Globalization: a Road to Innovation

Florentina IVANOV[1]

Abstract

Innovations are precious for an economy and quite valuable for their owners, too. But these good-for-everybody things are a strange product of the economic activity, they are based on creativity, they tend to be unpredictable and risky, they come up where one would least expect and many times fail to respond to economic incentives. This article argues that there is a less expensive way to foster innovation, and that is to open the economic sector towards external influence.

This article will test the following hypothesis: does an open economy have an increased innovation activity? In order to make a reasonable approximation of the level of openness and innovation, we used indicators like: the international mobility of the university students and teachers, the direct foreign investments and the percentage of population involved in R&D activities. More precisely, we tested if the level of globalisation of the Romanian macroeconomic regions had a significant impact over the R&D activity of the same regions.

Keywords: *knowledge transfer, transfer of competencies, R&D, mobility, globalisation.*

JEL classification: O31

1. Introduction

Then EU Strategy 2020 identified several modalities to raise growth. Among these initiatives, creating an innovation-friendly environment was one way of bringing growth and employment in the economy. But even though innovation is recognised as essential to our further development, the innovation culture continues to be underdeveloped in Romania. It seems that Romania did not make the necessary steps towards a high added value production, being more concerned with the efficiency of the economic system instead on promoting the creative potential of the population.

This article aims to study the added value of the external sector to the innovative process in the Romanian economy. The reason behind this argumentation is quite intuitively and it is connected to the fact that innovation flourishes in environments where ideas are exchanged, old solutions are applied to new problems and people interact with different cultures.

[1] **Florentina IVANOV,** The Bucharest University of Economic Studies, Romania
E-mail: flory.ivanov@gmail.com

2. Context

This study was inspired partially by the lecture of the "Research and Innovation Performance in Romania. Country Profile" report, written by the European Commission (2014). This recent country profile for research and innovation in Romania illustrates the week position of Romania in terms of innovation compared with the EU average. Romania has one of the lowest values in the EU for both R&D intensity (-4.2 % for 2007-2012) and business R&D investments, at a -6.8% annual average growth for 2007-2012. In this context, it comes to no surprise that Romania and Bulgaria are the only two countries from the EU which did not pass from an efficiency driven economy to an innovation-driven one.

The report of the European Commission recognizes the efforts made by the policy-makers to reform the research system in the country. Nevertheless, these efforts were not supported by a long-term political vision and a consistent implementation of the strategies to encourage innovation. The fact that Romania ranks the last one on the average public expenditure on R&D as percentage of GDP in 2007-2012 proves the lack of real support for research and development. According to the same report, the Romanian population is also unaware of the value that the R&D sector has for enhancing competitiveness and securing high-quality jobs. An analysis made by Cristina Cotocel et. al. (2014) showed that according to data presented by the Romanian Government in the National Reform Programme 2014, the chances to reach the proposed targets are quite low. In this context, our article aims at rising the interest in R&D activities by underlining some of the factors influencing it which do not require direct governmental investments.

3. The hypothesis and the model testing it

An article from the Business Week Magazine (2000) explained that "An open economy spurs innovation with fresh ideas from abroad". This finding, which is now more than a decade old, was confirmed by Andrew DuBrin, Professor Emeritus in Management at the Rochester Institute of Technology in his excellent book "Essentials of Management" (2011). An open economy benefits from foreign companies bringing new products and strategies to the local environment. By adapting these foreign products to the domestic circumstances, the companies create new outputs, and engage in the innovation process. Ultimately, they test their own limits, but also put pressure on the limits of the market.

The transfer of knowledge and inspiration at the confluence of the local and external sectors is not a one-way process, but rather a mutual benefit. By entering a new market, the globalized company adapts itself to the new economy and brings innovative ideas back home or elsewhere. A study conducted on the interaction of expatriates in multinational corporations with host country nationals shows that there is an active transfer of knowledge both ways, from the expatriates to the companies abroad and vice-versa (Hsu, 2012).

Our general hypothesis is therefore: are the openness and the innovation level of a given economy directly related?

The business sector is not the only means of innovation by pooling together diverse knowledge. International research projects, the inflow and outflow of students engaged in mobility programs and teachers' professional stages abroad are conductors of innovative ideas in the education and public research system. In the same time, the distribution of international publications and global access to data are all pathways for knowledge and ideas transfer and thus enablers of innovation in the private sector, with potential for entrepreneurship.

In this article, we will analyse if the internalization of the Romanian macroeconomic NUTS 2 regions relates in a significant way to the R&D activities in the country. Taken in consideration the data publicly available, we considered indicators measuring the presence of international companies, the number of students and teachers engaged in mobility programs and broader access to international data as suitable for giving an estimation of the level of openness of a region. These factors are expected to be in a consistent positive relationship with the R&D activities in the regions. In order to verify the consistency of our analysis, we considered all Romanian macro-economic regions during the last five years in the available statistics.

Our analysis focuses on the eight macroeconomic regions of Romania. In order to assure the relevance of the results for the policymaking, we considered only data starting one year after the membership in the European Union. Delayed effects of membership are thus accounted for by leaving one year for adaptation. For testing our hypothesis, we used and adapted a cross-sectional time series regression model.

Our dependent variable, the innovation activity transposed into the economy of the regions is estimated by the percentage of the total population engaged in R&D activities (y). The choice of the independent variables tried to estimate the openness level of the regions on three main dimensions: the connection of the local business sector with the foreign one, the exchange of experience and information in the public sector and the involvement of the private persons in activities linked to foreign information sources.

The knowledge and innovation channels linking the domestic business sector to the external sector was estimated by the level of foreign direct investments (x1). The data for this indicator was gathered from publicly available databases, named below.

The foreign knowledge inflow in the public sector was estimated by the number of students and teachers engaged in mobility programs. The data for this last indicator was computed by a laborious process of summing up the reported data from all public universities located in each of the regions. It includes both teachers and students engaged in study, research or practice stages on a temporary basis, reported to the regional population (x2). The analytical information is available upon request for consultation or verification purposes.

Finally, the access to international information was estimated by the

proportion of the population who used the internet at least once a week, including every day (x3). This last variable has a great limitation given by its mixed content: the population uses internet not only for research or ideas with the potential of becoming innovative products or strategies. We expect that a significant part of the population with internet access uses it for other purposes, like socialisation, entertainment, networking, shopping etc. Indeed, the Eurostat regional information society statistics shows that 66% of the individuals who used the internet in one week's time also used it for networking purposes, like creating user profile, or using social media in 2011. A similar study performed in 2014 shows an average of 74%. This proves that most of the individuals use the internet for other purposes than research and this trend is getting stronger. Of course, we expect that individuals using the internet as a source of innovation will also use it for networking purposes and the data does not allow us to differentiate on the exact purpose. Anyhow, this discussion is beyond the purpose of this article. It is not our intention to delimitate what kind of knowledge transfer is useful for the innovative process or what kind of specific interactions with the external sector are influencing the R&D process. There are sufficient grounds to consider that some of the networking activities might actually support the R&D activities in an indirect way. Therefore, we included this variable in our model, but expected that it might not be significant for our analysis.

To summarise the discussion above, our specific hypothesis becomes**: do foreign direct investments, number of students and teacher involved in exchange programs and internet access of the population have a positive impact over the R&D activities in a region?**

We can write our estimated model in the following way:

$$y_{it} = \beta_0 + \beta_1 * x_{1it} + \beta_2 * x_{2it} + \beta_3 * x_{3it} + u_{it} \qquad (1)$$

where i= 1,…8 is the individual dimension representing the number assigned to each macroeconomic region, t = 2008,…2012 is the time dimension and u is the error term.

The data for the four variables was collected and computed using databases from the Romanian National Institute of Statistics, Eurostat, the Romanian National Bank, the Romanian Ministry of Finance, UNCTAD and the National Office of Patents. A descriptive statistics of the observations is presented below:

Variable	Variable short name	Obs	Mean	Std. Dev.	Min	Max
X1	FDI	40	.0028129	.0045388	.0002623	.0157335
X2	Mobility in public univ.	40	.030256	.0192275	.0052138	.06953
X3	Internet usage	40	34.975	9.360275	22	61
Y	R&D employment	40	.2152427	.2669596	.0540583	.9805863

Figure 1. Summary of data. **(Computed using STATA)**

Where:

- The regions take into account are the 8 administrative regions of Romania as it follows: 1-Nord-West, 2-Center, 3-Nord-East, 4 – South-East, 5-South, 6-Bucharest and Ilfov, 7-South-West, 8 – West;
- The years take values from 2008 through 2012;
- X1 represents millions euros of foreign direct investments per capita, computed with the formula: x1 = foreign direct investments in each region/ the number of resident population. The foreign direct investments is calculated in mil. Euros, after the methodology recommended by the International Monetary Fund (IMF, 2009) and computed after the yearly reports published by the National Bank in each region at the beginning of each year, based on data from Eurostat database. All the variables in our model are compared to the corresponding regional population in order to account for regional differences and to make the values comparable;
- X2 is the rate of the students and teacher engaged in mobility programs as a percentage of the total population. It is computed taking in consideration the number of students and teachers who fulfilled mobility stages, computed for each region by adding the data reported by each university in the NUTS2 regions, based on statistics published by The Lifelong Learning Programme and UNCTAD;
- X3 is the variable describing the percentage of the population using the internet in the last week, based on data from Eurostat;
- Y is the dependent variable of our model and represents the percentage of the regional population working as employees in the R&D sector; it take in consideration the total employees in R&D activities by NUTS 2 regions at the end of the year, retrieved from the National Institute of Statistics.

The steps followed for estimating our model were the ones described by Stănilă, Andreica and Cristescu (Stănilă et al., 2013). After declaring the variables as panel dataset, with the identification variable A and the time variable B, the econometrics program recognized a strongly balanced panel (the same number of years for each region) with complete observations for each panel from 2008 through 2012, meaning 40 observations. Taking in consideration our assumptions, we expected a positive sign for all the three explanatory variables included.

Considering the relatively small number of observations and the possibility that additional unobserved variables affect the R&D activity, we conducted a Hausman test (Stata, 2013). This is because it is possible to assume that individual-specific, time-invariant effects, like the geographical resources, climate, historical developments for each region etc. that we assume are fixed during the period studied, not included in the model otherwise, affect the R&D activity. Therefore we can assume fixed effects and by this means control for unobserved heterogeneity of the regions, when this heterogeneity is constant over time and correlated with the R&D activity. However, the Hausman test revealed a P-value is statistically insignificant. The results are shown below:

```
                 ---- Coefficients ----
          |      (b)          (B)            (b-B)     sqrt(diag(V_b-V_B))
          |     fixed        random       Difference          S.E.
----------+------------------------------------------------------------------
          X1 |    45.8991    58.69103      -12.79193        25.06748
          X2 |   .0124632    1.426246      -1.413783        1.554075
          X3 |  -.0013923    -.002777       .0013847        .0015045
------------------------------------------------------------------------------
          b = consistent under Ho and Ha; obtained from xtreg
          B = inconsistent under Ha, efficient under Ho; obtained from xtreg
          Test:  Ho:  difference in coefficients not systematic
          chi2(2) = (b-B)'[(V_b-V_B)^(-1)](b-B) = 1.02
          Prob>chi2 =      0.6016
```

Figure 2. Hausman test. (Computed using STATA)

The Hausman test evaluates the hypothesis that the coefficients estimated by the efficient random effects estimator are the same as the ones estimated by the consistent fixed effects estimator (Stata, 2013). Our insignificant p-value does not support this hypothesis. Therefore, we used the random effects model in our analysis. (Wooldridge, 2010). This can be explained by the fact that some of the differences between the regions are anyhow accounted for in our model by adjusting all variables by the population size.

Additional, we considered robust standard errors for taking in consideration heteroskedasticity problems, which appear often in cross-sectional and time series measurements. Conducting a serial correlation test and a test for group heteroskedasticity indicated that a robust estimation was more appropriate. Accordingly, the random-effects linear regression with robust standard errors gave the following results:

```
Number of obs      =        40
Number of groups   =         8
R-sq:  within  = 0.0916                 Obs per group: min =         5
       between = 0.9945                                avg =       5.0
       overall = 0.9792                                max =         5


------------------------------------------------------------------------------
             |               Robust
           Y |      Coef.   Std. Err.      z    P>|z|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
          X1 |   58.69103   1.459233    40.22   0.000     55.83098    61.55107
          X2 |   1.426246   .3530637     4.04   0.000      .734254    2.118238
          X3 |   -.002777   .0007213    -3.85   0.000    -.0041908   -.0013632
       _cons |   .1041217   .0238296     4.37   0.000     .0574164    .1508269
-------------+----------------------------------------------------------------
```

Figure 3. Panel data regression (Computed using STATA)

The regression analysis shows that all the three explanatory variables considered are statistically significant at 1%. They are also jointly significant.

4. Interpretation of results

The overall fit of the model is very good, showing that the foreign direct investments (FDI), the mobility of students and teachers and the access to internet explain 97% of the R&D activities per capita in the Romanian macroeconomic regions after the adherence to the European Union, when controlling for the number of population in each region. This would mean that only 3% of the R&D employment variations are left unexplained. Even if this high goodness-of-fit shows that our model explains most of the R&D activity in Romania, we still have to treat with caution the practical significance of the exact percentage. Mainly, we can give a special attention to the fact that the number of individuals residing in each region, which was included in all the variables in our test, implicitly accounts for many other factors like the general regional economic conditions, climate, socio-economic development possibilities, ethnic situation, political stability etc. This makes the variables comparable across the regions.

From the three factors explaining the R&D activity, the FDI per capita has the most important influence on the number of jobs in R&D sector (variable X1). The results of our test show that 10,000 euros increase in FDI per capita will lead to an additional 0.59 % of the population working in the R&D activities, holding other factors fixed.

The rate of the students and teacher engaged in mobility programs (variable x2) has, as expected, a positive impact on the R&D employees. Holding other factors constant, double more students and teachers going abroad for short term professional stages will increase the R&D employment in the region by 1.4%.

Using the internet with at least a weekly frequency has however a negative, but practically insignificant impact on the number of R&D jobs, given by the low coefficient of -.002777. This is related to our previous discussion, in which we explained that given the fact that internet is mainly used for other activities than information purposes, this variable might not have a significant economic impact on the R&D sector. Finally, the intercept of 0.104 shows that there would be on average 0.104 % of the population working in the R&D sectors if the FDI would be zero and if there would not be any mobility at the university level.

5. Conclusions

This study shows that research and development is positively correlated to higher openness of the economy. An active presence of foreign companies and mobility of personnel at the tertiary education level is likely to bring an infusion of knowledge from abroad and has a positive impact on R&D jobs creation. Opening to external influences in business and education sectors has therefore the potential of developing the country and creating high-quality jobs, without relying on the

governmental R&D investments.

The media concentrated quite much lately on the negative effects of opening up the economies. Consequences like the immigration of the skilled labour force, instability of production, drain of resources, macroeconomic imbalances, criminality and cultural conflicts cannot be overseen and have a high political impact. However, isolation is also documented to be extremely unproductive for the countries or regions adopting it.

In our opinion, the risks associated with an open economy need to be handled by firmly coordinated strategies and not avoided by retreating from the globalisation process. It is very hard and expensive to swim against the tide and try stopping the natural exchange of information and work force movement across the country borders, especially in the technological era. Instead, we can concentrate on the positive aspects of globalisation and take the most out of them. The flow of knowledge across countries is an important positive aspect, because it stimulates creativity and innovation in the confluence space where different perspectives and ideas meet each other. Students and teachers travelling abroad, foreign companies developing new products and strategies in different markets and people accessing information from all around the world are the kind of factors that create diffusion of knowledge and transfer of competencies around the globe. The regions which manage to attract and stimulate this transfer of knowledge are the ones more likely to become the frontier where new competencies are combining, creating unexpected products and solutions.

Acknowledgement

This paper was co-financed from the European Social Fund, through the Sectorial Operational Programme Human Resources Development 2007-2013, project number POSDRU/159/1.5/S/138907 "Excellence in scientific interdisciplinary research, doctoral and postdoctoral, in the economic, social and medical fields -EXCELIS", coordinator The Bucharest University of Economic Studies..

References

1. Bernstein, A. (2000). “Backlash: Behind the Anxiety over Globalization”. Table. *Business Week Magazine*, April 24 issue.
2. Cotocel C., Grigoraş B, Florea C., Concioiu N, Stan A (2014) “Strategic Management of Sustainable Development of Romania in the European Context – Europe 202”. *Review of International Comparative Management* Volume 15, Issue 4, October 2014 (pp. 431-439)
3. Council Recommendation on Romania’s 2014 national reform programme and delivering a Council opinion on Romania’s 2014 convergence programme. Retrieved on 9 August 2014 from: http://ec.europa.eu/europe2020/pdf/ csr2014/ csr2014_romania_en.pdf

4. DuBrin, Andrew (2011). *Essentials of Management*. 9th edition, Connecticut: Cengage Learning, (p. 57).
5. European Commission. (2014). *Research and Innovation Performance in Romania. Country Profile*. Luxembourg: Publications Office of the European Union
6. EU launches Investment Offensive to boost jobs and growth. Retrieved on 9 September 2014 from: http://europa.eu/rapid/press-release_IP-14-2128_en.htm**.**
7. Europe 2020 in a nutshell. Retrieved on 9 August 2014 from: http://ec.europa.eu/eurostat/web/ europe-2020-indicators/statistics-illustrated.
8. Fourth Alert Mechanism Report on Macroeconomic imbalances in EU Member States. Retrieved on 9 September 2014 from: http://ec.europa.eu/europe2020/pdf/targets_en.pdf
9. Eurostat. Database. Retrieved August 10 to September 9, 2014 from http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database.
10. Eurostat regional information society statistics. Retrieved August 10 to September 9, 2014 from http://appsso.eurostat.ec.europa.eu/nui/ show.do?dataset=isoc_r_iuse_i&lang=en
11. Hsu, Yu-Shan. (2012). *Knowledge Transfer between Expatriates and Host Country Nationals: A Social Capital Perspective.* Milwaukee: The University of Wisconsin
12. International Monetary Fund. (2009). *Balance of payments and international investment position manual.* Fifth Edition (hereafter, BPM5). Washington, D.C.: International Monetary Fund
13. Lifelong Learning Programme (LLP) Retrieved August 29, 2014 from http://www.llp-ro.ro/llp.php?id=322&d=42
14. Romanian National Bank. Statistical publications on FDI. Retrieved September 10, 2014 from http://www.bnr.ro/PublicationDocuments. aspx?icid=9403.
15. Romanian National Institute of Statistics. Database Online Tempo and statistical publications. Retrieved September 10, 2014 from https://statistici.insse.ro/shop/.
16. Stata. (2013). *Longitudinal/Panel-Data Reference Manual* Release 13. Texas: Stata Press.
17. Stănilă, L., Andreica, M., & Cristescu, A. (2013). "Employment in the EU countries: a panel data analysis". *Theoretical and Applied Economics*, 18(1 (578)), 87-102.
18. UCLA Academic Technology Services. Stata. Retrieved August 11, 2014 from http://www.ats.ucla.edu/stat/stata/faq/revsfe.htm.
19. Wooldridge, J. M. (2010). *Econometric Analysis of Cross Section and Panel Data.* Cambridge, MA: MIT Press.