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## A SHORT REVIEW ON EUROPEAN DEVELOPMENTS IN AGRICULTURAL OUTPUT PRICE INDICES DURING 2008-2017: ARE THERE SIGNIFICANT CHANGES?

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### ABSTRACT

The evolution of the indices of the outputs of the production processes in agriculture could be considered proactive markers in understanding the effectiveness of the agricultural policies implementation and the functionality of the European Agricultural Model. The main aim of the research is centered on the analyzing the evolution of the European developments, in agricultural output price indices during 2008-2017, from the Romanian perspective. The main findings describe the long-term changes regarding the evolution of the agricultural sector in the analyzed countries.

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## Introduction

In the current context of the global economic transformations and of the rethinking of agricultural policies, including the European one, the agriculture continues to represent an economic domain (Andrei and Dragoi, 2019; Constantin et al., 2019) with high values and implications both for ensuring the food security and safety of the population and the need for raw materials supplies for secondary and tertiary economic sectors and as the beneficiary of inputs from the entire national economy. According to Dos Santos and Ahmad, (2020), the agricultural sector has an important contribution to meet the requirements of food security, both in the European Union (EU) and globally, and also being an essential element in the conservation of rural landscapes and providing essential goods for the rural population. Starting from these realities but also from some opinions expressed in the literature (Lerman et al., 2004; Balaceanu and Apostol, 2012; Loizou et al., 2019; Brada and Wadekin, 2019; Choi et al., 2021; Luković et al., 2021; Milojević et al., 2020; Živković et al., 2019), the agriculture is defined as an economy domain with multiple implications at different levels of aggregation that requires a deep and long-term understanding of the mechanism it forms and it sets in motion at the global economic level.

The optimization of agricultural production structures and, as a result, the application of appropriate agricultural policy measures in accordance with the requirements of the European Agricultural Model must take consideration not only obtaining higher production efficiency and production volumes to meet market requirements but also to obtain low prices. These must be relevant and sustainable for as long as possible.

Chen et al., (2020); Anríquez et al., (2013) as well as it's mentioned in previous works such as (Shumway et al., 1988) suggested that the setting of stable prices for agricultural products requires not only an intimate understanding of the specific mechanism of the agricultural production sector but also of the market, therefore the agricultural policies should concretize production relations in the supply.

The measures adopted to improve and increase the efficiency and effectiveness of the food production and supply chain, in the context of the need to increase sectoral competition should not only focus on obtaining the lowest possible price, input or highest output, but to pursue sustainability of the value chains throughout the entire agricultural sector. On the other hand, as (Helming and Tabeau, 2018) said in their study, although agricultural production prices fell during their analysis period of time, they continued to led to a slowing down in the upward trend in production and also in agriculture labour force.

Achieving the targets of a long-term sustainable and safe agriculture for everyone requires, not only the providing access to resources (to encourage the most efficient adaptation to existing market conditions), but also promoting more environmentally friendly practices and guarantee quantities and qualities for products that are placed on the market. As Suh and Moss, 2021 noted, promoting a policy that ignores the potential sectoral effects of rising prices can be problematic, creating long-term unknown consequences in related sectors.

The levels and the rapidity of the evolution of the prices of the agricultural outputs registered in the last period of time have generated complex phenomena with significant, irreversible negative influences, causing serious macroeconomic disequilibrium. Massive increases in global and European reference prices have forced a rethinking of the functioning mechanisms of the agricultural market. The slowdown in cereal production, the restrain of cropland and the reduce interest of European agricultural producers, plus an insufficient investment in agriculture, but also the decrease in financial support, all these partly reflect into a period of increasing agricultural prices in the EU.

As can be reamrked in European Commission Agriculture Report, 2008, the development of agricultural commodity prices are the result of a complex combination of structural and many temporary factors that doubles a significant, steady increase in demand for agricultural commodities, for basic raw materials and food products with a high degree of processing in emerging economies, which do nothing but complete the picture of the factors that determined an accelerate, long-term increase in the prices of agricultural products.

Starting from the reality expressed in the literature (Tsakok, 2019; Nazlioglu and Soytaş, 2011) that prices for agricultural products as well as other prices in the economy are subject to cyclical fluctuations, the essential question that transcends is whether the high level of product prices will persist for a long period of time or is only temporary, reflecting only the disequilibrium between the dynamic growth of demand and supply in this specific market. Abokyi et al., (2018) underline the fact that the inelasticity of the supply of agricultural products is one of the fundamental causes in generating imbalances in agricultural production markets, with a direct effect in inducing the increase in volatility of production prices. The main objective of this study is therefore to conduct an investigation on the evaluation of real price indices of agricultural outputs in Romania and the European Union in the period 2008-2017.

### **Data and methodology**

The understanding of the determining role, but especially of the impact that agriculture has on the economic system, can be achieved on the others o from the perspective of the evolution of the price indices of agricultural outputs. The evolution of prices therefore reflects, in addition to the effort made in the production flow, the resources mobilized and processed and the necessary supply. It is constituting an active resonance picture of a fundamental economic domain, both in ensuring the welfare and food security of citizens, and in terms of added value, also keeping and developing essential economic flows.

For the analysis of the evolution of the prices of the outputs of the agricultural production processes, the main source of documentation of the data used in the analysis process was a database of the European Union - Eurostat, from which was accessed the data series "Price indices of the means of agricultural

production, input (2010 = 100) - annual data [apri\_pi10\_ina]” and “Price indices of agricultural products, output (2010 = 100) - annual data [apri\_pi10\_outa]” and refers to two indicators as described in the table below (Table 1). Thus, the descriptive analysis was used from the perspective of the evolution of the indices of the outputs of the production processes in agriculture.

Considering both the availability of data series and the evolution of the two indicators used, we chose to open up to our analysis the period 2008-2017, respectively the first year after Romania’s integration into the European Union and the year for which we identified the consolidated data series. Thus, from the analysis of period of time we underlined the characteristics of the years 2008, 2012 and 2017. The evolution of the two indicators at the level of the European Union was taken into consideration from the perspective of the average values of the variables registered at EU28 level. This analysis interval was chosen also due to the fact that during this period the United Kingdom was a member of the EU, and the level of average values of the analyzed variables also reflects the impact of United Kingdom on the evolution of prices of agricultural production outputs.

**Table 1.** Variables description and measurement units

Variables	Significance of variables	UM
OIPV_08	Index of real vegetable production prices, including fruit and vegetables (output_1), 2008, (initial year of analysis)	%
OIPA_08	Real Livestock Price Index (output_2), 2008 (initial year of analysis)	%
OIPA_12	Index of real prices of animal production, year 2012	%
OIPA_17	Index of real prices of animal production, year 2017	%
OIPV_12	Index of real prices of vegetable production, year 2012	%
OIPV_17	Index of real prices of vegetable production, year 2017	%

*Source:* authors based Eurostat database

## Discussions

### *European developments in agricultural output price indices*

The first stage of the analysis of the evolutions and of Romania’s place in the EU from the point of view of the real price indices of vegetable production, including fruits and vegetables (OIPV), as well as of the real price indices of animal production (OIPA) was performed based on of the data series characteristics they are corresponding to them. (Table 2).

Analysis of the characteristics of the OIPV data series as well as of the OIPA at the level of all three years (Table 2), taking into account the values of the coefficient of variation (VC), as well as the values of dispersion (Simple Variance) and standard error (Standard Error), highlights, also in the case of outputs, that the averages (Mean) of the variables at the level of the states included in the analysis are representative. Regarding the shapes of the data series distributions, the values of the higher curve (Kurtosis) and the symmetry indicator (Skewness) show that, except for OIPV\_17,

the other variables have a normal distribution, of platycurtic type for OPIPV\_08, and leptocurtic for the others. On the other hand, given that for the variables OPIPV\_08 the average is higher than the median, most of the values of the indices of the real prices of vegetable production, including fruits and vegetables corresponding to the year 2008 are in the area of lower values. Regarding OPIPA, given that the average is lower than the median, most of the values are in the area of higher values (asymmetry to the right).

The evolution of vegetable production prices, both in Romania and in the EU28, was affected by the economic crisis started in 2009. This generated increases in the price level so that in Romania, the index of real vegetable production prices, including fruits and vegetables (Figure 1) increased from a value of 92.2%, recorded in 2009 compared to the base year (2010 = 100%), to a value of 122.0%, recorded in 2013, which represents an increase of 29,8 percentage points, the highest increase being in 2011 (11.1% compared to the previous year).

**Table 2** Main features of the data series on real price indices of agricultural outputs in 2008, 2012 and 2017

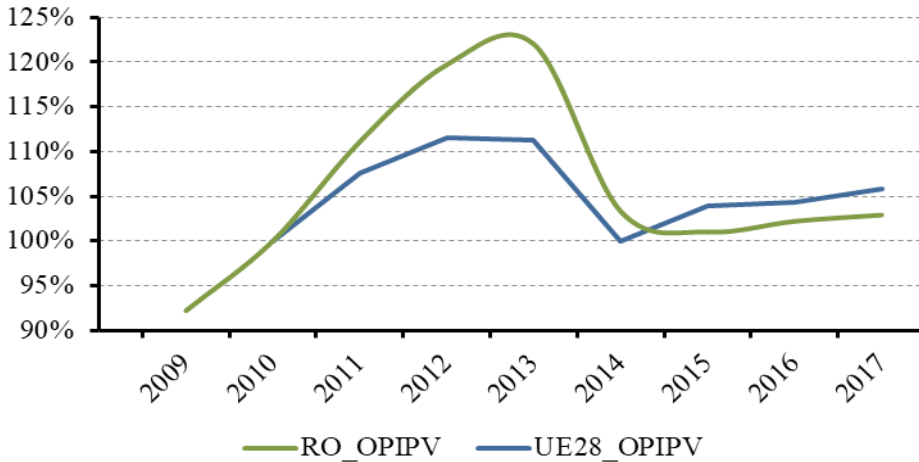
	OPIPA_08	OPIPA_12	OPIPA_17	OPIPV_08	OPIPV_12	OPIPV_17
Mean	113.08	114.94	104.13	110.94	108.85	105.17
Standard Error	2.45	2.29	2.03	1.50	0.85	1.13
Median	111.00	115.50	102.95	111.20	109.05	105.70
Standard Deviation	11.77	12.11	10.76	7.18	4.51	6.00
Sample Variance	138.42	146.68	115.74	51.53	20.30	35.97
Kurtosis	-0.37	0.98	7.33	0.27	0.81	0.09
Skewness	0.43	0.45	2.04	0.53	-0.32	-0.05
Minimum	42.50	57.10	58.40	28.50	19.80	26.10
Maximum	93.90	91.40	86.90	99.50	97.40	91.90
Cnf. Level (95.0%)	136.40	148.50	145.30	128.00	117.20	118.00
VC (%)	5.09	4.70	4.17	3.10	1.75	2.33

*Source:* calculated by the author using SPSS

At the same time, there has been a rise of prices in EU for vegetable production, including fruit and vegetables, but it has a lower intensity. Thus, in 2011 and 2012, compared to 2010, OPIPV reached 107.6% and 111.5%, while in Romania they were 3.5 and 8.2 percentage points higher. However, the biggest difference (10.8 percentage points) is registered in 2013, when the value of OPIPV at EU level decreases to 111.2%, while in Romania it increases to 122.2%.

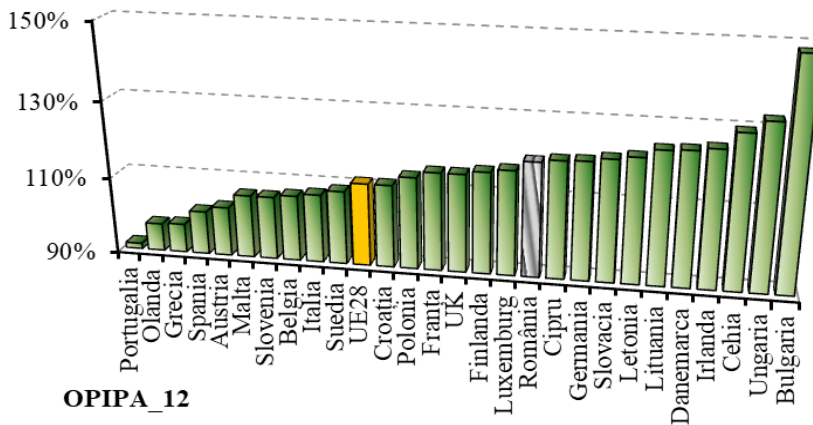
After 2013, the prices of vegetable production start to decrease in Romania as well, the OPIPV values tending to approach those registered in the EU, so that from a difference of 10.8 percentage points, in 2013, in 2014 it will be reduced to 3, 4 percentage points. Finally, the period 2015-2017 is a positive one for Romania in terms of OPIPV values, its values being below the EU average by about three percentage points.

**Figure 1.** Evolutions of real crop production price indices, including fruits and vegetables (OIPV) in Romania and at EU28 level in the period 2009-2017



From the point of view of the place ranked by Romania among the EU member states, according to the values of the index of the real prices of the vegetal production, in 2012, with a value of OIPV of 119.7% in relation to 2010, it ranked 17th in terms of performance (Figure 2), OIPV in Romania being 28.3 percentage points higher than in Portugal, the member state that is in first place in terms of this indicator. It should be noted that our neighbors EU members, Hungary was on the penultimate and Bulgaria was the last place with the highest values of OIPV, of 132.6% and 148.5% respectively.

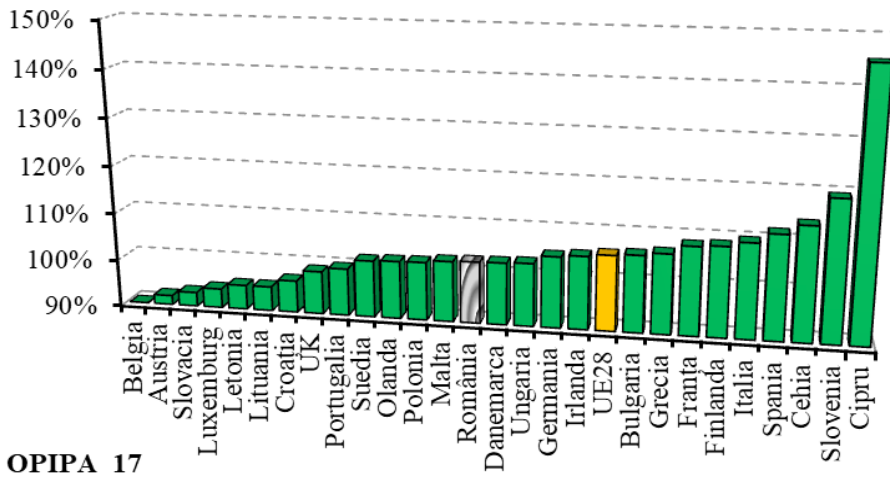
**Figure 2.** Romania's position between EU member states and the EU28 average in 2012 in terms of values of real crop production price indices



Economic developments in 2012-2017 have led to significant changes in the hierarchy of EU Member States in terms of indices of the real crop production price (Figure 3). Thus, if in 2012, the OIPV registered in Romania was 8.2 percentage points higher

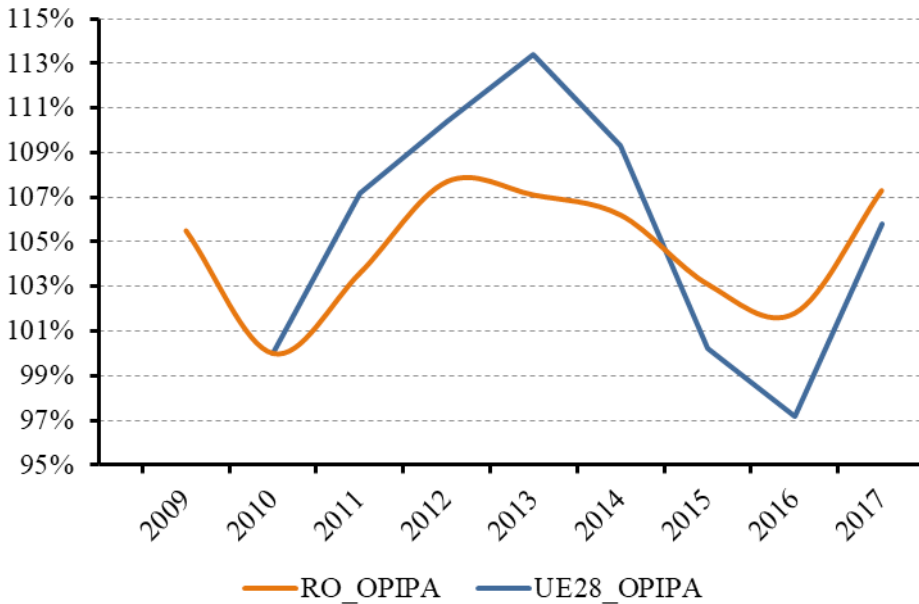
than the value of OIPV registered at EU28 level, in 2017, with a value of OIPV of 102.9%, it becomes 2.9 percentage points lower than the OIPV registered at EU28 level (105.8%) placing Romania among the states with values of indices of the real crop production price below the European average.

**Figure 3.** Romania's position between EU Member States and the EU28 average in 2017 in terms of the values of indices of the real crop production price



Although in 2017, Romania was ranked 14th in terms of performance on OIPV, the difference between the value recorded in Romania and that recorded in Belgium (86.9%) which was ranked first in this hierarchy was 16.0 percentage points. It should also be noted that in the period 2012-2017, although the OIPV registered in Romania decreased by 16.8 percentage points, in the case of Hungary the reduction of the OIPV was 29.4 percentage points, and in Bulgaria by 42.4 percentage points. (almost a halving of crop production prices), which led them to move from the last two places in 2012, to 16th place, with a value of OIPV of 103.2% in the case of Hungary (only 0.3 percentage points higher than in Romania) and 19th place in the case of Bulgaria, with a value of OIPV of 106.1% (4.2 percentage points more than in Romania).

Unlike OIPV evolutions, in the case of OIPIA the amplitude of their oscillations was higher, especially at EU28 level (Figure 4). The evolutions of the real prices of the animal production as in the case of those of the vegetal production were affected by the economic crisis, fact that generated their increases, so that in Romania the index of the real prices of the animal production, after a reduction of 5.5 percent in 2009-2010 recorded an increase of 107.7% in 2012 compared to 2010. However, this increase was lower than that recorded by OIPIA at EU28 level, which in 2012 had reached a value of 110, 4%, and in 2013, at 113.4% compared to 2010. These OIPIA values were 2.7 percentage points higher than the OIPIA value registered in Romania in 2012 and 6.6 percentage points higher than the OIPIA value registered in 2013.

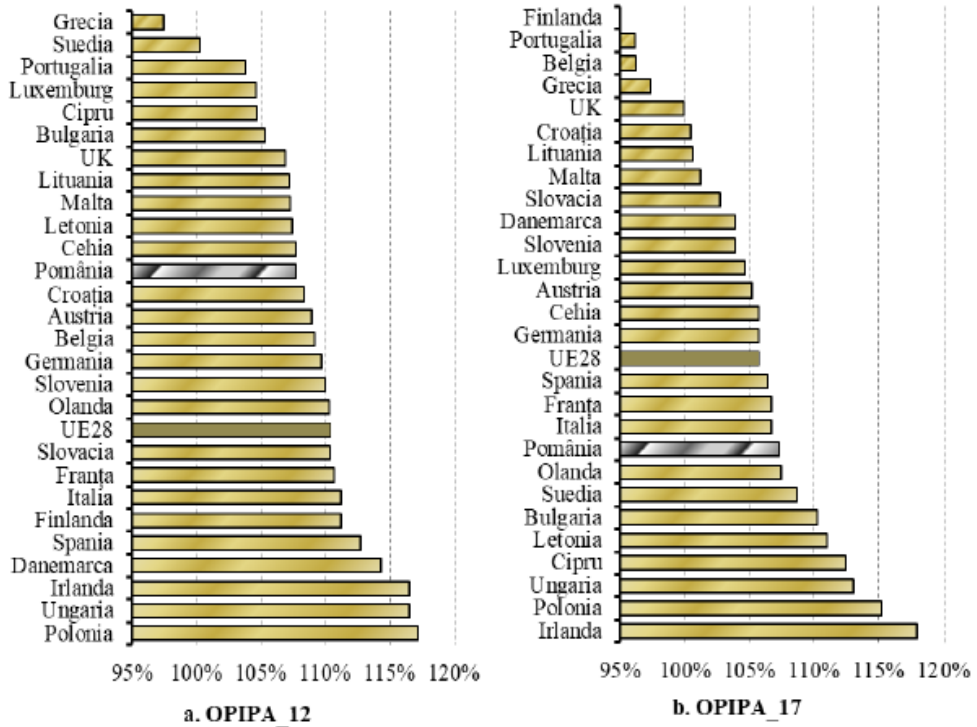
**Figure 4.** Evolutions of real animal production price indices (OPIPA) in Romania and at EU28 level in the period 2009-2017

The period 2013-2016 is characterized by significant reductions in OPIPA values. The reductions in the real prices of animal production, being much stronger at EU level than in Romania, result in the reversal of the ratios between the registered OPIPA values. Thus, while OPIPA at EU28 level is reduced by 16.2 percentage points, reaching 92.2% in 2016 compared to the value recorded in 2010, in Romania the reduction is only 5.9 percentage points, so that in 2016 OPIPA is 101.8% compared to 2010 (4.6 percentage points higher than at EU28).

However, the decreasing trend registered by the OPIPA values both in Romania and at the EU28 level is reversed in 2017, the OPIPA values registering increases by 8.6 percentage points at the EU28 level and by 5.5 percentage points in Romania. Under these conditions, in 2017, the OPIPA values, compared to 2010, were 105.8% at EU level and 107.3% in Romania. In 2012, Romania ranked 12th among EU states (figure 5a), as the performance of the values of the index of real prices of animal production, with a value of OPIPA of 107.7% compared to 2010, being at 10.3 percentage points of Greece, which was in the first place in terms of of this indicator with an OPIPA value of 97.4%. Compared to Romania, Bulgaria was in a better place (place 6) with an OPIPA value of 105.3%, while Hungary was in the penultimate place with an OPIPA value of 116.5%.



**Figure 5.** Romania's places in the hierarchy of the EU member states and compared to the value of OPIPA at European level in, 2012 and 2017



The period 2012-2017 also brought significant changes in the hierarchy of EU Member States in terms of indices of the real animal production price (Figure 5b). Although during this period the OPIPA value registered in Romania decreases by 0.4 percentage points, as a result of the economic developments in the other states, it lost 7 places, ranked the 19th place in 2017, with an OPIPA value of 107.3% compared to 2010, being above the EU average (105.8%).

The places occupied by Romania in 2017 both in terms of the real prices of vegetable production (14th place) and, especially, the index of real prices of animal production (19th place) highlight the fact that Romania must pay more attention to development agriculture both in terms of infrastructure, which is quite poor compared to other European countries, and by supporting producers by developing programs dedicated to them, supporting the absorption of European funds dedicated to this sector which is very important for Romanian economy.

## Conclusions

The analysis of the evolution of the price indices of the agricultural outputs constitutes an elementary approach in understanding and deepening of the demanding-supplying working mechanism for agricultural products, and of the agricultural market in general.

Fluctuations of agriculture products prices, and especially in output prices, affect the economy as a whole, not limited to the agricultural sector. The unpredictability of agricultural markets with increasingly difficult-to-manage effects requires increased flexibility, often incompatible with the specificity, characteristics and potential of agricultural production. Ensuring a fair and sustainable distribution of agricultural production but also increasing the remuneration of each of the links in the supply chain of agricultural products is a complex process with extensive interference with market processes and production processes as well.

Considering the analyzed period (2012-2017), there are important, long-term changes regarding the evolution of indices of the real price of the animal and vegetable agricultural production in Romania compared to the EU. From this analysis it's been noticed the necessity of a constant deepening and with determined impact of some measures that have as objective the development of agriculture in Romania. Thus, we can see the downward trend of both OPIPA and OPIPA values in Romania but also in the economies of EU28, but which in the case of OPIPA is reversed in 2017. The values of this indicator increasing by 8.6 percentage points in EU28 and 5.5 percentage points in the case of Romania.

The accentuated increase of the price of food and of the raw materials and final products from agriculture, including the outputs as well is one of the strict problems that mark the European agricultural sector and those from Romania as well. The evolution of agricultural and food production is closely linked and often correlated with the evolution and transformation of the European agricultural model. If, at first, European agricultural policy was based on the existence of a strong, deeply consolidated and heavily regulated internal market, the promotion and application of subsidy schemes designed to stabilize food production and supply have altered (not always for the better) the subtle balances of the market.

### **Conflict of interests**

The authors declare no conflict of interest.

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