DOI:10.17951/h.2023.57.3.139-156

ANNALES
UNIVERSITATIS MARIAE CURIE-SKŁODOWSKA
LUBLIN – POLONIA

VOL. LVII, 3 SECTIO H 2023

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Prices of Means of Production in Agriculture and Agricultural Prices and Income in Poland During the COVID-19 Pandemic[*]

Keywords: agricultural input; mean of production in agriculture; price gap; agricultural income; COVID-19 pandemic

JEL: E30; Q11; Q13; Q14; H12

How to quote this paper: Jędruchniewicz, A., & Wielechowski, M. (2023). Prices of Means of Production in Agriculture and Agricultural Prices and Income in Poland During the COVID-19 Pandemic. *Annales Universitatis Mariae Curie-Skłodowska, sectio H – Oeconomia*, *57*(3), 139–156.

Abstract

Theoretical background: Agriculture is an input-intensive sector of the economy. The sector of means of production in agriculture is one of the three basic components of the food economy. The prices of agricultural inputs shape the operational costs of farms and significantly affect their income situation.

[*] The publication is financed from the state budget under the project of the Ministry of Education and Science "Science for Society" No. NdS/532598/2021/2022. The total value of the project is PLN 290,950.00.

Key agricultural inputs represent fertilizers, plant protection products, seeds, energy and labour force. The COVID-19 pandemic has affected the functioning of food systems all over the world, including in Poland. The agricultural sector in Poland faced several challenges, including the surge in prices of means of production in agriculture.

Purpose of the article: The study aims to identify and assess changes in the prices of means of production in agriculture and the impact of changes in these prices on the dynamics of selling prices of agricultural products and the income situation of farms in Poland during the COVID-19 pandemic.

Research methods: The study employs various research methods, including critical literature analysis, the descriptive approach, the comparative method, verbal logic, and descriptive statistical methods. Moreover, we utilize a standardised questionnaire method utilising the CATI (computer-assisted telephone interviewing) technique, targeting 50 experts in the field of agricultural economics, to gather their perspectives on the possibility of transferring the rise in agricultural production costs to the pricing of products sold during the COVID-19 pandemic. The secondary data come from the Statistics Poland, the Agency for Restructuring and Modernization of Agriculture (ARMA), and the National Bank of Poland (NBP). The research period covers the years 2017–2021, with particular emphasis on the years 2020–2021, i.e. the period of the COVID-19 pandemic.

Main findings: Research results show that only in 2020, the prices of goods purchased for current agricultural production decreased. However, in 2021, the costs of materials and services and other costs in agriculture, including wages, increased at a record pace. The demand-side causes of such cost increases were increases in money supply and agricultural income. Supply-side causes were shaped by commodity prices and wages. In Poland, the prices of goods and services purchased by farms were less variable than the prices of goods sold. The data analysis did not reveal significant relationships regarding the dynamics of the prices discussed. Such a conclusion is also confirmed by the results of a questionnaire survey directed to experts in agricultural economics. The responses concerning the possibility of transferring the increase in production costs to the prices of sold products during the pandemic years varied. In the years 2017–2021, the income situation of Polish farms was variable. In 2020, increases in income from production factors, operating surplus, and farmer's income, and their decreases in 2021, were inversely correlated with changes in production costs in agriculture.

Introduction

The COVID-19 pandemic has been a global challenge that demanded researchers, policy makers, and governments address multiple dimensions which went far beyond the implications of this pandemic for health and wellbeing (Lambert et al., 2020). The outbreak of coronavirus disease 2019 (COVID-19) as of early 2020 has had a massive impact on the economy worldwide (Baldwin & Tomiura, 2020; Czech et al., 2021), and its consequences have been subject to continuing uncertainty (Baker et al., 2020). The onset of the COVID-19 pandemic profoundly impacted worldwide food security (Torero, 2020; Montanari et al., 2021). Hobbs (2020) notes that the initial stage of the worldwide pandemic necessitated prompt adaptation within food supply chains to cope with shocks on the demand side, such as impulsive purchasing and alterations in food buying habits. Additionally, provisions were made to mitigate potential shocks on the supply side, which could be triggered by possible workforce scarcities and disruption in transportation and supply networks. The novel coronavirus pandemic has substantially tested the resilience of food supply chains (Bochtis et al., 2020). The supply chain disruptions affected food prices globally (Bairagi et

al., 2022). Imposed lockdowns and restrictions on movement during the early stages of the pandemic incited consumers into a frenzy of panic purchases and stockpiling, which consequently resulted in a surge in demand for fundamental food and agricultural commodities (Prentice et al., 2020). Sudden COVID-19 restrictions were also a challenge for businesses, particularly family ones (Zajkowski & Żukowska, 2020). The novel coronavirus pandemic has adversely affected the value chain from farm to for, i.e. from farmers to retailers (Sharma et al., 2020).

The study aims to identify and assess changes in the prices of means of production in agriculture and the impact of changes in these prices on the dynamics of selling prices of agricultural products and the income situation of farms in Poland during the COVID-19 pandemic. The research period covers the years 2017–2021, with particular emphasis on the years 2020–2021, i.e. the period of the COVID-19 pandemic.

Our contribution is that, to the best of our knowledge, we are among the first in Poland to scrutinize this topic, thus, laying a groundwork for further research in this field. We initiated our exploration of this previously understudied issue in Poland using a structured questionnaire method to gather insights from experts in agricultural economics. Our study has the potential to inspire others to delve deeper into this vital subject, building upon the preliminary insights we have provided.

The outline of our paper proceeds as follows. The next section presents literature review. The posterior section shows the study's aim, material description, and research methods used. Then, we report the empirical findings and provide discussion. The final section offers our conclusions.

Literature review

In general, agriculture is an input-intensive sector of the economy. Key means of production in agriculture represent fertilizers, plant protection products, seeds, fuel and labour force (Lamichhane & Reay-Jones, 2021; Bański & Mazur, 2021). COVID-19-driven disruptions in the supply and availability of these inputs are likely to result in reductions in agricultural production (Aromolaran & Muyanga, 2020). Agricultural commodities' prices exhibited resilience during the early stage of the COVID-19 pandemic (Rubbaniy et al., 2022; Benton, 2020).

Fertilizers are critical for all agricultural practices. The fertilizer industry has shown some resilience in the supply chain during the COVID-19 pandemic (Ilinova et al., 2021). In fact, global fertilizer consumption has remained strong throughout the pandemic (Baffes & Koh, 2022). However, since the COVID-19 outbreak, the fertilizer industry has been significantly affected in many parts of the world by the outset of the pandemic (Globe Newswire, 2022). Höhler and Lansink (2021), measuring the impact of COVID-19 on stock prices and profits in the food supply chain in first phase of the pandemic, find that manufacturers of fertilizers and agrochemicals show particularly high volatilities in their stock prices. From the global perspective,

at the early stage of the pandemic, prices of fertilizers were relatively resilient, then in May 2020, declined by 8.5% in the consequence of production curtailments and supply chain disruptions (World Bank, 2020). However, later global fertilizer prices started increasing, and were at record levels in 2022 (USDA, 2022).

The use of high-quality seeds belongs to the most important elements in increasing agricultural production in any farming system (Elias, 2018). The OECD (2020) claimed that the novel coronavirus pandemic and the restrictions implemented by governments to protect their societies might have the potential to restrict the production, certification and international trade of seed with serious consequences for farmers and the global food chain. Overall, the impact of COVID-19 on the prices of seeds seems to be mixed. While there have been some challenges in producing and importing seeds, disruptions to food supply have been minimal. However, the countries most exposed to short-term food price inflation include those with elevated imports as a share of domestic food supply and developing countries already disproportionately at risk of food insecurity (Alliance for Science, 2020).

Energy security holds a pivotal role in safeguarding economic stability (Gomółka & Kasprzak, 2022). Energy is a crucial component of agriculture, as it is required for many activities such as land preparation, cultivation, irrigation, harvesting, post-harvest processing, food production, storage, and transportation (Kaygusuz, 2011). The energy market is extremely vulnerable to the uncertainty caused by the pandemic (Khan et al., 2022a). Khan et al. (2022b) observe that the outbreak of the COVID-19 pandemic has resulted in a decrease in energy demand, leading to a decline in energy prices. However, recovering demand in 2021 and 2022 has strained fossil fuel markets for oil, gas, and coal, leading to skyrocketing prices (Gilbert et al., 2021). The subsequent rise in global energy commodity prices was partly a reflection of a rebound in demand following the easing of lockdown measures after the first wave of the pandemic (Kuik et al., 2022).

In response to the agricultural epidemic crisis, governments have implemented a number of strategies to improve the prices of means of production in agriculture. These include increasing subsidies to purchase unsold agricultural products at a higher price than the market rate (Zhan & Chen, 2021). This strategy is intended to enhance the resilience of the agricultural supply chain to the pandemic and the resulting global market volatility (Mann, 2022). Governments prioritized the functioning of essential sectors, including food production and distribution, to ensure a stable supply of goods (Dell'Ariccia et al., 2020). Other strategies include providing incentives to farmers to adopt better production practices, and improving agricultural supply chain management (Mao et al., 2023). Additionally, governments have increased support to its citizens, which indirectly affects the agricultural sector (Shadmi et al., 2020). This strategy is also intended to address the issue of rising prices of oil-based inputs and other means of production in agriculture.

The COVID-19 pandemic has affected the functioning of food systems all over the world, including in Poland (Dudek & Śpiewak, 2022). The agricultural sector

in Poland faced several challenges, including the surge in prices of energy and agricultural inputs (European Commission, 2023). This has caused difficulties in market access, delays in logistics and distribution, and subsequently, an increase in food prices. Additionally, the pandemic has brought about both quantitative and structural changes in the demand and supply of individual food industries in Poland. For instance, there has been a decrease in demand for the baking industry, whereas the fruit and vegetable and milling industries have witnessed an increase in demand (Skawińska et al., 2021). The outbreak of the pandemic and its existence has had a clear impact on Polish poultry market (Maples et al., 2020; Pawłowska et al., 2022). However, Szajner (2020) claims that COVID-19 has had a relatively small impact on the functioning of the primary agricultural product market in Poland.

There is no specific information provided about the impact of the pandemic on the prices of means of production in agriculture from a Polish perspective. This is a gap in the literature and one that should be addressed. It is important to understand these changes and the underlying impacts of the pandemic on the prices of agricultural inputs in order to develop effective strategies for responding to future crises.

The income situation of agricultural households in Poland has been the subject of numerous studies. Mikuła et al. (2022) indicate a substantial decline in agricultural incomes in 2021. This was a consequence of the rapid increase in intermediate consumption costs. Conversely, in the first year of the pandemic, both the incomes from production factors and the earnings of agricultural service providers increased. This was reflected in the agricultural added value, which, after a significant rise in 2020, fell in the second year of the pandemic. Similarly, Kata and Leszczyńska (2021) observe that in 2020, despite the COVID-19 pandemic and its negative economic impact, farmers' incomes increased quite dynamically, rising by over 8% compared to 2019 when adjusted for inflation. Meanwhile, Zegar (2022) analyses the change in agricultural incomes over a longer period, namely in 2020 compared to 2010. He points out that the income growth during this period favoured the sustainable development of agricultural households in Poland. According to Mikuła et al. (2022), the income situation in agriculture during the COVID-19 pandemic varied depending on the type of production. Helfenstein et al. (2022), based on farmer surveys in Europe, find that specialized, intensive farms were more likely to perceive negative impacts from COVID-19.

Research methods

The conducted study attempts to answer the research question of how the COVID-19 pandemic influenced the changes in the prices of production means in agriculture. Another crucial research question pertains to the impact of these price alterations on the dynamics of agricultural product sales prices and the income

situation of agricultural households in Poland. The study employs various research methods, including critical literature analysis, the descriptive approach, the comparative method, verbal logic, and descriptive statistical methods.

Moreover, we employ a standardised questionnaire method utilising the CATI (computer-assisted telephone interviewing) technique, directed at 50 experts in the field of agricultural economics. The interviews were conducted with the management of 15 agricultural unions and organisations and 35 economic advisors from District Agricultural Advisory Teams from all provinces in Poland. The questionnaire used in the interviews addressed a range of issues related to agriculture in Poland during the COVID-19 pandemic. One of the questions explored the possibility of transferring the increase in agricultural production costs to the prices of products sold at that time. The interviews were conducted in March 2023.

The secondary data used in the article mainly come from the Statistics Poland (Central Statistical Office – GUS), the Agency for Restructuring and Modernization of Agriculture – ARMA, and the National Bank of Poland – NBP.

The research period covers the years 2017–2021, with particular emphasis on the years 2020–2021, i.e. the period of the COVID-19 pandemic.

Results

Prices of means of production in agriculture in Poland

The study of price changes in goods and services purchased by Polish farms for 2017–2021 indicates that 2021, the second year of the COVID-19 pandemic's existence, was exceptional. The annual dynamics of the prices of goods purchased for current agricultural production and for investment purposes were significantly higher than in other years (Figure 1). Then, the prices of goods purchased for current production increased by 11% and for investment purposes by 10.5%. This increase was higher than the increase in prices of sold production of industry (7.9%). On the other hand, in 2020, the prices of agricultural production means changed at a slower pace than in previous years. This was caused by increased uncertainty due to the onset of the pandemic.

The small scale of price changes in 2020 and their significant increase in 2021 are also evidenced by the annual dynamics of individual groups of means of production in agriculture (Table 1). In 2021, the prices of all analysed groups increased. The most considerable dynamics concerned fertilizer prices (21.5%). For example, the price of ammonium nitrate increased by as much as 103.5% and amounted to PLN 2,257.6 per ton. During this year, electricity, fuel, and lubricant prices also increased significantly (17.2%). The price of diesel fuel increased by almost 20%. On the other hand, the prices of plant protection products increased to the most minor extent (2.8%).

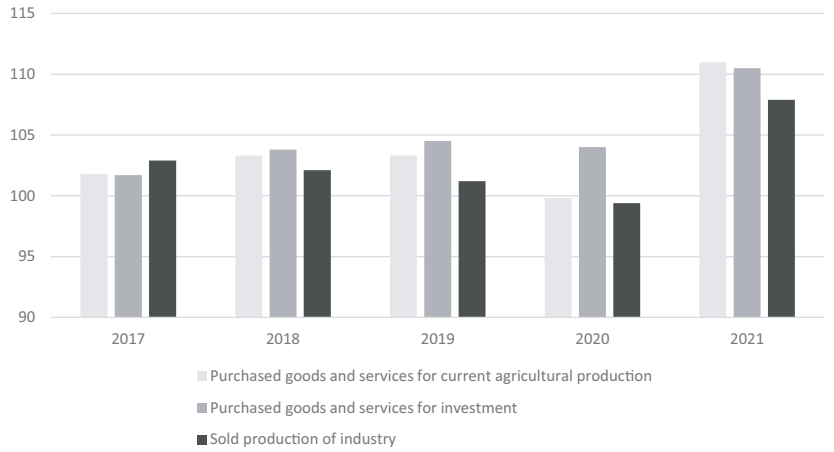

Figure 1. Price indices of goods and services purchased by farms and sold production of industry in 2017–2021

Source: Authors' own study based on (Statistics Poland, 2020b, 2020c, 2023b, 2023c) and unpublished data of Statistics Poland.

Table 1. Dynamics and level of prices of selected means of production in agriculture in 2017–2021

Specification	2017	2018	2019	2020	2021
Price dynamics (%)					
Fertilisers	98.2	100.5	106.8	97.5	121.5
Plant protection products	101.9	101.4	101.9	102.0	102.8
Animal feeding stuffs	100.7	102.5	103.8	101.4	110.1
Energy, fuel and lubricants	105.5	107.1	101.1	93.5	117.2
Agricultural machinery and tools	101.7	103.3	103.8	103.6	108.6
Price level (PLN)					
Saletrzak (28%) (ton)	1,071.6	1,124.4	1,184.0	1,109.2	2,257.6
Roundup (litre)	37.5	38.4	38.9	37.9	42.1
Hard coal (ton)	842.4	906.9	921.3	912.5	1020.6
Diesel (litre)	4.49	4.95	5.08	4.52	5.42
90kW tractor (4WD)	225,342	227,321	238,837	249,663	269,166

Source: Authors' own study based on (Statistics Poland, 2020a, 2022, 2023a; Zalewski, 2019, 2022).

The monetary policy of the National Bank of Poland from 2017 to 2019 was conducted in favourable economic and social conditions. However, during the COVID-19 pandemic, the NBP's policy aligned with the general economic policy of the Polish state. It aimed to mitigate the economic and social consequences of the restrictions introduced due to the pandemic. The very lenient policy of the NBP for most of the period 2020–2021 was characterised by a reduction of the reference rate to 0.1%, a decrease of the reserve requirement rate to 0.5%, and large-scale securities purchases.

According to the theory of many schools of economic thought, an expansive policy of the central bank results in rising prices, primarily of production goods (Garrison, 2001). Monetary policy also impacts the market for means of production in agriculture (Jędruchniewicz, 2013). The analysis of data from Figure 2 indicates that the increase in the money supply in Poland during the pandemic indirectly contributed to the increase in prices of agricultural production means. The dynamic growth of the monetary aggregates M1 and M3 in 2020 was an important reason for the significant increase in prices of purchased goods and services for current agricultural production (11%).

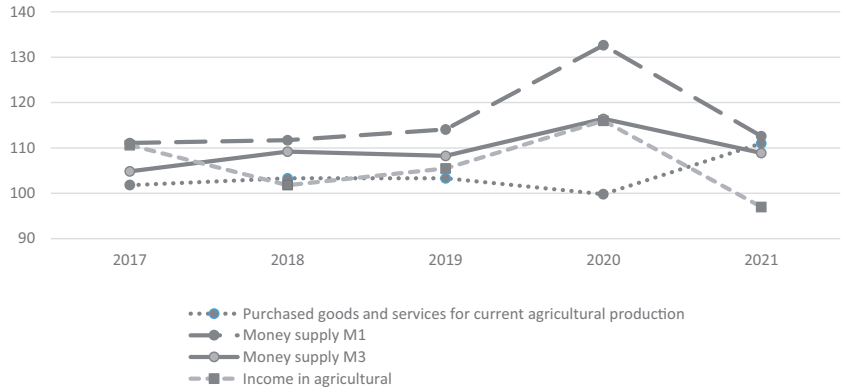

Figure 2. Prices indices of: goods and services purchased by farms, money supply and farm income

Source: Authors' own study based on (Statistics Poland, 2020b, 2023b; NBP, 2023) and unpublished data of Statistics Poland.

Income in agriculture significantly influences the level of purchases and prices of production inputs. In 2017–2019, the analysed income and prices fluctuated moderately (Figure 2). The dynamics of nominal gross disposable income in individual farms averaged 6.0% per annum, while the prices of goods purchased for ongoing agricultural production were 2.8% per annum. The income situation in agriculture significantly changed in 2020. Then, incomes increased by 16.0%, and the prices of production inputs fell by 0.2%. However, these prices dynamically increased a year later. It indicates that income growth, like the supply of money, indirectly influenced the rise in prices of goods and services purchased by farmers for ongoing production.

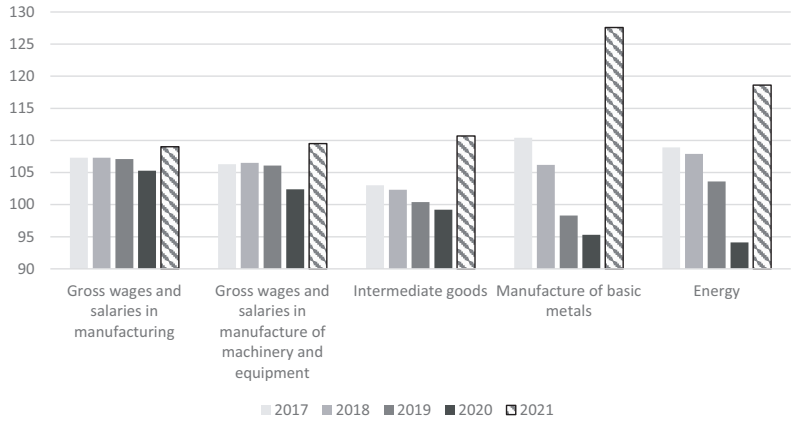

Figure 3. Prices indices of: goods and services purchased by farms, money supply and farm income

Source: Authors' own study based on (Statistics Poland, 2020b, 2023b; NBP, 2023) and unpublished data of Statistics Poland.

Changes in the prices of production inputs in agriculture are also influenced by changes in their production costs. The main costs include wages and prices of raw materials and energy. In 2017–2019, the dynamics of wages in industrial processing and the "Manufacture of machinery and equipment" sector were moderate and stable. The prices of metals and supply and energy-related goods were considerably more variable. In the first year of the COVID-19 pandemic, wage growth slowed.

Meanwhile, the prices of metals, supply goods, and energy-related goods fell. However, in the second year of the pandemic, all costs increased. Notably, the prices of metals (27.6%) and energy-related goods (18.6%) rose significantly. Unlike the demand causes, the impact of production cost changes did not show significant delays compared to changes in the prices of goods and services purchased for agricultural production. The situation in the years 2020–2021 illustrates this exceptionally well. In 2020, a significant part of the costs fell, which affected the decrease in prices of agricultural production inputs in that year. However, in 2021, the dynamic increase in all costs resulted in a significant increase in the prices of production inputs.

Prices of means of production in agriculture and sale prices of agricultural products

Between 2017 and 2021, the annual dynamics of prices for goods and services purchased for the current agricultural production and for investment purposes in farms generally showed an upward trend. The rise in these prices accelerated in 2021. On the other hand, the annual dynamics of prices of products sold by farms were characterized by high variability (Figure 4). Years of strong growth (2017, 2019, 2021) were interspersed with years of declining prices (2018, 2020). The reasons for such price behaviour of goods sold by farmers were cyclical fluctuations in agriculture and the COVID-19 pandemic (Jędruchniewicz, 2020; Hamulczuk & Skrzypczyk, 2022).

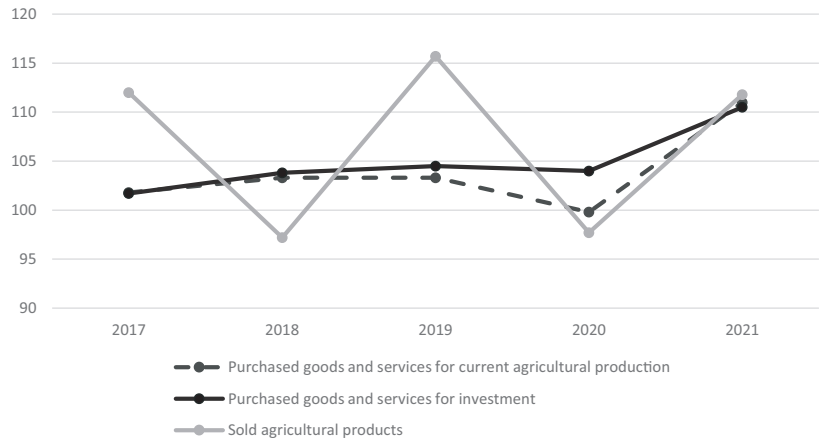

Figure 4. Price indices of goods bought and sold by farms

Source: Authors' own study based on (Statistics Poland, 2020b, 2023b) and unpublished data of Statistics Poland.

In Poland, the prices of goods and services purchased by farms were significantly less volatile than the prices of goods sold. Analysing the data from Figure 4, it is difficult to see a relationship regarding the dynamics of the discussed prices. It seems that the prices of products sold by farmers depend more on macroeconomic factors, including the economic situation, than the prices of goods purchased. One should also always remember about the weather conditions, which agriculture is strictly subject to, as a significant factor differentiating the dynamics of these prices.

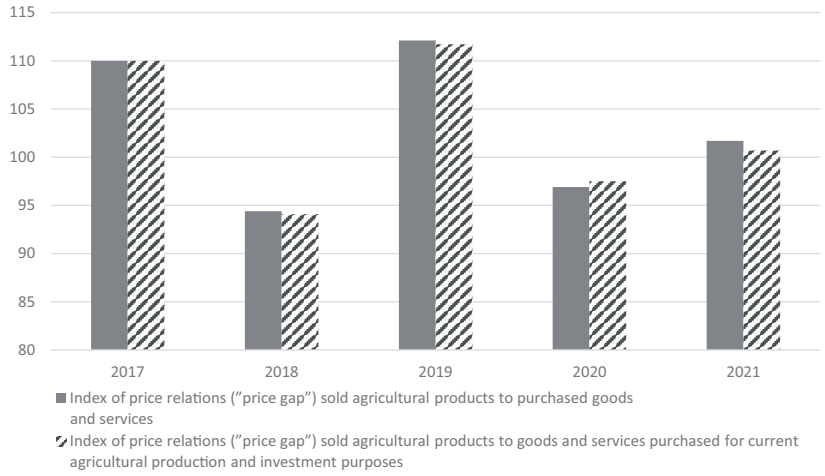

Figure 5. Price gap in Polish agriculture in 2017–2021

Source: Authors' own study based on data of Statistics Poland.

Changes in the prices of sold agricultural products and the prices of goods and services purchased by farmers are represented by the price gap. In Polish agriculture, favourable relations of the dynamics of prices of sold agricultural products and the dynamics of prices of goods and services purchased by farmers, as well as the dynamics of prices of goods and services purchased for current agricultural production and investment purposes, occurred in 2017, 2019, and 2021. The improvement in the price situation in the last year is particularly interesting, despite the high increase in the prices of purchased means of production in agriculture. In 2018 and the first year of the COVID-19 pandemic, the price relations were unfavourable (Figure 5). Then, the price gap was shaped below 100. Such price gap values worsened the economic situation of Polish farms.

The state, striving to improve the economic situation of agriculture, has taken a number of actions to limit the increase in agricultural production costs or the effects of this increase. In Poland, the main actions include: financial support for the purchase of agricultural machinery and equipment, refund of excise duty for fuel for agricultural production, subsidies for mineral fertilizers, subsidies for seed material, and limiting the increase in electricity prices. For example, in 2021, the excise tax refund limits were PLN 100 per 1 ha of agricultural land and PLN 30 for each large conversion unit (DJP) of cattle. On the other hand, subsidies for fertilizers purchased by farmers from September 1, 2021 to May 15, 2022, could not exceed PLN 500 per 1 ha of agricultural crops and PLN 250 per 1 ha of meadows and pastures and grasses on arable land (ARMA, 2023).

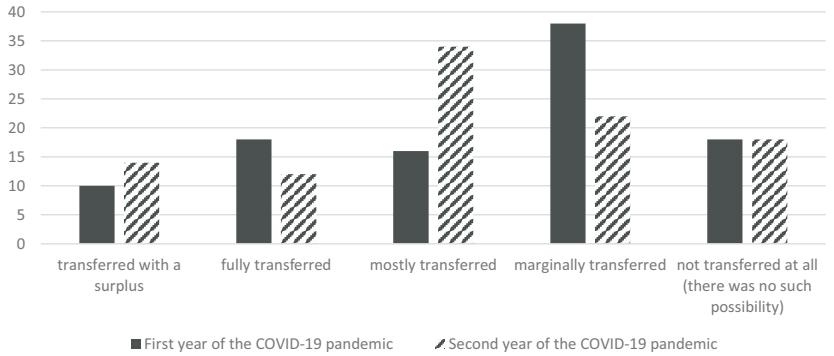

Figure 6. Assessment of the possibility of transferring the increase in prices of means of production in agriculture to the prices of agricultural products sold in the first and second year of the COVID-19 pandemic (%)

Source: Authors' own study.

Producers attempt to pass on the increase in production costs to the prices of the goods and services they sell. The results of a conducted questionnaire survey directed at experts in agricultural economics are varied (Figure 6). Only 28% of

experts indicated that in the first year of the COVID-19 pandemic, Polish farms had the ability to transfer with surplus or fully the increase in prices of agricultural production means to the prices of sold products. The majority of responses (38%) suggested that a small part of this price increase was passed on. However, in 2021, the ability to transfer the price increase with surplus or fully was mentioned by 26% of experts. In the year mentioned above, the most common answer (34%) was the ability to pass on a significant part of the production cost increase. In general, this study confirms the occurrence of variable price relations in Polish agriculture during the COVID-19 pandemic.

Agricultural production costs and farm income

From 2017 to 2021, the cost of agricultural production in Poland saw an annual increase. The only exception was a 0.2% drop in the prices of goods purchased for current agricultural production in 2020, resulting from the uncertainty caused by the COVID-19 pandemic. In contrast, 2021 saw a dynamic increase in all analysed production costs (Figure 7). The smallest increase was in costs associated with current production, i.e. materials and services (11%). The most significant increases were in the costs of employing agricultural workers (24.1%) and lease costs (19.1%). Lease costs had been rising significantly throughout the entire analysed period due to the high demand for agricultural land in Poland and its limited supply.

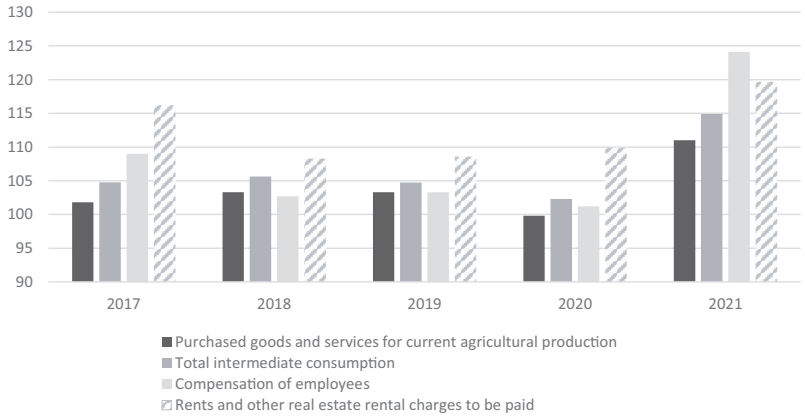

Figure 7. Price indices of goods and services purchased by farms and other production costs in agriculture

Source: Authors' own study based on (Statistics Poland, 2020a, 2023a; Eurostat, 2023).

Nearly throughout the entire study period, global agricultural production at current prices demonstrated annual increases. Only the production value decreased in 2018, resulting from the demanding market and macroeconomic conditions (Mikuła

et al., 2022). However, the income situation of Polish farms was more varied. It was at its best in the first year of the pandemic (Table 2). During that period, income from production factors, operating surplus, and farmer's income all reached their highest values. This was primarily due to the faster growth of global production compared to intermediate consumption. In contrast, the income situation in agriculture was significantly worse in 2021.

Table 2. Dynamics and level of prices of selected means of production in agriculture in 2017–2021

Specification	2017	2018	2019	2020	2021
Global agricultural production	105,407	104,336	111,358	117,321	127,460
Intermediate consumption	63,185	66,748	69,917	71,533	82,189
Gross value added	42,221	37,588	41,441	45,788	45,271
Income from production factors	49,161	46,940	50,982	53,833	52,036
Operating surplus	41,471	39,762	43,234	45,993	42,307
Farmer's income	39,952	38,177	41,594	44,678	40,928

Source: Authors' own study based on (Eurostat, 2023).

Farm income is derived from changes in the value of sold production, subsidies, and production costs. Analysis of the data from Figure 8 indicates an inverse relationship between changes in production costs and income generated in agriculture during the COVID-19 pandemic years. In 2020, farmers' incomes rose considerably. Farmer's income increased the most (10.7%). This resulted from a significant increase in production and state aid in relation to the pandemic, but primarily due to a drop in the prices of goods purchased for current agricultural production and slight increases in other agricultural production costs.

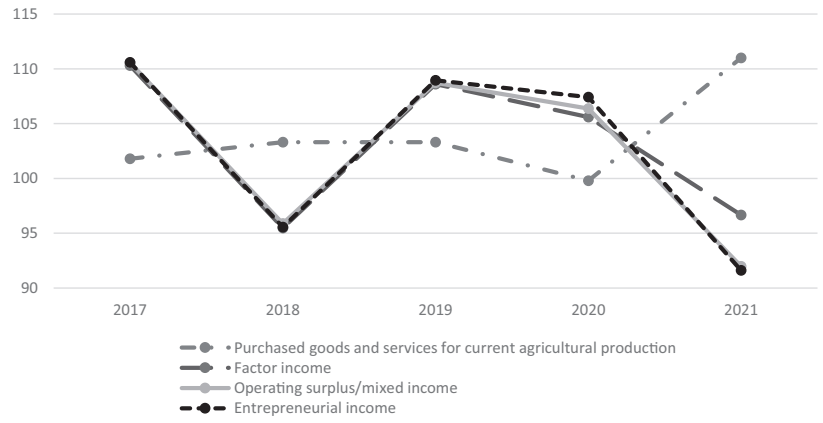

Figure 8. Price indices of goods and services purchased by farms and other production costs in agriculture

Source: Authors' own study based on (Statistics Poland, 2020a, 2023a; Eurostat, 2023).

In 2021, despite an even more significant increase in global agricultural production at current prices (8.6%) than the previous year, the income situation in agriculture was utterly reversed. Farmer's income fell the most (8.4%). The sharp increase in production costs led to a drop-in income. All cost categories increased. The purchase prices for materials and services, and the employment costs in agriculture, which grew at the fastest pace, rose.

Discussions

Our results correspond to Dudek and Śpiewak (2022) who showed that the COVID-19 pandemic has affected the functioning of food systems in Poland. We confirm the findings of Mikuła et al. (2022) who observed that the novel coronavirus pandemic era witnessed significant fluctuations in agricultural income. Unpropitious alterations in prices in 2021, driven by a substantial escalation in costs, led to an initial increase in agricultural earnings during the pandemic's first year. However, throughout the second year of COVID-19, the income scenario drastically worsened. Adverse agricultural conditions primarily associated with an uptick in loan costs and the prices of production inputs could notably influence the food security status of the Polish populace. The results analysing changes in prices of means of production in agriculture in Poland are in line with the Höhler and Lansink (2021), Gilbert et al. (2021), Sridhar et al. (2023), and Charlton and Castillo (2021).

As it was mentioned in the "Literature review" section, we observe that scientific literature lacks precise details regarding the influence of the pandemic on the costs of agricultural inputs from the standpoint of Poland. This presents an unexplored area in the current research which necessitates attention. Gaining insights into these alterations and the fundamental effects of the pandemic on the prices of agricultural inputs is crucial for the construction of efficacious strategies to tackle future adversities.

It is worth indicating that the COVID-19 predicament has induced a reassessment of the functioning of agriculture, particularly agricultural systems, in terms of their robustness in the face of any potential negative external shocks, including pandemics (Meuwissen et al., 2021).

Conclusions

The sector of means of production in agriculture is one of the three basic components of the food economy. The prices of agricultural inputs shape the operational costs of farms and significantly affect their income situation. The analysis carried out indicates that the years 2017–2021, the time of the COVID-19 pandemic, were an exceptional period. Only in 2020, did the prices of goods purchased for current agricultural production decrease. However, in 2021, the costs of materials and ser-

vices and other costs in agriculture, including wages, increased at a record pace. The demand-side causes of such cost increases were increases in money supply and agricultural income. The supply-side causes were shaped by commodity prices and wages. The increase in money supply and income affected the increase in prices of goods and services purchased by farmers for current production with a one-year delay. Meanwhile, the impact of production cost changes showed no delay.

In Poland, the prices of goods and services purchased by farms were less variable than the prices of goods sold. The data analysis did not reveal significant relationships regarding the dynamics of the prices discussed. Such a conclusion is also confirmed by the results of a questionnaire survey directed to experts in agricultural economics. The responses concerning the possibility of transferring the increase in production costs to the prices of sold products during the pandemic years varied.

In the years 2017–2021, the income situation of Polish farms was variable. The individual years of the COVID-19 pandemic were completely different in this respect. A significant cause of this were changes in the prices of means of production in agriculture and other costs. In 2020, increases in income from production factors, operating surplus, and farmer's income, and their decreases in 2021 were inversely correlated with changes in production costs in agriculture.

The conducted research encountered certain limitations, which are invariably present in scientific studies. The predominant constraint was the availability of more detailed data from the COVID-19 pandemic period related to the issue analysed. The limited ability to compare the results with the outcomes of other studies due to the scant number of studies pertaining to Poland was another limitation. Acquiring such data would facilitate further research in this area, steering towards analyses concerning individual sectors in Polish agriculture.

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