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TRENDS IN PRICE CHANGES OF BASIC AGRICULTURAL PRODUCE AND FOOD IN DOMESTIC MARKETS

TENDENCJE ZMIAN CEN PODSTAWOWYCH SUROWCÓW ROLNYCH I ARTYKUŁÓW ŻYWNOŚCIOWYCH NA RYNKACH KRAJOWYCH

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Streszczenie. Głównym celem pracy była ocena poziomu i tendencji zmian cen wybranych surowców rolnych oraz cen wytwarzanych z nich artykułów żywnościowych na krajowych rynkach rolnych, wpływających na stan rolnictwa i gospodarstw. Oceniono wzajemne relacje pomiędzy cenami detalicznymi żywności a cenami surowców rolnych niezbędnych do jej wytworzenia oraz określono dominujące kierunki ich zmian. Zbadano siłę wpływu cen skupu na kształtowanie się cen detalicznych żywności, wykorzystując wskaźnik nożyc cenowych, określany jako stosunek cen artykułów żywnościowych do cen skupu surowców rolnych uzyskiwanych przez producentów rolnych. W wyniku przeprowadzonych analiz stwierdzono, że zmniejsza się udział wartości produkcji rolnej w cenach detalicznych przeciętnego koszyka spożywczego, zaś związek pomiędzy produkcją rolną i jej podażą a popytem na żywność staje się coraz słabszy. Na podstawie funkcji trendu stwierdzono, iż zmiany cen bieżących w przypadku analizowanych produktów rolnych i żywnościowych charakteryzowały się długookresową tendencją wzrostową, której towarzyszyły wahania sezonowe i koniunkturalne. Wzrosty cen produktu finalnego były jednak w większości przypadków zdecydowanie większe od wzrostów cen surowca niezbędnego do jego wytworzenia. Zauważono także coraz większe rozpiętości pomiędzy cenami skupu surowców rolnych a cenami detalicznymi żywności.

Key words: agricultural prices, price scissors, price relations.
Słowa kluczowe: ceny rolne, nożyce cen, relacje cenowe.

INTRODUCTION

Free market economy, which is influenced by contradictory forces, develops in cycles. Economic processes usually do not advance in a consistent, peaceful or stable manner, economic indicators do not grow evenly, and their changes are periodic (Czech-Rogosz et al. 2009). Globalization and enhanced international trade increase the economy's vulnerability to cyclical market fluctuations that have a significant impact on the economy as a whole, as well as its particular components (Idzik 2007). Moreover, large-scale transformation of the market situation becomes a challenge for businesses such as farms, which are forced to adapt quickly to changes in the market (Płonka and Paluch 2016).

Prices of agricultural production are one of key parameters based on which the condition of agriculture can be evaluated (Klank 2008). It is commonly believed that the prices of

agricultural raw materials and food produce affect, to a significant degree, the level, type and structure of production (Tomek and Robinson 2001). They affect social attitudes and might cause fears concerning food safety, i.e., mostly food availability, especially in underdeveloped countries (Prakash 2011). For that reason regular and long-term monitoring of agricultural raw materials prices is a reasonable and highly recommended action, which as Skowronek and Sarjusz-Wolski (2003) emphasize, apart from obvious benefits, may also help develop the economic theory. The monitoring of price trends and agricultural markets allows to better understand all related phenomena, forecast and respond to changes (Poczta 2008).

Destabilization of global agricultural and food markets, coupled with significant growth in food prices, usually leads to increased interest in the pricing mechanisms. Special attention is paid to retail food price creation processes, particularly the role of given food chain participants in the creation of ultimate retail prices. With the advancement of food management, demand for convenience and ready-made foods which are preprocessed to optimize the ease of consumption, can be stored easily, and are ready to serve definitely increases in relative terms. Thus, before agricultural produce reaches the consumer's table, it will be processed by a marketing chain (Stańko 2006). Value is gradually added to each product that leaves the farm, and its final price is accepted by consumers. The relationship between the end prices of food commodities and the prices of raw materials required for their production plays an important role in the process of taking production-related decisions on farms. The share of prices received by agricultural producers in retail prices of a given product determines, on the one hand, agricultural revenues and, on the other, affects food retail prices (Płonka 2015). Moreover, the prices of raw materials produced by farms determine the commerciality of agricultural production, and indirectly also the demand for food (Płonka and Paluch 2016). Price relationships which are unfavorable to agriculture result in reducing the production to be sold and redirecting it to the so-called own use, that is, self-supply of farms as regards food commodities (Świetlik 2008). The relationship between the food prices and the prices of agricultural raw materials is thus a complex system reflecting the scale of inter--sectoral relations and transfers of funds and incomes (Poczta and Wysocki 2000).

From the farmer's perspective, an important issue in terms of price relations is the share of agricultural raw materials' sale prices in the prices of end food products. Affected by mark-up policies imposed by individual links of a supply chain and food processing market, it determines the amount of the funds received directly by farmers. Increase of the mark-up, despite increased consumer prices, results in decreasing producers' prices, whereas the diminishing difference between the product retail price and the materials price positively affects agricultural income (Świetlik 2008). Hence, to balance the agricultural commodity markets in the long run requires not only efficient price mechanisms, but also a more adequate share of individual market players in retail prices (Seremak-Bulge 2012). Thus, to understand the complex phenomena occurring on agricultural markets, constant monitoring and analysis is required.

METHODOLOGY

The work's main purpose was to assess the changes and trends in domestic farming market in relation to agricultural raw materials and prices of food produce. To analyze the impact of the purchase prices on food retail prices, the so-called margin squeeze was

applied, determined as a margin between food produce price and the purchase price paid to farmers. Price relationships were calculated based on average annual prices of agricultural staples, i.e. wheat, pork livestock, beef livestock and milk, and average annual retail prices of related major food commodities: wheat flour, bread, pork loin, pork ham, milk and butter. To identify main directions of changes and price relationships, special attention was paid to those phenomena during a period of recession that intensified in 2008–2012.

The directions of price changes of agricultural produce and food commodities were determined based on a model of a developmental trend accounting for regular fluctuations. Change trends were identified based on a linear equation (a linear trend function used to calculate a line match using the least squares method (Kukuła 2003). To assess the degree of the model match to real data, R^2 determination coefficient was used. Its value shows the part of variability of an y dependent variable was explained by that model, that is, the degree (expressed as %) to which the estimated model describes reality (Luszniewicz and Słaby 2003). The determination coefficient assumes values in the [0, 1] range that are most frequently expressed as percentage. The better the model match, the closer R^2 is to one. However, it is assumed that the value exceeding 0.6 (that is, 60%) means that the model match is satisfactory[1].

For the sake of greater clarity, to evaluate price relationships, the rates developed by Institute of Agricultural and Food Economics National Research Institute (IERiGŻ-PIB) were applied, i.e. a squared agricultural produce price growth rate and a squared food price growth rate[2]. The purchase price change rate was calculated as an arithmetic weighted average for a basket of products monthly recorded by Polish Central Statistical Office (CSO), i.e. cereals in total, including wheat and rye, potatoes, livestock in total, including beef, pork and poultry as well as milk. The food price growth rate was constructed based on observations of a broad range of food commodities. The work analyses accumulated values of those rates which show an average annual increase over the study period based on the assumption that annual increases are added to the base value for the next period.

RESULTS

An underlying assumption of the analysis was that relative decrease in agriculture produce prices with reference to prices of final food products has been recorded for a long time in highly developed economies. The share of product purchase prices of produce in retail prices is insignificant and decreases with economic growth. The primary component of retail prices is the profit margin of particular marketing chain actors of up to ca. 70–75% of the ultimate price (Urban 2002). With such profit margins, the ratio of agricultural produce sale price to consumer price is continuously decreasing. The share of value of agricultural production in retail prices of an average food basket is decreasing as well, while the relationship of agricultural production and its supply versus demand for food is weakening (Świetlik 2008).

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[1] The value of the determination coefficient ranging from 0.0 to 0.5 means that the match is not satisfactory, 0.5–0.6 – a poor match, 0.6–0.8 – a satisfactory match, 0.8–0.9 – a good match, 0.9–1.0 – a very good match.

[2] Based on GUS statistical data, the price growth rate is calculated with the use of a system of weights developed on the basis of the structure of household expenses versus purchases of commodities.

Higher degree of processing of farm produce, and the resulting increase in the costs of processing services entailed in the food production system, widen the discrepancy between prices received by farmers and prices paid by consumers, and wreck the price relations for the farming industry (Urban 2002).

The introduction of market economy principles in Poland triggered the emergence of the same mechanisms on domestic food market. With liberalization of prices, the high prices of agricultural produce that used to be guaranteed by the State were no more, while cheap food policy was replaced by growing food prices. Despite the increase in agricultural production value, as well as consumer spending on food during that time, the ratio of producer price to consumer price decreased significantly (Fig. 1). On the basis of the trend function, we may claim that expenditures on food grew at a twofold higher rate than the value of agricultural produce. Average annual growths of global production at PLN 3.9 billion were accompanied by increases of consumer spending of PLN 7.4 billion (for comparison, the value of agricultural production increased by PLN 6.8 billion on average and the amount of expenditure grew by PLN 9.3 billion during 1989–1996). In consequence, the share of agricultural production in the total expenditure on food decreased. It was nearly 90% in 1990, ranging around 75% during the following years, to decrease below 60% in 1998 and ranging within 56–48% since 2003.
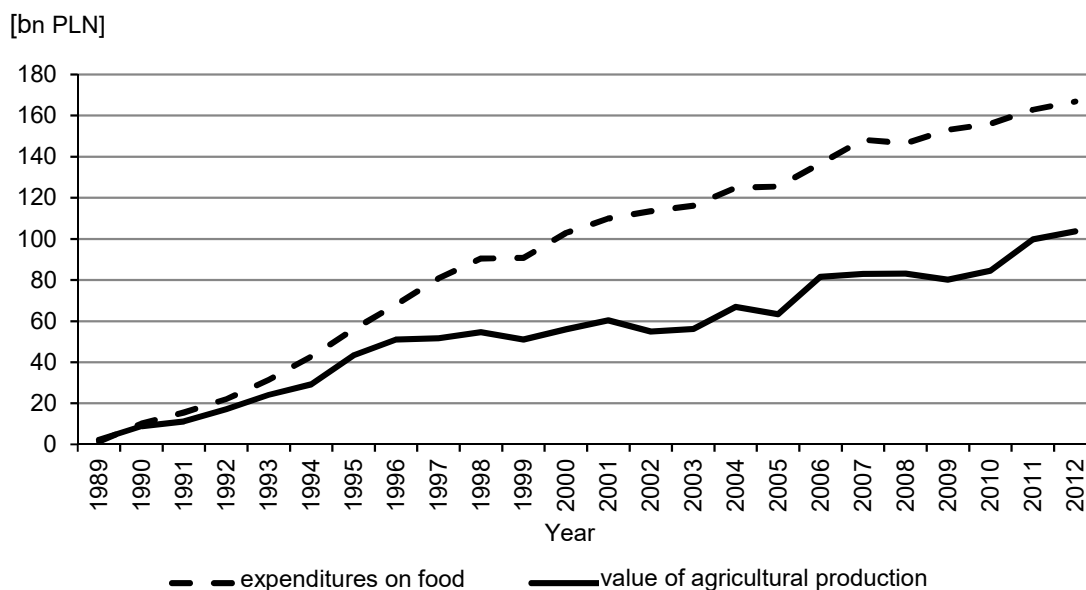

Fig. 1. Consumer expenditures on food and no-alcoholic beverages, and the value of global agricultural production in Poland during 1989–2012 (in billion PLN)
Source: own elaboration based on data retrieved from the Polish Central Statistical Office.

Price relations that were unfavorable for the farming industry are also evident upon analysis of fluctuations of produce procurement prices and final retail prices (Fig. 2). Although the prices of produce and food fluctuated at various rates, their aggregate ratios show that during the studied period, agricultural produce procurement prices determined the direction of changes in food prices and, in general, increased slower than consumer prices. Initially, the price growth rate was almost identical in both cases; however, the distance between the rates was recorded from 1997 to 2010. During that period, prices received by

farm producers were approx. 10% lower on average per annum than the prices of food products. The price relations were the most unfavorable for farmers in 2009, i.e. during the economic downturn, when the accumulated procurement price ratio was 400% compared to 1993, and the food price ratio was at 473%. Thus, the agricultural produce price rate decreased by more than 15% against the food price rate, which resulted in a decreased share of farmers in food product price, and a simultaneous increase in the share of processing and trading agents fees. An exception here was the period from 2011 to 2012 during which the growth rate of agricultural produce exceeded increase in food prices by 4%.
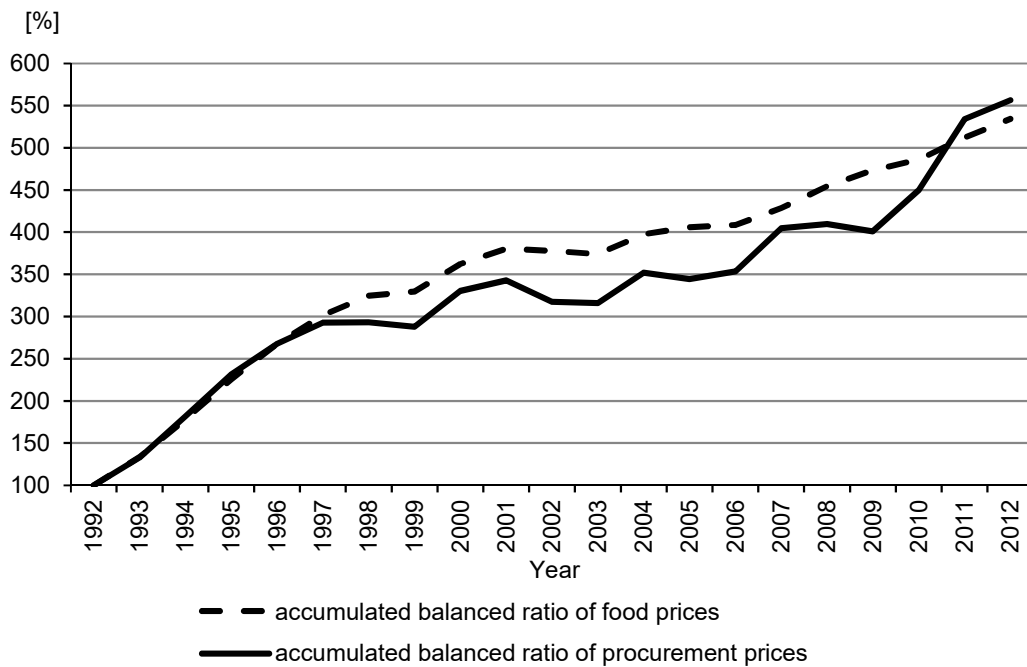

Fig. 2. Accumulated growth ratios for procurement prices of agricultural produce and retail prices of food and non-alcoholic beverages in Poland during 1992–2012 (1992 = 100)
Source: own elaboration based on data retrieved from the Polish Central Statistical Office.

Market price mechanisms predominantly take into account the final stages of food production, thus depreciating the raw materials sector (Zegar 2004). As emphasized by Świetlik (2008), the links of the food production chain which are the closest to the end buyer are more likely to benefit from pricing advantages than the more distant links which have little to say about the prices of their products. The food industry takes over the added value created in the agricultural sector, thus decreasing the share of the farming industry in food retail prices , and the relations between retail food prices and farm produce prices vary to the disadvantage of farm producers (Kułyk and Czyżewski 2012).

Comparison of wheat purchasing prices against wheat flour and bread retail prices attested to the growing price range in both price systems throughout the entire study period (Fig. 3). The growing purchasing prices of wheat influenced the upward trend of bread retail prices which was determined based on the trend function. Such increases were, however, definitely lower than those recorded with regard to end product prices. In the study period, the nominal prices of wheat rose from 0/03 PLN/kg in 1989 to 0.89 PLN/kg in 2012, that is,

approx. 30 times, whereas the bread prices grew from 0.11 PLN/kg to 4.50 PLN/kg, i.e. over 40 times (Płonka and Paluch 2016). Hence, it could be concluded that the reason for such a huge discrepancy between the prices of raw materials and the retail prices of related food commodities is the growth of mark-up which, in turn, led to the reduction of the farmer's share in the final sale price from the lowest level at 31% in 1996 to an average level at 16% recorded in 2008–2012. Moreover, this situation, unfavorable for agricultural producers, was worsened by price relations recorded in 2009 when the share of the price of wheat in bread retail price was just 13% ,i.e. the lowest in the entire period under analysis.
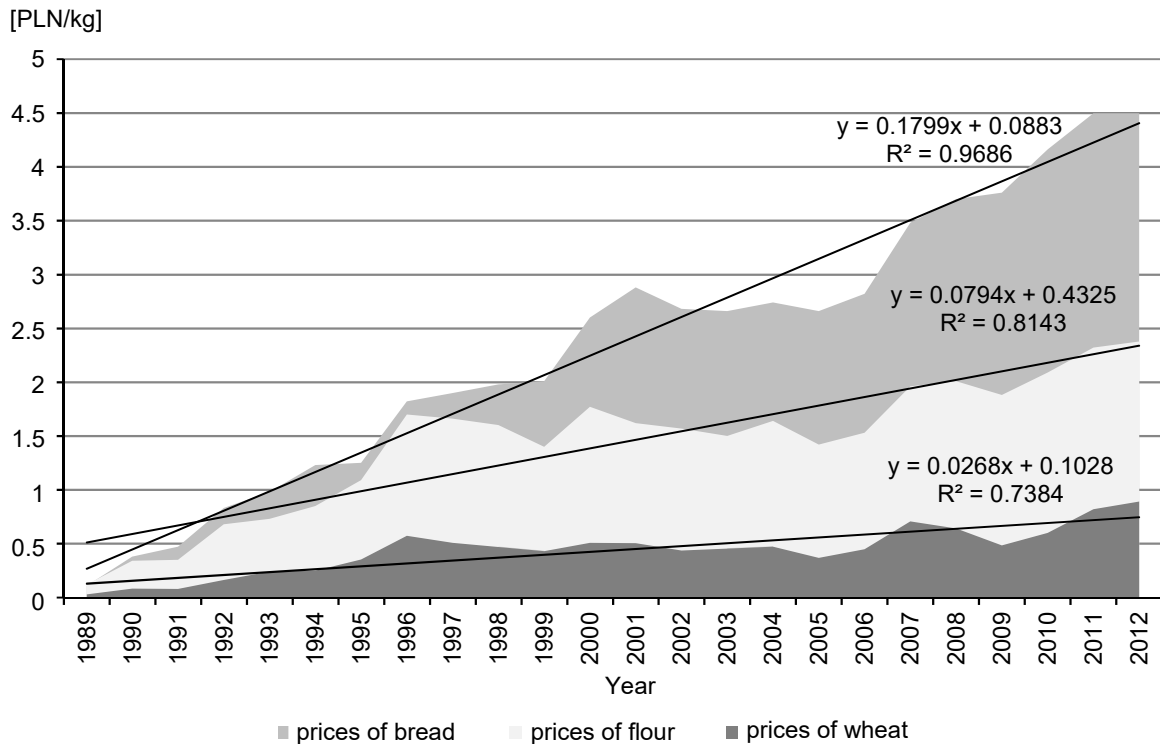

Fig. 3. Wheat procurement prices, "Poznańska" wheat flour and mixed wheat and rye bread retail prices, and trends during 1989–2012 [PLN/kg]
Source: Płonka and Paluch (2016).

The relationships between the prices of wheat and the prices of wheat flour were slightly more favorable. The share of the prices of wheat in that commodity's retail price was quite stable and rose from 23% in the first years of the study period to approx. 30% in subsequent years, reaching its maximal level at 38% in 2012. Hence, one may presume that favorable price relationships – from the perspective of agricultural producers – were caused by a small number of agents vis-a-vis bread production, and so the agents took over a smaller portion of value added developed at the initial stages of production (Płonka and Paluch 2012).

The price relations were favorable for the farming industry also in the dairy market. Based on the trending functions, we may conclude that both the procurement prices of milk and the dairy prices showed a growing trend during the 1989–2012 period, accompanied by certain seasonal and economic fluctuations, particularly with regard to prices of butter (Fig. 4). The widening gap between procurement prices and retail prices of milk and butter did not affect

adversely the price relationships, and therefore did not translate into lower farmer's share in the consumer price. Throughout the study period, the share of milk producers in the prices of selected dairy products was increasing systematically. The changes that were beneficial for farmers primarily consisted in increasing their share in milk retail prices by almost 55%, from 20% during the initial years of the free market economy to 44% in 2011 and 2012. This is a proof of the existence of strong competition among dairy processing plants which tended to minimize their production costs, but also of the competition on the consumer market, particularly in the form of supermarkets offering a smaller range of products at lower prices.
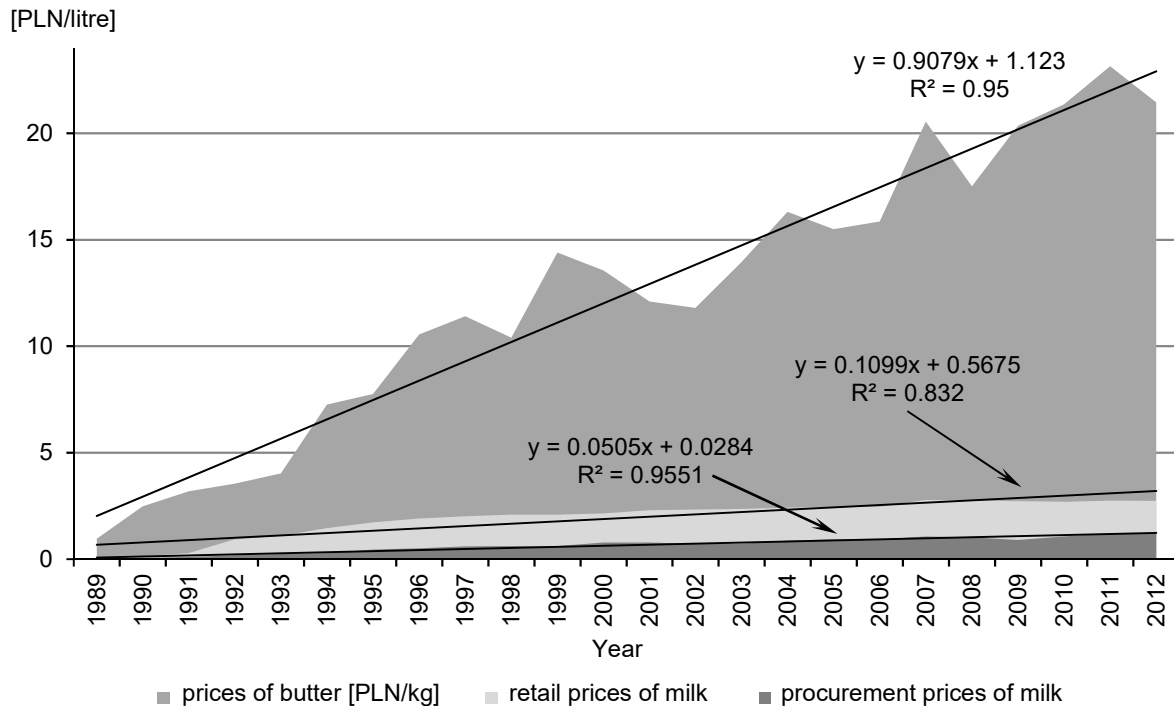

Fig. 4. Cow milk procurement prices, drinking milk and fresh butter retail prices, and trends during 1989–2012 [PLN/kg]
Source: own elaboration based on data retrieved from the Polish Central Statistical Office.

In comparison to the above examples, the share of milk procurement prices in retail prices of butter was the lowest, at a few percent only. Still, it exhibited a growing trend, rising from 2% in 1989 to 6% in 2012. The above indicates that the added value created in the farming industry was less consumed by specific links of the processing and distribution chain. In both cases, positive trends were accompanied by certain slumps in prices. Those were the worst in 2009 when agriculture hit an all-time low. At that time, the share of milk procurement prices in retail prices decreased by over 30% (procurement price of milk was at 0.9 PLN/liter and retail price was at 2.72 PLN/liter), as compared to the preceding year, while the share of milk procurement prices in retail prices of butter decreased by almost 15% (from 37% to 32%). It was also noted that, like in the other agricultural and food markets under consideration, the share of milk producers in the final consumer prices declined, along with decreasing procurement prices of farm produce.

Based on the analysis of statistical variability measures it was noted that the shares of agricultural producers in retail prices of processed foods were subject to relatively significant fluctuations during the study period. Coefficients of variation show a 13–23% variation in the relations of farm produce procurement prices and final prices in given agricultural and food markets (Table 1).

Table 1. Coefficient of variation of the farmers' shares in final prices of selected food products during 1989–2012

Relations of farm produce procurement prices to retail prices of food	Years					
	1989–1993	1994–1999	2000–2004	2004–2008	2008–2012	1989–2012
Wheat: flour[a]	0.1701	0.0570	0.0463	0.1266	0.1515	0.1370
Wheat: bread[b]	0.1632	0.1706	0.0693	0.1407	0.1733	0.2346
Swine livestock: pork loin[c]	0.2792	0.0756	0.0691	0.0567	0.0872	0.1626
Swine livestock: ham[d]	0.2573	0.0869	0.0847	0.0686	0.0881	0.1891
Cattle livestock: chuck and blade	0.1588	0.0434	0.1020	0.0589	0.1054	0.1341
Milk: drinking milk[e]	0.3554	0.1475	0.0825	0.0258	0.1173	0.2220
Milk: butter[f]	0.4371	0.1599	0.0901	0.0623	0.1045	0.2251

Explanations to the Table: [a]"Poznańska wheat flour", [b]mixed wheat and rye bread, [c]pork with a bone – middle pork loin, [d]boiled ham, [e]drinkable cow milk with fat content at 3–3.5%, [f]fresh butter with fat content at 82.5%.
Source: own elaboration based on data retrieved from the Polish Central Statistical Office.

Research shows that these fluctuations were significantly stronger during the initial years of economic transformation, which was most certainly determined by overall destabilization of prices and adaptation to the new market conditions. At that time, average variability of the share of farm producers in prices of food products ranged from 17% in case of cereal products to approx. 40% for milk and dairy products. Over time, the range of these fluctuations gradually decreased, and the relationship of procurement prices to food retail prices were most stable during 2000–2004 for wheat producers and 2004–2008 for animal-derived products. Coefficient of variation during that period ranged within 4–6% for cereal products, 5–6% for meat, and 2–6% for dairy products. During subsequent years, the variability of the share increased to reach an average within the range from 9 to 15%.

CONCLUSIONS

Based on the research conducted, we may conclude that the share of the value of agricultural produce in retail prices of an average food basket is decreasing, and increased food processing deepens the gap between producer and consumer prices. Despite evident growth in agricultural production, its share in consumer spending on food decreased significantly. Throughout the study period, consumer expenditure on food grew at twice the rate than the value of farm production, and the share of the latter decreased from 90% in

1990 to 56–48% during 2003–2012, which is a sign of deteriorating price relations between farm producers and food consumers. These trends, unfavorable for agricultural producers, were furthermore confirmed by an analysis of changes of farm produce and retail food prices. The aggregated ratios have shown that produce purchase prices grew at a lower rate than the prices of processed products. 2009 was particularly bad for the farming industry, since in that year the ratios of agricultural produce price against food price decreased by more than 15%, causing further shrinkage of the agricultural producer share in food prices, and simultaneous increase of processing and trading agents fees.

Yet, the analysis of price scissors ratios did not definitively confirm the trends indicated above. This is because the variance of share of procurement prices in food retail prices was slightly different, both on given food product markets and with respect to specific price relations. On the basis of the trend line it was established that current prices of all analyzed types of farm produce and food products exhibited a long-term increasing tendency, accompanied by seasonal and economic fluctuations. However, final product price increases were in most cases substantially higher than the increases of raw materials prices. Another observation was that the gap between the procurement prices of agricultural produce and food retail prices continues to broaden.

It was also noted that the producer share in retail prices of processed foods was subject to relatively significant fluctuations during the study period. However, these fluctuations were much stronger during the first years of economic transformation, and gradually decreased overtime. In addition, throughout the period of analysis, the procurement prices of agricultural produce and food retail prices were found to be strongly positively correlated, with 95% confidence interval for the correlation coefficients, which is statistically significant. The above implies that with the increase of procurement prices of agricultural produce, prices of final processed products would increase as well. Price signals were most strongly conveyed from producers to consumers during the period from 1989 to 1993, and weakened significantly in subsequent years.

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Summary. The paper's main purpose was to assess the level and trends in price changes of selected agricultural raw materials and related food products occurring in domestic market that affect farming and agriculture. Relationships between food retail prices and the prices of agricultural raw materials, as well as directions in which these changes are heading were evaluated in the paper. The impact of purchase prices on food retail prices was analyzed based on margin squeeze defined as a margin between the consumer price and the sale price received by farmers. The analysis led to the conclusion that the share of the value of agricultural production of an average retail food basket has decreased, and the relation between agricultural production and its supply versus demand for food has attenuated over time. The function of the trend line showed that current price changes of agricultural produce follow a long-term upward trend accompanied by seasonal and economic fluctuations. However, increases in end produce prices were in most cases much higher than increases in raw materials prices. It was also observed that the differential between the purchase prices of raw materials and retail prices of food produce is steadily growing.