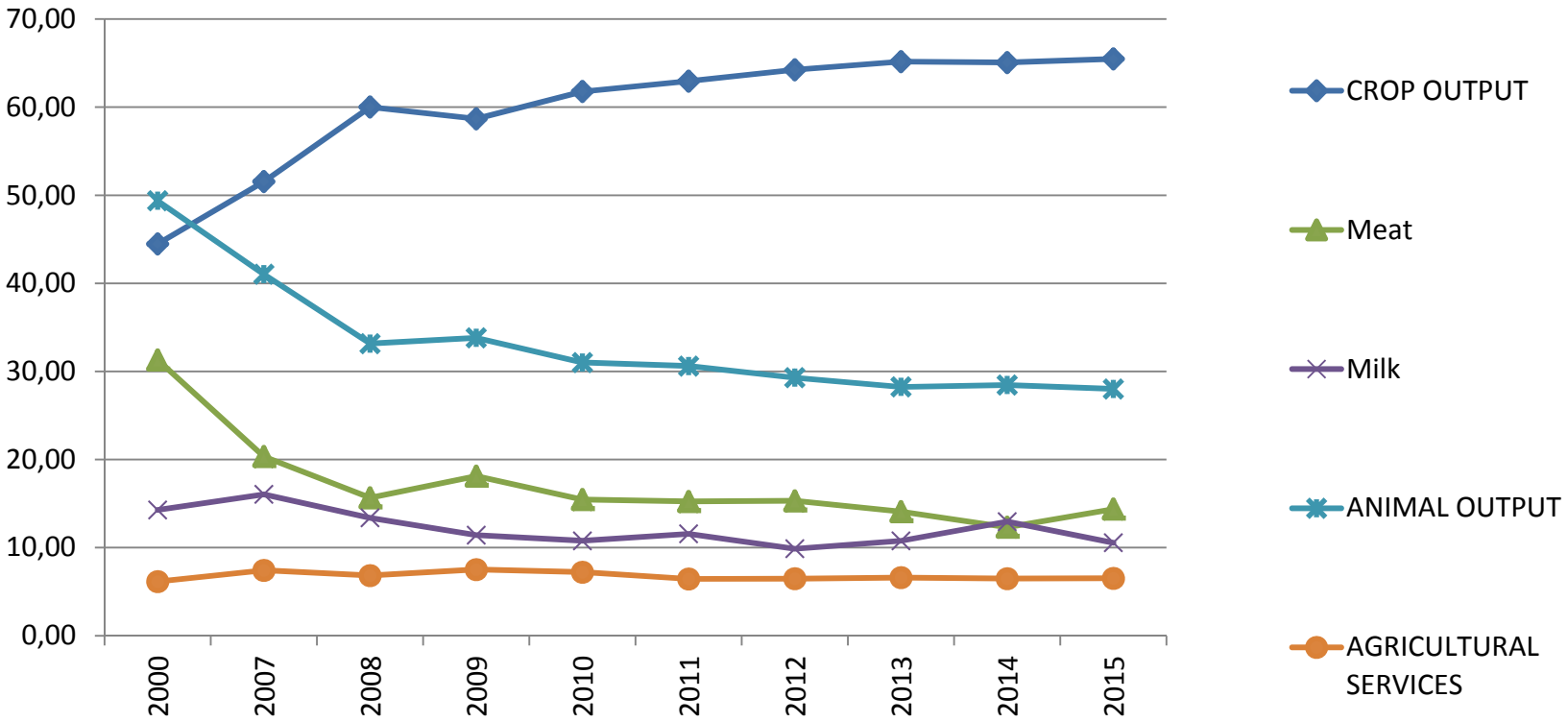
- The study aims to analyze the price mechanism in the dairy chain and transmission of milk price from the farm to the final products delivered by dairies.

- BG cow milk price transmission to EU price
- BG milk price elasticity
- Price cointegration – raw milk and cheese
- Price asymmetry – raw milk and cheese

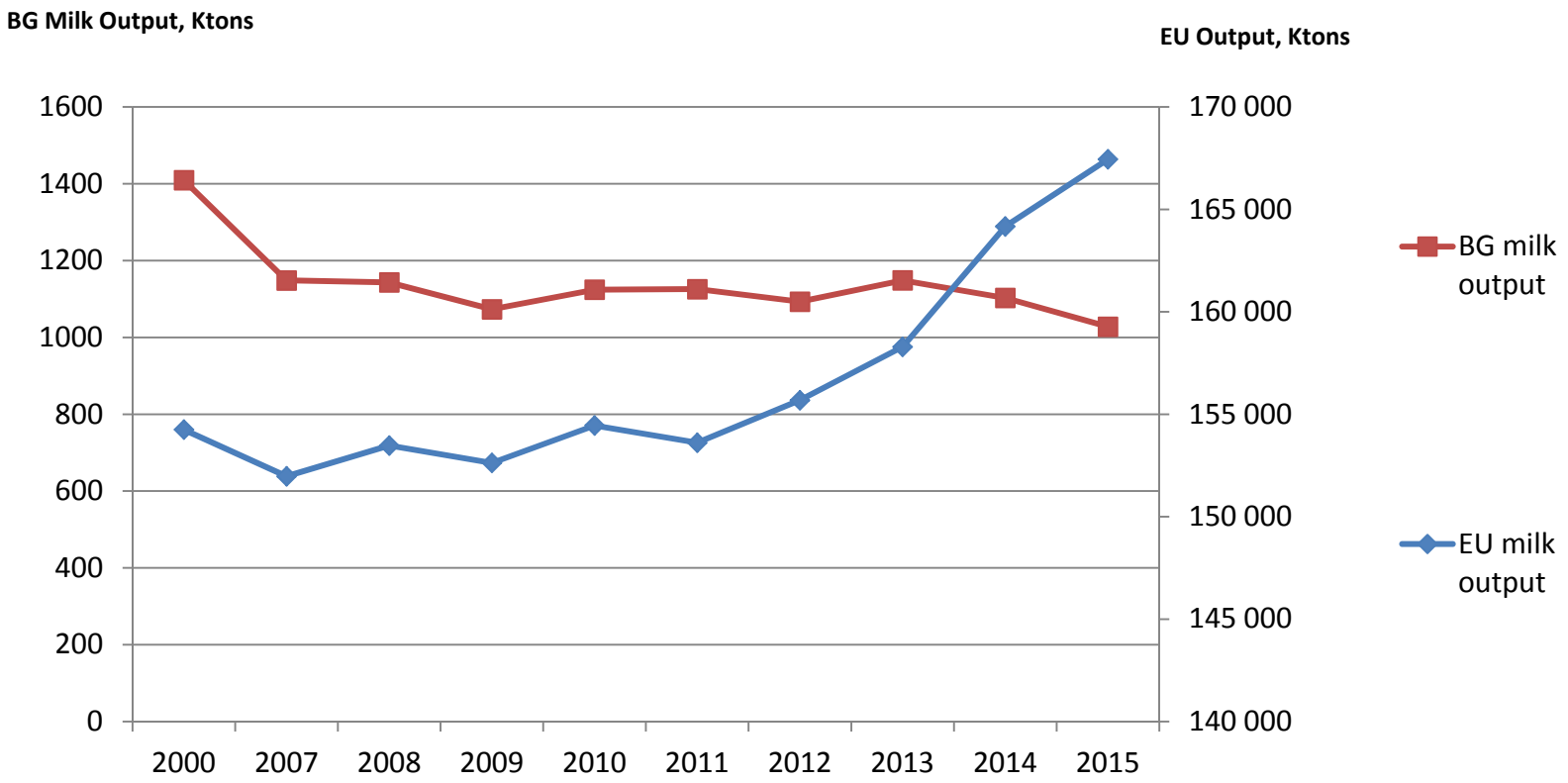
- Since August, 2014, the milk price in EU tumbles threatening the sustainability of dairy farms - Russian embargo, quota removal and overrunning supply upon demand.
- As of beginning of 2016, delivered milk in EU is 2,6% higher than 2015, a peak in last 5 years
- EU - 140 MT, USA - 95 MT and the increase lasts by more 2% in annual base. Cow herd rises up by 21K - totally 9,34 million heads.
- Average EU price slip down by about 25% - Nov 2014 – 2016. In Bulgaria, fall is average 17%, wide deviation – 18%

Share of dairy production in agricultural output, %



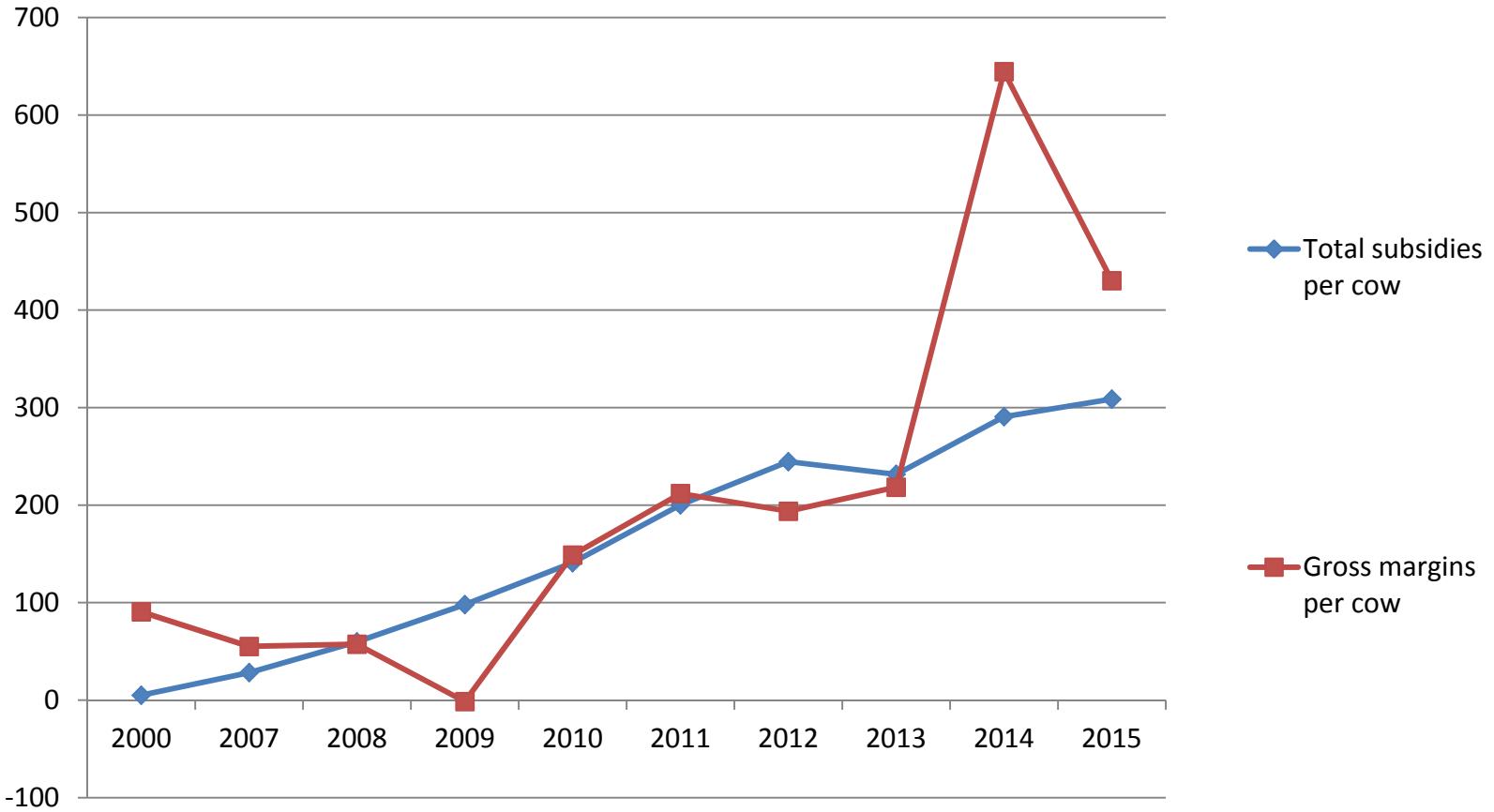
Source: Eurostat

EU and Bulgarian annual milk production, Kt



Source: Eurostat

Gross margins and subsides per cow, euro/head



Source: CAPA

Correlation

Correlation Monthly EU-BG milk prices	*EU – BG Milk Prices without lag*	*EU – BG Milk Prices without lag -1 month*
Multiple R	**0,87**	**0,90**
R Square	**0,76**	**0,81**
P-value	**0,00**	**0,00**
Standard Error	**1,90**	**1,68**

- Average 01.2007 – 10.2016 EU price – 0,33 EUR/kg, BG price 0,30 EUR/kg. Since the milk crisis, the price gap closes.
- DF and ADF Test to see stationary or not-stationary

$$\Delta Y = \alpha_0 + \alpha_1 Y_{t-1} + \varepsilon \qquad \Delta Y = \alpha_0 + \alpha_1 Y_{t-1} + \alpha_2 \Delta Y_{t-1} + \varepsilon$$

Running DF and ADF Test for prices

$$\Delta Y_{MI} = \underset{2,15}{0,37} - \underset{-2,87}{0,13} * Y_{t-1} + \varepsilon$$

$$\Delta Y_{MI} = \underset{2,14}{0,31} - \underset{-2,97}{1,23} * Y_{t-1} + \underset{-1,14}{0,11} * \Delta Y_{t-1} + \epsilon$$

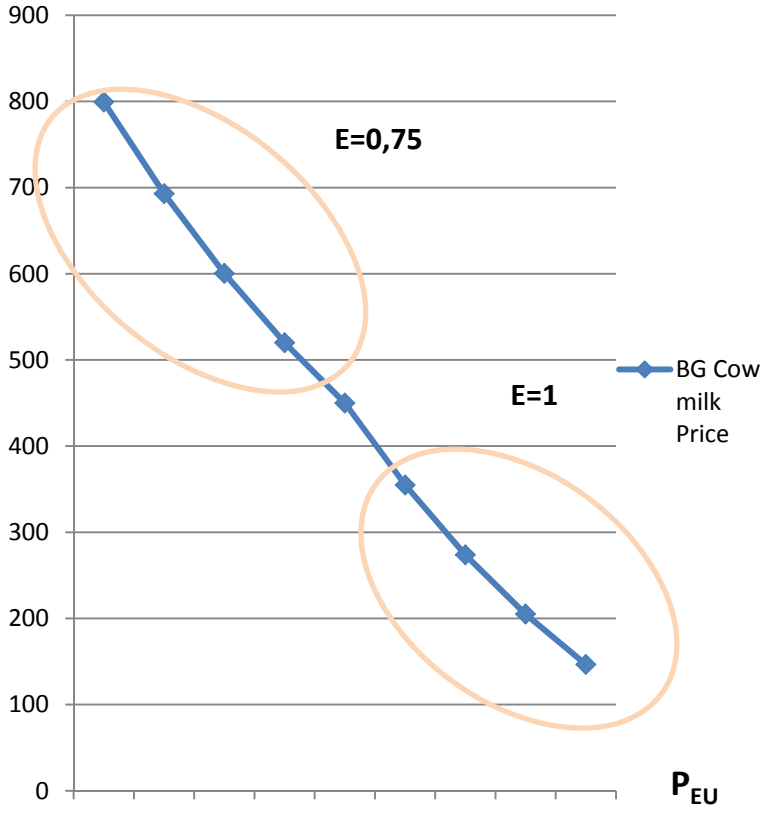
Regression Statistics and Test Statistics	*DF Test*	*ADF Test*
Multiple R	0,26	0,28
R Square	0,07	0,07
P-value	0,005	0,007
t Critical Stat α = 0,05, Constant	-2,89	-2,92
Observations	118	116

- t stat < t critical value in DF test (confidence level 95%), the Null hypothesis can't be certainty rejected that there is a unit error

Elasticity of BG milk price to EU average price change

- Elasticity is a change of BG milk price at any movement of EU price. Assumption is the price elasticity is not same at any point of the curve.

$$E_{PR} = Log\left(\frac{\Delta PR_{BG}}{\Delta PR_{EU}}\right)$$



Source: CAPA

Milk price elasticity matters

- Neoclassical concept is “one price theory” – the price of milk in BG and EU would at least move in same direction by same magnitude (regression coefficient 1);
- The BG price reacts by different elasticity in separate cases of EU price change. Perfect elasticity, when EU price is less than average over a period and strong elasticity (0,75), when the EU price is at higher price zone;
- Dairy farmers face a bigger risk – strong likeness to experience low price, when EU market is plumbing whereas, slower price recovery when the market climbs.

Running DF and ADF Test on milk and cheese prices

$$\Delta Y_{MI} = \underset{2,32}{0,46} - \underset{-2,23}{0,09} * Y_{t-1} + \varepsilon$$

$$\Delta Y_{MI} = \underset{2,54}{0,46} - \underset{-2,47}{0,12} * Y_{t-1} + \underset{-1,59}{0,23} * \Delta Y_{t-1} + \epsilon$$

Test Statistics milk – cheese prices	*DF Test*	*ADF Test*
Multiple R	0,32	0,35
R Square	0,10	0,12
P-value	0,03	0,048
t Critical Stat α = 0,05, Constant	-2,98	-2,97
Observations	47	46

- t stat < t critical value in DF and ADF test. Milk price and cheese prices are not clearly cointegrated.

Relationship milk and cheese prices

- Correlation and determination of milk price and cheese (wholesale) price are relatively low
- There is rather a lag in milk price print in the cheese price t-2, t-1

Correlation milk – cheese prices	*Milk – cheese price without lag*	*Milk – cheese price, Lag t-1*	*Milk – cheese price, Lag t-2*
Multiple R	0,43	0,47	0,48
R Square	0,18	0,22	0,23
P-value	0,002	0,0	0,0
Standard Error	0,30	0,29	0,28

- Weak relationship between milk and cheese prices implies for presence of other significant factors influencing cheese price – import price, input deflator, price asymmetry.

Price asymmetry milk-cheese prices

- When downstream (milk) prices react in a different manner to upstream (Wholesale cheese) price changes – characterizing by contrary movement either over or under-reaction;

$$APT = \frac{\frac{(PR_t^{CH} - PR_{t-1}^{CH})}{PR_{t-1}^{CH}}}{\frac{(PR_t^{MI} - PR_{t-1}^{MI})}{PR_{t-1}^{MI}}} \qquad APT_n = \sum_{t=1}^{N=48} (APT_t)$$

- In the period 2012 – 2015 – the milk price change is -3%, the cheese price 13,8%;
- Milk price makes up 60% of the wholesale cheese price;
- Variation of milk prices is higher (7,7%) than cheese prices (4,9%)

Equating asymmetry milk-cheese prices

- Price asymmetry in the dairy chain is: APT = -0,92;
- where APT<-1 – the upstream prices rise up higher or oppositely to milk prices fall;
- APT>-1<0 – the upstream price rise higher or slumps slower than milk price;
- APT>0<1 – milk prices goes up higher than cheese prices or it declines slower than cheese price;
- APT>1 – milk prices elevate reversed or higher then cheese prices drop;

$$APT = \alpha + \varepsilon * \beta * \frac{dTRPR_{CH}}{dPR_{MI}} + \epsilon$$

Specific conclusions

1. Price asymmetry between milk and cheese prices is high as the cheese price is driven mostly by other factors (inflation, production costs, import prices) than local milk prices;
2. Farmers face economic risk from price asymmetry: price pressure on milk price and limited benefit when cheese and upstream prices go up;
3. APT can be equated as a regression function by including cheese price trend change and milk price change – ($R=0,73$, $R^2=0,52$).

General conclusions

1. Dairy farmers recently and ahead will meet serious competition and prices is unlikely to rise to levels in 2013-2014 – challenge how to handle costs and keep production;
2. Most vulnerable are small dairy farms, which are not well integrated in the value chain and suffers price asymmetry and lower market prices;
3. CAP policy should rather focus on price crisis and income losses than to aid farmers on “decoupled” schemes.

THANK YOU FOR YOUR ATTENTION!

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