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The High-Tech Exports of Romania
during the Period 2013-2020.
An Analysis of Their Evolution and Structure

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Abstract

The aim of this paper is a multiparameter analysis of the evolution and structure of Romanian high-tech exports compared to other member countries of the European Union and some emerging countries having a higher share of high-tech commodities in their exports. In the current paper, the authors propose a phenomenological research trying to capture the more significant aspects of the export sectors of Romania which involve a high intensity of R&D, according to the Standard International Trade Classification (SITC). The novelty resides in a recent and detailed picture of Romanian high-tech exports which could be used in order to determine the trend and potential of the essential flow components. Although the research is limited at a theoretical approach, it might be continued with identifying the exporters of high-tech manufactures and doing a stakeholder analysis. The research used the World Bank and Eurostat databases, the authors' findings confirming that Romania lags behind the most of developed and some emerging states. The gap can be caused by conjunctural factors, small public expenditures with research, development, and innovation, and the lack of stimulation and interest of private sector in making such investments. Moreover, the Romanian high-tech exports are highly dependent on the IT&C sector, which reveals both an important vulnerability in the context of the trade barriers which might raise for a sector and a big opportunity for restructuring the economy.

Keywords: high-tech exports, high-tech evolution, high-tech structure, Romanian trade, technological intensity.

JEL Classification: F14, F43.

1. Introduction

The external trade allows countries to acquire materials, finished goods or services which are either not available domestically or if producing them costs more than importing and also to capitalize on the comparative or competitive advantages

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they have, to promote entrepreneurship, to capitalize on the effects of economies of scale or the experience curve of indigenous producers. The dynamics of embedding high technology in goods and services, corroborated with the increasing of global demand of this kind of products, has led recently to an acceleration of the high-tech exports. The ability of developing countries to reach their full potential also depends on the volumes of their high-tech exports. The large share of high-tech exports in total exports of a country is among the most relevant signs of a high competitiveness of the respective economy (Gheorghe, 2018; Zaman et al., 2018).

The aim of this paper is the analysis of the structure and the evolution of the high-exports of Romania compared to other countries with high shares of high-tech exports in total exports. The paper is structured as follows: section 2, literature review, section 3, research methodology, section 4, findings and section 5, conclusions.

2. Literature Review

The growing competition on the international markets of less knowledge intensive products determines the exporting countries to align to the natural shift from a low level of technological intensity of productive processes towards a higher intensity, performing preferably high-tech exports in order to increase their market and profit shares. Globally, there are important differences in how well regions perform in terms of doing such type of exports. If the European Union (EU) states register a decrease of the share of high-tech exports in total exports from 17.4% in 2009 to 16.3% in 2018, in the case of the USA, the indicator decreased from 25.01% to 18.9% during the same period, the Asian countries record an important growth: South Korea from 32% to 36.4, Vietnam from 10.5% in 2009 to 41.4% in 2017 (Braja, Gemzik-Salwach, 2020). Regarding the structure of high-tech exports of EU countries, Braja, Gemzik-Salwach (2020) found out that, during the period 2008-2011 with only a few exceptions, namely Belgium, Croatia, Cyprus, Slovenia, where the pharmaceutical industry was the main high-tech exporting sector, all other countries relied on the export of electronics.

While the entire international economic community agrees that all countries seize an “export led growth” phenomenon, more and more studies lead to the conclusion that the composition and diversification of exports have a bigger impact on the economic growth than just the flows volumes. Burciu et al. (2020) compared the evolution of export structure and gross domestic product (GDP) per capita of Romania and Czech Republic, Hungary, Poland, and Slovakia and their findings demonstrate that the impact on the economic growth differs by component and also by country. Thus, a 1% increase in the absolute change of medium-tech manufactures (MTMs) exports led to a growth in GDP per capita of 0.45% in Hungary, 0.39% in Poland and Slovakia, 0.38% in Czechia, 0.35% in Romania and 1% in the change of high-tech manufactures (HTMs) export led to a growth in GDP per capita of 0.37% in Poland and Slovakia, 0.34% in Romania, 0.31% in Hungary and 0.3% in Czechia. These findings show that even if the high-tech exports still have the smallest share in the total exports of the selected countries, their impact on

the economic growth is almost similar to that of MTMs. The sustainability of the high-tech industry has also been proven in times of crisis, when it showed the highest growth rate among the EU countries compared to medium-tech or low-tech ones. In the EU-27, the average growth rate of high-tech exports during the period 2005-2015 was 3.3%, the highest rates recorded in Germany (6.6%), Czech Republic (5.4%), and Hungary (4.6%), Romania, recording one of the lowest growth rates for high-tech industry (1.7%). Therefore, the gap between the high-income countries and Romania, which has an upper-middle economy according to the World Bank data for 2020, increased during the period 2005-2011. However, Romania registered the highest growth rate of MTMs exports of all EU-27 states (12.7%), at the middle of 2000s their share in total exports exceeding the one of low-tech manufactures (LTMs) exports for the first time (Ekananda, Parlingoman, 2017; Sandu, Ciocanel, 2014).

The study of Kheyfets, Chernova (2021) confirms that the endowment with technological factor encourages the economic growth through better allocation of resources, the share of innovations, and the high-tech exports increase. According to the authors' regression models, China ranks first in technological effectiveness followed by the USA and Japan, Brazil, Kazakhstan, Turkey, Ukraine and Mexico lag significantly behind Poland, Romania, and Bulgaria. However, the gaps are very large as China and the USA account for 90% of the market capitalization value of 70 largest digital platforms, 75% of the blockchain technologies patents, more than 75% of the global market share of public cloud computing, about 50% of world's spending in Internet of Things, 69% of supercomputers, or 36% of the total value of e-commerce.

As our research paper analyses the evolution of HTMs exports of Romania in a worldwide context and the weight of every sector incorporating high intensity of technology by means of most recent available data, it will offer an actual image of sustainability of the Romanian economy in terms of commercial outflows at global level, and it will illustrate whether there is a balanced structure or an unbalanced one.

3. Research Methods

In order to perform the analysis of the most recent evolution and structure of the high-tech exports of Romania, which is the stated goal of our study, we have tested the following hypotheses:

H1: An increasing share in exports of high-tech intensive commodities is closely correlated with the level of modernity of an economy and leads to the improvement of the exchange relationship with foreign countries and to the better positioning of Romania at the level of the economic picture of the European Union.

H2: The commodity structure of Romanian exports of highly technology-intensive products is asymmetric, but during the analyzed period some sustainable progress was registered.

The authors propose in the current paper a phenomenological research trying to capture the more significant aspects of the export sectors of Romania which

involve a high intensity of R&D, according to Standard International Trade Classification (SITC). The Eurostat database uses SITC Rev. 4 since 2007 while the World Bank, through the World Development Indicators (WDI), uses SITC Rev. 3, as per 1997 Thomas Hatzichronoglou's working paper, OECD. Both revisions classify the HTMs into the following sections:

- aerospace (aeroplane motors, other aircrafts, spacecraft and spacecraft launch vehicles, propellers, rotors and other parts, undercarriages and other parts, direction finding compasses, other navigational instruments and appliances);
- computers-office machines (computers, office machines, parts and accessories);
- electronics-telecommunications (sound and video apparatus, telecommunications equipment, circuit integrated boards, optical fibre cables, semiconductor devices and media, etc.);
- pharmacy (antibiotics, hormones and derivates, glycosides, glands, antisera, vaccines and other medicaments);
- scientific instruments (electrodiagnostic and radiological apparatus for medicine and surgery, cameras, contact lenses, measuring instruments and apparatus, orthopaedic appliances, optical fibres other than the above-mentioned ones);
- electrical machinery (electrical capacitors, machines, sound and visual signalling apparatus);
- chemistry (chemical products);
- non-electrical machinery (other gas turbines and parts, drilling, boring, grinding, sharpening, punching machines, other machines and apparatus);
- armaments (arms and ammunition).

The WDI and Eurostat data were processed in order to highlight a panel of most relevant 50 countries and calculate the yearly share of every section of Romanian high-tech exports in total exports. Aiming at continuing the work of Braja & Gemzik-Salwach (2020), the authors have grouped the exported volumes of computers-office machines and electronics-telecommunications between years 2013 and 2018, the most recent data provided by the Eurostat in April 2022.

4. Findings

From Table 1 we may observe a positive evolution of the share of high-tech exports in total manufactures exports of Romania, with a steady and continuous improvement. The indicator increased from 7.4% in 2013 to 11.9% in 2020 (which represents an increase of 60.8% on the 2013 value). The table also illustrates that except for the EU and North America, all regions and income categories registered increases of high-tech exports shares in manufactured exports, although not as notable as Romania. However, the Romanian high-tech exports share in total manufactures exports remains at a low level, its average being less than half of the total average share of all countries in the world, 59.8% of the EU average and even worse performance compared to Asian countries and North America (31.4% and 51.3%, respectively).

When comparing Romania with other groups of countries in terms of income level, its volumes of high-tech exports are way behind the ones of other countries except the low-income countries, the gap being very large. Thus, the Romanian high-tech exports average share represents 49.5% of the average share of high-income countries, 41.4% of the average share of upper-middle income countries, 46.2% of the average share of low & middle-income countries, and 200.3% of the average share of low-income countries. It is worth mentioning that Romania belongs to the upper-middle income according to the World Bank classification in 2020, following a very good performance in 2019, when for the first time Romania was in the high-income group of countries thanks to the higher volume of GDP per capita. Another interesting finding deriving from the table is that the East Asia & Pacific countries registered an important value of standard deviation – 3.6, which is very much resembling the one registered by Romania as proportional growth – 1.4, more than 10% of the average shares in both cases.

Table 1. An international picture of weight of high-tech exports in total manufactured exports during the period 2013-2018 (p.p.)

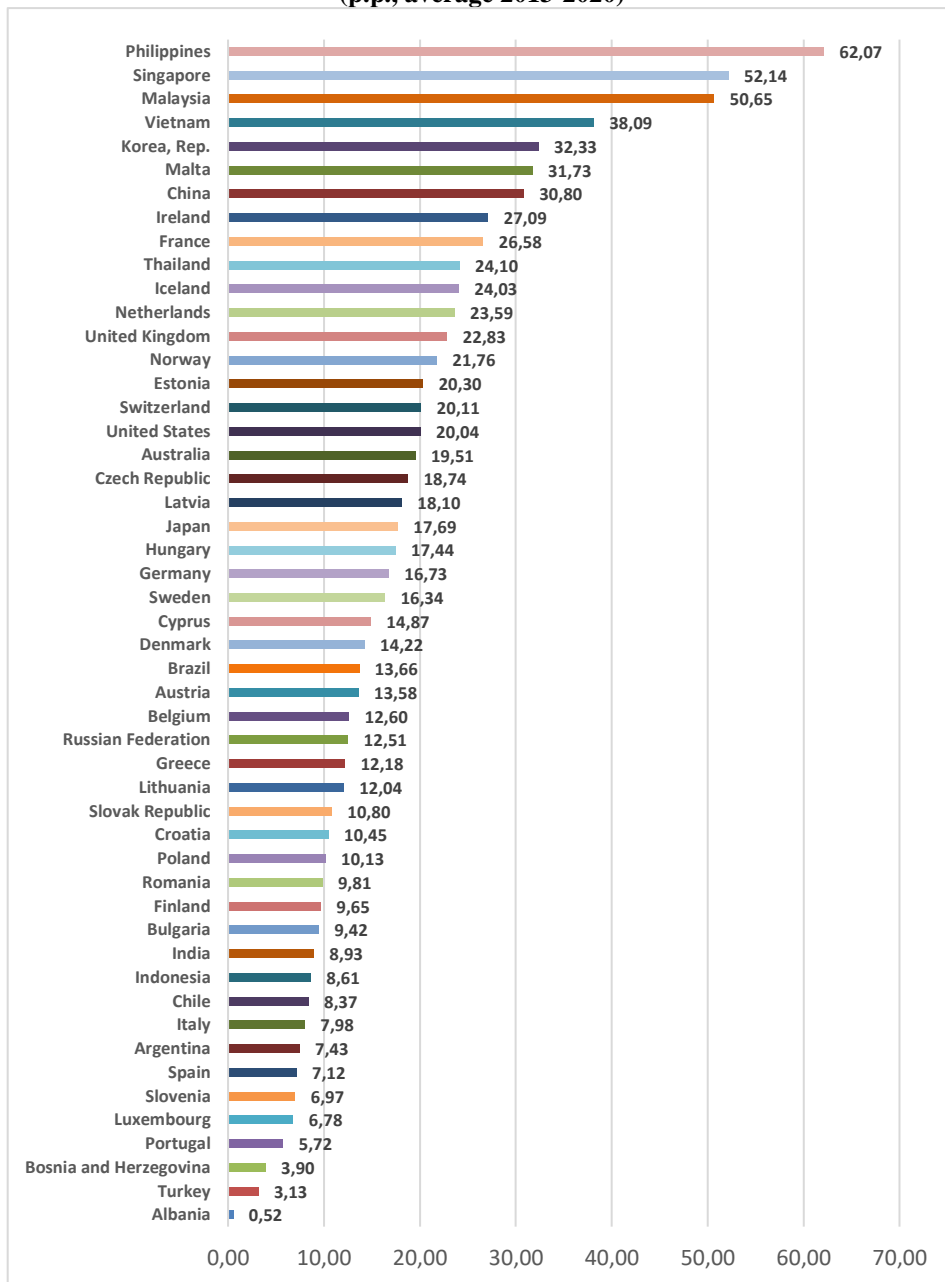
Country / Group	2013	2014	2015	2016	2017	2018	2019	2020	Average	Std. deviation
Romania	7.4	8.4	9.4	10.4	9.8	10.1	11.1	11.9	9.8	1.4
World	18.9	18.9	19.9	20.0	20.5	20.4	20.7	22.2	20.2	1.1
European Union	16.4	16.5	17.2	17.5	16.0	15.6	16.2	16.1	16.4	0.6
East Asia & Pacific	28.2	27.2	28.0	28.0	33.9	34.4	33.9	35.7	31.2	3.6
North America	19.2	19.4	20.2	21.0	18.4	17.9	18.2	18.7	19.1	1.0
Latin America & Caribbean	13.5	13.3	13.9	14.8	14.6	14.3	14.1	15.0	14.2	0.6
High-income	18.5	18.6	19.5	19.7	20.1	20.0	20.2	21.7	19.8	1.0
Upper-middle income	23.1	22.7	24.0	23.8	23.8	23.8	23.6	24.8	23.7	0.6
Low & middle income	19.8	19.7	20.8	20.7	21.3	21.5	21.9	23.3	21.2	1.2
Low income	N/A	N/A	4.9	2.9	3.6	4.3	5.4	N/A	4.2	1.0

Source: Authors calculations based on World Development Indicators [TX.VAL.TECH.MF.ZS], last update 15.02.2022, extracted on 28.03.2022.

The leading countries with highest shares of HTMs in manufactured exports during the period 2013-2020 belong to Asia and are situated far ahead from the followers. Philippines, Singapore, Malaysia record more than 50% average share of high-tech exports in total manufactured exports, followed by Vietnam with 38.09% (Figure 1). Among the countries with a more discreet performance compared to

Romania, we can find Albania (0.52%), Turkey (3.13%), Portugal (5.72%), Luxembourg (6.78%), Spain (7.12%), Italy (7.98%) or Finland (9.65%).

Figure 1. Share of high-tech exports in total manufactured exports (p.p., average 2013-2020)



Source: Authors calculations based on World Development Indicators [TX.VAL.TECH.MF.ZS], last update 15.02.2022, extracted on 28.03.2022.

Table 2 illustrates a sinuous evolution of the IT&C share in HTMs of Romania: if its share in total high-tech exports recorded a maximum of 70.4% in 2015, it decreased to 65.9% in 2017 and increased again until 67% in 2018. Significant increases within the analysed period are recorded by the share of scientific instruments sector (82.3%), reaching an important value of 20.6% in 2018 and in case of chemistry, where we notice an increase of 30%. The sectors with a negative evolution of their weight in the total exports are the aerospace (a contraction of more than 300%), electrical machinery (a contraction of 71.9%), pharmacy (contraction of 71.4%) and non-electrical machinery (a contraction of 44%). The armament sector records insignificant volumes, decreasing to a share of only 0.1% of high-tech exports of Romania in 2018.

Table 2. Romanian high-tech sectors in total high-tech exports during the period 2013-2018

HTMs sector	2013	2014	2015	2016	2017	2018
Aerospace	3.7%	3.3%	2.2%	1.3%	1.5%	1.2%
Information Technology and Communications	68.7%	68.3%	70.4%	70.0%	65.9%	67.0%
Pharmacy	4.8%	4.1%	3.2%	2.7%	2.7%	2.8%
Scientific instruments	11.3%	13.0%	14.1%	16.2%	21.4%	20.6%
Electrical machinery	5.5%	5.4%	5.1%	4.9%	3.4%	3.2%
Chemistry	2.0%	2.2%	2.1%	2.0%	2.4%	2.6%
Non-electrical machinery	3.6%	3.4%	2.8%	2.7%	2.6%	2.5%
Armament	0.4%	0.4%	0.1%	0.2%	0.1%	0.1%

Source: Authors calculations based on Eurostat, [htec_trd_group4], last update 08.02.2021, extracted on 28.03.2022.

5. Conclusions

Starting from the scientific hypothesis and applying the research methodology, the authors found that the hypothesis H1 is partially confirmed as the share of HTMs in total exports or manufactured exports of Romania generally lags behind most developed or developing countries, and there are a few exceptions of countries with smaller shares of HTMs in their manufactured exports in our panel. Yet, the trend of high-tech exports of Romania is positive and encouraging, their share in manufactured exports reaching 11.9% in 2020. Moreover, if we add the value of MTMs, which are considered by some researchers the heartland of mature economies (Burciu et al., 2020), Romania performed very well, recording every year an important growth until 62.5% in 2019 (ranking 21st in the world), right after the USA with 63.6% and Malaysia 65.7% (The World Bank, 2022). This is a surprising improvement, since the lowest total recorded share of HTMs and MTMs in manufactured exports was only 21.8% in 1998.

The hypothesis H2 is confirmed as Romania changed its export structure from mainly low-tech products toward medium and high-tech output. The IT&C sector held the highest part of high-tech exports of Romania with an average of 69.4% in total high-tech exports during the period 2013-2018. We should also mention the fast growing share of scientific instruments in high-tech exports, which reached 20.6% in 2018. The very large share of IT&C sector reveals an important vulnerability of Romanian high-tech exports in the context of trade barriers which might be raised by other countries in order to protect their respective sector whereas it might be also a big opportunity for restructuring the Romanian economy. However, importing high-tech intensive products for a while and exporting semiconductors and other intermediary products could be an appropriate strategy which depends on the production capacity, external competition, and/or the international market evolution.

The ability of developing countries to reach the level of developed countries depends on the high-tech exports that these countries can make. Mehrara et al. (2017) identified the determinants of the high-tech exports evolution: the human capital (proxied by the index of gross tertiary education enrolment rate), the institutional quality index, the ratio of imports value to GDP (representing the trade openness) and GDP. Sandu & Ciocanel (2014) show that 1 percentage point increase in the R&D government expenses would lead to an increase of 8.23 p.p. in the share of high-tech exports in total exports after two years and an increase of 1 p.p. in R&D made by the private sector would determine an increase in HTMs exports share of 9.17 p.p. The impact is even higher if a temporal lag of 5 years is considered, as 1 p.p. increase in public R&D is expected to lead to an increase of 14.42 p.p. in high-tech exports share and if the lag is extended until 7 years, the positive effect will reach 16.07 p.p. Therefore, the decision-making factors should prepare a set of medium and long-term measures and initiatives starting with stimulating the R&D expenses, improving the quality of education, and acquiring the equipment needed for producing goods with a high level of technological intensity, the final goal being the increase of volumes and share of high-tech exports in total exports.

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