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Impact of the COVID-19 Pandemic on the World Energy and Food Commodity Prices: Implications for Global Economic Growth

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Abstract: The negative socio-economic consequences of the COVID-19 pandemic are widely discussed. However, relatively less attention is paid to its impact on the world commodity price formation including energy and food prices. The aim of this paper is to examine the impact of the COVID-19 pandemic on world energy commodity prices and their interactions with world food commodity prices. Using the World Bank data on commodity prices we look for evidence of changes in energy and food prices caused by occurrence of the COVID-19 pandemic, which was assumed to be a negative shock to the global economy in terms of both supply and demand. Based on data series analysis of indices of world energy and food commodity prices, it is evident that after the outbreak of the COVID-19 pandemic the energy prices, especially oil prices, plummeted. Food prices followed the same direction; however, their plunge was much less extreme. In general, it can be concluded that the pandemic caused a severe energy price shock which clearly had a negative impact on global economic growth, but the scale of this impact differs depending on the type of economic sector and countries' net export positions in energy and food trade.

Keywords: demand and supply shocks; energy prices; food prices; economic growth

Citation: Figiel, S.; Floriańczyk, Z.; Wigier, M. Impact of the COVID-19 Pandemic on the World Energy and Food Commodity Prices: Implications for Global Economic Growth. *Energies* **2023**, *16*, 3152. https://doi.org/10.3390/en16073152

Academic Editors: Sebastian Saniuk, Piotr Bórawski and Tomasz Rokicki

Received: 13 March 2023
Revised: 27 March 2023
Accepted: 28 March 2023
Published: 31 March 2023

1. Introduction

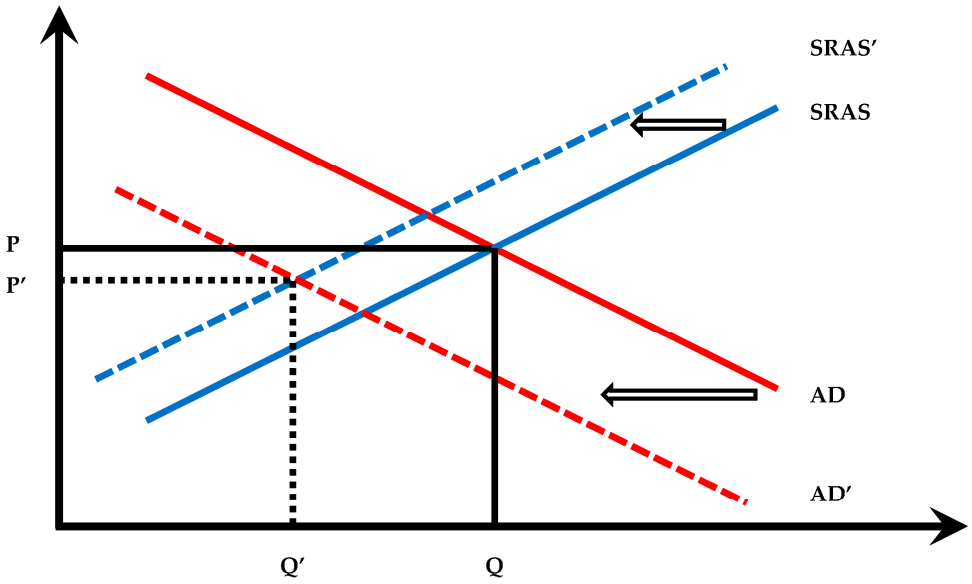
The COVID-19 pandemic has led to numerous negative socio-economic consequences, mostly discussed with regard to the performance of healthcare systems and functioning of global supply chains [1]. Relatively less attention is paid to its impact on world commodity price formation including energy and food prices. World commodity prices are reflections of the global demand and supply conditions. To a great extent the determined commodity prices in national economies are interconnected by foreign trade linkages. Prices of major commodities, especially energy, translate into production costs; therefore, excessive volatility of these prices constitutes a major risk for businesses and potentially hampers global economic growth. This is especially noticeable if energy price shocks occur. The price movements triggered by the crisis are crucial and market prices swiftly reflect upward and downward trends, which are further reflected in the economy. In the event of an economic, political, or geopolitical catastrophe, international energy market prices become prominent [2]. Such shocks are usually viewed from the perspective of so-called oil shocks, or oil crises, beginning with the 1973 oil shock caused by an embargo which Arab members of Organization of the Petroleum Exporting Countries (OPEC) imposed on supply to the US, Japan, and Western Europe for supporting Israel in the Yom Kippur war. At the time, this situation was considered an irreversible upward shift in the oil price level, marking the end of times of cheap oil. As the World Bank data show, annual crude oil prices (in nominal dollars) in 1974 compared to 1973 almost quadrupled to about $11/bbl. Much higher crude oil price expectations were even strengthened after the second oil shock triggered by the Iranian revolution in 1979 followed by the outbreak of the Iran-Iraq war (1980–1988). In 1980, the annual crude oil price reached almost $37/bbl. In the next years

it systematically dropped and stayed very significantly below this level (often even less than $20/bbl). The world oil importers enjoyed such advantageous market development for almost two decades, apart from a relatively short-lasting increase due to the Gulf War (Iraq's invasion of Kuwait in 1990). In 2004, annual crude oil prices started to climb from $37.7/bbl to $97/bbl in 2008. Eruption of the global financial crisis in the same year was associated with downward pressure on crude oil prices in 2009 (less than $62/bbl). In 2010, they began to rise once again, achieving a record level $105/bbl in 2012. In subsequent years they fluctuated around a decreasing trend, and in 2019 reached $61.4/bbl. Then, in 2020, they dropped quite rapidly to $41.3/bbl.

This very brief overview of the long run formation of the annual nominal prices of crude oil shows that the world witnessed numerous swings and sharp changes for about 50 years before the outbreak of the COVID-19 pandemic. Usually, in economic and business terms, the most attention is paid to oil shocks seen as sudden rises in the price of oil often accompanied by decreased supply [3]. This commodity constitutes the main source of energy for the majority of advanced industrial economies; hence, oil shocks can negatively influence economic stability of the global economy and its growth. Namely, increases in the price of oil triggered by oil supply shocks have negative impacts on economic activity [4]. The opposite market development, i.e., sudden falls in crude oil prices, seems to attract less research interest in this context. Economists have no doubt that the COVID-19 pandemic engendered a macroeconomic shock to the global economy. The global economy has been devastated by social distancing and lockdown, which has undermined demand. Similarly, before the pandemic, the pricing war between Saudi Arabia and Russia left the energy market uncertain and oversupplied [5]. However, it is matter of ongoing discussion whether this was mainly demand or supply shock or both and, if so, in what proportion. It is argued that supply shocks have little influence on crude oil price fluctuation, while demand shocks have prominent effects [6]. This can be explained with the impact of US dollar liquidity on the fluctuation of oil prices.

Preliminary expectations regarding the economic shock effect of the COVID-19 pandemic were logically based on the observed disruptions in the world's supply chain and strong signals of reducing demand. Consequently, it could be surmised that the world was faced with a negative supply shock (aggregate supply shifting left) and a negative demand shock (aggregate demand shifting left, too). Such a scenario translates definitively into a lower global output yet changes in the price level are possible as well [7]. Economic implications of the supply shock caused by the COVID-19 pandemic were presented in the literature both from purely theoretical perspective and based on empirical studies [8–10]. The issue of decreased quantity produced is a main focus, whereas the price aspect of the shock is examined to a lesser extent. Some studies indicate the repercussions of the COVID-19 crisis for producer and retail prices of agri-food commodities [11]. Price adjustments to COVID-19 occur simultaneously in a complex system of price discovery and these adjustments are bellwethers of market efficiency and resilience [12].

Our hypothesis is that during the COVID-19 pandemic the negative demand shock outweighed the negative supply shock significantly enough to decrease the price level apart from lowering the quantity. In other words, the aggregate demand (AD) shifted left much more (to AD') than the short run aggregate supply (from SRAS to SRAS'), which is graphically illustrated in Figure 1. Consequently, in the context of our research hypothesis the aim of the paper is to examine impact of the COVID-19 pandemic on the level and variability of world energy commodity prices and their interactions with world food commodity prices. Additionally, implications of the observed energy price shock for the growth of global economy and their key sectors and main players are highlighted.



AD—aggregate demand, SRAS—short run aggregate supply, Q—quantity, P—price

Figure 1. Hypothesized demand and supply shock effects of the COVID-19 pandemic.

Verification of such formulated hypotheses is focused on examining changes in the world energy and food prices and the GDP growth after the outbreak of COVID-19 pandemic. We believe that movements in world energy and food commodity prices are good reflections of actual changes in the overall price level in the global economy. This is because energy and food commodities are crucial inputs determining production costs of consumer goods, hence, influencing their prices, but also their exemption from calculation of core inflation. To the best of our knowledge such an approach to empirically analyze the COVID-19 pandemic shock effects has not been used yet.

In our analysis we use the World Bank data on commodity prices and economic growth, and we look for an evidence of changes in energy and food prices caused by occurrence of the COVID-19 pandemic.

We have demonstrated that interconnected downturns in world energy and food commodity prices after the outbreak of the COVID-19 pandemic is a reflection of a lower overall price level in the global economy associated with the macroeconomic demand shock, which was of larger size than the parallelly occurring supply shock. Therefore, a contribution of the study is to underline that tracking energy and food commodity price shocks helps determine type as well as size and scale of the macroeconomic demand and supply shocks.

In general, it can be concluded that the pandemic caused a severe slump in energy prices, which clearly had a negative impact on global economic growth. However, this impact differed depending on the type of economic sector and countries' net export positions in energy and food trade. In the next sections of the article, empirical evidence justifying these statements is provided.

2. Materials and Methods

In the analyses carried out the following data were used:

- time series data of world energy and food price monthly indices reported by the World Bank ("pink sheet" data available at https://www.worldbank.org/en/research/commodity-markets#1, accessed on 12 March 2023);
- time series data regarding world economic development indicators such as growth of GDP (gross domestic product) and VA (value added) by key economic sectors and

countries provided by the World Bank (available at https://databank.worldbank.org/source/world -development-indicators#, accessed on 12 March 2023);
- data on export and import of energy and food commodities reported by the WTO (available at https://stats.wto.org/, accessed on 12 March 2023).

The time span covered in the analysis is 2011–2021 which allowed comparison of changes in values of the considered variables long before the outbreak the COVID-19 pandemic and throughout its duration. The data collected are presented graphically together with related basic descriptive statistics. Also, statistical methods such as correlation, testing for causality, and the Chow test for a structural break [13] were employed to examine relationships between the world energy and food prices and their formation over time in comparison to changes in the global economic growth.

Because correlation in levels might spurious, the ADF and KPSS tests were applied to avoid false identification [13]. Testing for causality was carried out using a VAR model containing a constant as the only exogenous variable and two lagged values of the world energy and food price indices as respective endogenous variables. The number of lags was determined based on the information criteria such as the AIC, BIC, and HQC [11].

The Chow test was applied [13] from June of 2018–December 2021specifying the outbreak of the pandemic (March 2020) as the split point for 43 monthly observations regarding values of the price indices (21 before and 21 after the month of the pandemic outbreak). Apart from the world energy and food price indices as variables, a constant and a time variable were included in the models.

Additionally, to measure relative magnitude of a growth shock (*RSM*) a unique elaborated formula was applied. The formula can be written as follows:

$$RSM = |PGR - OGR|/SEGR$$

where:

PGR—projected growth rate for the time of shock occurrence based on extrapolation of a linear trend estimated using prior observations;
OGR—observed growth rate at the time of shock occurrence;
SEGR—standard error of the estimated trend values.

The formula measures relative departure from the ex post growth rate trend. The calculated values exceeding one indicate a shock compare to previous periods considered.

3. Results

3.1. Variability of World Energy and Food Prices in 2011–2021

As it can be seen in Figures 2 and 3, the world energy and food prices, expressed in the form of indices, varied enormously in the period considered (2011–2021).

The variability interval in this period for the world energy price indices was between values of 31.6 and 148.3 which implies strong fluctuations around the mean of 93.5. Volatility was calculated as value of the standard deviation multiplied by the square root of the number of observations (132) and amounted to 369. Variability of world food price indices was noticeably lower, although still substantial. Its interval was between values of 82.9 and 132.4 with a mean of 102.5 and volatility amounting to 177. Considering these statistics as an interesting research question is how the COVID-19 pandemic influenced movements of the world energy and food prices.

3.2. Impact of the COVID-19 Pandemic on the Formation of the World Energy and Food Prices

The World Health Organization (WHO) declared the outbreak a public health emergency of international concern on 30 January 2020, and a pandemic on 11 March 2020. To compare graphically the impact of the COVID-19 pandemic on the formation of both the world energy and food price, their indices were plotted in Figure 4 with indication of the date of its outbreak (March, 2020). It can be noted that after this date, almost instantly, the world energy prices dropped very sharply.

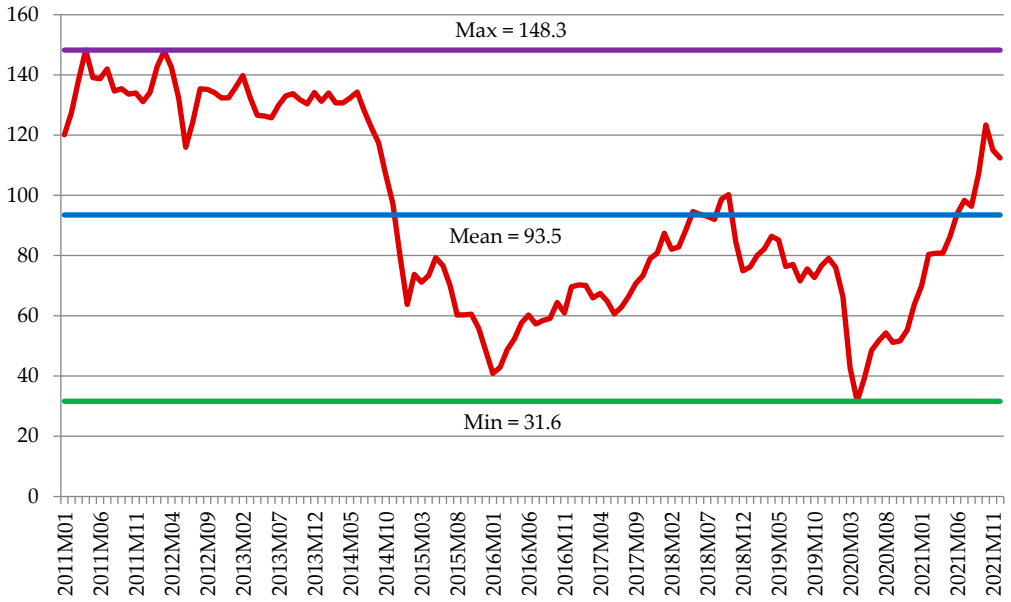


Figure 2. Monthly indices of world energy prices (based on nominal US dollars, 2010 = 100) and their variability in 2011–2021.

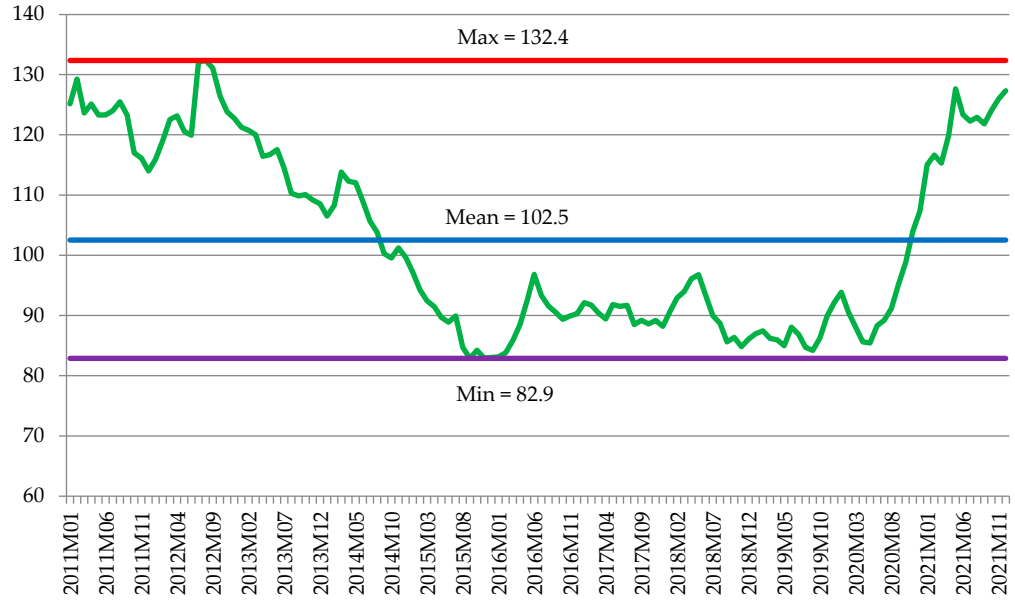


Figure 3. Monthly indices of world food prices (based on nominal US dollars, 2010 = 100) and their variability in 2011–2021.

World food prices declined from the previous levels, too, but to a much lesser degree. Shortly after, together with world energy prices, they began to rise very visibly. This noticeable co-movement of their indices indicates a kind of connectedness or interdependence of world energy and food prices. In fact, they were positively correlated at 0.8 in the analyzed period. The results of the ADF test (with constant and trend plus seasonal dummies) and the KPSS test were consistent and did not support the hypothesis of non-stationarities of the compared world energy and food commodity price indices time series. It should also be added that the values of the F-statistic and associated probabilities in the estimated VAR models indicated the world energy commodity prices as Granger causal for world food commodity prices.

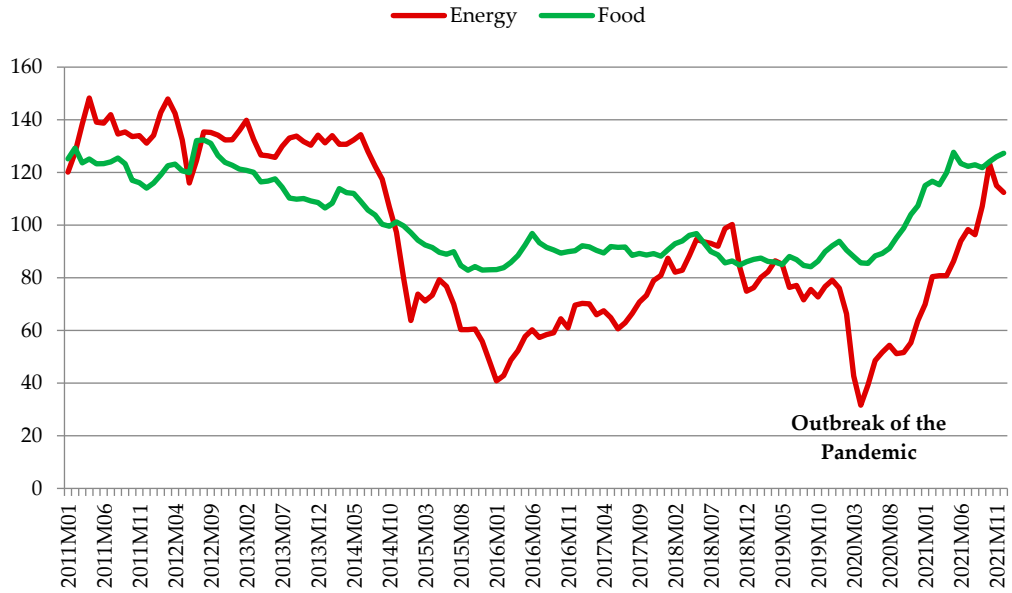


Figure 4. Formation of the monthly world energy and food price indices in 2011–2021.

Apart from a relatively obvious cost transmission microeconomic mechanism as energy constitutes an important input, especially in industrial agriculture, there are other explanations for the existence of potential linkages between world energy and food prices. One of them is production of biofuels competing for resources used for producing agricultural commodities, hence, influencing food prices [14]. Another factor which can contribute to interdependence of the world energy and food prices is financialization of the commodity futures markets. Especially, this refers to investment funds and index trading based on a basket of underlying commodities. Trading multiple commodities through one contract inevitably connects their prices somehow [15].

In order to compare in greater detail the formation of world energy and food prices after the outbreak of the COVID-19 pandemic, Figure 5 displays a series of monthly energy and food price indices for 2020–2021.

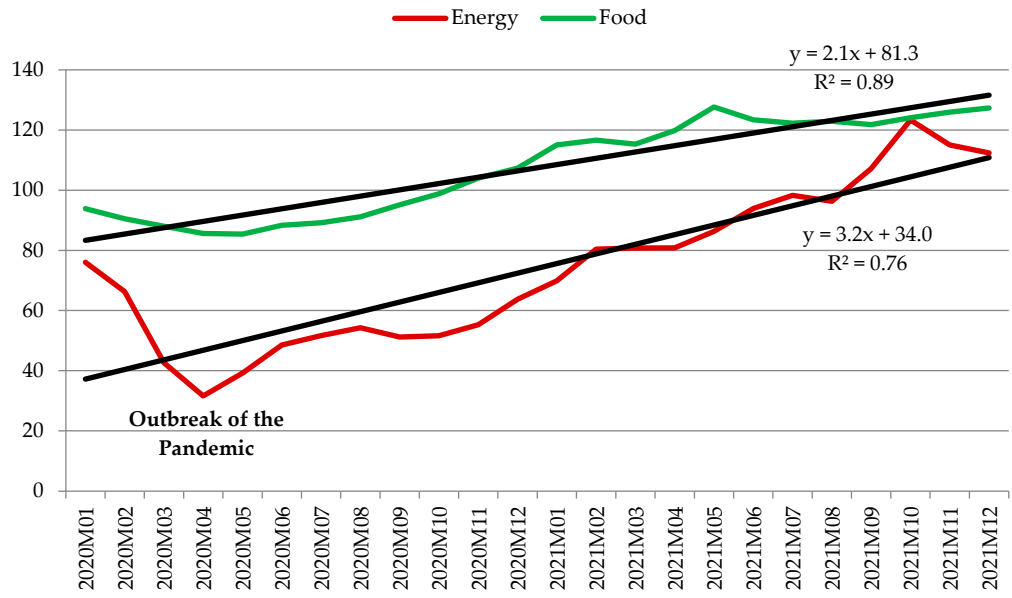


Figure 5. Formation of the monthly world energy and food price indices in 2020–2021.

Based on the results of the ADF and KPSS tests (with constant and trend), the examined series of price indices in this shorter period can be considered stationary. Moreover,

a statistically significant correlation between them increased to 0.9 what may suggest increasing interconnectedness between the years of the COVID-19 pandemic duration. The upward trends displayed in Figure 5 are also statistically significant and indicate co-movement of world energy and food commodity prices in the same direction after the outbreak of the pandemic. The Granger causality testing confirmed that food commodity prices were also driven by energy commodity prices in this period. Moreover, based on the results of the Chow test, drastic declines in both the world energy and food commodity prices occurring after the outbreak of the COVID-19 pandemic can be treated as structural breaks in formation of these prices.

3.3. The COVID-19 Pandemic and Distortion of the Global Economic Growth

The outbreak of the COVID-19 pandemic led to a very drastic decline in global GDP growth. Its rate was virtually flat for the nine years prior to the pandemic, ranging from 2.6 to 3.4%, and in 2020 fell to a negative value of −3.1% (Figure 6). This clearly indicates a global growth shock resulting from a widespread reduction of world economic output due to various anti-pandemic measures and related restrictions. However, unavoidable economic consequences of such actions, such as degree of the growth distortion, differed depending on the type of economic sector as well as among countries. Subsequently, the impact of the COVID-19 pandemic on the growth of the global economy is discussed considering those two dimensions.

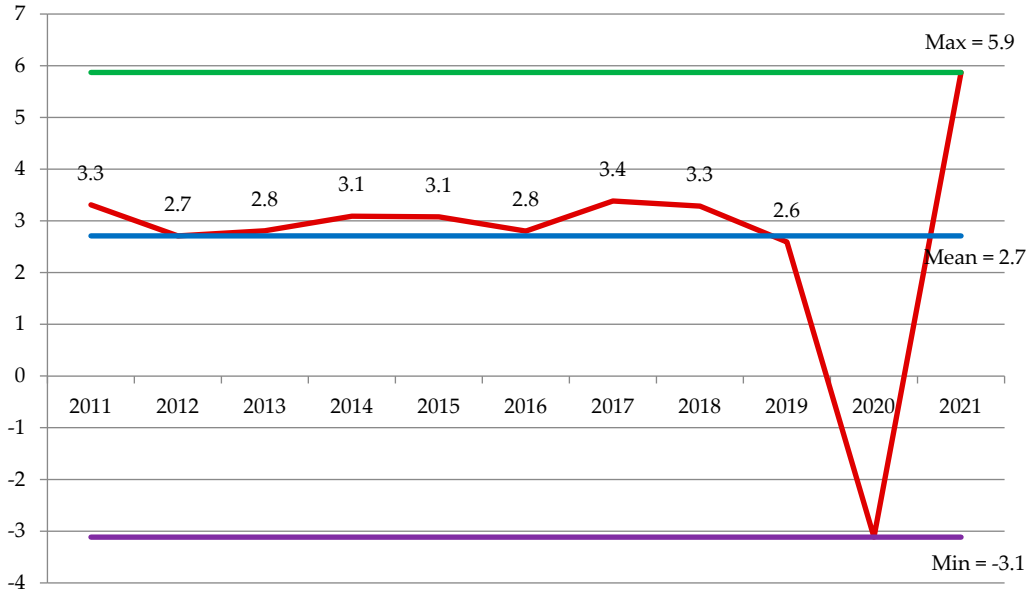


Figure 6. The world GDP growth rates (%) and their variability in 2011–2021.

As it appears from Figure 7, all economic sectors as categorized by the World Bank except for agriculture, forestry, and fishing had negative growth rates in 2020. The deepest decline occurred in case of manufacturing (−4.4%). Industry and service sectors suffered less, though still much more considerably than agriculture, forestry, and fishing sectors. Also, variability measures included in Table 1 show differences in distortion of stability of the economic growth by sectors. This suggests that resilience to economic growth shocks is sector specific.

Like in the case of key economic sectors, it could be expected that the impact of the COVID-19 pandemic on economic growth was not the same for every national economy. In order to visualize differences in the economic growth shock caused by the COVID-19 pandemic across countries, a comparison of changes in the GDP rates (%) in 2011–2021 for the TOP-10 economies is presented in Figure 8.

Table 1. Variability of the global value-added growth rates (%) by key sectors of the world economy in 2011–2021.

Sector	Min–Max	Range	Mean	SD
Agriculture, forestry, and fishing	1.4–4.6	3.2	2.8	0.9
Industry	−2.4–6.1	8.5	2.9	2.0
Manufacturing [1]	−4.4–3.9	8.3	1.5	2.3
Services	−3.3–6.2	9.5	2.7	2.2

[1] Data on value added growth in 2021 for the manufacturing sector not available.

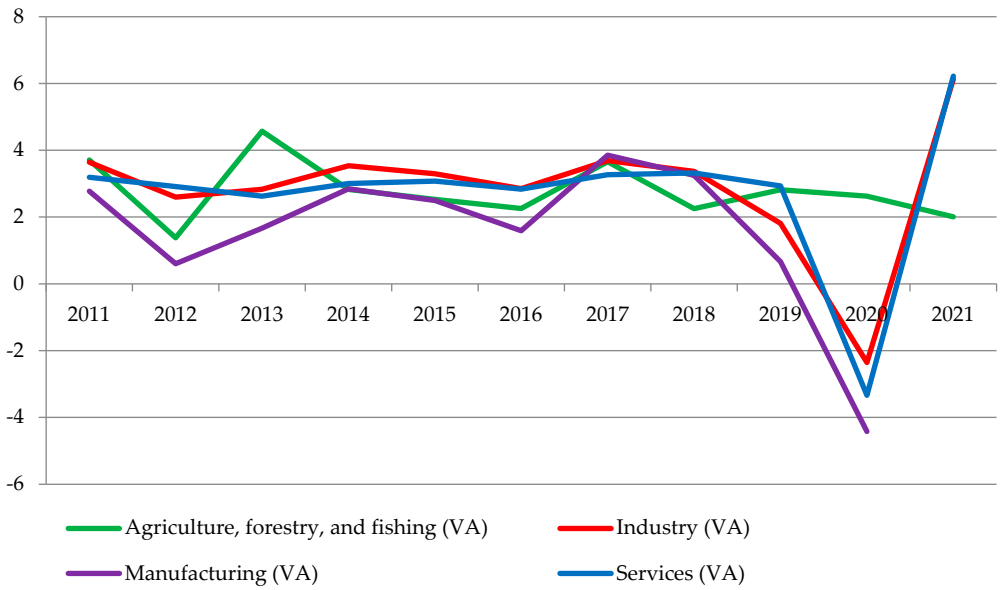


Figure 7. The world value added growth rates (%) by key sectors of the global economy in 2011–2021.

Keeping in mind that these countries account for about two-thirds of the overall world product, it can be assumed that they are a good reflection of the global economy while exhibiting visible differences in the country GDP growth rates before and during the COVID-19 pandemic period. Table 2 includes basic descriptive statistics providing more insight into these cross-country differences.

It should be noted that while the growth rate for the whole world economy was flat until the pandemic, the GDP growth rates for the economies considered differed regarding both levels and variability. First, the strongest average economic growth in the analyzed period was in China, the only country where the growth rate remained positive in 2020. From 2011 until the pandemic, the Indian economy was also fast-growing, but in 2020 it experienced a drastic contraction as its growth rate became negative (−6.6%). The most severe, relative decreases in the GDP in 2020 occurred in the United Kingdom, Italy, and France (−11, −9.0, and −7.8%, respectively). South Korea, the United Sates, and Germany displayed much lower decreases in the GDP.

Second, during 2011–2021 the growth rates of the world TOP-10 economies fluctuated very differently, mostly as a consequence of cross-country unevenness of COVID-19 pandemic effects. The largest ranges and standard deviations of the growth rates, indicating the least stable economic growth, characterized the United Kingdom, Italy, India, and France, whilst South Korea, Japan, China, and Germany represented the most stable economic growth.

It needs to be emphasized that economic growth of all the TOP-10 world economies in 2020 was severely hampered no matter the growth rate achieved in previous years. As they represented different economic growth paths, to measure relative magnitude of a growth shock (*RSM*) the formula described in Section 2 was applied. The results obtained are shown in Figure 9.

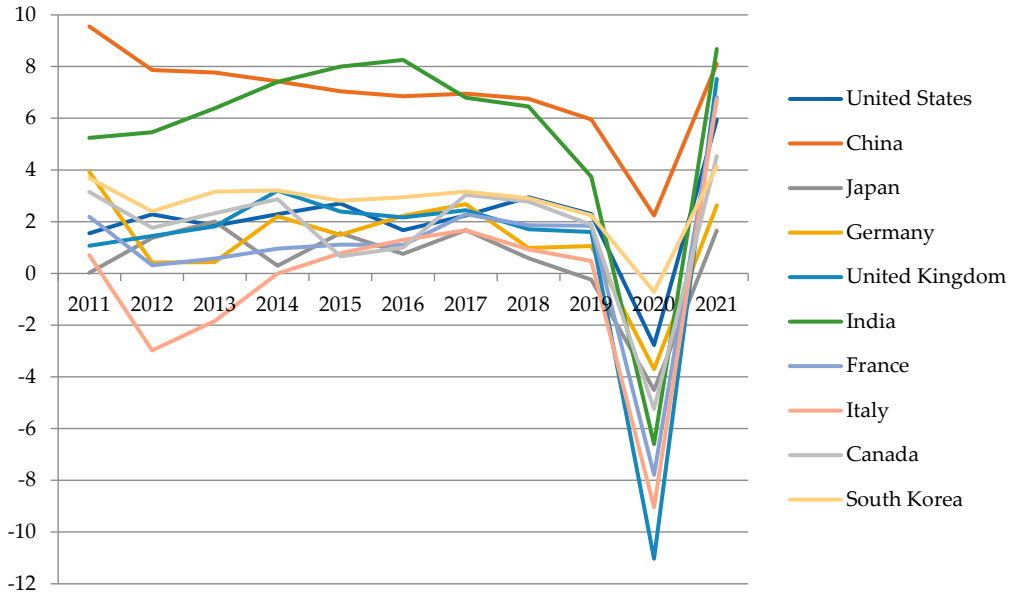


Figure 8. The GDP growth rates (%) for the TOP-10 world economies in 2011–2021.

Table 2. Variability of the GDP growth rates (%) for the TOP-10 world economies in 2011–2021.

Country	Min–Max	Range	Mean	SD
United States	−2.8–5.9	8.7	2.1	2.0
China	2.2–9.6	7.4	7.0	1.8
Japan	−4.5–2.0	6.5	0.47	1.8
Germany	−3.7–3.9	7.6	1.3	2.0
United Kingdom	−11.0–7.5	18.5	1.3	4.5
India	−6.6–8,7	15.3	5.4	4.2
France	−7.8–6.8	14.6	1.0	3.4
Italy	−9.0–6.7	15.7	−0.1	3.8
Canada	−5.3–4.5	9.8	1.7	2.5
South Korea	−0.7–4.1	4.8	2.7	1.3

This provides clear evidence that all the TOP-10 world economies experienced considerable growth shocks (all values above 1—solid horizontal line). In terms of magnitude, the highest shocks appeared to be in the United Kingdom, France, and the United States. Moderate growth shocks were experienced in India, Canada, Italy, and South Korea. China, Japan, and Germany were subject to the lowest growth shocks. There might be multiple reasons for differentiation of these shock magnitudes. Some possible factors are the effectiveness of the adopted anti-COVID-19 measures and health policies, sectoral structure of the economies, and each country's international net trade positions regarding energy and food. Some factors could be also country specific, such as Brexit, which is estimated to have made the United Kingdom's economy 5.5% poorer now than it would have been had the UK stayed in the EU, mainly due to its departure from the single market [16].

Our special focus is the coincidence of energy and food commodity price falls and collapsing economic growth in 2020. Having examined the net trade positions in energy and food commodities of the TOP-10 world economies and their GDP growth rates in 2020, negative correlations between respective variables were found (−0.59 for energy and −0.56 for food commodities). This finding indicates existence of an adverse effect of the energy and food commodity price shocks on the economic growth in the countries with better net trade positions regarding these commodities in 2020.

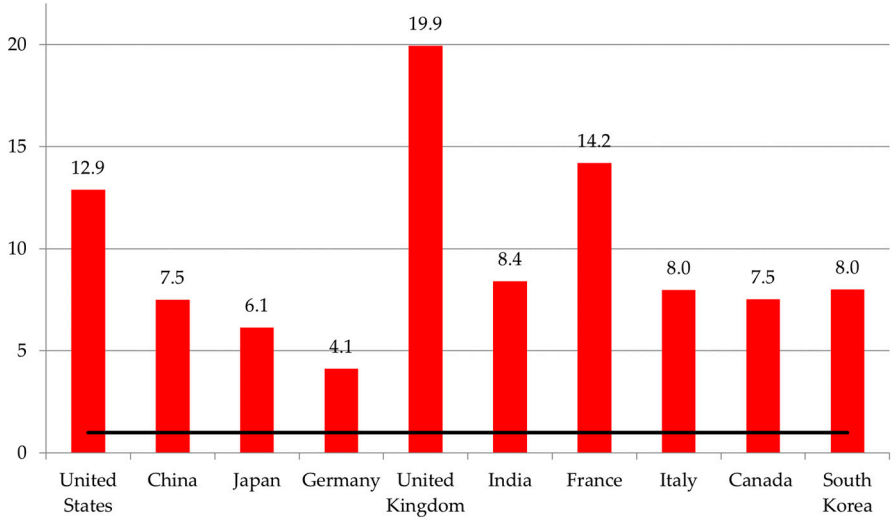


Figure 9. Relative magnitude of the GDP growth shocks for the top-10 world economies in 2020—border line presenting reference shock level (values above 1 indicate shocks).

4. Discussion

In general, world energy prices in the past several decades have been exhibiting a lot of variability. In certain periods, they were very volatile mainly to due to events influencing supply and demand relations and causing global energy price shocks. As it was already mentioned, since the Arab oil embargo in 1973 the world experienced a number of such shocks and the COVID-19 pandemic appeared to be the source of another one. Based on data series analysis of indices of world energy and food commodity prices, it can be determined that, as compared to 2010, energy prices, especially oil prices, plummeted during the base year after the outbreak of the COVID-19 pandemic. Food prices followed the same direction, however their plunge was not as extreme. This finding is confirmed by other research suggesting low levels of temporal variability of the agricultural sector during economic crises [17]. Nevertheless, in both energy and food commodity cases, our findings based on the Chow test results indicate presence of structural breaks which confirms our hypothesis about energy and food commodity price shocks causing the COVID-19 pandemic. This is similar to the impact on the S&P 500 and the S&P GSCI Agriculture and Livestock Indices as presented in the literature [18]. Also, interdependence characterizing formation of these prices, especially casual relationships, should be kept in mind to properly identify consequences of their volatility [19].

Rapid and sharp commodity price downturns and upturns are not only a source of measurable market risk for many individual businesses [20] but may also have devastating effects on the global economy. This is especially true in the case of energy and food commodities due to their great importance in production and consumption activities. Oil shocks connected with unexpected energy price upsurges are seen as a source of serious distortions in the stability of economic growth. Long lasting falls in economic activity in response to a supply-driven surge in oil prices are typical for oil importers [21]. Therefore, consequences of such shocks have historically more frequently attracted attention than energy price falls, which may lead to advantageous cost reductions improving overall economic performance. Although, as discussed e.g., by Baumeister et al. [22], when oil prices increase, the impact on economic growth may be very different across economies. They showed that whereas net oil and energy importers all face a permanent fall in economic activity following an adverse supply shock, the impact is insignificant or even positive for net energy exporters.

A decline in oil prices may also have wide-ranging implications for economic growth, e.g., significant real income shifts from oil exporters to oil importers, likely resulting in a net positive effect for global activity over the medium term [23]. The focus of our analysis

is the 2020 slump in the world energy and food commodity prices following the outbreak of the COVID-19 pandemic. Assuming such an event is exogenous to the energy and food sectors, to capture the transmission mechanism through which it affected formation of these prices, we adopted a macroeconomic approach. Referring to an old idea by Say that supply creates demand, and consistently with a very recent, theoretical study of macroeconomic implications of COVID-19 by Guerrieri et al. [9], labeling such a situation as "Keynesian supply shock", we looked at the impact of the COVID-19 pandemic on the world energy and food process through a combination of negative supply and demand shocks to the global economy. Our framework is also similar to that of Gelerman [24] who examined changes to the aggregate demand and supply relationship the United States economy experienced due to COVID-19. However, it is used to explain the economic growth shock transmission mechanism with reference to the impact on the global economy, including differences between their key sectors as well as the among the largest world economies.

World economic growth indicators for 2020 reached negative rates, except for the combined value added of agriculture, forestry, and fishing. A slowdown in the growth of this variable, instead of a sharp decline, suggest that those sectors in total appeared to be more resilient to negative effects of the COVID-19 pandemic than other parts of the global economy. This is in line with considerations about differences in sectoral origin of a shock to potential output and job losses resulting from outbreak of the pandemic [8,9]. Supply and demand shocks were transmitted across sectors of the global economy along with disruption of supply chains [9]. The manufacturing sector, specifically the electronics industry, are good examples of such developments negatively influencing global production [7]. Due to anti-COVID restrictions and limitations, significant job losses became inevitable in various industries, especially HoReCa and tourism. Therefore, the impact of the COVID-19 pandemic can be characterized as strongly heterogeneous and relatively more destructive for labor-intensive food systems [25]. In this context, considering the world energy and food energy price falls, our working hypothesis that, in case of the COVID-19 pandemic, the negative demand shock outweighed the negative supply shock, is supported.

Agriculture, forestry, and fishing appeared to be less vulnerable to the shocks caused by the pandemic because of their specificity mainly related to dispersed locations of production activities and their lower individual scales than in other sectors. Also, because of allocation of natural resource endowments, the level of self-sufficiency in food production and supply in national economies is not so differentiated as in case of energy commodities. Hence, the dependence on international food trade is, in addition, fairly restricted. This can be noticed when comparing country net trade positions in food and energy commodities. This also adds to explanation why disruptions of global supply chains were not as harmful for agriculture, forestry, and fishing as for other sectors. Somme's results [26] show that changes in trade remained limited to short-term disruptions that mostly occurred at the extensive margin of trade and, primarily, at the height of policy stringency, mobility reductions, and the overall reduction of economic output. The trade of staples was most resilient, while that of other agri-food products declined considerably. On the other hand, more capital- and knowledge-intensive food chains have greater possibilities to adopt innovative solutions to mitigate shock related disturbances [27]. However, strengthening resilience of the food sector still requires strategic reorganization of the food supply [28].

Noticeable differences in the magnitudes of growth shocks experienced by the TOP-10 world economies in 2020 can partly be explained by changes in the world energy and food commodity prices. This is because commodity prices determine economic growth. As argued in the literature, net commodity-importing economies are likely to benefit from a downturn in commodity prices thanks to higher disposable incomes, greater domestic demand, and faster economic growth [23,29]. This is consistent with our finding regarding negative correlations between the net trade positions in energy and food commodities of the TOP-10 world economies and their GDP growth rates in 2020. Simply put, lower energy and food commodity prices could moderate consequences for economic activity in

countries highly dependent on import of these commodities, which was mostly the case with the largest world economies.

All of these observations reinforce the importance of free trade in assuring stability of global growth. Unfortunately, the COVID-19 pandemic, a source of global supply and demand shocks distorting this growth, happened when the world had been already witnessing reluctance to global trade liberalization. Marginalization of the World Trade Organization (WTO) connected with the failure of the Doha Round, deadlock in negotiations, blockage of institutional reforms, and paralysis of the dispute settlement mechanisms led states to focus on regional and bilateral agreements. Moreover, concerns about jeopardizing recoveries from the COVID-19 pandemic recession magnified divergence from the WTO rules [30,31]. Arguments for multilateral cooperation and free trade as essential condition for a speedy recovery of the global economy [31] in the face of the current international political situation shaped by Russia's invasion of Ukraine and the tensions between the United States and China sound unrealistic, if not naive. If so, the only viable alternative to trade protectionism and ongoing distortions in the world energy and food commodity trading would be development of renewable sources of energy and domestic food production capacities [32]. Such tendencies are observed in many countries, especially in the European Union member states, where the share of renewable energy more than doubled between 2004 and 2021 from 9.6 to 21.8 [33]. An enormous potential to produce solar and wind energy as well as energy from biomass exists in rural areas, however appropriate policy actions are needed to utilize it to a greater extent and more effectively [32].

In 2021 after a collapse in 2020, the world GDP growth rate bounced back to 5.9% (Figure 6). In the same year, world energy and food commodity prices began to rise (Figure 5). This coincidence reinforces our reasoning about interdependence between changes in the levels of these prices and the pace of global economic growth. In a sense, they are two sides of the same coin, however, this issue deserves constant research attention due to dynamic changes in importance of factors determining economic growth and prosperity. Economic impact of global demand and supply shocks and related price shocks may be different across national economies with relative losers and winners. Therefore, the sources and outcomes of the observed economic growth distortions should be studied in the context of policy responses and building resilience to future shocks. An interesting research direction is development of renewable energy sources and their contribution to sustainable global economic growth. The largest world economies were also leading countries in installed renewable energy capacity in 2021 [34]. Especially worth exploring is whether an increased supply from renewable sources helps stabilize the world energy prices.

5. Conclusions

Economic and social consequences of the COVID-19 pandemic are numerous and broadly discussed from various perspectives. The combination of a negative supply shock and a negative demand shock (demand shortages) generated by the COVID-19 pandemic hampering global economic growth was not neutral to the world energy and food commodity prices. In fact, it triggered a drastic plunge in world energy commodity prices, followed by a decline in world food commodity prices. In the article we provided empirical evidence that the COVID-19 pandemic caused a visible short-term energy price shock of different origin compare to the past oil energy shocks. The shock was clearly associated with a negative impact on the global economic growth. This impact differed depending on the type of economic sector and countries' net export positions in energy and food trade, which highlights the potential role of free trade in mitigating consequences of such shocks.

Volatile energy and food prices are one of the major sources of the global economic growth instability. Theoretically, free trade still remains a good remedy for getting over this problem so, instead of marginalization the WTO role, actions to promote trade liberalization despite political obstacles and protectionism are very desirable. Trade protectionism policies imposed by some countries additionally damaged the global food supply chain instead of mitigating the effects of the virus [35]. However, in the face of little chance for

successful implementation of such scenario, the second-best alternative is to build countries' resilience to global energy and food price shocks based on efforts aimed at achieving high self-sufficiency. This, however, requires strategic redefinition of the food supply chain [28] with emphasis on the role of innovations [27]. Even if this is not the best solution to maximize global economic welfare, transformation of the worldwide energy sector toward widespread use of renewable energy sources might be vital for assuring stability of the energy prices and domestic food supply. Policymakers and investors should therefore focus more on specific oil-demand shocks, as they contribute most to possible contagion effects between oil and food markets [36]. Global markets can be seen as helpful in mitigating asymmetric shocks on different commodity markets [37]. Our contribution indicating linkages between the world energy commodity prices and food commodity under the supply and demand shock engendered by the COVID-19 pandemic entails that stability of the former is important for the stability of the latter, thus, for world food security.

Author Contributions: Conceptualization, S.F.; Methodology, S.F.; Formal analysis, S.F., Z.F. and M.W.; Writing—original draft, S.F., Z.F. and M.W.; Writing—review & editing, Z.F. All authors have read and agreed to the published version of the manuscript.

Funding: This research was funded by the Institute of Agricultural and Food Economics—National Research Institute, Warsaw, Poland.

Data Availability Statement: Data sharing not applicable.

Conflicts of Interest: The authors declare no conflict of interest.

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