

NEW ECONOMY Section

DO STRUCTURAL AND TECHNOLOGICAL CHANGES CORRELATE IN THE CASE OF THE ROMANIAN MANUFACTURING INDUSTRY?

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Abstract. *The highly competitive and integrated world economy is increasingly relying on complex production and distribution processes as well as constant and rapid product innovation. The manufacturing sector is one of the sectors at the forefront of this technological shift. The development of new technologies leads to increased productivity and stronger growth but simultaneously acts as an economic shock leading to structural changes. In this context, the present paper aims at investigating the relationship between structural changes and technological intensity of the Romanian manufacturing subsectors and analysis the impact of new technologies on two key variables: employment and gross value-added. The results point to the high impact of technological changes on employment, while gross value-added was more affected by the reallocation of resources to more efficient sectors.*

Keywords: *structural changes, manufacturing industry, Schwarz test, employment, gross value-added*

1. Introduction

The manufacturing sector remains one of the main engines of growth and a key sector in promoting product and process innovations. The highly competitive and integrated world economy is increasingly relaying on complex production and distribution processes as well as constant and rapid product innovation. In this context, the quality of the workforce and the capacity of the industries to innovate are critical for their survivor.

The Romanian economy is increasingly integrated in the EU economy and in the EU and global value chains. This is an important ingredient in promoting growth but at the same time is a challenge which

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incentivize the Romanian firms to become more competitive and optimize their internal processes, including production and distribution.

Recent studies have documented the impact of the new technologies on the manufacturing sectors (see Cimini et al. 2019, Anderson 2016, Brettel et al. 2014) highlighting the critical role of innovation to their economic success. These new technologies act as a technological shock that can generate structural changes to the economy. In this context, the present paper aims at investigating the relation between structural changes and technological intensity of the Romanian manufacturing subsectors.

2. Structural characteristics of the Romanian manufacturing subsector grouped by technological intensity

The subsectors of the manufacturing industry were grouped into three categories according to their specific technological intensity (Eurostat 2018). The grouping of activities took into account the level of technological intensity in the manufacturing subsectors and high technology patents, as well as biotech patents. High-tech products have been grouped on the basis of the International Classification of International Trade (SITC). Patents have been grouped on the basis of the International Patent Classification (IPC). The statistical data was available at the aggregate level of manufacturing activities, but not at available for each technology. This did not allow to analyze the disaggregated impact at the level of technology, but only at the level of technological groups according to their characteristics.

The evolution of the manufacturing industry subsectors in term of technological intensity reflects the role that technology played in impacting employment and gross value added.

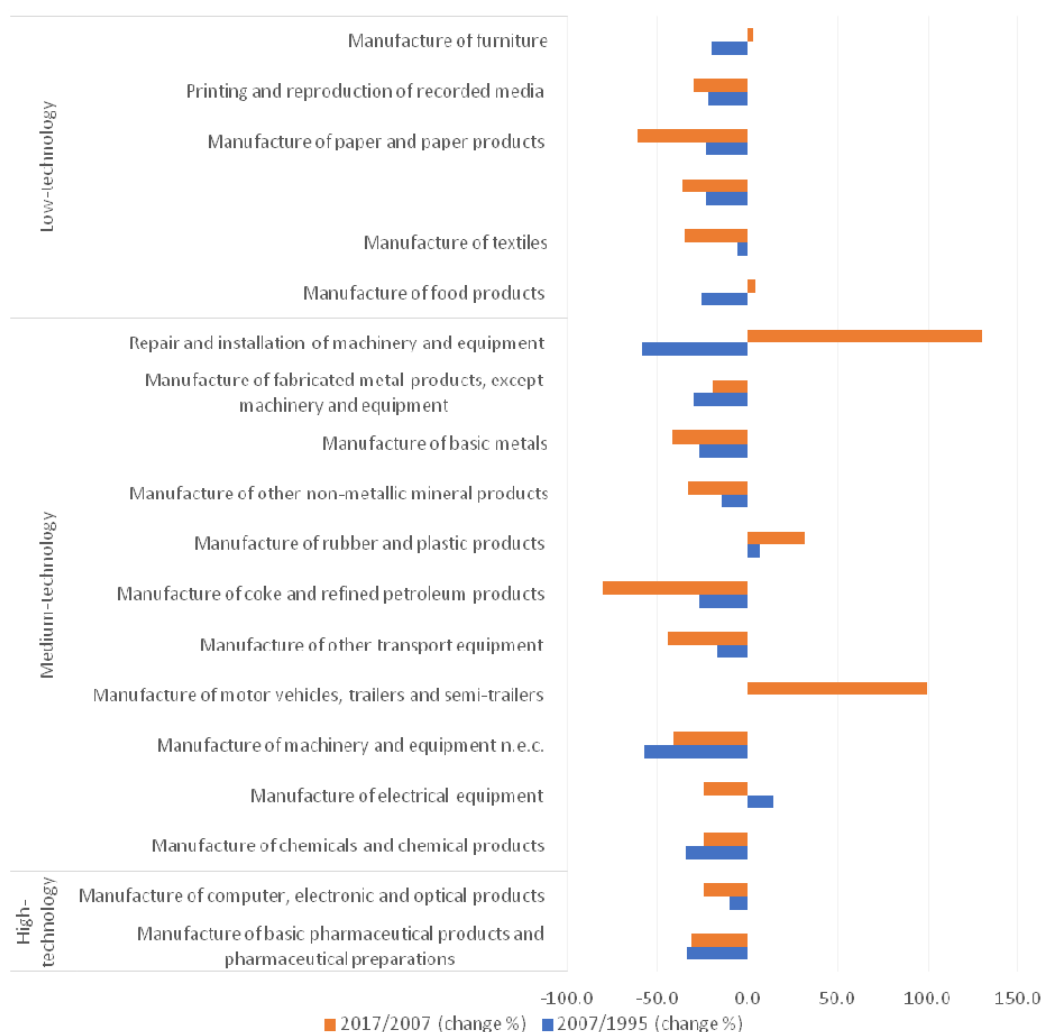


Figure 1. Employment dynamics in the Romanian manufacturing subsectors grouped by technological intensity.

Source: Own calculations based on Eurostat data

Note: 2017 is the last year with available data for this level of sectoral disaggregation based on the July 2020 update from Eurostat

Employment in the high-tech manufacturing subsectors is declining both for the pre-accession period 1995-2007 and in the post-accession period. This phenomenon reflects multiple causes. First, it reflects the impact of the contraction in production in these activities as a result of the transition to a market economy. Secondly, it reflects the loss of highly qualified labor force in Romania. In this sense, Romania ranks last, among the EU28 states, in terms of the working age population with higher

education. The share of this population in total, as of 2019, was 16% in Romania compared to the EU28 average at 29.5%. The evolution of employment in the medium technology manufacturing subsectors reflects their increase specialization. Figure 1 illustrates the significant increases in employment in Repair, maintenance and installation of machinery and equipment, Manufacture of road transport vehicles, trailers and semi-trailers and Manufacture of rubber and plastics products.

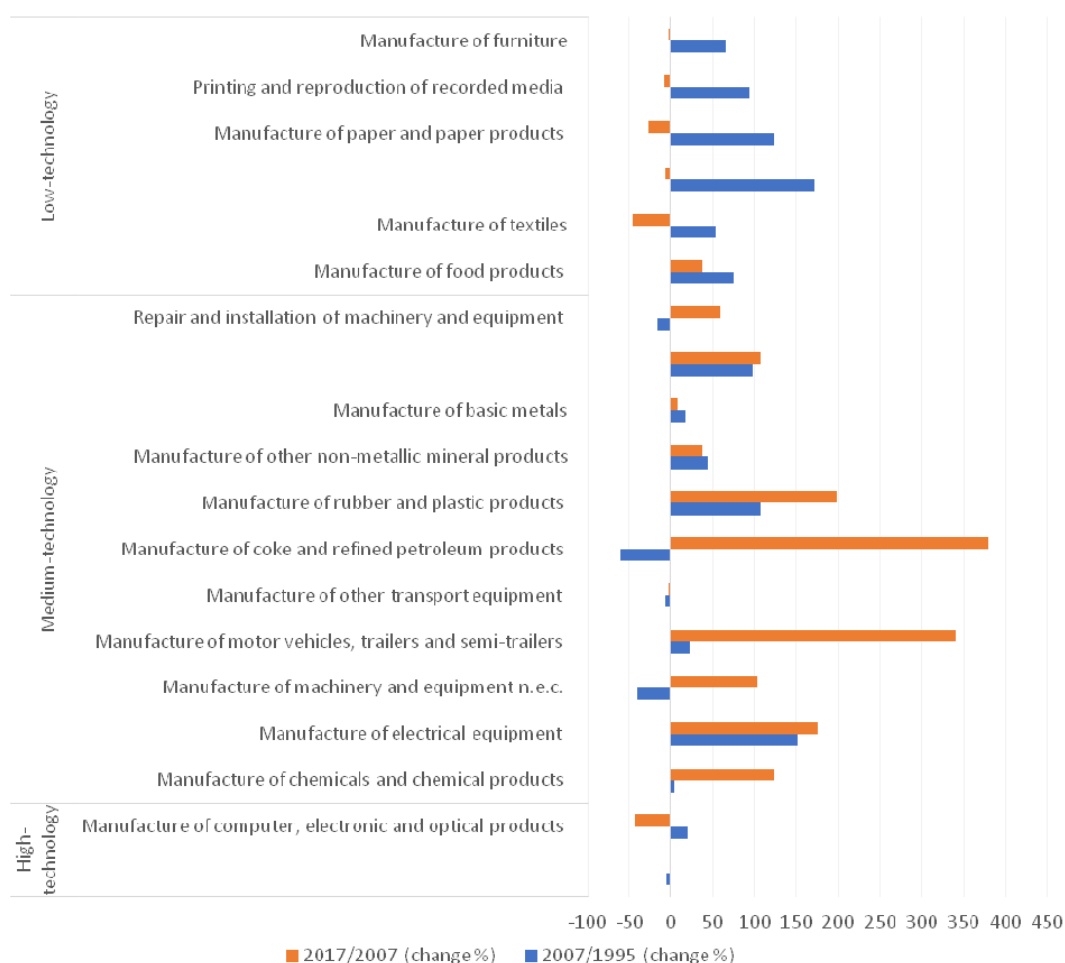


Figure 2. Gross value added dynamics in the Romanian manufacturing subsectors grouped by technological intensity.

Source: Own calculations based on Eurostat data.

Note: 2017 is the last year with available data for this level of sectoral disaggregation based on the July 2020 update from Eurostat

The low-tech manufacturing subsectors' employment dynamics reflect the effect of the labor restructuring process and the closure of important productive units. Negative dynamics are observed, in particular, in the case of the Manufacture of paper and paper products and Manufacture of textiles (see Figure 1). In this respect, it is worth mentioning the closure of Letea Bacău, the largest paper mill in Eastern Europe. In the textile industry, out of the 820 active textile factories before '89, less than 40 still operate today.

The manufacturing subsectors which register a positive dynamics in terms of gross added value are mainly in the category of medium technology. It can be seen the partial correlation between the dynamics of employment and that of gross value added. The activities for which there is a positive correlation are represented by the Manufacture of motor vehicles, trailers and semi-trailers, and Manufacture of rubber and plastic products. There is also a strong positive dynamics of gross value added at the level of Manufacture of coke and refined petroleum products. However, the positive evolution did not generate enough jobs at the subsector level, as the evolution of employment was negative in both analyzed periods 1995-2007, respectively 2007-2017.

3. The relation between structural changes and technological intensity of the Romanian manufacturing subsectors

The high impact of new technologies on employment and gross value added suggests the usefulness of statistically testing for the presence of structural changes in the subsectors of the manufacturing industry grouped according to their technological intensity.

The Schwarz test for identifying the multiple structural breaks in time series was applied in the case of gross value added and employment for the 19 subsectors analyzed in the paper. The methodology proposed by Schwarz (1978) allows the identification of structural changes when neither their number nor their position are known and the relationship between variables is not linear. This gives flexibility, not limiting the testing to a set of predefined economic events or a linear relationship between variables.

Tabel 1.
Structural breaks identification in the case of the Manufacturing industry subsectors

Subsector	Structural breaks (Schwarz test)*			
	Gross value added at the subsector level		Employment at the subsector level	
	Number of structural breaks	Years	Number of structural breaks	Years
High-technology				
Manufacture of basic pharmaceutical products and pharmaceutical preparations	2	2006, 2010	4	1999, 2005, 2009, 2013
Manufacture of computer, electronic and optical products	3	2004, 2008, 2012	4	1998, 2004, 2008, 2011
Medium-technology				
Manufacture of chemicals and chemical products	3	2001, 2012, 2015	3	1999, 2005, 2008
Manufacture of electrical equipment	2	2005, 2010	5	1998, 2003, 2006, 2009, 2015
Manufacture of machinery and equipment n.e.c.	3	1998, 2008, 2014	5	1998, 2001, 2004, 2007, 2010
Manufacture of motor vehicles, trailers and semi-trailers	2	2008, 2015	4	1998, 2004, 2008, 2011, 2014
Manufacture of other transport equipment	3	1998, 2007, 2012	2	1998, 2008
Manufacture of coke and refined petroleum products	2	2007, 2014	5	1998, 2002, 2005, 2008, 2011
Manufacture of rubber and plastic products	2	2004, 2013	3	1998, 2004, 2015
Manufacture of other non-metallic mineral products	4	2006, 2009, 2012, 2015	2	1999, 2009
Manufacture of basic metals	2	2010, 2013	4	1998, 2005, 2011, 2014
Manufacture of fabricated metal products, except	3	2006, 2012, 2015	4	1998, 2004, 2010, 2015

machinery and equipment				
Repair and installation of machinery and equipment	2	1998, 2009	3	1998, 2004, 2008
Low-technology				
Manufacture of food products	3	2001, 2004, 2008	1	1999
Manufacture of textiles	3	2001, 2009, 2014	5	1999, 2002, 2006, 2009, 2015
Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials	4	2001, 2004, 2009, 2014	2	2000, 2009
Manufacture of paper and paper products	3	2002, 2007, 2010	4	1998, 2002, 2006, 2010
Printing and reproduction of recorded media	4	2000, 2004, 2008, 2012	4	1998, 2002, 2006, 2010
Manufacture of furniture	4	2003, 2006, 2010, 2013	3	1998, 2004, 2009

Source: Own calculations using E-views 9

Note: *Statistical significant at the 0.05 threshold. The statistical results of the Schwarz test will be provided on request.

The results of the Schwarz test are consistent with the impact of the technological changes on employment. The highest number of identified structural breaks in employment was recorded for high-tech industries, followed by those with medium technologies. Most of the structural changes were recorded for the following subsectors: Manufacture of machinery and equipment n.e.c., Manufacture of electrical equipment, Manufacture of coke and refined petroleum products, Manufacture of basic pharmaceutical products and pharmaceutical preparations and Manufacture of computer, electronic and optical products. Extensive structural changes have also been registered in the case of Manufacture of textiles highlighting the role played by labor in the process of restructuring of the manufacturing industry.

In the case of gross value added, the most frequent structural changes were recorded for the low-technology subsectors, indicating the high

impact of the restructuring process. The highest number of structural changes were recorded in the case of: Manufacture of furniture, Printing and reproduction of recorded media, Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials and Manufacture of other non-metallic mineral products. All activities experienced a significant increase of over 60% in gross value added in 2017 compared to 1995.

4. Conclusions

The analysis of the relationship between structural changes and technological intensity of the Romanian manufacturing subsectors point to several conclusions.

Firstly, the highest number of identified structural breaks in employment was recorded for high-tech industries indicating the high impact of the new technologies on employment especially for low and medium skilled employees.

Secondly, the highest number of identified structural breaks in gross value-added was recorded in the case of low-technology subsectors suggesting that the dynamics of gross value-added were more affected by the reallocation of resources to more efficient sectors.

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