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Article

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EuroEconomica

Provided in Cooperation with:
Danubius University of Galati

Reference: Nuţă, Florian/Puşcă, Andy Corneliu et. al. (2020). Scientific production : a quantitative assessment based on Scopus entries. In: EuroEconomica 39 (1), S. 128 - 133. https://dj.univ-danubius.ro/index.php/EE/article/view/158/380.

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E u r o E c o n o m i c a
Issue 1(39)/2020 *ISSN: 1582-8859*

Scientific Production – a Quantitative Assessment Based on Scopus Entries

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Abstract: Based on the historical (1900-2020) entries from the Scopus database we are trying to explain the evolution of the scientific production in three different countries (Romania, Denmark and Turkey). The three countries have similar scientific profile but different patterns regarding their evolution and this may also be observed in the bibliometric indicators along the assessed period of time. There are some inflection points connected with historical events and major political and socio-economic transformations that happened at some stage.

Keywords: scientific paper; research; expenses efficiency; Scopus; scientific production

JEL Classification: C80

Introduction

The economic activities are mainly based on innovation which is a driver for the socio-economic development and the technical change is responsible for most of the economic growth (Solow, 1957). But the innovation cannot be done without basic research and the set of ideas in one field that all the innovations rely on. As Mokyr (2002) stated the differences between techniques that society uses for producing growth and the propositional knowledge. The techniques are commercially used, can be patented and are mainly a result of profit-base research activities. The propositional knowledge cannot be bought or sold and represents the framework of ideas and theories and laws (Prettner and Werner, 2016) about the natural phenomena (social phenomena may be included also), being the foundation for the patented knowledge. Prettner and Werner (2016) also demonstrate the fact that higher investments in basic research bring a better long-run output and more welfare for the society. The long-run expectations of growth are connected with the gestation lag of the basic research. That is why a public policy that involves higher basic research expenditures is the proper way of preparing future development and growth and ensuring the long-run success of the community. Therefore, simply investing in innovation and techniques bring a short-run growth but for ensuring sustainable welfare a long-run socio-economic development the basic research should be encouraged and invested in.

The science, research techniques and methodologies evolved during the last century, but also the access at scientific knowledge. The present scholars benefit from the knowledge and the ideas produced before

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them (Giuffrida et al., 2019) and have better research infrastructure and financing. Analyzing only the figures and compare the nowadays number of produced scientific papers with the numbers at the beginning of the 20th century is not conclusive at all and cannot give us any idea about the proportion of research or its impact upon the society. Assessing the trends and discuss it along with the financing can describe an image about the contribution of a country or another to the knowledge production and its scientific profile. Speaking about numbers it could also be a matter of quality as big numbers doesn't necessary mean bigger quality of research but maybe only a better access at publication possibilities and better dissemination network today in comparison with the 1900s.

Data and Assessment

For assessing the scientific results and the implications of the scientific production we used the entries in Scopus between 1900 and 2020 for three countries: Romania, Denmark and Turkey. The selection by country is made taking into account the affiliation of the author/s, which means that the authors doesn't necessary hold the ethnicity of the country but is just affiliated to an institution in that country. Romania and Denmark were chosen based on a comparison developed by Murgescu (2010) describing the two countries having historically similar development conditions, while Turkey was added because of its highly dynamic research environment after the 90s.

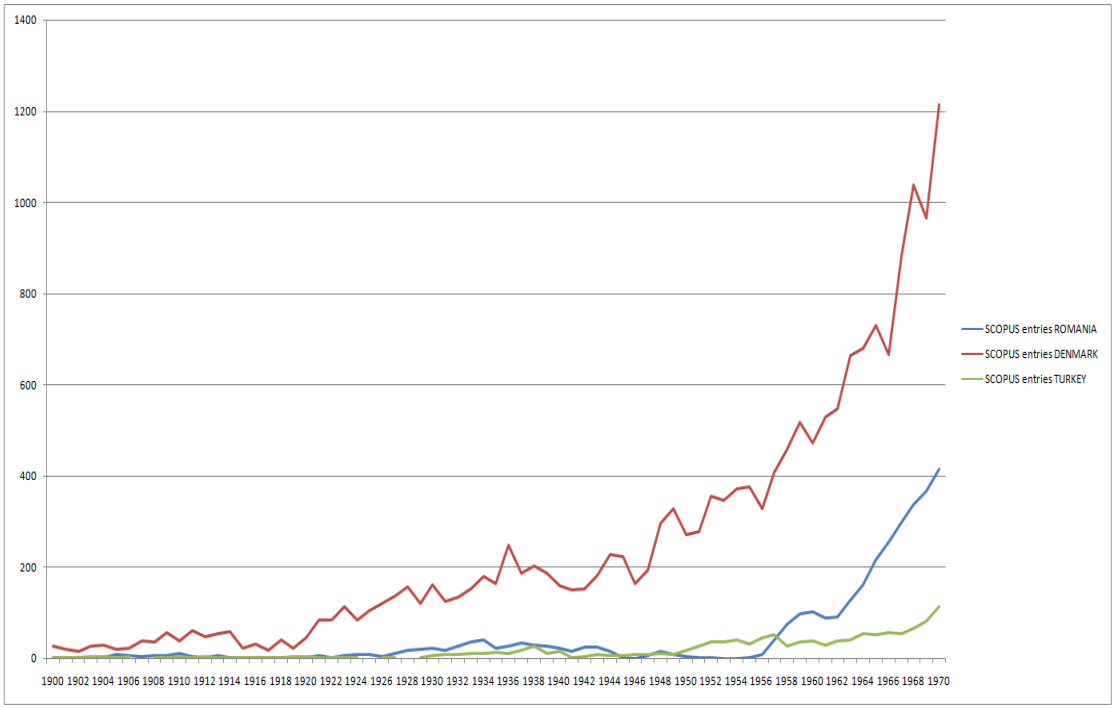

Figure 1. SCOPUS entries 1900-1970
Source: Own processing based on Scopus

The scientific profile of the three selected countries is similar as the Medicine, Engineering and Physics are among top five most productive fields in terms of entries in Scopus for all of them. Materials science and Biochemistry are also common for the three countries taken two by two. The occurrence of papers by scientific field is also similar with little delays between the three countries for most of the fields. The

biggest delay is in the field of physics between Denmark and Turkey. The first registered paper in Physics with Danish affiliation is published in 1800 while the Turkish counterpart can be found in 1930.

The first time interval may be divided into three separate periods. The first from 1900 to 1920 is characterized by a constant trend for all the three countries and comparable data with a small advance for Denmark.

The second time interval, from 1921 to 1950, shows a constant growth rate for the Denmark affiliated entries, while the Romanian and Turkish papers are few and the small growth registered in the 30s slows in the World War II years and between 1945 and 1950 the decline is prominent.

From the 1950 Denmark shows a remarkable growth and separates from the other two countries. Romania is also performing well beginning with 1960 but is still at less than a half distance from Denmark, while the Turkish entries are still struggling below one hundred papers per year.

At the end of the time interval we notice the first papers in Computer Science and Nursing for Turkey, while Romania has the first papers in Dentistry, Business, management and accounting also at the end of the 60s. By the end of the 60s Denmark reaches on thousand papers in Scopus.

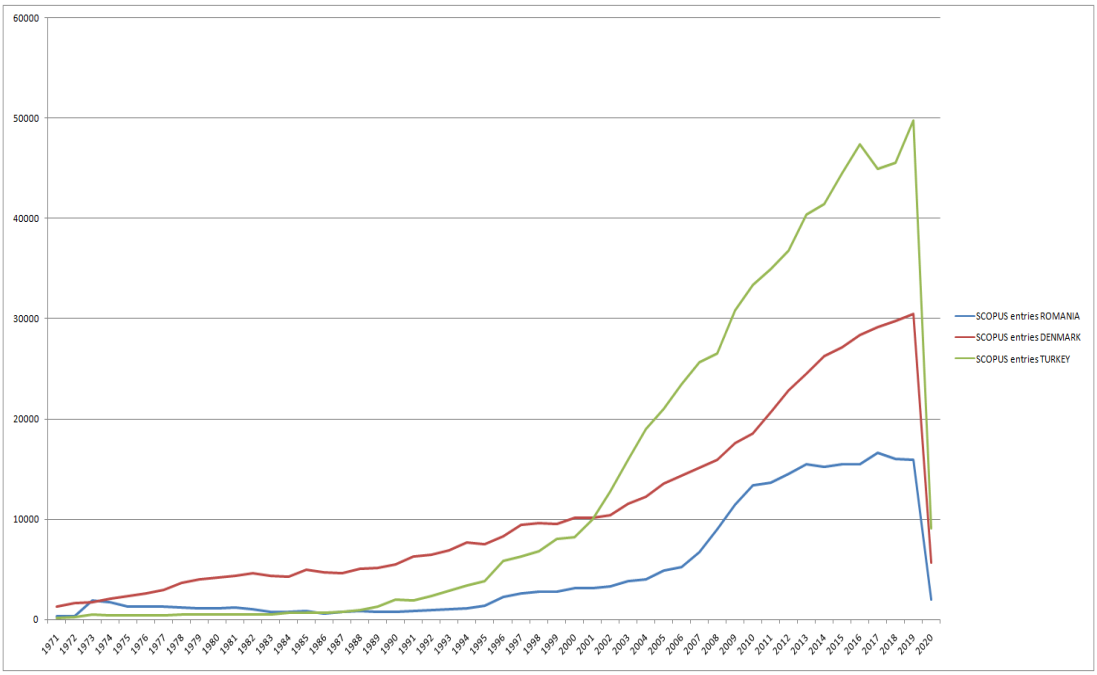

Figure 2. SCOPUS entries 1971-2020
Source: Own processing based on Scopus

Research Productivity

We are assessing the research productivity in two directions. First, by the numbers of papers registered in Scopus per a thousand dollars' research expenditures. Second, we are describing it by the number of population needed for one entry in Scopus. The time coverage for all the three countries for the first

assessment is from 1991 to 2017. The second analyze spreads from 1960 to 2018. The data were available beginning with 1981 for Denmark but not for the other two countries.

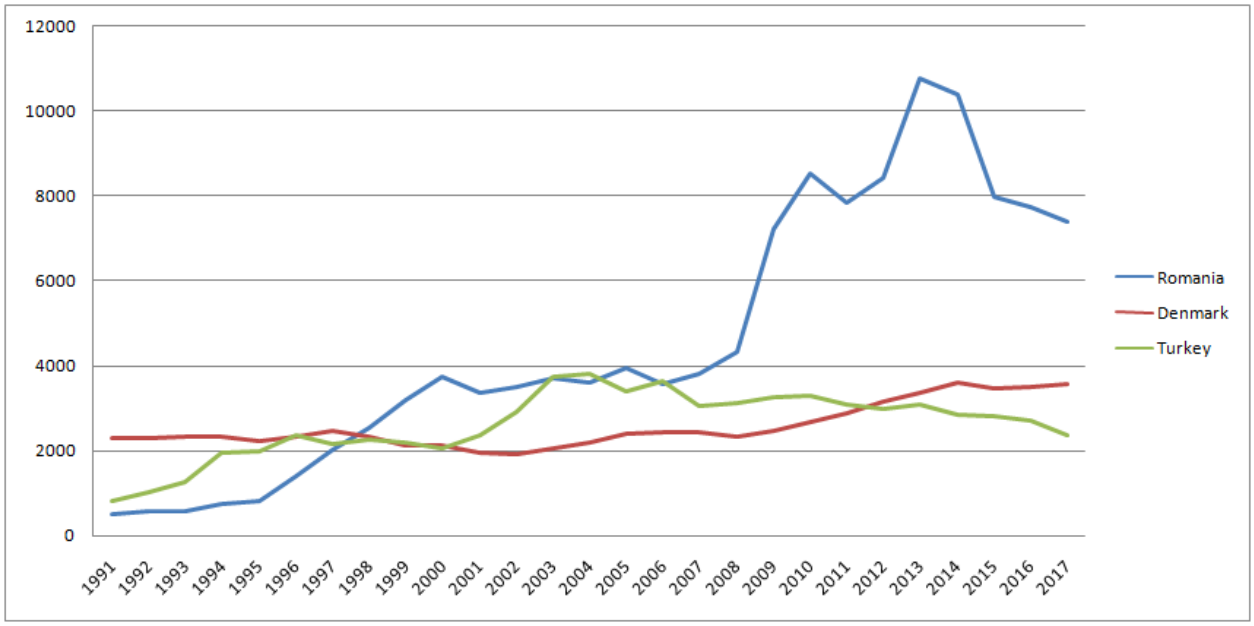

Figure 3. Papers per 1000 dollars spent for research

Source: own calculations

The most spectacular evolution is for the case of Romania for a minimum of 508 papers in 1991 to a peak of 10783 papers in 2013 slowing down afterwards and falling at 7410 papers per a thousand dollars in 2017. The growth is exceptional but is accounted for constant small figures in terms of research spending and growth in terms of indexed papers. In the case of Turkey the growth is from about 800 papers per a thousand dollars spent in 1991 to 3831 papers in 2004, dropping to 2375 papers in 2017. In the same period (1991-2017) the research investment rises by almost ten times. In the meantime, Denmark has a smooth evolution growing both the research expenditures and published scientific papers. The paper productivity is growing for Denmark from 2295 papers in 1991 to a peak of 3622 papers in 2014 and 3596 papers at the end of the assessed period in 2017 for each thousand dollars spent for research.

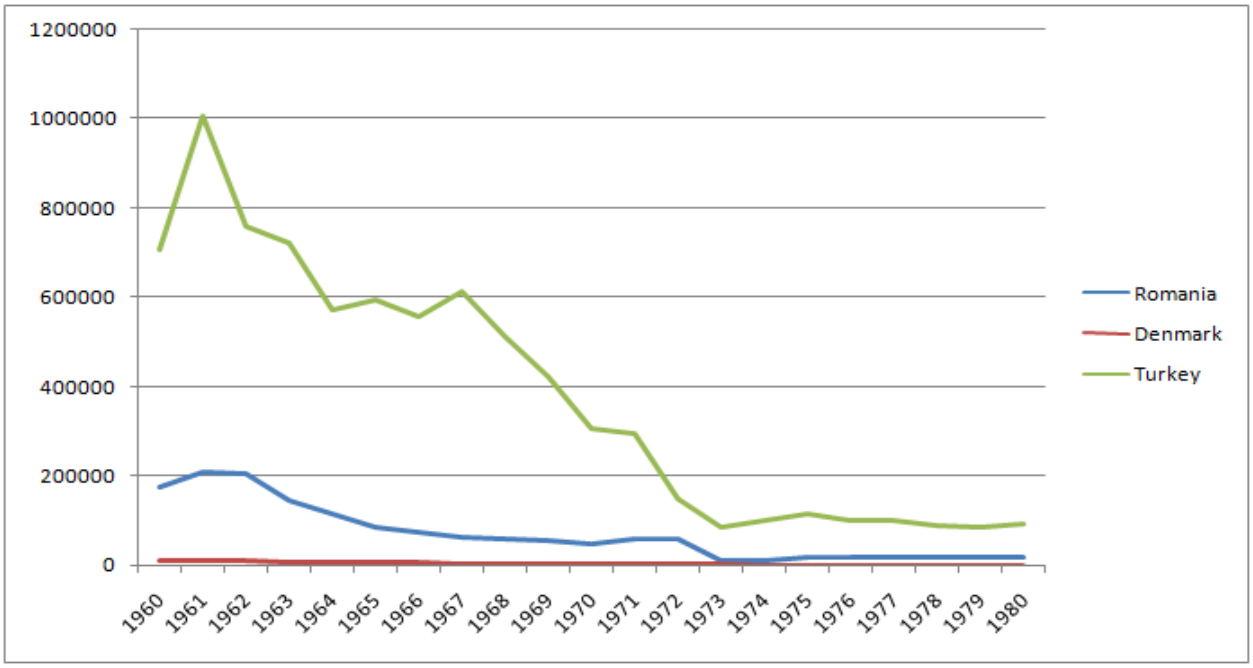

Figure 4. Number of population per article 1960-1980

Source: own calculations

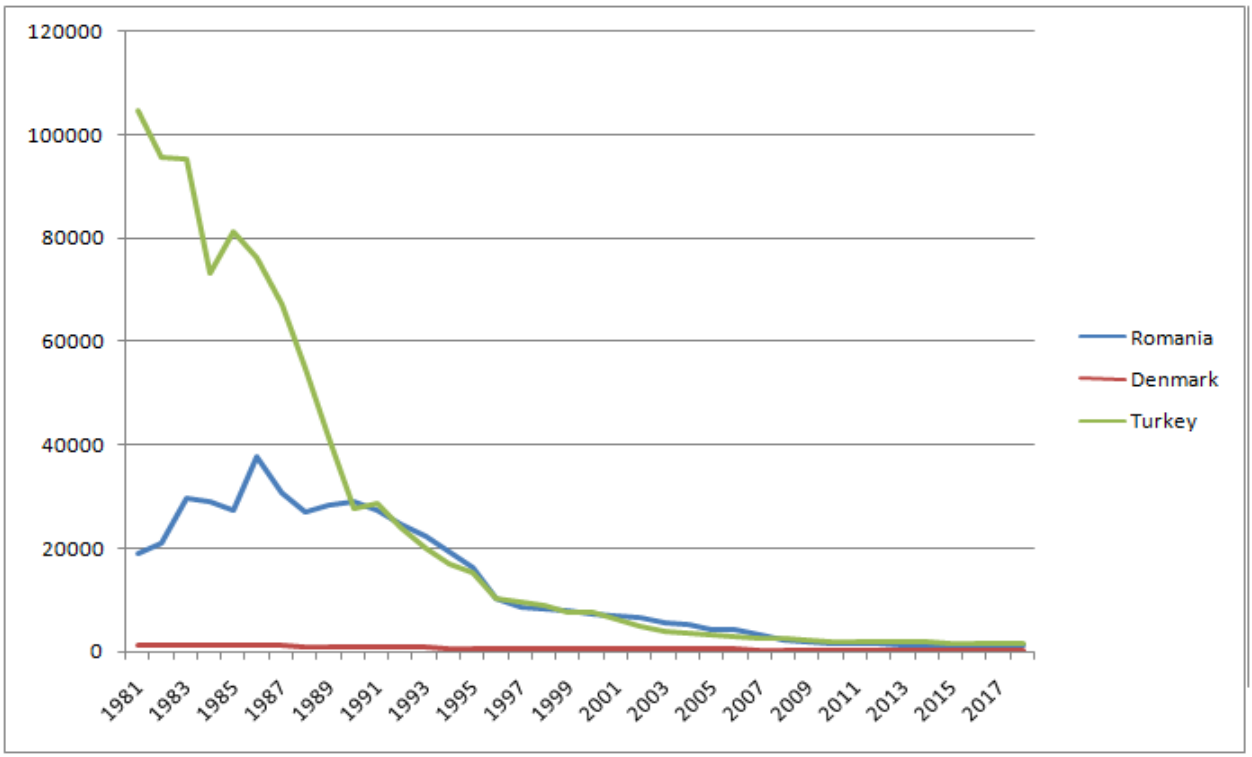

Figure 5. Number of population per article 1981-2018

Source: own calculations

In terms of number of people per scientific article there are some clarifications to be made. First, in the case of Romania, the total population at the end of the time interval is almost the same as was at the beginning. The difference between the highest number of population and the lowest is of about 3 million people (1990 is the peak in terms of total population). Comparatively, Turkey has gain around 50 million people from 1960 to 2017 having a constant growth (2017 is the peak year). The same situation is for the case of Denmark which gains around 1.3 million people between 1960 and 2017 with a less spectacular but still constant growth (the peak is also registered in 2017). Given the conditions, Turkey has the highest productivity in terms of number of people per article and Denmark has the smoothest evolution.

Concluding Remarks

Even is at first Romania and Denmark have a similar scientific profile and progress in terms of research productivity assessed by the papers indexed in Scopus database, by the end of the analyzed period of time (2020), the differences are obvious in terms of scientific production, research investments and number of scientific articles per 1000 dollars invested. Each country has its own evolution pattern. It also clear from the data that the political changes over each country history affected the scientific activity and the knowledge production fecundity of the country. Romania entered after the 40s in the communist sphere of influence and knew major transformations in the society affecting the academic and research environment, a fact that is obvious looking at the research dissemination stats. It is also important to consider the national tendency for a scientific field or another. The scientific tendency is connected not only with an historical profile but is also influenced by social and political transformation at national and regional scale. The industrialization effort of the communist era in the 60s and 70s as well as the deindustrialization from the late 90s is also identifiable in the Romanian scientific pattern.

The future extent of the research is related to adding new countries and new reference databases in the assessment and creating an econometric model describing the factors influencing the scientific activity. Based on previous studies it is also relevant to develop such assessments on different scientific areas/domains rather than on global scale due to national specialization tendency for a field or another.

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