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# Competitiveness through innovation for the Romanian Economy. Allocations correlated with outputs. Patent applications and their effect on competitiveness

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**Abstract**

This paper aims to study the way that the efforts put into increasing one of the competitiveness pillars (innovation) with results (especially Patent production) correlate for the Romanian economy in the last 5 years, after the crisis started officially. We will then use as effort indicators the R&D expenses and the Innovation costs, as reported by the National Institute of Statistics and as result indicators we use the number and provenience of Patent registered with World Intellectual Property Organization, as well as GDP.


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*Keywords*: innovation, competitiveness, R&D expenses;

## 1. Introduction

It is well known that Romania is subject of a continuous brain drain since even before the great opening of 1989. The best and the brightest were leaving the country in droves, taking their work and prowess to other places (than the originating accumulation of knowledge) where their work was generally well received. This tendency is commonly seen as prejudicial for the country of origin and an unearned benefit for the countries of

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destination. The Romanian politicians wanting to unravel this situation are periodically proposing policies to stop and maybe reversing the tide. We will attempt to show that:

- Firstly, the brain drain is a net positive for the aggregate economies of originating and destination countries
- Secondly, the Romanian brain drain continues with no sign of abatement showing that the stemming policies are either not effective, or not well conceived and implemented.

We start with a literature review on three aspects, as revealed by the scope of the paper, namely: on competitiveness and its indicators, on innovation linked to productivity increase and on the brain drain. The understanding of innovation as a key driver to competitiveness has its roots in the works of Schumpeter, who described market dynamics as a process of creative destruction. Later he developed further this concept, referring it as a process of "creative accumulation" (Dobrinsky, 2008). The competitiveness concept apply both to the national range as to the sectoral level; we base the national competitiveness performance on the sectoral competitiveness indicators, the same way that global indexes of competitiveness (used by WEF and IMD - Institute of Management Development) use national performance indicators in order to imbricate world classification of countries.

Some of the main constrains in achieving the competitiveness are represented by the lack of resources that SMEs have to face in order to innovate (Minarelli et al., 2013). As stated in several scientific works, small and medium sized companies have also some advantages compare to larger firms in promptly responding to new market opportunities (Olander-Argilés et al., 2009; Narula, 1994) but mostly they suffer from an insufficient amount of resources to be addressed for innovation process (Narula, 1994). Such lack of resources can be overcome through membership of networks. Literature analysis show that small businesses associated in network produce more innovation compared to those standing alone (Ahuja, 2000; Baptista, 2000) Cabral and Traill (2001) state that the relation between firm size and innovation depends on several factors such as context, industry, or sector.

The review of existent literature reveals that diffusion of innovation in network, over the past twenty years, received significant research attention within scientific literature (Gulati, 1998; Kogut, 2000; Konsti-Laakso, 2012). Many authors widely investigated on firm's size influencing innovation performance and networking (Konsti-Laakso et al., 2012; Lee et al., 2010; Narula, 2004; Santarelli and Sterlacchini, 1990; Thorgren et al., 2009).

The concept of learning opportunities which emerges from actors collaboration was already highlighted by Roberts and Berry in 1985, while in 1996 Inkpen focused the attention on the network contribution for innovation. Later, this theory was developed by several authors (Beeby and Booth, 2000; Larsson et al., 1998) describes the fundamental role of the interaction among actors for the knowledge creation and diffusion.

Competitiveness can be quantified, or at least can be used as ranking criteria. The World Economic Forum (WEF) is well known for measuring the level of worldwide economies national competitiveness yearly, based on a twelve pillars system. WEF is not a benchmark but it measures the respective factors with a specific method and ranks the countries according to it, while the reports based on the Lisbon Plan compare the facts to a previously planned objective. Authors mention that the objectives are determined based on the situation of the member countries which differ a lot from the situation of the new ones which sometimes make the comparison difficult or even impossible (Nagy, 2010). It is not only the WEF that measure and benchmark the global competitiveness yearly. There are some structural indicators calculated in the EU countries, reunited in the called Lisbon Scorecards, as they were established in the Lisbon Strategy for Europe in order to increase the European countries competitiveness in the battle of globalization.

Every competitiveness index must start from a measure of national competitiveness performance (variable depending on analysis) bordered by activities which imply the competition with other countries (Coculescu, 2008).

As to the link between innovation and productivity increase, various authors stress on the importance of the national environment (institutions, policies, strategies) that encourage at different levels the innovative

processes in the economy and create a upright, effervescent milieu for new ideas. Innovation is particularly important for economies as they integrate the new knowledge into production process for creating modern technologies in order to maintain the firms and the nations 'competitive edge. This requires an institutional environment that is conductive to innovative activity, supporting by the public and the private sector. The importance of a solid institutional environment becomes even more apparent during the after-crisis economic recovery. Innovation is not possible without institutions that guarantee intellectual property rights […] so innovation and institutions are not only related to each other, but also tend to reinforce each other (Taranenko, 2010).

Other authors (Joumandreu, 2009) point out that the positive impact of R&D investment has on (general) welfare surpasses its cost, but only a small part of this impact is appropriable privately in the form of revenue. This is why private investments on innovation tend to be suboptimal, so public policies have to be put in place in order to sustain innovative activities.

On the brain drain topic, several authors (Beine et al., 2003) report that most countries which combine low levels of human capital with low rates of skilled workers migration seem to be positively affected by the brain drain. On the contrary, brain drain appears to have negative growth effects in countries where the migration rate of the highly educated is above 20% and/or where the proportion of those with higher education is above 5% (Cozmei and Rusu, 2012). As other authors have emphasized it, education is in general a prerequisite for migration (Stark, Helmenstein and Prskawetz, 1997).

## 2. Link between competitiveness and patent applications

WIPO stands for World Intellectual Property Organization and is the global forum for intellectual property services, policy, information and cooperation. It is the global aggregator of patterns and intellectual property throughout the world. All innovations and property rights apply in principle to be protected through this organism (for worldwide intellectual protection) or to similar one in order to protect the author's rights to fruitfully use their innovation and related products and services.

The ultimate measure of competitiveness is the actual profit and the accumulation of wealth. In the case of countries other non-pecuniary measurements might be considered e.g. international standing, standard of living, size of the economy, size of the military, welfare volume, foreign investments, etc.

Table 1. Main contributors to the IP activity, worldwide, pre and post crisis

| Office | Contribution (%) 2005-07 | Office | Contribution (%) 2010-12 |
|---|---|---|---|
| China | 44,2 | China | 72,6 |
| United States of America | 40,3 | United States of America | 14,6 |
| European Patent Office | 7,4 | Brazil | 2,1 |
| Republic of Korea | 7,1 | Republic of Korea | 5,2 |
| Others | 1,0 | Others | 5,5 |

We will start the logical link with the innovation: an improvement in way of doing things. The improvement translates in lower costs or higher benefits thus better competitive position. A direct and logical consequence of an innovation is a patent application. The inventor wants its rights recognized and protected. Consequently we consider that the competitiveness of a particular national economy is directly correlated with the number of patent applications submitted by its nationals.

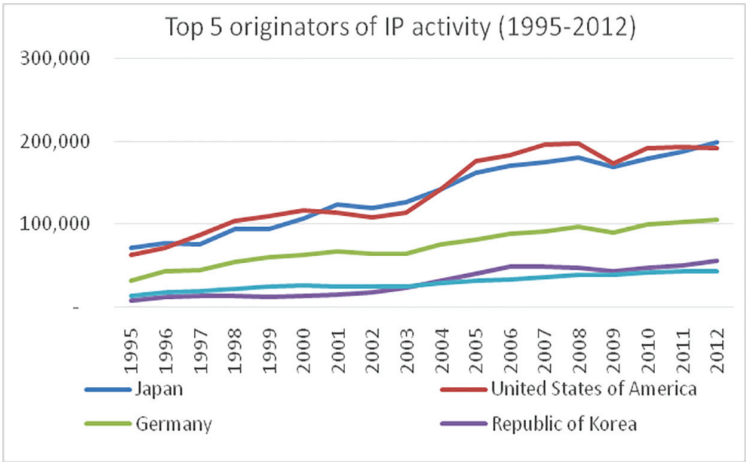


Fig. 1. Top 5 originators of IP activity (1995-2012)

We then take into consideration the fastest growing group of countries, as recorded by the number of applications, the BRICS (Brazil, Russia, India, China and South Africa). Number of patent applications from nationals between 1995 and 2012 is shown in diagram 2.

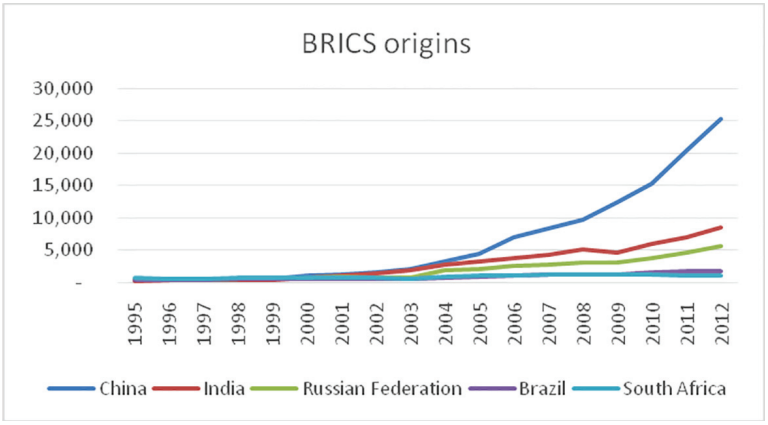


Fig. 2. BRICS origins

## 3. Why are the applications of residents and non-residents registered separately?

The residents' applications are the ones registered by a national office by its respective nationals with the purpose of protecting the innovation within the borders of the country of residence. The non-residents are registering in specific national markets intending to export goods and services there and preferring to have their innovations protected. The distinction is important because it shows where the capital expenditure was made and where the profits most probably will be reported and taxed.

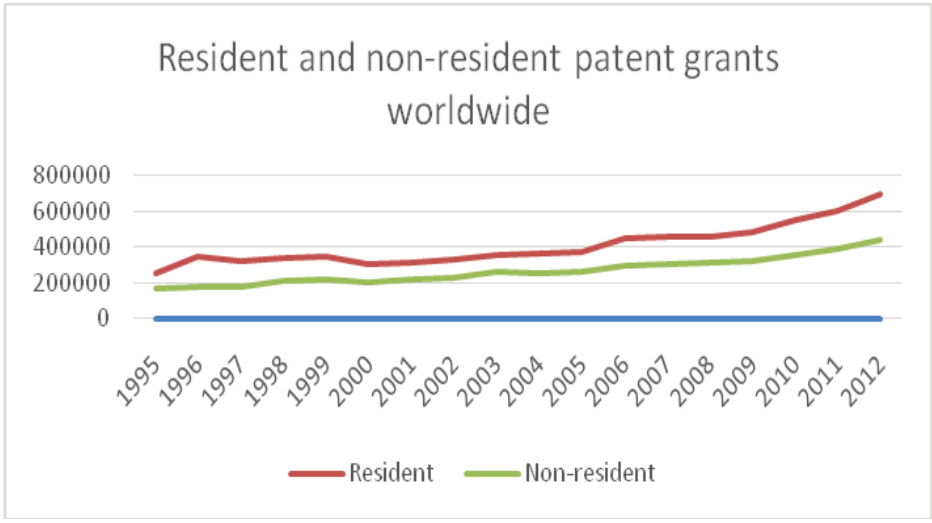


Fig. 3. Resident and non-resident patents grants worldwide

We can infer the brain drain measure by examining some details of the patent applications. The applicants are required to submit information on the nationality and information on residence, revealing that brain drain had occurred in the past.

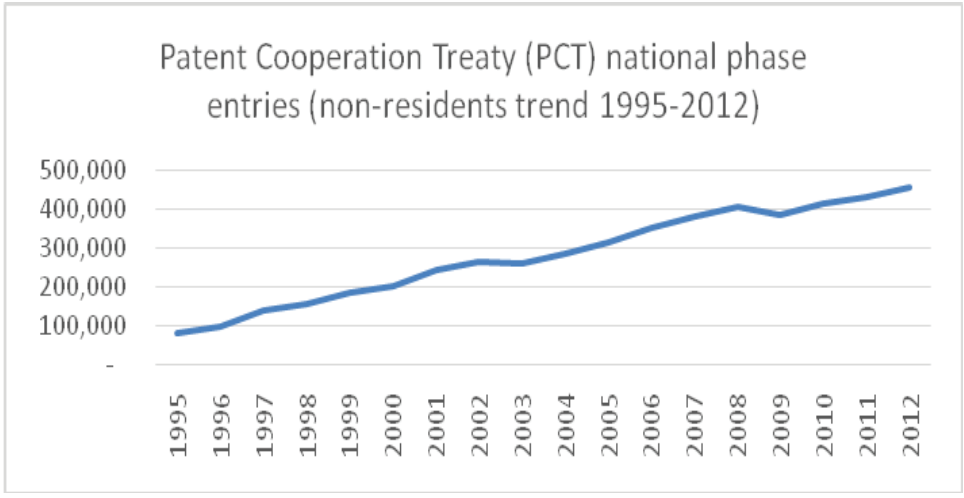


Fig. 4. Patent Cooperation Treaty national phase entries (non-residents trend 1995-2012)

As seen above, there is a trend of increasing applications of non-residents, in line with the globalization and the integration of the national markets. More and more agents are looking to exports and to ways to protect their intellectual property wherever they can find clients.

For Romania, the relevant statistics as published by WIPO count in 2012 a resident Intellectual Property (IP) activity of 35 patents, 30 marks and 32 designed registered, out of a total applications filled by residents of 23,595. As compared to 2011, in 2012 Romania registered 21 more IP results, as reported by WIPO statistical data.

| Year | 2000 | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| % R&D expenditures in GDP, out of which: | 0,37 | 0,39 | 0,38 | 0,39 | 0,39 | 0,41 | 0,45 | 0,52 | 0,58 | 0,47 | 0,47 | 0,48 |
| % R&D expenditures in Private Sector | 0,26 | 0,24 | 0,23 | 0,22 | 0,21 | 0,20 | 0,22 | 0,22 | 0,17 | 0,19 | 0,18 | nc |
| % R&D expenditures in Public Sector | 0,11 | 0,15 | 0,15 | 0,16 | 0,17 | 0,21 | 0,23 | 0,30 | 0,40 | 0,28 | 0,29 | nc |
| GDP (billion lei) | 80,3 | 116,7 | 151,4 | 189,1 | 238,7 | 287,2 | 342,4 | 404,7 | 513 | 499,5 | 504,2 | 578,5 |
| R&D expenditures (billion lei) | 0,2971 | 0,4551 | 0,5753 | 0,7375 | 0,9309 | 1,1775 | 1,5408 | 2,1044 | 2,9754 | 2,3477 | 2,3697 | 2,7768 |
| Inflation rate (%) | 0,457 | 0,345 | 0,225 | 0,153 | 0,119 | 0,091 | 0,066 | 0,049 | 0,063 | 0,0474 | 0,0796 | 0,0314 |
| GDP corrected (billion lei) | 80,3 | 86,7658 | 91,8898 | 99,541 | 112,29 | 123,835 | 138,49 | 156,048 | 186,08 | 172,987 | 161,741 | 179,93 |
| **% of variation (GDP corrected)** | | **108,05** | **105,91** | **108,33** | **112,81** | **110,28** | **111,84** | **112,67** | **119,25** | **92,96** | **93,50** | **111,24** |
| R&D corrected expenditures (bill. lei) | 0,2971 | 0,3384 | 0,3492 | 0,3882 | 0,4379 | 0,5077 | 0,6232 | 0,8114 | 1,0793 | 0,8130 | 0,7602 | 0,8636 |
| **% of variation (R&D corrected)** | | **113,89** | **103,19** | **111,18** | **112,81** | **115,94** | **122,75** | **130,20** | **133,01** | **75,33** | **93,50** | **113,61** |

Fig. 5. Romanian R&D expenditures as % of GDP (2000-2011, source Romanian Institute of Statistics)

In 2012, total class counts in applications filed by residents of Bulgaria, just an example (26,025) and Romania (23,596) were similar. However, in terms of originators and destination of the IP activity, residents of Bulgaria had a much higher proportion of their application class counts in applications filed abroad, namely 42.4%, compared to a surprisingly low rate (3.9%) for Romania.

Corroborated with R&D expenditures infused in the Romanian economy (Table 1), we find that registered IP results is extremely poor, even in intervals with positive dynamics in stimulating innovation thru public policies and investment in research.

## 4. Brain drain as net positive aspect

It is normally thought that the country of origin loses on every person going away in the so called brain drain. The corollary being that the receiving country is getting an unearned benefit and that some way of compensation needs devising. This idea is superficially appealing but the error starts from considering the two national economies as separate.

We establish some facts first:

- the country of origin is not as developed as the country of destination;

$$GDP\_origin < GDP\_destination \quad (1)$$

- the country of destination has higher levels of capital investments, meaning that the productivity is preeminent compared with the country of origin;

$$W\_origin < W\_destination \quad (2)$$

Before moving away, this particular person has a net contribution to the national economy of $\xi\_origin$. Afterwards, its contribution is $\xi\_destination$. In general,

$$\varepsilon\_destination > \varepsilon\_origin \quad (3)$$

which explains the whole motivation of the move in the first place.

Let us consider now the two economies not separated but joined as befits to the globalization or to the EU common market. The integrated economy flow will be

$$GDP\_origin+GDP\_destination \quad (4)$$

Before the move, the contribution if the person in question will bring this to:

$$GDP\_origin+GDP\_destination+ \varepsilon\_origin \quad (5)$$

And after the move:

$$GDP\_origin+GDP\_destination+ \varepsilon\_destination \quad (6)$$

Consequently, the net benefit becomes obvious when we note that (6) is higher than (5). This person's potential will simply produce additional value in a more advanced economy.

## 5. Lack of link between official R&D expenditures and Romanian utility model applications

A utility model is an exclusive right granted for an invention, which allows the right holder to prevent others from commercially using the protected invention, without his authorization, for a limited period of time. In its basic definition, which may vary from one country (where such protection is available) to another, a utility model is similar to a patent. In fact, utility models are sometimes referred to as "petty patents" or "innovation patents."" (WIPO Report, 2013)

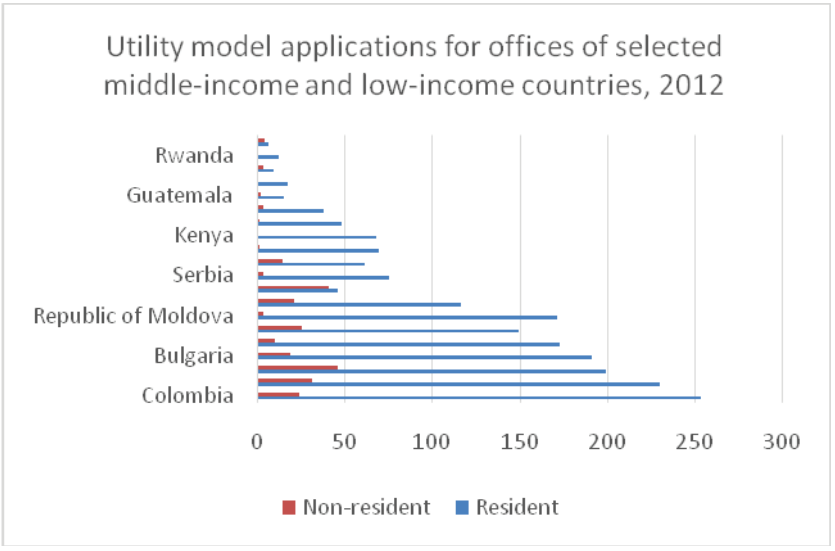


Fig. 6. Utility model applications for offices of selected middle-income and low-income countries in 2012

Diagram above shows the filing activity for selected applicants residing in middle- and low-income countries. The lack of correlation suggests that the Romanian research expenditures are not having the desired effect because the number of Romanian applications stays very low (despite efforts made in increasing R&D expenditures level) demonstrating an important lack of innovation in the Romanian economy.

## 6. Evidence for continuing brain drain

An interesting trend suggested by the aggregated patents, trade and marks activity worldwide is that the inventor emigration (the most important part of the brain drain) does not happen as much from low income countries to high income countries but more between high income countries themselves.

This is because a person's potential needs to be fulfilled in a favorable education environment and in a sufficiently deep and wide industrial pool, which strains again, if necessary, the important of institutional support in the innovation processes. Figure 2 shows the main immigration conduits across the world. We see mostly US as destination country in terms of inventors' accretion, from countries where innovation is insufficiently stimulated (not necessarily due to lack of resources).

**Largest Inventor migration corridors**

| Origin | Destination | Inventors |
|---|---|---|
| China | United States of America | 27,698 |
| India | United States of America | 21,712 |
| Canada | United States of America | 11,363 |
| United Kingdom | United States of America | 8,314 |
| Germany | United States of America | 5,894 |
| Germany | Switzerland | 4,949 |
| Republic of Korea | United States of America | 4,876 |
| France | United States of America | 3,901 |
| Japan | United States of America | 2,843 |
| Russian Federation | United States of America | 2,308 |
| France | Switzerland | 1,879 |
| Israel | United States of America | 1,875 |
| Australia | United States of America | 1,783 |
| Netherlands | United States of America | 1,670 |
| Italy | United States of America | 1,492 |
| France | Germany | 1,492 |
| China | Japan | 1,462 |
| Germany | Netherlands | 1,332 |
| Austria | Germany | 1,307 |
| Turkey | United States of America | 1,233 |

**Largest Inventor migration corridors excluding US (as destination)**

| Origin | Destination | Inventors |
|---|---|---|
| Germany | Switzerland | 4,949 |
| France | Switzerland | 1,879 |
| France | Germany | 1,492 |
| China | Japan | 1,462 |
| Germany | Netherlands | 1,332 |
| Austria | Germany | 1,307 |
| France | United Kingdom | 1,210 |
| China | Singapore | 1,149 |
| Germany | Austria | 1,107 |
| United Kingdom | Germany | 1,080 |
| Netherlands | Germany | 1,049 |
| United States of America | China | 1,041 |
| Germany | United Kingdom | 969 |
| Italy | Germany | 956 |
| Italy | Switzerland | 955 |
| France | Belgium | 934 |
| Germany | France | 916 |
| United Kingdom | Switzerland | 887 |
| United States of America | Germany | 820 |
| United States of America | Canada | 807 |

Fig. 7. Uttermost populated inventors' migration corridors (2006-2010)

## 7. Conclusions

Although the Romanian public and the body politic are decrying the brain drain as having a negative impact to the country, the emigrants' accomplishments are reason for national pride and enrolment in the national narrative supposedly showing that we are as capable as others or even more. This seems no longer to be the case. The general decrease in the Romanian competitiveness has finally touched the stock of brains to be drained. Not because the Romanian IQ has decreased but because the educational and the economic

environments are not beneficial to the full expression of potential. The fact that many of the Romanian emigrants are successful professionals and innovators reinforces the proof that the potential exists.

Yes, the brain drain continues but at lower expertise levels because Romania is no longer offering growth opportunities despite the increasing mandated R&D expenditure.

No, the brain drain is not a net negative for the country of origin; on the contrary, the emigrants keep in touch and diffuse back some of their advancements. Evidence shows that invertors brains drainers do not break ties with their countries of origin, on the contrary, as diasporas, they may form a valuable resource in disseminating funds but most importantly knowledge and new technologies.

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