Consumer price volatility in the New Member States: Insights from the agri-food sector

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Abstract

The article analyses the volatility of food prices in the New Member States that acceded to the European Union in 2004 and 2007, using Eurostat monthly food price data. Results suggest that food prices have been continuously increasing in the New Member States since 2005, and calculated coefficients of variation identify well the 2008 and 2011 price spikes. According to these results and an analysis of 10% price bands, the New Member States can be divided into groups with high and low price volatility. Reasons listed are mainly in line with international trends but the article also identifies some regional particularities.

Keywords: food prices, volatility, NMS, agriculture

1. Introduction

The issue of food prices has always been of great importance. It is a key question for stakeholders and policy makers to be aware of food price changes and the reasons behind. Since the 1970s, food prices have not been so high and so volatile than nowadays (Sumner, 2009). Agricultural commodity and food prices soared in 2008 and 2011, increasing the scientific need to analyse agricultural commodity price volatility whilst bringing the issue back to the high level policy agenda.

Although volatility has a wide scientific literature, the majority of papers analyse industrial or financial products, while agriculture is neglected in the majority of the cases. This argument is especially true for New Member States (NMS), where the analysis of food price volatility is actually missing.

On the basis of above, the aim of the paper is to analyse food price volatility in the NMS since EU accession. The paper contributes to the existing literature in many ways: (1) NMS is analysed instead of a single country; (2) agriculture and food prices are in the focus and (3) impacts of EU accession are also investigated.

In order to reach the aim mentioned above, Section 2 discusses the theoretical and empirical background of the topic, followed by the description of the methods used. Section 4 analyses the results obtained, while Section 5 investigates the reasons behind changes. The final section concludes.

2. The theory and empirics of food price volatility

Due to changes in supply and demand, food prices are always on the move, generating uncertainty and risk for market players. Although the definition of uncertainty and risk is usually mixed, the major difference between the two is that risk is associated with probabilities and therefore is measurable. Volatility is related to risk and is generally used to measure the changing patterns of price movements (Piot-Lepetit and M'Barek, 2011). If volatility is high, prices show large fluctuations, while low volatility is associated with small price movements, though the exact definition of 'low' and 'high' volatility is always an issue. When analysing price volatility, historical and implicit volatility is usually distinguished, referring to the difference in investigating past price movements (historical) and future price estimations (implicit). It is important to note that volatility should not be confused with the magnitude of prices as some experts interpret high volatility as prices are high (Gilbert-Morgan, 2011).

The volatility of food prices is due to the specificities of agricultural markets such as weather dependence, seasonality of supply, derived demand or inelastic supply and demand. Agriculture is probably the most weather dependent sector of national economies, which is especially important in the light of changing climatic conditions. Seasonality may also arise from natural-biological factors – certain types of agricultural products can only be produced in certain periods and the production cycle is relatively longer and more self-dependent compared to industrial sectors. Derived demand for agricultural products refer to the fact that prices of raw materials are incorporated in food prices, while the inelasticity of supply and demand is due to the core demand for foodstuffs necessary for living. An extended literature is analysing these issues, see e.g. Martiin (2013) for further details.

Although agricultural prices are constantly changing because of the reasons listed above, this phenomenon is normal in a market economy. Volatility becomes an issue when price changes are hectic in the short run, usually due to unexpected events. Such events (and the associated volatility) generally mean uncertainty and risk, therefore volatility is also treated as a measure of risk. A sudden fall of food prices, for instance, causes hard times for farmers but favours consumers, while sharp price increases have opposite effects. Although there exists many arguments on the right price of food, debates are still ongoing on setting 'favourable' food prices (Swinnen, 2011).

One of the most coherent books on the theory and practice of food price volatility was written by Piot-Lepetit and M'Barek (2011), setting the scene, discussing methods and consequences for agricultural policy. Huchet-Bourdon (2011) investigated agricultural price changes and rejected the hypotheses of a long term price increase. Sumner (2009) also reached a similar conclusion, revealing that agricultural prices, with some exceptions, have been continuously decreasing since the Second World War. Gilbert-Morgan (2010) analysed prices of 19 agricultural products between 1970 and 2009 and suggested that volatility of agricultural prices had not grown globally.

Ai-Chatrath-Song (2006) investigated co-movements of agricultural prices and presented strong evidence against the excess-comovement hypothesis (e.g. that prices of commodities move together beyond what can be explained by fundamentals). Figiel–Hamulczuk–Klimkowski (2012) analysed changes in weekly prices of common wheat in nine EU countries between 2004 and 2011 and showed that Hungarian and Slovak wheat prices had the highest volatility. Bakucs–Falkowski–Fertő (2012) assessed price transmission in the Polish and Hungarian dairy sector and concluded that Polish milk producer and consumer prices were less volatile than Hungarian ones. Csáki-Jámbor (2013) analysed impacts of EU accession on NMS agriculture and indicated that recent growth in agricultural prices had increased profitability of farmers in the region.

With respect to the reasons behind high food volatility, Balcombe (2009) suggested that rising oil prices, volatile exchange rates and inventory changes definitely had an impact. Babcock (2011) stressed that biofuels policy of the US also played a role and identified rising oil prices as the core reason behind. Zhang et al. (2010) questioned the role of biofuel policies as according to their calculations, no correlation existed between agricultural and bioethanol prices. However, Gilbert (2010) suggested that speculation was the main reason behind food price volatility.

3. Methods and data

Agricultural price volatility is usually analysed on time series datasets. Systematic price changes are made up of trend, season, cycle and random elements (Piot-Lepetit and M'Barek, 2011). Trend refers to long term changes in time series, seasonal changes are observable within a year, cycles contain changes not related to a calendar year, while random changes consist of all other elements. Based on this concept, various indicators are available to analyse price volatility. One of the most commonly used one is the standard deviation, which is the expected value of the squared deviation from the mean:

$$S = \sqrt{\frac{1}{n}\sum_{i=1}^{n}(Xi - X)^2} \tag{1}$$

where *S* means standard deviation from the mean, X_i means food price for the period concerned and *n* is for the number of observations. As the value of variance and its square root, standard deviation, largely depends on the unit of measurement, the coefficient of variation can be used to catch price changes:

$$V = \frac{S}{X} \tag{2}$$

where *V* is the coefficient of variation, *s* is the standard deviation and *X* stands for the sample mean. As the coefficient of variation is unitless, it makes price changes easy to compare by country, product or time. By comparing coefficient of variation in time, long term price changes become apparent, also indicating the magnitude of risks. The higher (lower) the value of the coefficient of variation is, the higher (lower) price volatility is.

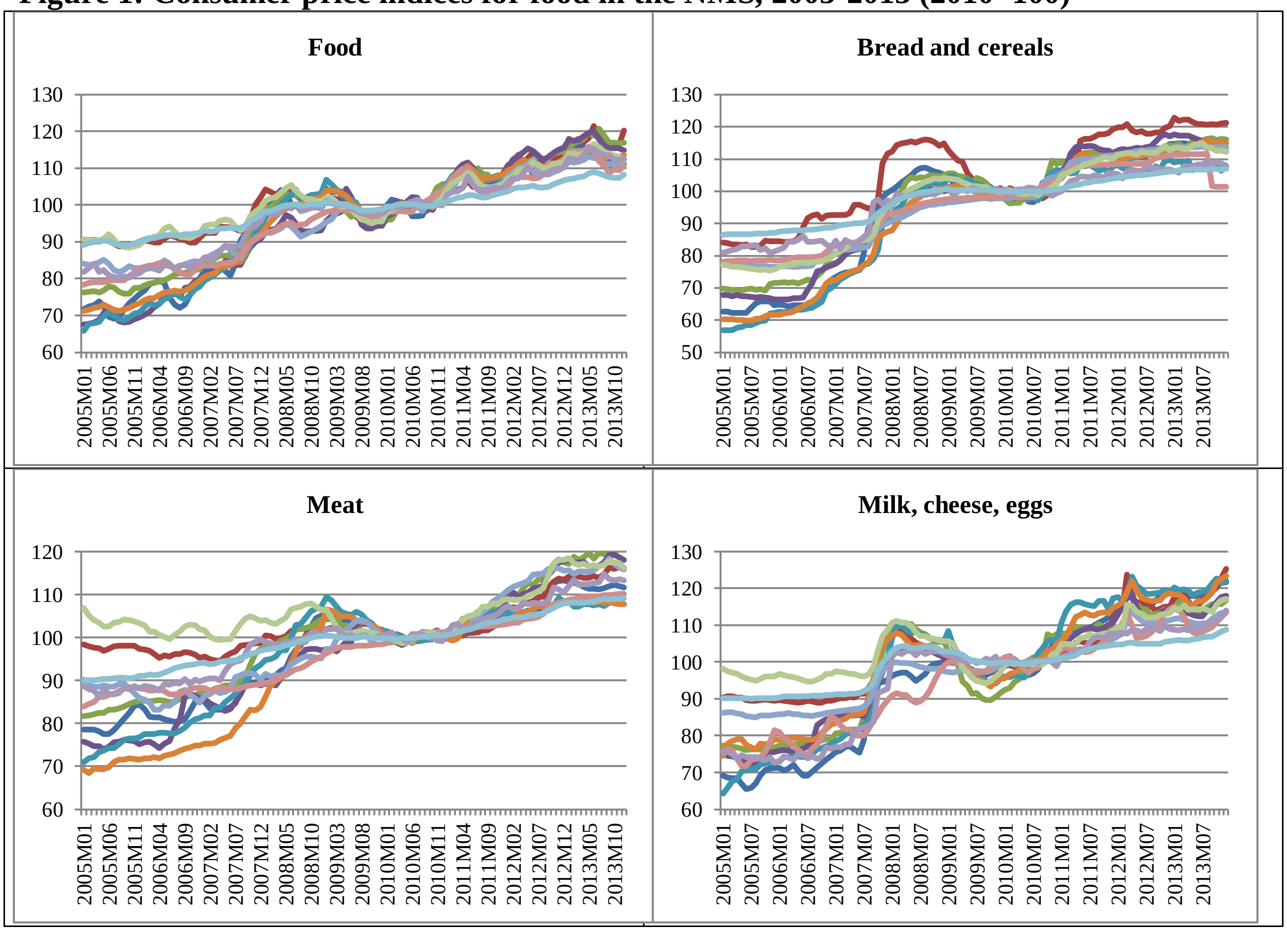
Price changes are also commonly presented along trend lines. In this case, a linear trend is fitted to time series, followed by adding (and substracting) a certain percentage, thus creating a 'tunnel' for price movements. Depending on the exact size of the tunnel (10%, 20%, etc.), prices outside are considered volatile, while prices inside are not considered to be volatile. There is no consensus on the suggested size of the tunnel, though literature suggests that 15% and 20% price bands show similar results than the 10% band (Piot-Lepetit and M'Barek, 2011).

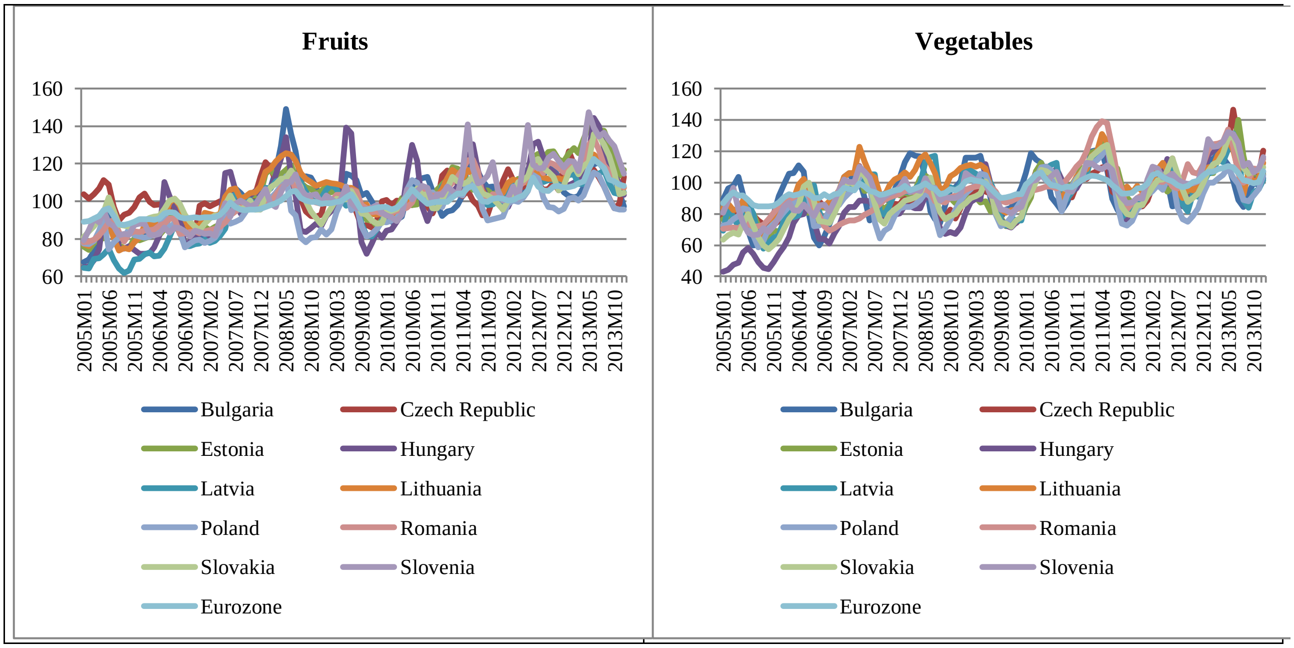
This paper calculates the indices above using the Eurostat monthly food price index database between January 2005 and December 2013. It is important to stress that instead of real prices, price indices are used, for two reasons: (1) food as a category does not have a price and (2) indices are not dependent on exchange rates. Our sample contains 1188 observations (108 months, 10 countries + EU27). EU27 stands for European Union member states until 2012, though Cyprus and Malta were omitted from the sample due to data constraints and the limited role of their agriculture in the national economy.

4. Volatility of food prices in the NMS

Food prices in the NMS have been increasing, though to different extent, since 2005 (Figure 1). For the same amount of food, consumers had to pay 50% more on average in 2013 than they did in 2005. The biggest increase in food prices from January 2005 to December 2013 was observable in Estonia, while the smallest was in Romania. Note that prices of the region were actually moving together, and after accession, the food price index growth exceeded the average of the Eurozone in the vast majority of the cases. In other words, NMS food prices have grown to a greater extent than respective prices of the Eurozone. The reason behind lies in the originally higher food prices of the Eurozone – however, since the accession, the food price gap between Old and New Members was continuously decreasing.

Figure 1: Consumer price indices for food in the NMS, 2005-2013 (2010=100)



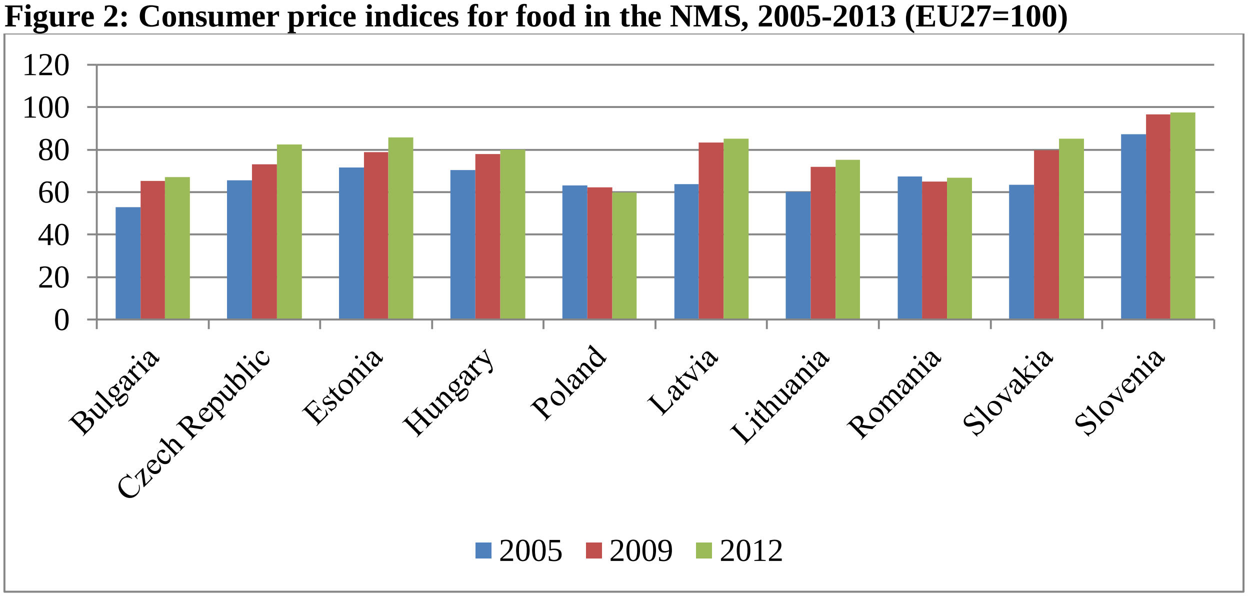


Note: Colours of countries are the same in all figures.
Source: Own calculations based on Eurostat (2014)

However, the evolution of price indices was not uniform across the different food product groups. On the one hand, cereals, meat and milk (as basic food) prices moved in a similar band, while on the other hand, heavy fluctuations were observable for fruit and vegetable products. Moreover, there existed a high monthly variation in fruit and vegetable product prices, probably due to specific characteristics of these products. Note again, that growth in NMS price indices of different food products exceeded those of the Eurozone in the majority of the cases.

If prices are analysed on a regional basis, price equalisation becomes more apparent (Figure 2).

Figure 2: Consumer price indices for food in the NMS, 2005-2013 (EU27=100)

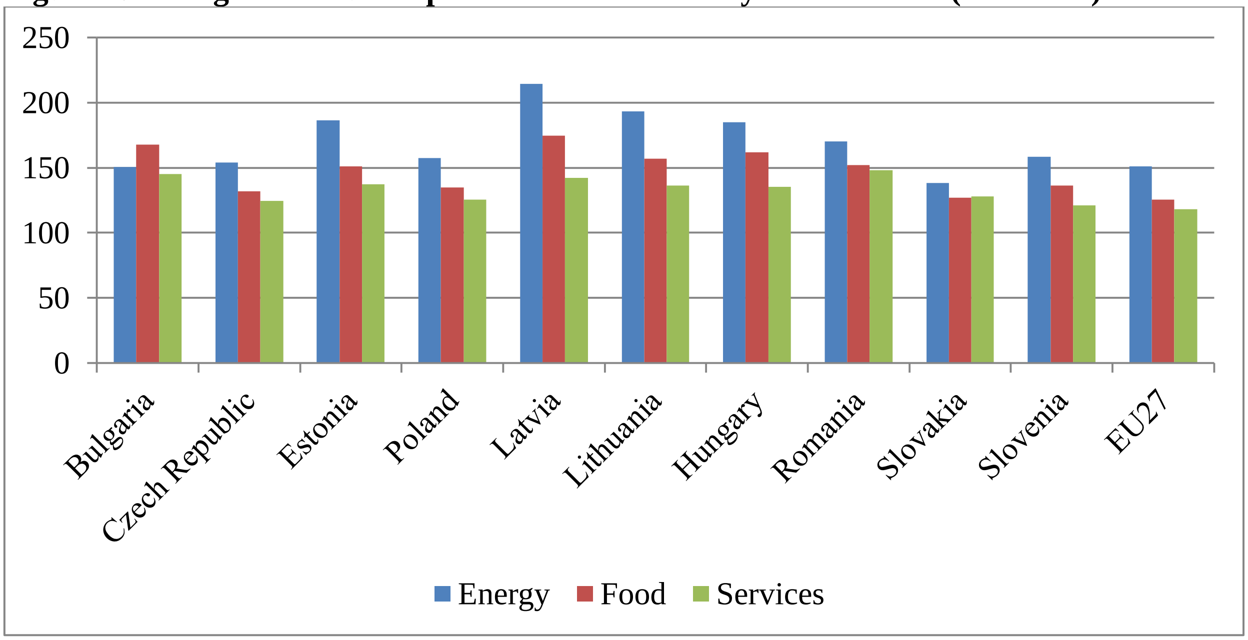


Source: Own calculations based on Eurostat (2014)

Except for Poland, consumer prices for food increased when compared to EU27 levels. However, a large diversity exists among member states in this regard: for example, while food prices in Poland were equal to 60% of EU27 average in 2012, those of Slovenia reached 98% of EU27 level. In other words, when the region is considered, food was the cheapest in Poland in 2012, while it was the most expensive in Slovenia – on average, NMS food prices were 20-30% less than EU27 food prices.

However, not only food prices increased in the NMS. By analysing changes in price indices by sector, it becomes apparent that energy prices increased more and prices of services increased less than food prices from 2005 to 2012. In most cases, consumer prices in all sectors increased by at least 50% from 2005 to 2012, though a 100% increase also occurred. Note again the price growth in all sectors increased EU27 levels.

Figure 3: Change in consumer price indices for food by 2012 in NMS (2005=100)



Source: Own calculations based on Eurostat (2014)

Besides these trends, descriptive statistics of the sample reveal some food price volatility patterns. Based on the 108 observations, it is evident that food price volatility (measured by standard deviation) was the highest in Hungary and Latvia, while the lowest in Czech Republic and Slovakia (Table 1) in the period analysed. Moreover, food prices were moving at a maximum of 3% to negative and 21% to positive directions, compared to 2010. Volatility of EU27 food prices were below that of NMS food prices in all the cases, meaning that food prices have changed less from month to month in the EU27 than in the NMS.

Table 1: Descriptive statistics of monthly food price indices, 2005-2013 (2010=100)

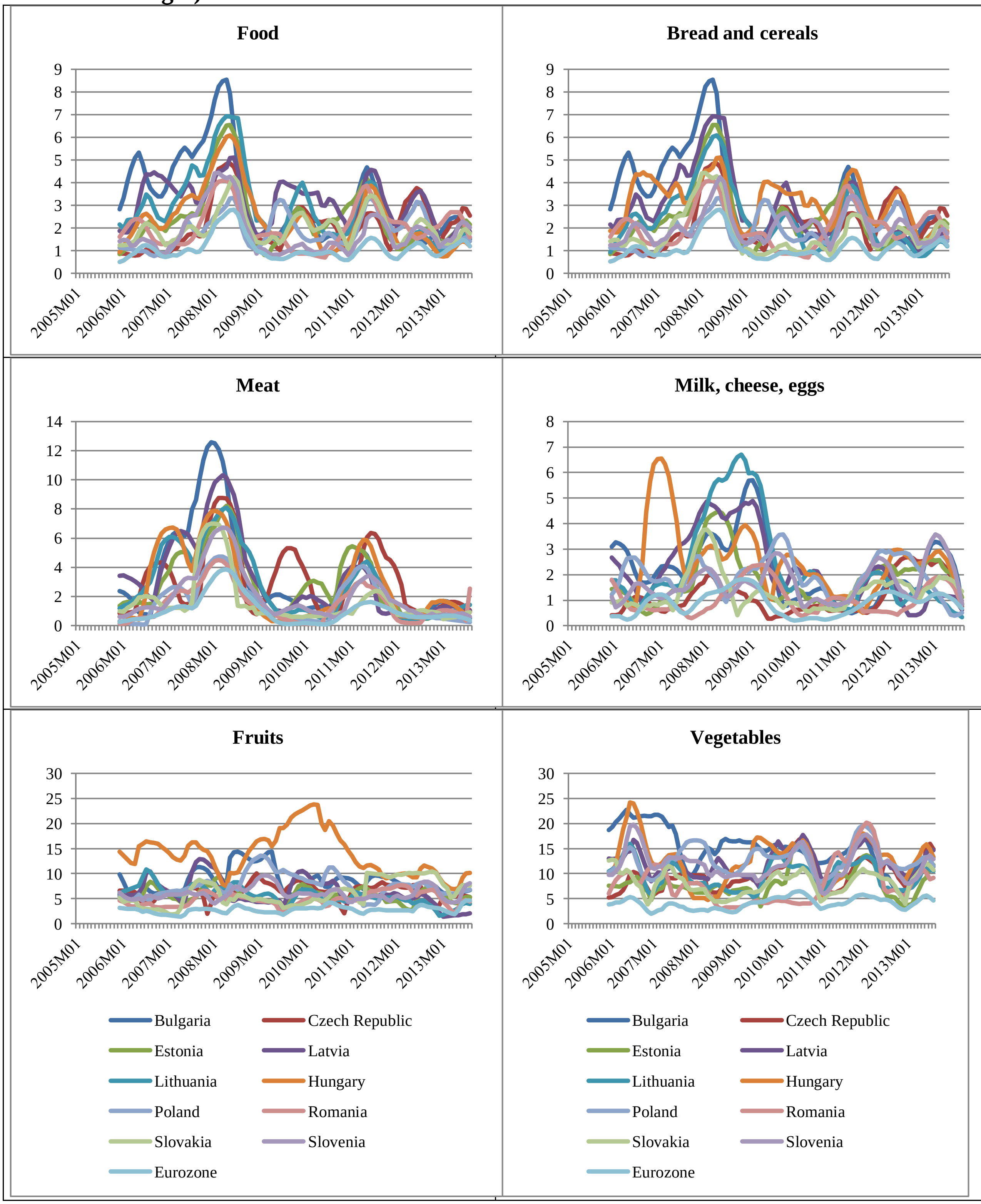
Country	Mean	Median	Maximum	Minimum	Std. Dev.	Skewness	Kurtosis
Bulgaria	96.66	100.85	116.30	69.10	14.28	-0.59	1.99
Czech Republic	101.24	100.50	121.40	88.70	9.10	0.45	2.17
Estonia	98.10	99.85	120.80	75.90	13.46	-0.22	1.86
Hungary	95.44	96.95	120.10	67.60	15.84	-0.28	1.92
Latvia	95.65	100.65	114.90	65.80	15.01	-0.65	1.97
Lithuania	96.19	99.85	114.90	71.20	14.32	-0.51	1.85
Poland	96.95	97.25	113.10	81.90	10.20	0.06	1.64
Romania	96.56	97.90	115.90	78.40	11.21	-0.10	1.76
Slovakia	100.95	100.65	116.50	88.50	7.84	0.22	1.96
Slovenia	97.63	99.30	115.70	80.20	10.47	-0.22	1.91
Eurozone	98.88	99.90	109.00	89.10	5.76	-0.16	1.97

Source: Own calculations based on Eurostat (2014)

As it is evident from the literature review above, another way of measuring price volatility is the calculation of coefficient of variation via 12 month rolling window averages, analysing dynamic patterns of changes. Price spikes of 2008 and 2011 can easily be seen together with the higher volatility of NMS food prices compared to EU27 ones (Figure 4). However, intra-NMS patterns show a huge diversity: food prices changed four times the EU27 average in the beginning of 2008 in Bulgaria, while two- or threefold difference is pretty normal in the sample.

Coefficient of variation also differs by product (Figure 4). On the one hand, price volatility of cereals and meat show very similar trends, while milk prices somewhat follow cereal and meat price changes, although with a time lag. On the other hand, fruits and vegetables prices are two times more volatile than prices of other products, though without any recognisable pattern. Hungarian fruit prices seem to have had the highest volatility in the period analysed, while volatility of Bulgarian and Romanian vegetable prices were also higher than the regional average. Note again that volatility of food prices were on the average higher in the NMS than in the Eurozone.

Figure 4: Coefficient of variation of food price indices in the NMS (12 month rolling window averages)



Note: Colours of countries are the same in all figures.
Source: Own calculations based on Eurostat (2014)

Last but not least, similar conclusions can be drawn if analysing changes in food price volatility by using price bands. As Table 2 suggests, a 10% price band put above and below the linear trend of price changes show that food prices were not particulary volatile in the NMS as the majority of price changes were located within the 10% price band. However, volatility of individual product prices show a great diversity – as expected from the above, fruits and vegetables prices were exceeding the 10% range in many cases. Latvia and Lithuania have experienced the highest volatility when this method is applied, while Slovenia the lowest. It seems that Slovenian food prices had lower volatility because of their closesness to EU27 levels. It is also observable, that the NMS price volatility was higher than respective EU27 values for all the analysed cases.

Table 2: Occurrence of volatile observations (%)

Country	Food			Cereals			Meat			Milk			Fruits			Vegetables		
	W	A	B	W	A	B	W	A	B	W	A	B	W	A	B	W	A	B
Bulgaria	90	7	3	74	16	10	97	3	0	92	8	0	66	14	19	35	33	33
Czech Republic	100	0	0	84	13	3	100	0	0	93	7	0	78	12	11	63	18	19
Estonia	97	3	0	88	12	0	100	0	0	87	13	0	15	0	85	63	19	17
Hungary	99	1	0	85	11	5	100	0	0	91	9	0	44	28	28	39	29	32
Latvia	87	13	0	63	20	16	89	11	0	87	13	0	69	18	13	50	25	25
Lithuania	98	2	0	82	13	5	88	12	0	90	10	0	77	12	12	60	22	18
Poland	100	0	0	100	0	0	99	1	0	100	0	0	76	13	11	50	23	27
Romania	100	0	0	100	0	0	100	0	0	100	0	0	93	6	1	72	15	13
Slovakia	100	0	0	96	4	0	100	0	0	98	2	0	86	10	5	54	22	24
Slovenia	100	0	0	100	0	0	100	0	0	88	11	1	81	11	9	67	17	15
EU27	100	0	0	100	0	0	100	0	0	100	0	0	99	1	0	100	0	0

Note: W=Within 10%, A=Above 10%, B=Below 10%.
Source: Own calculations based on Eurostat (2014) data

5. Possible reasons explaining differences in volatility

The differences above can be explained by various factors, some of which may be highlighted from a policy perspective. On the whole, it is clearly seen that changes in NMS food prices are principally originating on the world markets, as small countries of the region are practically price takers. However, there are some regional specificities.

First, an important external factor behind, we suggest, has been the tough adjustment to new market conditions. EU membership has made the NMS part of a much larger and very competitive market. Whilst this offers tremendous opportunities, the NMS are faced with significantly increased competition in their domestic markets. This situation reflects the rapid emergence of vertically coordinated food chains, creating very strong price competition. Although consumers are generally the beneficiaries of these changes, producers are not always able to adjust, or to cope with the business practices employed by the large chains (Csáki-Jámbor, 2013).

We also believe that the subsidy policy of competitors is also important as an external reason. The traditionally high agricultural subsidies of the EU15 have artificially increased the competitiveness of agri-food products imported by NMS after accession, generating unequal competitive market positions. This argument is strengthened if we account for the small proportion of direct payments that have been received by the NMS immediately after accession. Moreover, adjustment to EU subsidy levels, to the new legislative system and the creation of the necessary institutional infrastructure has been time consuming, which has delayed the response of the region to address its competitive disadvantages.

Several national factors have had an impact on the different performances observed. Depreciation of national currencies against the euro has resulted in price increases in many countries. For instance, it is not accidantely that Slovakia and Slovenia as Eurozone members experienced less volatility of their food prices. Another national factor lies in the agricultural policy chosen by a country. Evidence shows that those countries performing better in the agriculture sector (e.g. Poland and Slovenia) experienced EU accession much less as a shock (Csáki-Jámbor, 2013), also affecting food prices.

High price level and volatility of food prices are also associated with the unique agri-food trade structure of the region. As the majority of NMS export agricultural raw materials and import processed products, they experience food prices to be determined by external markets.

Conclusions

The article analysed consumer food price volatility of the NMS between 2005 and 2013, reaching a number of conclusions. First, our results suggest that food prices have continuously grown in the NMS during the period analysed and this was greater than in EU27 countries. Second, it became observable that price equalisation between Old and New Members has started after accession and this trend will possibly continue in the future. Third, we have shown that growth in energy prices were higher in the NMS than food prices growth, though the latter have increased by at least 50% in the years analysed.

Fourth, analysing variance and coefficient of variation suggest that Hungary experienced probably the highest food price volatility in the region, while Slovakia and Slovenia the lowest. Volatility by product shows huge differences as fruits and vegetables prices proved to be much more volatile than others. Moreover, it turned out that volatility of NMS food prices exceeded EU27 levels in the majority of the cases. Fifth, possible reasons behind changes were discussed, focusing on national characteristics.

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