

NEW ECONOMY Section

AN EVALUATION OF THE ECONOMIC IMPACT OF COVID-19 ON THE MEDIUM-TECHNOLOGY MANUFACTURING INDUSTRY IN ROMANIA

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***Abstract.** The COVID-19 pandemic delivered one of the strongest blows to the Romanian economy in the last 25 years. The global value chain disruptions correlated with the significant increase in commodity prices, and volatile consumption affected the manufacturing industry. In this context, this paper analyzes the dynamics of production and employment in the medium-technology activities specific to the Romanian manufacturing industry and compares the dynamics in Romania with the main economies in the region and the EU average. The impact of the COVID-19 shock is also captured through an autoregressive vector model. The results indicate that the medium-technology activities reacted non-homogenously to the COVID-19 shock. Activities such as the Automotive industry, which were influenced to a larger extent by the mobility restrictions, experienced a strong output contraction, while activities such as the Manufacture of chemicals and chemical products were less affected.*

***Keywords:** manufacturing industry, medium-technology activities, exogenous shock, VAR model, impulse response function.*

1. Introduction

The COVID-19 crisis dealt a heavy blow to the manufacturing industry and to the economy in general. Industry was affected by a constellation of factors, including the impact of global value chain disruptions, sharp increases in commodity prices, increased volatility of domestic and foreign demand. The pandemic accelerated some of the global tendencies as the reallocation of economic activity to more productive companies. More productive firms prior to the COVID-19 crisis saw significantly smaller declines in sales and employment compared to

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less productive firms (Bruhn et al. 2021). Medium-technology activities are the most representative of the Romanian manufacturing industries both in terms of output and employment and are subject to significant technological changes.

The paper analyzes the impact of the COVID-19 crisis on medium-technology activities specific to the manufacturing industry. The analysis uses quarterly data for 2020 and 2021, data on production, and employment. The economic shock induced by COVID-19 revealed and accentuated several trends prior to the health crisis. In this context, the present analysis facilitates the identification of the current trends in the analyzed activities of the manufacturing industry.

The paper estimates a vector autoregression model that groups the specific activities of the medium-technology manufacturing industry and generates impulse response functions to estimate the shape and magnitude of the shock induced by COVID-19 on the production of the medium-technology manufacturing industry.

2. Methodology

Autoregressive models are ideal for analyzing the impact of the COVID-19 pandemic as they are frequently used in the econometric analysis of economic shocks, including the impact of COVID-19 (Sims 1980, Hamilton 1994, Bobeica and Hartwig 2021).

Vector autoregression models (VARs) are statistical models that facilitate the analysis of the relations between economic variables without a priori assumptions about the causal relations between these variables. Mathematically, the model is described below:

$$y_t = c + A_1 y_{t-1} + A_2 y_{t-2} + \dots + A_p y_{t-p} + e_t, \quad (1)$$

Where Y is a vector of the analyzed variables, t is the number of lags used, e is a vector of errors of mean 0 and finite variation.

VAR models capture the structural relations in the economy and doesn't impose assumptions about the causal structure of the investigated data. The impact is usually summarized using the impulse response function.

The paper estimates a vector autoregression model that groups the specific activities of the medium-technology manufacturing industry and generates impulse response functions to estimate the shape and magnitude of the shock induced by the COVID-19 pandemic on output.

3. COVID-19 impact on medium-technology activities from the perspective of output and employment

The shock induced by COVID-19 was stronger than the one caused by the great financial crisis of 2009, as the Romanian economy contracted by 10.1% in the second quarter of 2020. This is the highest quarterly contraction since 1995. The sanitary restrictions have severely affected the services sector, which contracted by 13.4% in the second quarter of 2020. The hotel and restaurant business recorded a contraction of 65.2%. Against the background of the reduction of international trade and the shock induced on the global value chains, the industrial production contracted by 19.1% in the same analyzed period. The manufacturing industry was more strongly affected by the above-mentioned factors, contracting by 29.1% in the second quarter of 2020. In what follows will analyze the impact of COVID-19 on the medium-technology activities of the manufacturing industry, highlighting the main specificities in terms of production and employment.

Manufacture of chemicals and chemical products

Production in the Manufacture of chemicals and chemical products benefited from the central role it plays in the industrial value chains. The chemical industry transforms raw materials into several tens of thousands of different products specific to industrial activities, constructions and services. These products have a wide range of uses in the food industry, health, consumer goods construction, agriculture and transport. Products in the chemical sector include surfactants, pigments, synthetic rubber, polymers, fertilizers and battery materials, to name just a few of these products. The intensification of the transition to a green economy has led energy and chemical companies to explore decarbonization technologies. These trends may represent an opportunity for the chemical industry. Examples of emerging opportunities in the chemical industry are insulation materials for buildings and to protect electrical infrastructure from increasing fire risks, materials that enable energy storage, bio or recyclable materials. The strategic role that the chemical industry plays as well as the intensification of the transition to the green economy contributed to the production of the chemical industry, helping the industry to be less affected by COVID-19 both in Romania and in the main states in the region (see Figure 1). The chemical industry recorded a contraction of 5.2% in the 2nd quarter of 2020 compared to 29.1% recorded in the case of the manufacturing industry (see Figure 2).

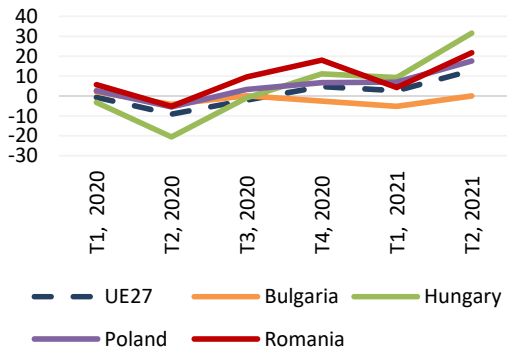


Figure 1. COVID-19 impact on the output of the Manufacture of chemicals and chemical products (% y-o-y).

Source: Eurostat

Note: Index calculated using chain linked volumes 2015 prices

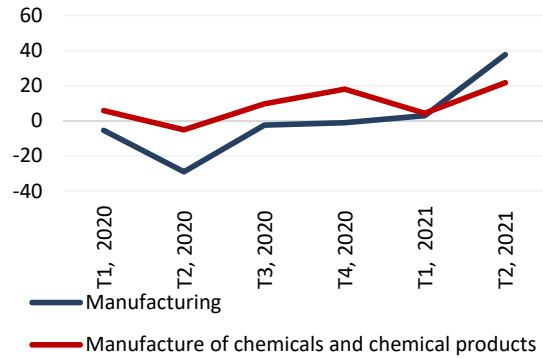


Figure 2. COVID-19 impact on the output of Manufacturing vs Manufacture of chemicals and chemical products (% y-o-y).

Employment in the Manufacture of chemicals and chemical products registered a slightly downward trend from the 3rd and 4th quarter of 2020 amid increasing pressures on global supply chains. However, the employment contraction at the activity level was more reduced compared to the manufacturing industry as a whole (see Figure 4).

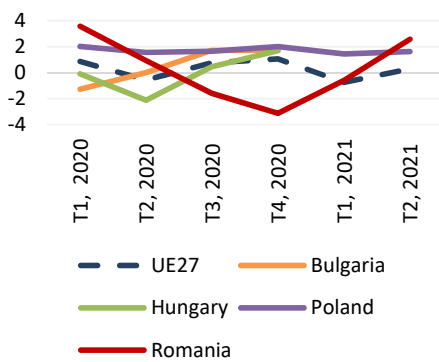


Figure 3. COVID-19 impact on the employment of the Manufacture of chemicals and chemical products (% y-o-y)

Source: Eurostat

Note: Index calculated using chain linked volumes 2015 prices

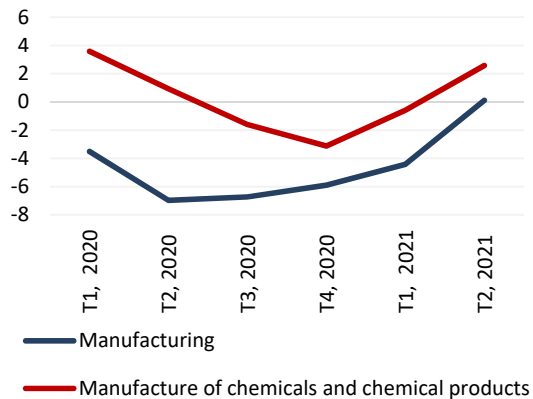


Figure 4. COVID-19 impact on the employment of Manufacturing vs Manufacture of chemicals and chemical products (% y-o-y)

Manufacture of machinery and equipment n.e.c.

Manufacture of machinery and equipment n.e.c. is one of the activities most affected by economic cycles. The activity is highly dependent on the import of intermediate products from Asia, in particular, China. Due to lower demand, especially in 2020, and the economic uncertainty, many companies have postponed purchases of new machinery or canceled existing orders. The Mechanical Engineering Industry Association, the largest organization of its kind in Europe, reported that 49% of companies in the field of Manufacture of machinery and equipment n.e.c. surveyed in mid-March 2020 reported a strong or very strong decrease in demand. By mid-April 2020, this number had increased to 77%, and 89% of respondents were experiencing the negative effects of COVID-19 (McKinsey 2021). This setback is noticeable in the dynamics of production in 2020. In this sense, production contracted by 37.1% in the 2nd quarter of 2020 in Romania. High output contractions were also registered in the main countries in the region (see Figure 5).

The economic revival in 2021 led to an increase in demand in the Manufacture of machinery and equipment n.e.c.. In this sense, a spectacular increase in production at the activity level of 59%, in the 2nd quarter of 2021 can be observed. Spectacular increases were also recorded in the main countries in the region as well as in the case of the EU average (see Figure 5). However, companies' revenues have been affected by the COVID-19-induced crisis, which is likely to lead to the postponement of major investments in machinery. This could slow down the return of production to the level prior to COVID-19.

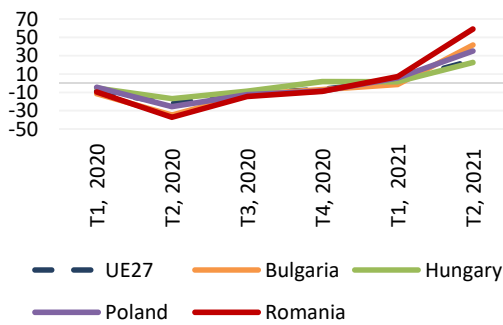


Figure 5. COVID-19 impact on the output of the Manufacture of machinery and equipment n.e.c. (% y-o-y)

Source: Eurostat

Note: Index calculated using chain linked volumes 2015 prices

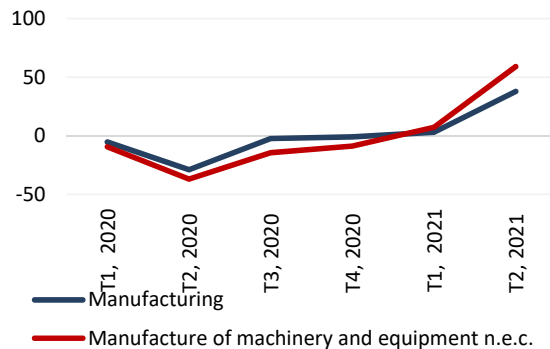


Figure 6. COVID-19 impact on the output of Manufacturing vs Manufacture of machinery and equipment n.e.c. (% y-o-y)

Employment dynamics in the Manufacture of machinery and equipment n.e.c.. reflected the contraction in production in the first half of 2020. In the 2nd quarter of 2020, employment at the activity level contracted by 9.9%. The return of output to levels close to those before the COVID-19 crisis has not led to an equivalent return of employment (see Figure 8).

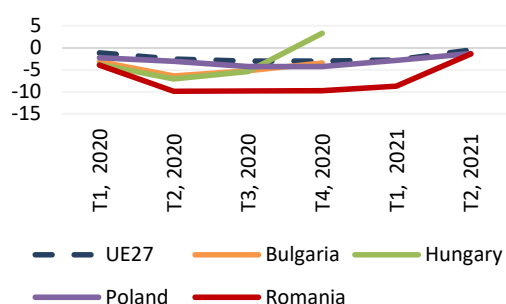


Figure 7. COVID-19 impact on the employment of the Manufacture of machinery and equipment n.e.c.(%,y-o-y)

Source: Eurostat

Note: Index calculated using chain linked volumes 2015 prices

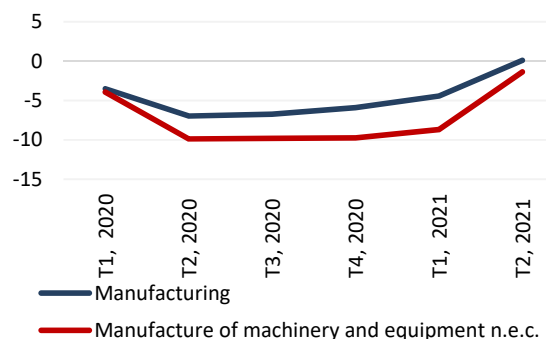


Figure 8. COVID-19 impact on the employment of Manufacturing vs Manufacture of machinery and equipment n.e.c.(%, y-o-y)

Manufacture of motor vehicles, trailers, semi-trailers and of other transport equipment

The automotive industry was strongly affected by the pandemic due to the high degree of integration of the analyzed industry globally. Affected exports from China, large-scale production disruptions in Europe, and the closing of assembly plants in the United States weighed on production globally, particularly in 2020. Production contracted by 51.8% in Q2 2020 in Romania. This is the highest contraction recorded in the manufacturing industry. In comparison, the 2nd place is occupied by the Manufacture of machinery and equipment n.e.c.with a contraction of 37.1% in the same analyzed quarter. Strong output contraction in the automotive industry was also registered for the main countries in the region, illustrating the significant degree of global integration of production (see Figure 9).

Demand recovered in 2021, supporting the recovery of production. However, if we compare the dynamics of the automotive industry with that of the Manufacture of machinery and equipment n.e.c. (compare Figures 5 and 9) we can see that the recovery in production is more restrained in the

case of the automotive industry. This reflects the significant pressures on supply chains in 2021, particularly from the microchip crisis. The recovery of the automotive industry is strategic for the manufacturing industry and the economy. In this regard, an OECD study (2021) indicates that a decline in demand for cars will have a major negative impact on overall economic activity. OECD estimates based on value-added multipliers suggest that a drop in demand for cars by €10 million will reduce production by €16 million and value added by €4 million in the case of Central and Eastern European countries.

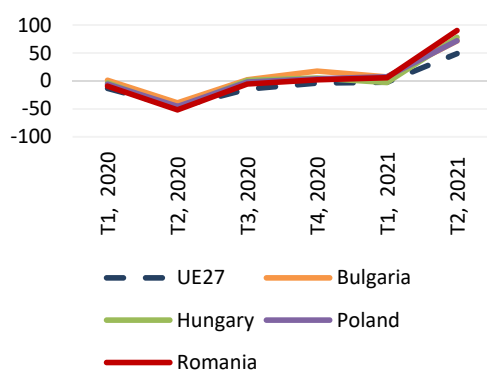


Figure 9. COVID-19 impact on the output of the Manufacture of motor vehicles, trailers, semi-trailers and of other transport equipment (% y-o-y)

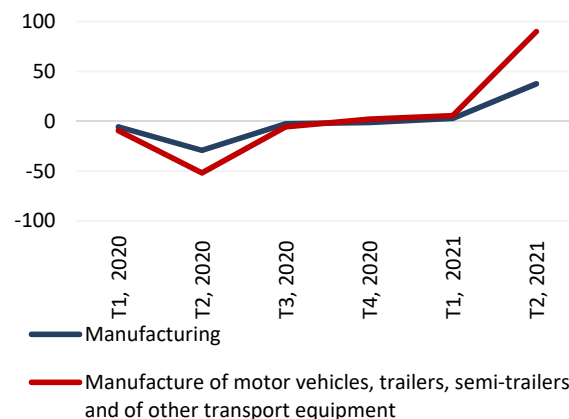


Figure 10. COVID-19 impact on the output of Manufacturing vs. Manufacture of motor vehicles, trailers, semi-trailers and of other transport equipment (% y-o-y)

Source: Eurostat

Note: Index calculated using chain linked volumes 2015 prices

Manufacture of coke and refined petroleum products

The demand for oil and oil products decreased significantly in 2020 as a result of the global economic contraction. Falling demand coupled with an unexpected increase in global supply led to a collapse in the price of crude oil and a subsequent reduction in the price of refined petroleum products and other downstream products, particularly gasoline. In April 2020, OPEC increased production by 1.7 million barrels per day to 30.4 million barrels per day, the largest increase in production in 30 years. This significant increase in production coincided with global oil demand falling by nearly 30 million barrels per day due to the slowdown or shutdown of some production activities in response to the COVID-19 pandemic. The combination of lower demand, increased supply and

reduced storage caused a pronounced drop in the price of crude oil, so that on April 20, 2020, crude oil traded at a negative price on the intraday futures market. The production price of crude oil decreased by 34.0 percent in March and by 48.8 percent in April 2020. The impact of the reduction in economic activity, as well as the decrease in the price of crude oil in 2020, was reflected in the contraction of production in Romania, in particular, in the 2nd quarter of 2020, a period which registered a contraction of 24.6% (see Figure 11).

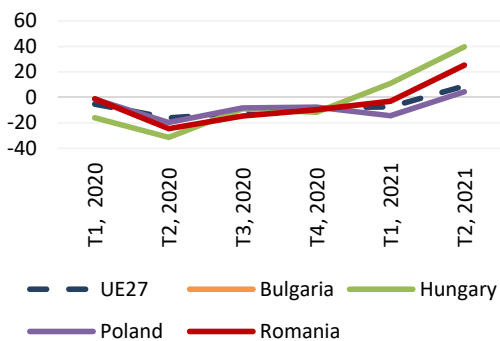


Figure 11. COVID-19 impact on the output of the Manufacture of coke and refined petroleum products (% y-o-y)

Source: Eurostat

Note: Index calculated using chain linked volumes 2015 prices

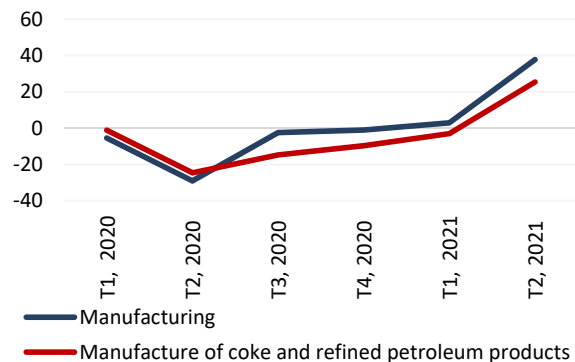


Figure 12. COVID-19 impact on the output of Manufacturing vs Manufacture of coke and refined petroleum products (% y-o-y)

The recent increases in energy prices as well as the economic recovery in 2021 boosted activity-level production which rose 25.3% in Q2 2021. Globally, in 2021, oil refiners increased production to cope with increased synchronized demand in Asia, Europe, and the United States. The coal and natural gas crisis in Europe and Asia, which forced some power generators to burn kerosene, diesel, or fuel oil, also supported global oil prices. These factors will help to maintain the increased dynamics of production at the level of activity in the short and medium term.

Employment at the activity level reflects the contraction of production in 2020. It can be seen that the impact of the contraction of production at the branch level, in 2020, on employment was comparatively higher than the impact on employment in the manufacturing industry as a whole.

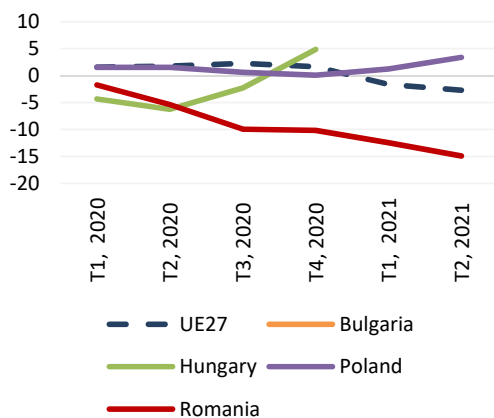


Figure 13. COVID-19 impact on the employment of the Manufacture of coke and refined petroleum products (% y-o-y).

Source: Eurostat

Note: Index calculated using chain linked volumes 2015 prices

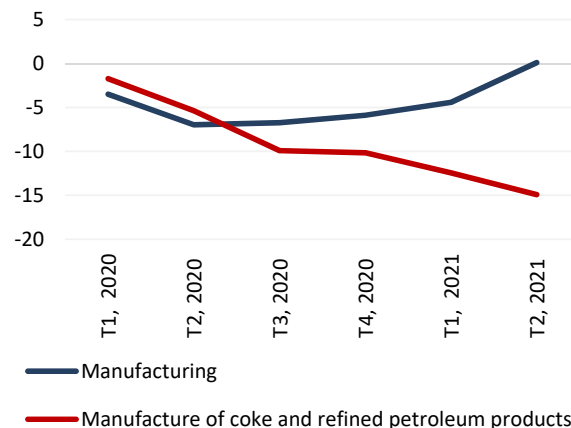


Figure 14. COVID-19 impact on the employment of Manufacturing vs Manufacture of coke and refined petroleum products (% y-o-y).

Manufacture of rubber and plastic products and other non-metallic mineral products

The shock induced by COVID-19 had a significant impact on the activity Manufacture of rubber and plastic products and other non-metallic mineral products, causing interruptions in production activities. Supply chains have been affected, with many manufacturers of rubber and plastic products facing shortages of raw materials. Manufacturers have begun to reorient to local supplier networks, diversifying the risks associated with supply chains. The challenges faced by the analyzed activity were reflected in the contraction of production by 21.6% in the 2nd quarter of 2020 in Romania. Significant contractions were also recorded in other countries in the region (see Figure 15).

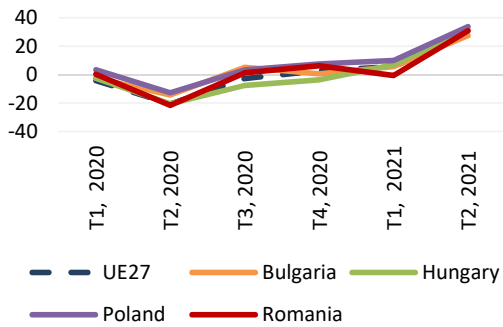


Figure 15. COVID-19 impact on the output of the Manufacture of rubber and plastic products and other non-metallic mineral products (% y-o-y).

Source: Eurostat

Note: Index calculated using chain linked volumes 2015 prices

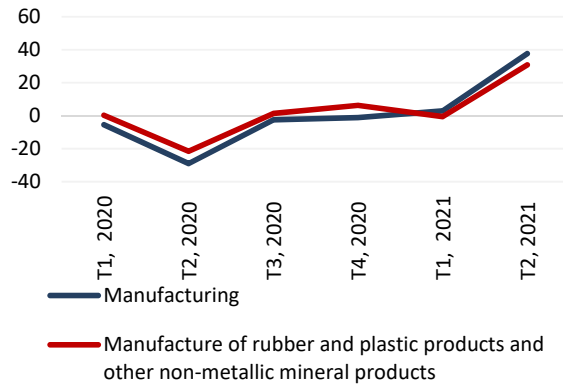


Figure 16. COVID-19 impact on the output of Manufacturing vs Manufacture of rubber and plastic products and other non-metallic mineral products (% y-o-y).

The speed of the transition to the green economy is impacting the analyzed activity, which will have to adapt its production technologies and marketed products. Rubber and plastics will have to be produced in an ecological way, and materials will have to be recyclable and integrated into a circular economy.

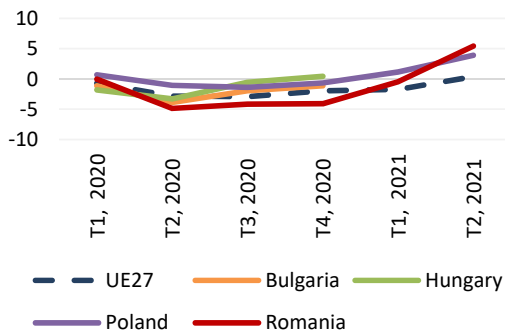


Figure 17. COVID-19 impact on the employment of the Manufacture of rubber and plastic products and other non-metallic mineral products (% y-o-y)

Source: Eurostat

Note: Index calculated using chain linked volumes 2015 prices

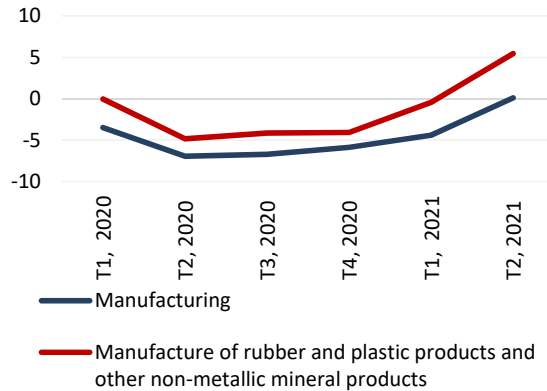


Figure 18. COVID-19 impact on the employment of Manufacturing vs Manufacture of rubber and plastic products and other non-metallic mineral products (% y-o-y)

Employment at the activity level contracted by 4.9% in the 2nd quarter of 2020 in Romania, more than other countries in the region, and recovered strongly in 2021 (see Figure 17). The contraction in employment was smaller compared to the contraction in manufacturing as a whole (see Figure 18).

Manufacture of basic metals and fabricated metal products, except machinery and equipment

Manufacture of basic metals and fabricated metal products, except machinery and equipment was strongly affected by the shock induced by COVID-19. China produces approximately 20% of the intermediate products specific to the analyzed activity. Intermediate products from China are a critical element of the global value chain in the production of metals and metal products. In this context, the initial shock of COVID-19 led to a strong contraction of the production at the EU level, and also in Romania. Production contracted by 20.1% in the 2nd quarter of 2020 in the case of Romania. Subsequently, production at the activity level recovered, especially in 2021. The positive dynamics of demand led to an output recovery, in particular, in 2021. In this sense, the production of the analyzed activity increased by 25.7% in the 2nd quarter of 2021 (see Figure 20).

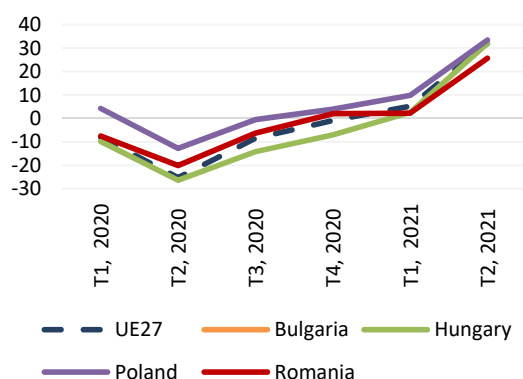


Figure 19. COVID-19 impact on the output of the Manufacture of basic metals and fabricated metal products, except machinery and equipment (% y-o-y)

Source: Eurostat

Note: Index calculated using chain linked volumes 2015 prices

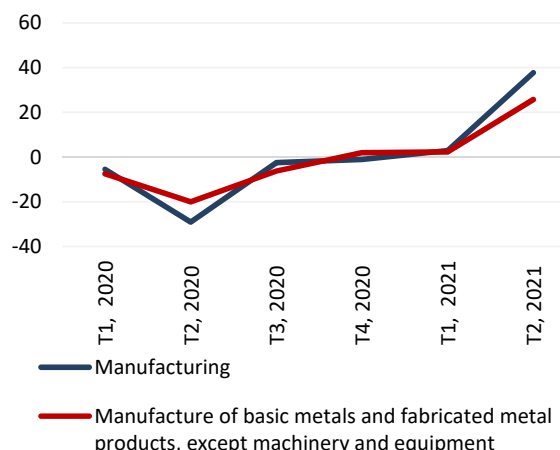
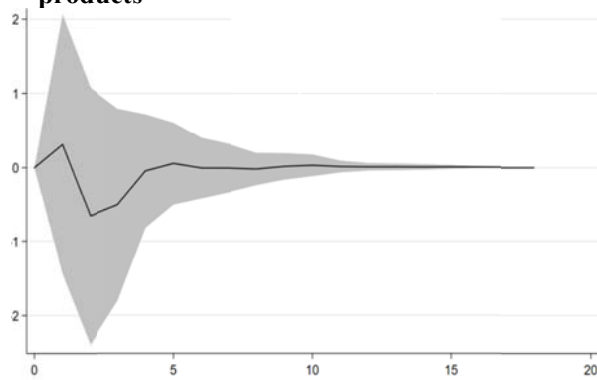


Figure 20. COVID-19 impact on the output of Manufacturing vs Manufacture of basic metals and fabricated metal products, except machinery and equipment (% y-o-y)

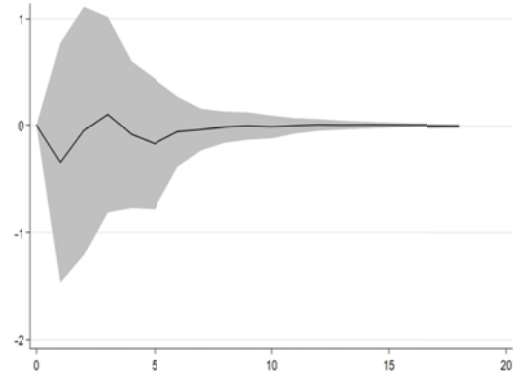
4. Econometric analysis of the impact of the COVID-19 shock on medium-technology activities

Medium-technology activities were significantly affected by the shock induced by COVID-19, in particular the Manufacture of motor vehicles, trailers, semi-trailers and of other transport equipment and the Manufacture of machinery and equipment n.e.c. The impact on the aforementioned activities was higher in 2020, reflecting the significant contraction of demand in the context of health restrictions that affected mobility. It can be seen that the impact is absorbed in about six periods and the statistical confidence interval narrows. This result is consistent with the economic revival in 2021, which led to an increase in demand in the activity of Manufacture of motor vehicles, trailers, semi-trailers and of other transport equipment and Manufacture of machinery, machinery and equipment n.e.c.

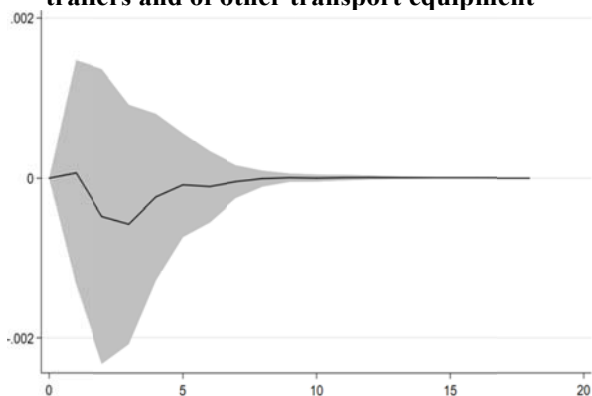
a. Manufacture of chemicals and chemical products



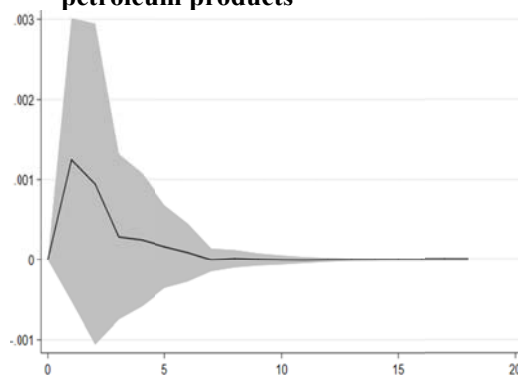
b. Manufacture of machinery and equipment n.e.c.



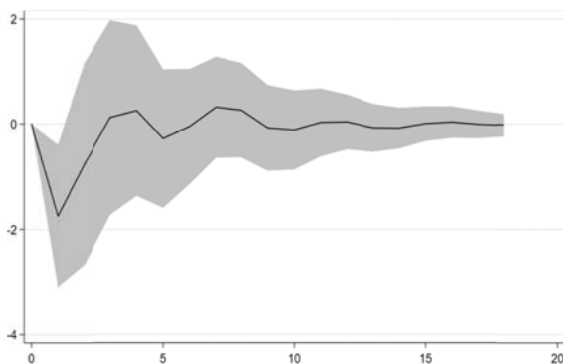
c. Manufacture of motor vehicles, trailers, semi-trailers and of other transport equipment



d. Manufacture of coke and refined petroleum products



e. Manufacture of rubber and plastic products and other non-metallic mineral products



f. Manufacture of basic metals and fabricated metal products, except machinery and equipment



Figure 21. The response of medium-technology activities to a shock to manufacturing.

Source: Author's calculations using STATA 15

Legend: The shock response function measures the impact of a shock equal to one standard deviation of the residuals of the manufacturing industry-specific regression equation. The shock response is followed for 18 periods equivalent to 18 months.

The response of Manufacture of coke and refined petroleum products to a shock in the manufacturing industry is positive, but the statistical confidence interval is high in the first periods and includes the value 0. This indicates the reduced statistical confidence in the positive response of the analyzed activity. The result is consistent with the increased volatility recorded in the analyzed activity, reflecting the high volatility of energy prices.

5. Conclusions

Medium-technology activities specific to the manufacturing industry reacted non-homogenously to the economic shock induced by the COVID-19 pandemic. Activities like the Manufacturing of substances and chemical products contracted less as the activity benefited from the central role it plays in the industrial value chains. Activities that are more affected by the business cycle and are more vulnerable to the mobility restriction as the Manufacture of motor vehicles, trailers, semi-trailers and of other transport equipment and the Manufacture of machinery and equipment n.e.c. were affected more.

The econometric analysis of the manufacturing industry's response to the economic shock induced by the COVID-19 pandemic illustrates that, on average, medium-technology manufacturing activities were significantly affected by the COVID-19 shock, especially in 2020, reflecting the significant contraction of demand in the context of health restrictions that affected mobility. Most of the impact of the COVID-19 shock was absorbed in about six periods, and the statistical confidence interval narrowed. This result is consistent with the economic revival in 2021.

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