

AN ATTEMPT AT EXPRESSING THE TURNOVER OF FOREIGN TRADE IN DAIRY PRODUCTS AS A MILK EQUIVALENT

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The paper proposes two methods of expressing the turnover of foreign trade in dairy products using a milk equivalent. The first of them is based on applying conversion ratios indicating how many liters of milk are needed to manufacture a unit of a given product. The ratio allowing calculation of butter quantity that could be obtained from fat retained during processing milk into individual products is used in this method as supplementary.

The second of the presented methods for calculation of milk equivalent is based on the chemical composition (content of protein and fat) of dairy products and milk purchased.

INTRODUCTION

Integration of economies of individual countries into uniform bodies of regional economic entities and even, in many respects, a single global economy is among the most important processes characterising contemporary economic relations. Liberalization of the flow of goods, people, capital and services and next free flow of those economic factors are the key components of those processes. Under such circumstances it becomes necessary for business entities to fulfill the condition of economic effectiveness not only in the local or domestic market but also in the international market. As a consequence, knowledge and current analysis of the competitive position of the company or the economic sector are necessary for managing a company and the economic policy. Analysis of foreign trade turnover is one of the methods for investigating the competitive position of a given sector. Accession of Poland to the European Union increased the dynamics of our foreign trade and as a consequence that method of investigating the competitiveness has currently gained even higher importance [Gornowicz, 2003].

Agricultural food products are one of the most important groups of goods in Polish exports. Dairy products have a significant position among them [Zalewski, 2000]. They have the highest share in the structure of Polish agricultural food exports after fruit and fruit products and meat (10.6% in 2004). Monetary units usually fulfill the role of aggregated measure in analyses of foreign trade [Szajner, 2005]. However, they are unsuitable for, e.g. studies that link foreign trade with the milk use balance. In such a case it is necessary to express exports and imports of dairy products

in the so-called “a milk equivalent”, *i.e.* mass or volume of raw material milk necessary for manufacturing of a specific volume of dairy products. The method of expressing the volume of dairy products as the milk equivalent raises methodological controversies and as a consequence that issue is the subject of this paper. It attempts at expressing Polish foreign trade in dairy products as milk equivalent.

METHODS

Consumption of milk for individual products was determined by applying two methods. In the first one the conversion ratios showing how many liters of milk are needed for the production of 1 kg of a given product were used. Those ratios represent modified version of ratios given by Mikkelsen & Richarts [1995] and Bazydło & Sokołowski [1998]. The modification represented taking into account the actual chemical composition (fat and protein content) of milk purchased in Poland. The quantity of milk corresponding to the volume of exports or imports of individual products was obtained by multiplying those values by the ratio appropriate for a given product. During standardisation of raw material for the production of individual products a certain quantity of milk fat is left. The volume of milk necessary to obtain the volume of fat needed for the production of 1 kg of butter during the process of milk standardisation for manufacture of a given product was calculated. That value represented the second ratio enabling the calculation of the mass of butter that could be obtained from fat remaining after allocating the necessary quantity of milk for individual products.

In case of the second method proposed for calculation

of milk equivalent for a given mass of dairy products the first stage consisted in determining the main milk components, *i.e.* protein and fat, contained in them. That was achieved on the basis of the chemical composition of dairy products that are subject of our foreign trade. Next, assuming the average protein content in bulk milk at 3.24% and average fat content at 3.93% [Babuchowski & Seremak-Bulge, 2005] the quantity of components was converted to the equivalent of milk purchased. The conversion of milk quantity corresponding to consumption of protein and fat to the quantity of milk purchased was done according to proportions at which those components determine the price of full milk [Imbs & Bazydło, 1994; Mikkelsen & Richarts, 1995].

The study covered the years 2004–2005. The data on quantities and values of exported and imported dairy products were obtained from market reports published by the Institute of Agricultural Economics and Food Management in Warsaw [Rynek Mleka (The Milk Market), 2005].

RESULTS AND DISCUSSION

Dairy products are among those few groups of agricultural food products the exports of which have exceeded imports for many years import. In both 2004 and 2005 only in casein and caseinates imports exceeded exports. In case of the other products the situation was the opposite – the exports exceeded, in most cases significantly, the imports. The exports are dominated by ripening cheeses and skim

milk powder, whereas imports are dominated by casein and caseinates as well as ripening cheeses. In 2004, exports of dairy products from Poland exceeded imports by 506 million while in 2005 the surplus in turnovers is to amount *ca.* 650 million (Table 1).

In the situation of increasing international division of work and liberalization of international trade coupled with increasingly fierce international competition the question concerning the position of exports and imports of dairy products in the milk balance seems important. The answer to that question requires expressing the mass of products that are subject of foreign trade in the milk equivalent (Table 2).

The definitely largest quantity of milk is allocated for exported skim milk powder (SMP). In 2004, it represented 43.1% and in 2005 37.8% of the total quantity of milk used for manufacture of export products. The fat remaining from processing of milk purchased to exported SMP during the investigated years allowed manufacturing of 52,000–54,000 tons of butter, which represents *ca.* 30% of butter manufactured in Poland. Manufacturing of all dairy products exported from Poland consumed 2,654 million liters of milk in 2004 and 3,113 million liters of milk in 2005. Those values represent 23.1% and 26.8% of milk production during those years, respectively. In case the volumes used for export production are compared to milk purchased during those years that percentage would reach 34.9% and 37.0%, respectively.

The volume of milk fat left from processing the above

TABLE 1. Structure of dairy products exports and imports in Poland (source: Rynek mleka volumes 28 and 29, 2005; own calculations).

Product	Exports			Imports		
	mass '000 t	million EUR	structure %	mass '000 t	million EUR	structure %
2004						
Milk powder						
– skim	97.2	162.2	26.3	2.5	4.4	3.9
– other	31.8	44.9	7.3	3.4	5.6	5.0
Cheeses and cottage cheeses						
– ripening	66.1	172.3	27.9	6.4	21.6	19.3
– other	15.2	18.8	3.0	2.3	6.1	5.5
Casein and caseinates	12.3	57.0	9.2	17.9	49.6	44.4
Ice creams	8.2	10.7	1.7	2.0	2.8	2.5
Butter and milk fats	27.6	66.2	10.7	4.1	9.1	8.1
Liquid milk and cream	52.9	28.9	4.7	3.7	5.3	4.7
Yogurts and dairy drinks	43.7	35.9	5.8	1.9	1.5	1.3
Whey	47.8	21.0	3.4	8.3	5.7	5.1
TOTAL		617.9	100.0		111.7	100.0
2005						
Milk powder						
– skim	100.0	175.0	20.8	5.0	9.0	4.7
– other	40.0	80.0	9.5	5.0	9.0	4.7
Cheeses and cottage cheeses						
– ripening	75.0	200.0	23.8	12.0	45.0	23.6
– other	20.0	45.0	5.4	3.0	5.0	2.6
Casein and caseinates	15.0	55.0	6.5	20.0	90.0	47.1
Ice creams	15.0	25.0	3.0	3.0	5.0	2.6
Butter and milk fats	30.0	75.0	8.9	4.0	10.0	5.2
Liquid milk and cream	160.0	90.0	10.7	4.0	6.0	3.1
Yogurts and dairy drinks	75.0	70.0	8.3	3.0	3.5	1.8
Whey	60.0	25.0	3.0	10.0	8.5	4.5
TOTAL		840.0	100.0		191.0	100.0

TABLE 2. Determination of milk equivalent based on conversion ratios (Source: Rynek mleka volumes 28 and 29, 2005; own calculations).

Products	Conversion rates		Milk involved in exports		Milk involved in imports	
	L of material kg product	L of material kg butter	milk million L	butter '000 t	milk million L	butter '000 t
2004						
Milk powder						
– skim	11.78	21.90	1145	52.3	30	1.4
– other	8.50	123.52	270	2.0	29	0.2
Cheeses						
– ripening	10.11	89.85	668	7.4	65	0.7
– other	7.49	31.20	114	3.6	17	0.5
Casein and caseinates	28.21	21.90	347	15.8	506	23.1
Other products excluding butter and whey	1.05	42.66	110	2.6	8	0.2
TOTAL			2654	83.7	655	26.1
2005						
Milk powder						
– skim	11.78	21.90	1178	53.8	59	2.7
– other	8.50	123.52	340	2.8	43	0.3
Cheeses						
– ripening	10.11	89.85	758	8.4	121	1.4
– other	7.49	31.20	150	4.8	22	0.7
Casein and caseinates	28.21	21.90	424	19.4	565	25.8
Other products excluding butter and whey	1.05	42.66	263	6.2	11	0.2
TOTAL			3113	95.4	821	31.1

volumes of milk for export products allowed manufacturing 83.7 thousand tons of butter in 2004 and 95.4 thousand tons in 2005. During those years Poland exported 27.6 and 30.0 thousand tons of butter, respectively. As a consequence, from milk allocated for export production during the years 2004 and 2005 56.1 and 65.4 thousand tons of butter, respectively, remained in Poland representing 31.7% and 36.9% of the domestic production of butter.

Imports of all dairy products to Poland expressed by the milk equivalent was 655 million liters in 2004 and 821 million liters of milk in 2005. As a consequence, the positive balance of foreign trade in dairy products, expressed as the milk equivalent, during the two investigated years was 1,999 and 2,292 million liters of milk, respectively. The highest by far part of milk equivalent imported into Poland as dairy product was that used for the processing of milk into imported casein. Its share was 77.3% in 2004 and 68.8% in 2005.

The volume of milk fat left from processing the above volumes of bulk milk into products of Polish imports allowed the production of 26.1 thousand tons of butter in 2004 and 31.1 thousand tons in 2005. The volume of butter imported to Poland during those years was 4.1 thousand tons and 4.0 thousand tons, respectively. As a consequence, 22.0 thousand tons of butter in 2004 and 27.1 thousand tons in 2005 produced from milk used in manufacture of dairy imports to Poland remained abroad. Comparison of the volumes of butter remaining as a consequence of production exported from Poland and imported into Poland shows that the volumes remaining from exports were higher by 34.1 thousand tons of butter in 2004 and 38.3 thousand tons of butter in 2005.

A similar calculation of milk equivalent for exported and imported dairy products was done using the chemical composition of those products and milk purchased (Table 3). That method of calculating the milk equivalent corresponding to products that are subject of international

trade generally confirms the observations made on the basis of calculations done according to the first proposed methodology. To obtain the volume of protein necessary to manufacture all dairy products exported from Poland in 2005, 2,531 million liters of milk were necessary while that quantity for 2005 was 2,965 million liters. During both those years *ca.* 40% of those quantities corresponded to the processing of raw material to the exported skim milk powder. Obtaining the necessary fat mass necessary for manufacturing of exported products required a much lower volume of milk. In 2004 it was 1,366 million liters and in 2005 1,661 million liters of milk. Those quantities represented respectively 54.0% and 56.0% of milk allocated for export production as a consequence of protein content requirements. Ripening cheeses and butter dominated among exported products in use of fat. In 2004 they used in total 74.6% and in 2005 68.2% of that component.

Clearly lower values of milk equivalent corresponded to products imported by Poland. As concerns protein content they represented 594 million liters of milk in 2004 and 748 million of liters in 2005. If those values are deducted from corresponding values of milk equivalent corresponding to our exports then the clearly positive balance of foreign trade amounted 1,937 million liters of milk in 2004 and 2,217 million liters in 2005. In 2004 it represented 16.9% of production and 25.5% of milk purchased in Poland. A year later that values represented 19.1% and 26.4%, respectively.

Similarly to exports, also imports of dairy products to Poland absorbed lower volumes of milk needed for fat. The milk equivalent necessary for the production of imported products calculated for fat content represented only 27.6% of the milk equivalent required to provide the necessary quantity of protein in 2004. In 2005 that proportion amounted 29.8%. In both cases the presented distribution was much higher in case of export production.

TABLE 3. Determination of milk equivalent based on chemical composition of exported and imported dairy products (Source: own calculations).

Products	Components in '000 t				Milk in million liters			
	2004		2005		2004		2005	
	fat	protein	fat	protein	fat	protein	fat	protein
	2004							
Milk powder								
– skim	0.583	35.673	0.600	36.700	15	1071	15	1102
– other	8.554	8.427	10.760	10.600	217	259	272	326
Cheeses								
– ripening	19.83	21.81	22.50	24.75	502	671	570	762
– other	1.22	2.96	1.60	3.90	31	91	41	120
Casein and caseinates	0.16	10.65	0.20	12.99	4	317	5	387
Other products (ice creams, liquid milk and cream, yogurts and dairy drinks)	3.14	3.41	7.75	8.13	80	105	196	250
Butter and milk fats	20.42	0.55	22.20	0.60	517	17	562	18
TOTAL	53.907	83.480	65.61	97.47	1366	2531	1661	2965
	2005							
Milk powder								
– skim	0.02	0.92	0.03	1.84	4	28	8	56
– other	0.92	0.90	1.35	1.33	23	28	34	41
Cheeses								
– ripening	1.92	2.11	3.60	3.96	48	65	91	122
– other								
Casein and caseinates	0.23	15.50	0.26	17.32	6	462	7	516
Other products (ice creams, liquid milk)	0.25	0.26	0.33	0.34	6	8	8	10
Butter and milk fats	3.03	0.08	2.96	0.08	77	3	75	3
TOTAL	6.37	19.77	8.53	24.87	164	594	223	748

The balance of our foreign trade expressed in the milk equivalent calculated using the fat content is clearly positive. In 2004 it represented 10.5% of production and 15.8% of milk purchased in Poland. In 2005 those proportions increased to 12.4% and 17.1%, respectively.

To express the balance of foreign trade by one number representing the corresponding quantity of milk as raw material it was assumed that the fat and protein used should be taken into account to the extent to which they determine the price of full milk. It was assumed that the proportions were: 60% for protein and 40% for fat. The calculation for 2004 was as follows:

$$(2531 - 594) 0.6 + (1366 - 164) 0.4 = 1643 \text{ (million liters)}$$

while for 2005 it was:

$$(2965 - 748) 0.6 + (1661 - 223) 0.4 = 1905 \text{ (million liters)}$$

Those values are lower than those obtained using the first method. Nevertheless, it should be remembered that the values of milk equivalent in that first method also included the raw material from which a part of butter that remained in the country was produced. At the same time the obtained values of foreign trade balances expressed in the milk equivalent were higher than those published in "Rynek mleka" (The Milk Market) [2005]. The difference of results for 2004 was 8.8% while for 2005 – 12.0%.

CONCLUSIONS

1. Since Poland's accession to the European Union the volumes of dairy products exports and imports have been

increasing. The positive balance of trade and its share in milk balance have also increased. That indicates an improvement in competitiveness of Polish dairy sector.

2. According to the first method proposed for calculating the milk equivalent the positive balance of foreign trade for 2004 was 1,999 and for 2005 2,292 million liters of milk. That corresponded to 17.4% and 19.8% of milk production during the respective years. At the same time, that milk was used for the production of 34.1 thousand tons of butter in 2004 and 38.3 thousand tons of butter in 2005 representing around 20% of the domestic butter production.

3. The second method proposed for calculating the milk equivalent allowed determining that the positive balance of international trade in 2004 amounted 1,643 million liters of milk and in 2005 1,905 million liters of milk. That represented 14.3% and 16.4% of milk production during the analysed years, respectively. That means that currently every 6th–7th liter of milk produced in Poland is allocated for manufacture of products for exports.

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PRÓBA WYRAŻENIA OBROTÓW HANDLU ZAGRANICZNEGO PRODUKTAMI MLECZARSKIMI W EKWIWALENCIE MLEKA

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W pracy zaproponowano dwie metody wyrażania obrotów handlu zagranicznego artykułami mleczarskimi za pomocą ekwiwalentu mleka. Pierwsza z nich polega na wykorzystaniu współczynników przeliczeniowych wskazujących ile litrów mleka zbiorowego jest potrzebne do wyprodukowania jednostki danego wyrobu. Przy normalizacji surowca do produkcji poszczególnych wyrobów pozostaje określona ilość tłuszczu mlecznego. Dlatego zastosowano drugi współczynnik pozwalający wyliczyć ilość masła możliwą do otrzymania z tłuszczu pozostającego przy przerobie mleka zbiorowego na poszczególne produkty.

Druga z przedstawionych metod wyliczenia ekwiwalentu mleka wykorzystuje skład chemiczny (zawartość białka i tłuszczu) produktów mleczarskich i mleka zbiorowego.

W obu przypadkach uzyskano zbliżone wyniki. Przy zastosowaniu pierwszej metody dodatnie saldo wymiany z zagranicą w 2004 r. wyniosło 17,4, a w 2005 r. 19,8% produkcji mleka w Polsce. Wielkości te zawierają jednak również surowiec potrzebny do wytworzenia ok. 20% krajowej produkcji masła.

Według drugiej metody dodatnie saldo obrotów międzynarodowych w 2004 r. wyniosło 14,3, a w 2005 r. 16,4% produkowanego w Polsce mleka. Oba uzyskane wyniki wskazują zatem na powiększanie się dodatniego salda handlu zagranicznego artykułami mleczarskimi.