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RAW MILK PRICE TRANSMISSION IN THE SELECTED EU COUNTRIES

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Abstract

The EU dairy sector has faced new challenges since the main EU enlargement in 2004. This paper investigates spatial raw milk price transmission between Germany, France, the Netherlands, Poland, Lithuania, and Latvia. The study applies the Granger Causality test to analyse the short-term raw milk price movements between the selected markets. Results suggest that the raw milk markets of six countries have survived important price shocks over the investigated period. Furthermore, the raw milk price development patterns of countries that joined the EU in 2004 move towards the more integrated EU raw milk market. Results of the Granger Causality tests suggest that countries could be grouped in accordance to raw milk price setting. The price development patterns in countries that joined the EU in 2004 and before differ.

Key words**:** *horizontal price transmission, market, milk*

INTRODUCTION

Over the recent decades, the dairy sector has faced significant challenges of the raw milk market introduced by the enlargement of the European Union (EU) and removal of trade barriers, the changes in the EU standards and regulation (for example, removal of milk quotas) as well as the impact of another important factors that have contributed to the development of prices in member states. This study focuses on spatial price transmission of raw milk prices and EU market integration, because market malfunctions are closely related to the welfare issues.

Although the growing interest in price transmission topic is observed after the food crisis and the recent price spikes, the academic research on spatial price transmission in the EU dairy sector is not excessive. The largest share of studies deals with vertical price transmission and examines how price changes are passed along domestic supply chains. The examples of such studies in the EU countries include [1, 4, 8, 14, 16]. This academic research niche contributes to the understanding of domestic supply chains and empowers the revision and improvement of policy measures that assist in solving specific raw milk market problems.

The spatial price transmission research niche became more attractive in light of the EU enlargement that had changed business environment in member states. In dairy sector, such studies vary in terms of the geographical coverage and include the research on horizontal price transmission between different locations of the same country [13], analyse price changes between the groups of member states or deal with the EU-wide coverage [2, 11, 15], and investigate price transmission between the EU market and other countries [9]. Studies on price transmission in the EU dairy sector vary greatly in terms of applied methodological frameworks, selected data frequency and periods of investigation, the coverage of member states, and etc. Furthermore, most of these academic contributions bring important fragments of knowledge and support a better-targeted policy on both national and the EU levels. Indeed, the most recent progress in methodological developments of spatial price transmission research and related academic challenges are discussed in [12].

This study contributes to the better understanding of raw milk market integration processes after the EU enlargement in 2004. The research investigates spatial raw milk price transmissions between Germany (DE),

France (FR), the Netherlands (NL), Poland (PL), Lithuania (LT), and Latvia (LV). A question to be answered is whether there is a difference between price behaviour in countries that joined the EU in 2004 and before this date. The understanding of price development patterns between the EU markets is critical for policy makers and academic society. This knowledge contributes to the discourse on the progress towards greater integration of the EU market and the relevant challenges.

The paper is organized as follows. Materials and Methods section informs about the origin of the used data and introduces applied econometric techniques. Results and Discussion section reports on the main results of the spatial price transmission between the selected six markets and link the relevance of main findings with other academic contributions. Conclusions section gives essential remarks on the main findings.

MATERIALS AND METHODS

Data. This study investigates spatial raw milk price transmissions between the selected EU countries. According to Eurostat [7], in 2019, the main producing countries were Germany (20.9% of the EU-27 raw milk, total available on farm), France (16.4%), and the Netherlands (9.5%). These countries represent the EU-15 group that has benefited from the more stable business environment and support policy. The second group includes the major raw milk producer in EU-12, namely Poland, and the neighbouring Lithuania and Latvia with the corresponding raw milk shares accounting for 9.2%, 1.0%, and 0.6%.

The study uses the monthly raw milk price data collected by the European Commission from the EU member states and covers the period from January 2005 to June 2020. The selected period demonstrates the changes in raw milk prices of the investigated member states after the EU enlargement in 2004. The study uses natural logarithms of prices and the methodological development is set as follows.

Methods. In this study, spatial price transmission focuses on the investigation of raw milk price links between markets of six member states in different locations. The study employs the Granger Causality test for the investigation of the short-term relationships between raw milk prices in the selected member states.

First, the study introduces the results of the Augmented Dickey-Fuller (ADF) test [3] for the price series of individual member states. This test classifies data into stationary and non-stationary.

The next step is the selection of the lag length for the Granger Causality test. In order to select a lag order, the unrestricted vector autoregressions are estimated for the each pair of countries. The decision on the lag order selection is made applying Schwarz information criterion (including 12 lags into lag specification).

Third, the Granger Causality test [10] investigates the nature of the short-term relationships between raw milk prices for the each pair of countries. This test allows understanding if the changes in raw milk prices of one member state could be explained by the previous price changes of this country and the lagged raw milk prices of another country. In fact, this test is often applied to identify a country that leads in price setting. However, the desired situation is the bidirectional price movement between two markets.

RESULTS AND DISCUSSIONS

The ADF test is applied to investigate the presence of the unit root in the selected price series of Germany, France, the Netherlands, Poland, Lithuania, and Latvia.

Table 1. Results of the ADF test for the logarithms of raw milk prices

Country	ADF test statistic	Test critical values 1.0%	Test critical values 5.0%	Prob.
Germany	-3.4596	-3.4666	-2.8774	0.0102
France	-4.4409	-3.4683	-2.8781	0.0004
Netherlands	-4.7196	-3.4717	-2.8796	0.0001
Poland	-3.1999	-3.4660	-2.8771	0.0216
Lithuania	-3.4965	-3.4662	-2.8772	0.0091
Latvia	-3.4462	-3.4670	-2.8775	0.0106

Source: Own calculation.

Results of the corresponding ADF tests are summarised in Table 1 and allow classifying data and considering the importance of significance level.

According to Table 1, tests for Latvia, Germany, and Poland cannot reject the hypothesis at 1.0% significance level. Thus, the conclusions on the stationary nature of price series depend on the selected significance level. However, the hypothesis of the unit root for the price series of all investigated countries can be rejected at 5.0% significance level. Thus, time series of six member states are stationary.

The next step is the selection of the lag lengths for the Granger Causality tests. It should be noted that this step is important, because the length of time delay can have an impact on the results of the Granger Causality tests. Table 2 shows the selected number of lags for unrestricted vector autoreressions.

Table 2. The selected lag length for unrestricted vector autoregressions by Schwarz information criterion

Countries selected for vector autoregressions	Selected lag order
Germany – France	2
Germany – Netherlands	2
Germany – Poland	2
Germany – Lithuania	3
Germany – Latvia	2
France – Netherlands	2
France – Poland	2
France – Lithuania	2
France – Latvia	2
Netherlands – Poland	2
Netherlands – Lithuania	2
Netherlands – Latvia	2
Poland – Lithuania	2
Poland – Latvia	2
Lithuania – Latvia	2

Source: Own calculation.

According to results demonstrated in Table 2, the Granger Causality tests should include two lags for the each pair of the investigated countries. However, in case of Germany and Lithuania, Schwarz information criterion suggests including three lags.

In the short run, the interactions between raw milk prices in alternative bilateral combinations of markets are analyzed employing the Granger Causality test. In Table 3, the hypothesis on the absence of the Granger Causality is rejected at the significance level lower than 5.0%.

Table 3. Results of the Granger Causality tests for the logarithms of raw milk prices

Hypothesis	F-stat	Prob.	Direction at 5.0% significance level
DE does not GC LV	15.0280	1.E-06	
			one-way
LV does not GC DE	2.1512	0.1194	
FR does not GC LV	4.0513	0.0190	
			two-way
LV does not GC FR	10.8300	4.E-05	
LT does not GC LV	14.0259	2.E-06	
			two-way
LV does not GC LT	4.1663	0.0171	
PL does not GC LV	19.4987	2.E-08	
			one-way
LV does not GC PL	1.5588	0.2133	
NL does not GC LV	6.2981	0.0023	
			two-way
LV does not GC NL	7.0809	0.0011	
FR does not GC DE	2.6531	0.0732	
			one-way
DE does not GC FR	16.3932	3.E-07	
DE does not GC LT	11.6418	6.E-07	
			two-way
LT does not GC DE	15.2291	8.E-09	
PL does not GC DE	3.9280	0.0214	
			two-way
DE does not GC PL	16.2921	3.E-07	
NL does not GC DE	1.3194	0.2700	
			one-way
DE does not GC NL	27.1789	5.E-11	
LT does not GC FR	5.5009	0.0048	
			two-way
FR does not GC LT	16.0350	4.E-07	
PL does not GC FR	13.3373	4.E-06	
			two-way
FR does not GC PL	5.0942	0.0071	
NL does not GC FR	32.0334	1.E-12	
			two-way
FR does not GC NL	6.4980	0.0019	
PL does not GC LT	14.5416	1.E-06	
			two-way
LT does not GC PL	6.7907	0.0014	
NL does not GC LT	14.5727	1.E-06	
			two-way
LT does not GC NL	5.4005	0.0053	
NL does not GC PL	3.5879	0.0297	
			two-way
PL does not GC NL	13.3640	4.E-06	

Note: GC – Granger Cause
Source: Own calculation.

According to Table 3, results suggest that the bidirectional price movement is violated between Germany and Latvia, Poland and Latvia, France and Germany, the Netherlands and Germany. It should be noted that results for Latvia are unexpected, because this country is not among the leading producers. However, according to the Granger Causality test, a price setting moves from Latvia to

Germany and Poland, while the latter countries represent a significant share of the EU dairy market.

The analysis of raw milk price series introduced in Fig. 1 sheds some light on this situation. According to Fig. 1, Latvia was the only country with the most remarkable raw milk price development differences after the accession to the EU. Indeed, the membership in the EU has changed the behaviour of the Latvian raw milk prices. Since 2007, the Latvian market has demonstrated a higher interaction of raw milk prices with other member states. In fact, the elimination of price series for the period 2005–2007 changes the results of the Granger Causality test fundamentally. Results for the shorter period also confirm one-way price movement, but the direction of the price setting goes in line with expectations, because the Latvian raw milk prices follow the development patterns of the leading producers.

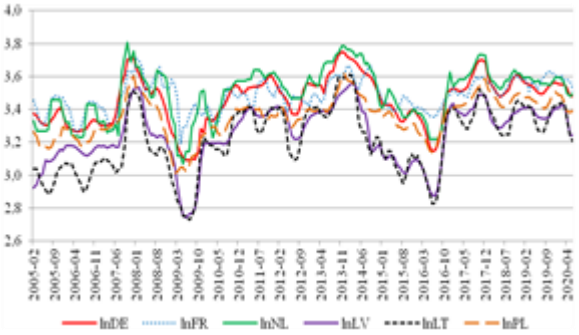

Fig. 1. Logarithms of raw milk prices for the selected countries
Source: Own elaboration.

Roman [13] argues that the decreasing gap between prices show the progress of the integration between markets. From this point of view, Fig. 1 demonstrates a higher level of market integration in countries that joined the EU in 2004 over the last couple years, compared to the early post-accession period.

Another interesting aspect is the status of the Lithuanian raw milk market. The Granger Causality test shows that the price series of the investigated countries have a weaker power explaining changes in raw milk prices in the Lithuanian market in the short run. It could be explained by peculiarities of the Lithuanian raw milk market and the challenges of the domestic supply chains.

Results of the Granger Causality tests also imply that raw milk price changes in Germany contribute to the price development in the Netherlands and France in the short run. This finding falls in line with the role of Germany in the EU raw milk market. Results also contribute to the study by [2] that finds a support for the higher integration of the EU raw milk market in countries that joined the EU before 2004.

Nevertheless, the slower process of raw milk market integration and differences in price setting between EU member states are often explained by a highly perishable nature of this commodity. In fact, some researchers argue that raw milk prices depend on the milk collecting hubs [2], because processors select reasonable raw milk transportation distances and need special facilities to operate a business.

For these reasons, the lower price level in Lithuania and Latvia, as well as similar price development patterns, could be explained by distances allowing to collect raw milk. The modest shares of the aforementioned markets in the EU dairy sector to some extent could be linked with production efficiency and competitiveness issues.

Although Poland and Lithuania are neighboring countries, the gap between raw milk prices during the post-accession period was high. Indeed, Fig. 1 shows that the Lithuanian raw milk prices are approaching the higher level over the recent years.

Main producing countries, namely Germany, France, the Netherlands, and Poland, demonstrate similar price development patterns and could be classified as a group of countries with higher price level. Granger Causality tests show that the EU raw milk market faces the similar challenges as other agricultural markets with the dominant share of production in several member states. For example, the EU pigmeat market study by [6] concludes that markets of member states with high power often drive price changes on smaller markets. However, the aforementioned study finds differences in price interactions between markets and

suggests meaningful grouping considering this criteria. Furthermore, researchers [6] link market non-efficiency with the fragmentation of the EU market into such groups.

Indeed, the changes in price development patterns and the improved EU market integration can be explained by dramatic structural changes in dairy sectors of member states over the investigated period. According to EU Agricultural Outlook [5], the EU average dairy farm size rose by more than 50.0% over the period from 2005 to 2016. These structural changes allowed decreasing productivity gaps between EU countries. However, the process is not over and EU Agricultural Outlook [5] projects higher EU average yields.

For example, in Poland, the process of the successful integration was lead by high level of concentration in milk production [13]. The disappearance of small farms and the movement towards the higher level of the average milk productivity became a challenge in many countries that joined the EU after 2004. In some countries, the situation in dairy sector was exacerbated by the failure of efforts to overcome problems of domestic supply chains.

CONCLUSIONS

Findings support the previous academic research in favour of the EU progress towards a more integrated raw milk market. According to results, even Latvia that has demonstrated dramatic price development differences, compared to other investigated countries, moves towards a higher level of market integration over the time.

Another important aspect is the difference between price interactions of different markets. The Granger Causality test shows that countries could be grouped in accordance with raw milk price setting directions. In the short run, German raw milk prices could be used to explain price developments in France and the Netherlands, while the situation with Lithuanian, Polish, and Latvian markets differs. As a result, there are differences between price interactions in countries that joined the EU in 2004 and before the main enlargement. The countries of the earlier accession have a clear short-term price setting direction from the leading market, while in the case of those that joined in 2004, the links are not so obvious and price development patterns demonstrate importance of the post-accession period.

Although the higher integration level of the EU market is treated as a desired objective, policy makers should not forget about the pressure of similar price development patterns when the countries with lower productivity, higher production costs, and inefficient domestic supply chains are forced to follow unfavorable price development trends in highly productive countries. The Common Agricultural Policy should be a useful tool that allows us to overcome the aforementioned challenges and strengthen national dairy sectors.

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