

DYNAMICS OF DAIRY PRODUCTS CONSUMPTION IN POLAND AGAINST THE BACKGROUND OF THE EU

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Abstract. Consumption is among the key determinants of milk production and profitability. The main purpose of this paper is to present the level of and changes in milk and dairy products consumption in the EU in 2004–2018. Due to changing consumer preferences, the average consumption of milk and milk products in EU countries is on an increase. In turn, Poland witnesses growth in consumption of milk for ripening and processed cheese and yogurt. In 2004–2017, per capita consumption of ice cream, cheese and powdered milk followed a downward trend. In order to examine changes in the consumption of milk and milk products, a forecast was prepared which shows that in 2018–2022, Poland will experience an increase in the average monthly consumption of milk, ice cream and cheese. On the other hand, the EU will report growth in consumption of fresh dairy products, butter, cheese, skim milk and powdered milk, and a decrease in casein consumption.

Keywords: consumption, milk, EU countries, Poland

INTRODUCTION

The global milk market is undergoing changes related to production, consumption, prices and other factors. Generally, EU countries recorded an increase in the consumption of processed dairy products such as butter, cheese, skim milk powder and whole milk powder in 2004–2018. However, the consumption of fresh dairy products and casein decreased (Rynek mleka..., 2016).

The main EU milk producers are Germany, France, UK, the Netherlands and Poland. Germany continues to be the most important milk producer and consumer, where milk consumption in kilograms per capita increased from 292 to 364 in 2005–2017 (Dairy report, 2018). In the major milk producing regions, farmers make investments that help them increase production while also improving competitiveness in the marketplace (Guth, 2017).

Among the EU-13 countries, Poland remains an important producer and a major consumer of milk. Between 2000 and 2016, Poland saw improvements in the milk consumption balance, including as regards milk intended for dairy products (except for milk processed into butter), and enhancements in the integration and logistics of the dairy industry. This increased the importance of supply chains which enable greater cooperation between dairy companies, suppliers and customers (Bórawski, 2016).

Generally, underdeveloped, developing and developed countries all saw an increase in milk consumption. This is due to the growing awareness of the role of milk as an essential ingredient in human diet. The increase in milk consumption is mainly driven by world population growth. Milk consumption increased almost four times in China between 2000 and 2013 (Kołoszyk, 2016).

There are many factors that increase milk consumption, primarily including the increase in population and in consumption per capita. Currently, population is

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observed to grow at an annual rate of 1.2–1.3% which causes consumption to increase by 7–9 million tons per year (Sahdev, 2015). The second factor is the increase in incomes per capita which leads to an increased consumption of dairy products (FAO, 2013).

Moreover, the dairy industry is growing rapidly in China, and milk consumption has become more common in urban areas (Wiley and Madison, 2007). A significant increase has been observed in India, too. “Meanwhile, in the United States, consumption has declined markedly, especially among children” (Wiley, 2011).

The consequence of the increasing consumption of dairy products has contributed to the increase in milk production. According to the Food and Agriculture Organization of the United Nations (FAO), the total dairy production around the world was 805 million tons in 2015 (Ogunyale and Mayorga, 2017).

Milk is considered a healthy product for people, and should be included in human diet. “Milk is viewed as especially appropriate for children, with growth-promoting properties; the larger size and athletic success of western athletes is often attributed to their greater milk consumption” (Wiley and Madison, 2007).

PURPOSE AND METHODOLOGY

The main purpose of this research was to identify changes in the consumption of milk and dairy products in Poland compared to the EU. In addition to the main objective, the following specific objectives were also met:

1. Evaluating milk and dairy products consumption in Poland and the EU.
2. Assessing changes in the consumption of milk and dairy products in Poland and the EU.
3. Developing a forecast of milk and dairy products consumption.
4. Identifying the drivers of milk consumption in Poland.

This paper uses tabular and descriptive methods. In turn, deductive inference based on a mathematical analysis of historical data was used to determine the expected future changes for 2018–2020. The time series consisted of annual data for 2004–2017. The authors relied on Statistica 13 in preparing the forecast based on this data.

The following multiple regression equation was used to identify the factors affecting milk production in Poland (Sobczyk, 2005):

$$y_i = \beta_o + \sum_{j=1}^K \beta_j X_{ij} + \varepsilon_i \quad (1)$$

where:

y_i : i^{th} – observation for the explanatory variable ($i = 1, 2, \dots, n$)

X_{ij} : i^{th} – observation for the j^{th} explanatory variable from the set of explanatory variables

β_o, β_j – structural parameters of the regression equation

Milk consumption was described using a variable with variability characteristics shown in the following model (1):

Y_1 : milk consumption per capita.

Substantive criteria and data availability were taken into account when selecting the model’s explanatory variables as shown below:

X_1 – milk production (thousand liters)

X_2 – PLN/EUR exchange rate

X_3 – milk prices paid to farmers in Poland (EUR/100 kg)

X_4 – retail prices of milk with a 3–3.5% fat content (PLN/1 l)

X_5 – FAO global milk price index

X_6 – net trade in dairy products (EUR million)

X_7 – disposable income (PLN)

X_8 – average monthly expenses per capita (PLN)

X_9 – the share of expenses in disposable income (%)

The authors used different sources of data. Historical data from the domestic dairy market was used to estimate the development trends in milk and dairy products consumption in Poland. Moreover, OECD data was used to describe the consumption of dairy products in EU countries between 2004 and 2017. EU country-level trends in butter and butteroil consumption between 2008 and 2017 were identified based on the analysis of milk market data.

RESEARCH RESULTS

The authors of this paper wanted to identify the factors affecting milk consumption. The first of them is milk production (Table 1) which increased from 11566 million liters in 2004 to 13305 million liters in 2017 (Bórawski, 2015). The EU is an important milk producer

Table 1. Market conditions for milk production in Poland in 2004–2017

Specification	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Milk production (million liters)	11 566	11 905	11 974	12 088	12 418	12 439	12 270	12 405	12 659	12 718	12 986	13 236	13 244	13 305
Exchange rate (PLN)	4.6640	4.0373	3.8952	3.7829	3.5166	4.3273	3.9946	4.1198	4.1969	4.2033	4.1847	4.1848	4.3757	4.2260
Milk prices paid to farmers in Poland (EUR/100 kg)	23.8	24.9	25.4	29.6	30.3	22.2	27.3	29.5	28.8	31.8	32.3	27.8	26.0	32.3
Retail prices of milk with a 3–3.5% fat content (PLN/liter)	2.43	2.46	2.42	2.54	2.80	2.72	2.68	2.73	2.77	2.81	2.99	2.87	2.73	2.77
FAO global milk price index	123.5	135.2	129.7	219.1	223.1	148.6	206.6	229.5	193.6	242.7	224.1	60.3	153.8	202.2
Net trade in dairy products (EUR million)	505	752.7	748	866.4	889	633	777.8	874.4	911.6	1017.5	1108.1	856.5	691.7	1185
Disposable income (PLN)	735	761	835	929	1 046	1 114	1 201	1 235	1 278	1 299	1 340	1 386	1 475	1 598
Average monthly expenses per capita (PLN)	702	697	751	816	911	964	1 005	1 028	1 059	1 062	1 079	1 091	1 132	1 176
Share of expenses in disposable income (%)	95.4	91.5	90.5	87.9	87.1	86.5	83.7	83.2	82.8	81.7	80.5	78.7	76.7	73.6

Source: own compilation based on data from the Institute of Agricultural and Food Economics — National Research Institute in Warsaw and on the 2014 Agricultural Statistical Yearbook.

worldwide. The surplus of milk was the reason to develop exports of dairy products (Seremak-Bulge and Bodył, 2014). Export development became particularly intense after Poland's accession to the EU (Pietrzak and Szajner, 2006). Higher EUR/PLN exchange rates encouraged milk processors to export milk and dairy products. The exchange rate can be defined as the price of euro expressed in the national currency (PLN) (Samuelson and Nordhaus, 1996).

High purchase prices of milk encourage farmers to produce more milk. However, higher milk prices reduce consumer purchases.

In Poland, annual per capita consumption of milk and butter increased by over 25% and over 2%, respectively, between 2004 and 2017. The sharpest increase in annual per capita consumption of milk and butter was recorded in 2016 (222 liters of milk and 4.7 kg of butter) (Table 2).

Changes in the structure of milk and dairy products consumption in Poland are caused by various factors

such as population ageing, increased rates of female economic activity and growing consumer awareness. The consumption level of cheese and curd in Poland varies depending on economic and social characteristics of households. The highest consumption levels are recorded in farms where managing person has a university degree. The relatively high price of these product types (when compared to meat prices, for instance) means that the consumption of ripening cheese is lower in poorer households. Also, the place of residence has an impact on the consumption of these products, with city dwellers consuming more ripening cheese than rural residents.

In Poland, the consumption of yoghurt has grown intensively since 2000, increasing by over 80% within 17 successive years. The increase in consumption of these products is driven by growing consumer interest in healthy lifestyles, and in having a diet based on products deemed “healthy” which are natural and rich in nutritional values. However, these products are also a source of calories due to high carbohydrate contents.

Table 2. Milk and dairy products consumption in Poland in 2004–2017 and forecasts for 2018–2022

Year	Consumption per capita		Average monthly consumption in households (kg per capita)								
	milk (l)	butter (kg)	milk (l)	whole milk (l)	milk (with less than 3.2% fat content)	condensed milk (kg)	yogurt (kg)	cheese (kg)	cottage cheese (kg)	ripening and processed cheese (kg)	cream (kg)
2004	174	4.4	4.59	2.45	2.14	0.04	0.35	0.87	0.53	0.34	0.44
2005	173	4.2	4.43	2.45	1.98	0.04	0.34	0.87	0.52	0.35	0.43
2006	176	4.3	4.12	2.31	1.81	0.04	0.37	0.89	0.52	0.36	0.41
2007	179	4.2	3.84	2.19	1.65	0.05	0.40	0.89	0.52	0.37	0.40
2008	182	4.3	3.64	2.13	1.51	0.05	0.44	0.88	0.51	0.37	0.40
2009	187	4.7	3.64	2.02	1.49	0.05	0.47	0.92	0.52	0.40	0.40
2010	189	4.3	3.51	2.14	1.37	0.06	0.54	0.94	0.55	0.39	0.38
2011	194	4.0	3.42	2.08	1.34	0.05	0.54	0.95	0.56	0.39	0.37
2012	193	4.1	3.39	2.04	1.35	0.05	0.52	0.94	0.55	0.39	0.37
2013	206	4.1	3.35	2.08	1.27	0.02	0.51	0.83	0.44	0.38	0.37
2014	205	4.2	3.25	1.99	1.26	0.02	0.50	0.82	0.43	0.39	0.36
2015	213	4.5	3.16	1.93	1.23	0.02	0.50	0.83	0.43	0.40	0.35
2016	222	4.7	3.08	1.98	1.10	0.02	0.53	0.85	0.44	0.41	0.36
2017	218	4.5	2.99	1.93	1.06	0.02	0.52	0.86	0.44	0.42	0.36
Forecast											
2018	219.51	4.5	2.97	1.94	1.10	0.02	0.51	0.87	0.45	0.42	0.36
2019	221.00	4.7	3.00	1.96	1.12	0.03	0.50	0.87	0.47	0.41	0.36
2020	221.54	4.7	3.02	1.98	1.14	0.03	0.49	0.88	0.48	0.41	0.36
2021	222.16	4.8	3.04	2.00	1.16	0.03	0.49	0.88	0.48	0.41	0.37
2022	222.67	4.9	3.06	2.01	1.18	0.03	0.49	0.88	0.48	0.41	0.37

Source: Rynek mleka 2005–2019.

In the analysis of milk and dairy products consumption in Poland, the consumption of products considered to be richer in nutritional values tends to follow an upward trend whereas a decrease is observed in the consumption of high-calorie products. When making a decision to buy a food product, the consumer is guided by many selection criteria. However, milk and dairy products may differ in role and importance from other food groups. The dairy market is affected by increasing competition, and the main goal of producers is to meet customer expectations and preferences and make their customers highly

satisfied with product quality. Defining consumer quality criteria means searching for the most recent trends in consumer preferences underpinning their market choices. Polish consumers expect the products available on the market to be diverse, of a high quality, sensory attractive, with a high nutritional value, produced using natural methods and safe while requiring little effort and time to prepare for consumption (Grzybowska-Brzezińska and Grzywińska-Rapca, 2016).

It is difficult to explain the changes in milk and dairy products consumption in Poland. It is widely confirmed

that dairy products are nutrient-dense foods in the overall human diet, and they contain necessary nutrients such as calcium, potassium, protein, fat and vitamin D, which help to keep the human body healthy (Simo et al., 2016). Milk and dairy products “may reduce the risk of osteoporosis and cardiovascular diseases and type 2 diabetes, and are the best complement for a healthy meal” (Gulseven and Wohlgenant, 2017).

In their forecast, the authors of this paper expect the consumption of milk and dairy products in Poland to change. On one hand, the consumption of whole milk, milk with less than 3.2% fat content, cottage cheese, condensed milk and cream will increase. However, the consumption of yogurt and cheese will follow a downward trend (Table 2).

According to FAO data, global consumption of milk and dairy products will return to levels recorded 20 years ago (Bórawski and Kowalska, 2017). The average level of milk consumption around the world is 109 kg/person. Although the highest consumption occurs in North America, the levels recorded in China and the EU are increasing (Baer-Nawrocka et al., 2012). Milk consumption in the European Union, United States and Australia is almost three times the world average level (Bórawski and Kowalska, 2017). Milk shortages in Asian countries have increased despite an increase in production, while the shortage of dairy products in Africa has not changed (Seremak-Bulge and Bodył, 2014).

OECD data shows that in EU countries, average consumption of fresh dairy products decreased between 2004 and 2018 from 94.52 kg per capita to 88.17 kg per capita (a decline by 6.7%). In turn, Eurostat data shows that in 2018 in the EU, butter consumption was at a level of 4.3 kg per capita, which is the same as in the previous two years (Rynek mleka, 2019).

In the future, the consumption of fluid milk will decline whereas the consumption of cheese and other processed dairy products will increase. In France, Germany and Spain, the consumption of flavored, vitamin-enriched, lactose-free, and plant-based milk has been observed to follow an upward trend. Almost all EU countries have noticed an increase in organic milk production and consumption. Austria, for example, exports organic milk to Germany and Italy (EU-28, 2018).

Butter consumption in 2018 was 4.33 kg per capita, which is higher than in 2004 (3.57 kg). This increase is the effect of changes driven by consumers who consider butter to be a healthful product more natural than

margarine. “Although EU-28 butter prices in September 2018 decreased by 19% against September 2017’s record-high of level of EUR 6,500 (USD 7,735) per ton, they were still five percent above the prices of Oceania or U.S.-origin butter” (EU-28, 2018).

A forecast was elaborated in order to evaluate the future changes in milk and dairy products consumption. It suggests that per capita consumption of fresh dairy products and casein will increase in 2009–2023. In turn, the consumption of butter, cheese, skim milk powder, whole milk powder and whey powder will decrease in the EU for numerous reasons. First, the consumption of lactose-free dairy products will follow an upward trend. Moreover, the overall EU population is going to stagnate and will decline in some countries.

In the analysis of milk and milk products consumption in EU countries, the consumption of products considered to be richer in nutritional values tends to follow an upward trend whereas a decrease is observed in the consumption of high-calorie products. Milk is one of the basic and most valuable food products in human diet, and therefore an increase in the consumption of skim milk is experienced.

Additionally, strong competition in the milk market will cause farmers from some EU countries to exit the business (Table 3).

Both in EU countries and around the world, milk is mostly consumed fresh or as only slightly processed products. According to forecasts, the share of fresh products in total consumption of dairy products will increase due to strong demand in developing countries (driven by an increase in incomes and population growth). However, in the EU, fresh products consumption will decrease in favor of processed products. OECD-FAO forecasts that EU milk production in 2019–2028 will grow at a slower rate than average global production growth. Production will increase through improved cow productivity (at an annual rate of 1.1%) while cow numbers will decrease at an annual average rate of 0.5%. In the European Union, the share of organic milk in the production mix will increase. Currently, in countries such as Austria, Sweden, Latvia, Greece and Denmark, over 10% of milk is produced organically. On average, around 3% of EU milk production comes from organic farms.

Growth in world milk production is projected to increase by 22% over the projection period, with a large share of the increase coming from Pakistan and India.

Table 3. Consumption of dairy products in the EU in 2004–2018 and forecasted levels for 2019–2023 (kg)

Year	Fresh dairy products		Butter		Cheese		Skim milk powder		Whole milk powder		Whey powder		Casein	
	total	per capita	total	per capita	total	per capita	total	per capita	total	per capita	total	per capita	total	per capita
2004	46,657.39	94.52	1,763.58	3.57	8,161.33	16.53	963.85	1.11	290.15	0.59	1,273.92	0	113.43	0.23
2005	47,248.1	95.36	1,795.27	3.62	8,511.17	17.18	880.89	0.95	284.44	0.57	1,272.46	0	116.75	0.24
2006	47,140.71	94.8	1,882.31	3.79	8,726.15	17.55	807.57	0.95	306.41	0.62	1,278.27	0	114.6	0.23
2007	46,635.18	93.43	2,047.24	4.10	8,680.79	17.39	708.73	0.88	346.73	0.69	1,370.61	0	131.91	0.26
2008	46,367.57	92.57	2,034.38	4.06	8,634.81	17.24	600.44	0.72	317.81	0.63	1,338.08	0	125.03	0.25
2009	46,263.8	92.07	1,827.45	3.64	8,680.42	17.27	786.82	1.09	239.15	0.48	1,158.41	0	90.21	0.18
2010	46,608.24	92.51	2,022.85	4.01	8,754.25	17.38	685.85	0.90	254.75	0.51	1,370.90	0	113.02	0.22
2011	46,343.36	91.79	2,007.06	3.98	8,792.72	17.41	688.93	0.95	295.74	0.59	1,286.60	0	105.36	0.21
2012	46,108.43	91.18	2,078.57	4.11	8,913.79	17.63	677.18	1.01	267.19	0.53	1,376.07	0	88.31	0.17
2013	46,112.74	91.08	2,044.31	4.04	8,655.05	17.09	696.65	1.10	352.11	0.7	1,406.24	0	94.91	0.19
2014	45,670.57	90.10	2,117.06	4.18	8,869.62	17.50	720.87	1.19	367.46	0.72	1,352.72	0	92.89	0.18
2015	45,898.73	90.44	2,134.09	4.21	9,200.72	18.13	740.67	1.23	320.64	0.63	1,371.63	0	89.26	0.18
2016	45,119.94	88.79	2,187.19	4.30	9,358.52	18.42	767.78	1.27	354.1	0.70	1,256.67	0	71.27	0.14
2017	45,030.23	88.48	2,198.3	4.32	9,472.09	18.61	774.07	1.27	360.15	0.71	1,305.75	0	69.88	0.14
2018	44,939.08	88.17	2,207.28	4.33	9,687.25	19.01	820.65	1.35	363.3	0.71	1,340.22	0	71.16	0.14
Forecast														
2019	45,055.36	88.62	2,177.16	4.26	9,717.59	19.01	808.31	1.28	339.61	0.66	1,308.66	0	75.74	0.15
2020	45,163.37	88.28	2,157.00	4.22	9,653.63	18.85	800.94	1.25	313.50	0.62	1,311.56	0	78.33	0.15
2021	45,255.57	88.46	2,139.21	4.18	9,594.64	18.70	795.89	1.23	315.20	0.63	1,313.67	0	80.59	0.16
2022	45,342.49	88.62	2,123.52	4.15	9,540.24	18.57	792.43	1.21	315.09	0.63	1,315.22	0	82.57	0.16
2023	45,416.45	99.78	2,109.68	4.13	9,490.08	18.46	790.07	1.20	315.00	0.63	1,316.85	0	84.30	0.16

Source: own elaboration based on OECD data, n.d.

In 2027, these two countries are expected to jointly account for 32% of global milk production. Most of the additional production in these countries will be consumed domestically as fresh dairy products. Over the projection period, the European Union's share in global exports of dairy commodities is expected to increase from 27% to 29%. As the 2017 butter bubble continues to deflate, nominal and real prices for butter will decrease over the projection period. With the exception of skim milk powder (SMP), dairy prices are expected to decrease in real terms (OECD-FAO..., 2018).

Next, the authors of this paper analyzed the consumption of butter and butteroil across EU countries in 2008–2017. The data presented above confirms the increase in butter and butteroil consumption in most EU countries between 2008 and 2017 (Table 3). This can be the effect of growing production of milk and dairy products and of changing consumer preferences for milk and processed dairy products. The new consumer base has challenged the industry to extend their product range (Zuba-Ciszewska, 2018). The demand for dairy products in emerging economies that cannot fulfill their

domestic needs created an increase in global dairy trade (von Keyserlingk et al., 2013).

The consumption of butter and butteroil decreased in 2008–2017 in Belgium, Estonia, Germany, Luxembourg, and Spain. France is a leader in the consumption of butter and fats with an average consumption of

ca. 7.8 kg/person, which is more than twice the average level for the 28 EU countries. The lowest consumption (only 0.4 kg/person) was recorded in Spain. Due to lack of relevant data, this study did not include Bulgaria, Greece, Malta, Portugal, Romania and Slovenia (Table 4).

Table 4. Butter and butteroil consumption in the EU in 2008–2017 (kilograms/person)

Country/region	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	Forecast				
											2018	2019	2020	2021	2022
EU 28 countries	3.6	3.6	3.6	3.6	3.7	3.7	3.7	3.9	3.9	3.8	3.8	3.7	3.7	3.7	3.7
Austria	4.9	4.9	5.1	5.0	5.0	5.3	5.3	4.9	5.3	5.5	5.1	5.1	5.1	5.1	5.1
Belgium	2.4	2.4	2.4	2.4	2.5	2.3	2.3	2.3	2.3	2.2	2.3	2.3	2.3	2.3	2.3
Bulgaria	–	–	–	–	0.8	0.9	0.9	–	–	–	–	–	–	–	–
Cyprus	1.4	1.4	1.8	1.8	1.9	1.8	1.9	1.9	1.9	1.9	1.9	1.8	1.8	1.8	1.8
Croatia	0.9	1.2	1.0	0.6	1.0	1.0	1.2	1.6	1.5	1.5	1.4	1.3	1.2	1.2	1.2
Czech Republic	4.7	5.0	4.9	4.9	5.2	5.0	5.1	5.5	5.4	5.0	4.9	5.0	5.0	5.0	5.0
Denmark	1.8	1.8	1.8	1.8	2.5	3.9	4.9	5.0	6.3	6.2	6.0	5.0	4.6	3.7	2.9
Estonia	4.3	5.7	4.3	4.1	2.5	1.5	2.2	1.6	2.7	2.7	2.9	3.0	3.1	3.2	3.2
Finland	2.7	3.1	3.4	4.1	4.5	3.7	3.2	3.3	3.3	3.4	3.5	3.4	3.4	3.4	3.4
France	7.5	7.7	7.6	7.6	7.3	7.7	8.3	8.2	8.2	8.0	7.9	7.8	7.8	7.8	7.8
Germany	6.2	5.8	5.7	6.3	6.2	5.8	5.7	6.1	6.1	5.9	5.9	6.0	6.0	6.0	6.0
Greece	–	0.6	0.6	0.7	–	–	–	–	–	–	–	–	–	–	–
Hungary	0.9	1.0	1.0	0.9	1.0	1.0	1.2	1.6	2.2	2.5	2.7	2.9	3.3	3.9	4.6
Ireland	2.5	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Italy	2.4	2.5	2.3	2.3	2.3	2.4	2.3	2.5	2.6	2.6	2.5	2.5	2.5	2.4	2.4
Latvia	2.6	2.6	2.5	2.8	2.8	2.3	2.9	3.0	2.9	3.5	3.0	3.0	2.9	2.9	2.9
Lithuania	1.4	2.2	2.0	2.2	2.8	2.6	3.0	3.3	3.8	4.1	4.0	3.9	3.8	3.7	3.7
Luxemburg	–	–	5.8	6.0	6.1	5.4	5.3	5.6	5.6	5.5	5.6	5.7	5.7	5.7	5.7
Malta	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Netherlands	3.3	3.7	3.0	3.0	3.0	3.0	3.0	3.9	4.3	4.0	3.9	3.7	3.5	3.5	3.4
Poland	4.3	4.4	4.2	4.2	3.9	4.0	4.1	4.3	4.6	4.5	4.5	4.4	4.3	4.3	4.3
Portugal	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Romania	–	0.8	0.6	0.6	–	–	–	–	–	–	–	–	–	–	–
Slovakia	2.2	2.8	2.6	2.6	3.2	3.0	3.2	3.6	3.9	3.9	3.8	3.7	3.6	3.6	3.5
Slovenia	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Spain	0.5	0.5	0.5	0.5	0.6	0.5	0.5	0.4	0.4	0.3	0.3	0.4	0.4	0.4	0.4
Sweden	1.6	1.8	1.6	2.6	3.0	2.2	2.3	2.5	2.5	2.4	2.4	2.2	2.2	2.2	2.2
United Kingdom	2.8	3.0	3.2	3.1	3.4	3.2	2.9	3.1	2.7	2.7	2.9	2.9	3.0	3.0	3.0

– Data not available.

Source: own calculations based on 2004–2018 monthly milk price data for EU countries (EC, n.d.).

In most European Union countries, vegetable fat dominates fat consumption. The greatest dominance of vegetable fats over animal fats is found in food consumed by people living in Spain, Greece and Cyprus who have a Mediterranean diet with a high proportion of oils and olive oil. In turn, the smallest share of vegetable fats in total fat consumption occurs in the diet of the inhabitants of Belgium, Hungary, Poland, Germany, Austria, and Croatia.

On the one hand, most EU countries are self-sufficient in the production of animal fats (butter and raw animal fats), but they have a low production volume of vegetable fats relative to domestic consumption and therefore remain a significant importer. On the other hand, many European Union members produce insufficient volumes of butter and raw animal fats to address domestic consumption, which suggests they have a problem in their distribution policy and organization of the common market for vegetable and animal fats (Rosiak, 2016).

According to OECD-FAO forecasts, global milk production in 2019–2028 will grow at a rate of 1.7% per year, to 981 million tons in 2028. Countries with the largest increases in milk production include India and Pakistan, which will jointly be responsible for more

than half of global production growth in the next decade. As a consequence, in 2028, these countries will account for over 30% of global production. The global volume of trade in skim milk powder will increase at an average annual rate of 1.7%; the corresponding rates for butter and whole milk powder are 1.6% and 1.1%, respectively.

This study analyzes the relationships between variables explaining milk production in Poland. The relationship is measured with the correlation coefficient which takes on values ranging between –1 and 1. When the coefficient is 0, it means there is no correlation between variables. A positive correlation coefficient means an increase in both features, while a negative increase means an increase in one feature and a decrease in the other (Bórawski, 2015).

Milk consumption was positively correlated with milk production, net trade in dairy products and average monthly expenses per capita (Table 5).

So far, this study has explored the determinants of dairy products consumption and their mutual correlations. However, it was also considered important to examine the impact of drivers of milk consumption in Poland using a regression equation (Table 6). The multiple regression routine found milk consumption in Poland to

Table 5. Results of correlation analysis between explanatory variables

Specification	Y_1	X_1	X_2	X_3	X_4	X_5	X_6	X_7	X_8	X_9
Y_1 : milk consumption per capita	1.000	0.905	–0.829	–0.778	–0.828	–0.030	0.809	0.088	0.973	–0.921
X_1 : milk production (thousand liters)	0.905	1.000	–0.987	–0.961	–0.986	0.106	0.795	0.179	0.895	–0.714
X_2 : PLN/EUR exchange rate	–0.829	–0.987	1.000	0.986	0.999	–0.152	–0.740	–0.203	–0.819	0.597
X_3 : milk prices paid to farmers in Poland (EUR/100 kg)	–0.778	–0.961	0.986	1.000	0.987	–0.167	–0.628	–0.163	–0.759	0.516
X_4 : retail milk prices (PLN/liter)	–0.828	–0.986	0.999	0.987	1.000	–0.151	–0.736	–0.201	–0.817	0.595
X_5 : FAO global milk price index	–0.030	0.106	–0.152	–0.167	–0.151	1.000	0.072	–0.054	–0.062	0.110
X_6 : net trade in dairy products (EUR million)	0.809	0.795	–0.740	–0.628	–0.736	0.072	1.000	0.223	0.838	–0.780
X_7 : disposable income (PLN)	0.089	0.179	–0.203	–0.163	–0.201	–0.054	0.223	1.000	0.082	–0.075
X_8 : average monthly expenses per capita (PLN)	0.973	0.895	–0.819	–0.759	–0.817	–0.062	0.838	0.082	1.000	–0.930
X_9 : share of expenses in the disposable income (%)	–0.921	–0.714	0.597	0.516	0.595	0.110	–0.799	–0.075	–0.930	1.000

Source: own calculations.

Table 6. Results of regression analysis between the change in milk production in Poland (as the dependent variable) and independent variables

Specification	Coefficient	Std. error	F test	p-value
X_1 : milk production (thousand liters)	2.75			
X_2 : PLN/EUR exchange rate	10.4	53.125	190.759	0.000
X_4 : retail milk prices (PLN/liter)	-8.3			
X_8 : average monthly expenses per capita (PLN)	0.216			

Source: own calculations.

be dependent on X_1 (milk production, thousand liters), X_2 (euro exchange rate) and X_8 (average monthly expenses per capita, PLN). The regression coefficient of X_4 (retail price of milk, PLN/liter) was negative which means that an increase in milk prices makes consumption levels decrease. The R^2 determination coefficient was high and reached 0.99 which means a good fit of the model.

SUMMARY

Milk and dairy products consumption has increased around the world, especially in China, India and the EU. In Polish self-employed households, milk and dairy products consumption has decreased over the last five years. However, the consumption of ripened and processed cheese was on the rise.

The consumption of milk and dairy products in Poland changed between 2004 and 2018. The biggest increase was observed in the consumption of yogurt (+48.6%), milk (+34.9%), and ripened and processed cheese (+23.5%). Conversely, the study period witnessed a decrease in the average monthly consumption of whole milk (-21.2%), milk with a fat content less than 3.2% (-50.5%), concentrated milk (-50.0%), cottage cheese (-17.0%) and cream (-18.8%).

At the EU-wide level, a decrease in the consumption of fresh dairy products and casein was observed, whereas the consumption of butter, cheese, skim milk powder, whole milk powder and whey powder increased over the study period. Such changes can result from the consumers shifting their preferences towards more processed foods. Another reason could be the changing lifestyle of modern consumers who often have lunch and dinner in restaurants instead of preparing home-cooked meals.

The analysis shows that milk consumption in Poland depended mainly on X_1 (milk production, thousand liters), X_2 (euro exchange rate) and X_8 (average monthly expenses per capita, PLN). Conversely, the increase in milk prices had a negative impact on consumption levels.

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