INNOVATION AS THE PATHWAY TO GROWTH. THE CONNECTION WITH THE LABOUR MARKET

BURCIU Andreea[1]

University of Economic Studies, Bucharest, Romania

Abstract

The EU is crossing an era of challenges, while implementing a new set of strategies meant to put it back on the map of competitiveness and economic power. The boost of employment is one of the signs of prosperity after the economic crisis, while innovation can be the one of the key factors to this growth. The paper aims to study the links between innovation and employment using panel data models, on a time frame of 8 years.

Key words: *labour market, innovation union, economic sustainability, panel data analysis*

JEL classification: *J21, O30, O40*

1. Introduction

Innovation can be considered the "new economic engine". In this paper my aim is to study whether innovation can be the answer for economic growth and re-launch of the EU as a leader in the global markets and which are the links between innovation and employment.

The European Commission defined in the past innovation like a synonym for successful production, assimilation and exploitation of novelty in the economic and social spheres, offering solutions to problems and making it possible to meet the needs of both individuals and society. (EC, 1995). Moreover, innovation can be the one providing sustainable prosperity

[1] Ph.D. student, Department of Statistics and Econometrics, andreea.burciu@gmail.com

(Grossman, 1994; Helpman, 1994; Baumol, 2002; Bhidé, 2008) and a competitive advantage.

Going through a phase of transformation, Europe is trying to catch up and finally overcome the gap created by the economic crisis, which enlightened many deficiencies. The fast changing environment, the progress of the emerging markets, the aging population, the increasing resources' scarcity, plus the territorial tensions around the globe bring in a series of factors that need to be addressed as soon as possible. Adding up the unemployment, the shy energy efficiency and a rather formal use of renewables, a weak inclusion policy and many other factors, we can define the perfect framework for other than positive outcomes.

Therefore, since 2010, in the middle of the rebound from the crisis, Europe came up with Europe 2020 strategy which meant to solve as much as possible these issues. This strategy has three priorities for smart growth (through more effective investments in education, research and innovation); sustainable growth (thanks to a decisive move towards a low-carbon economy) and inclusive growth (with a strong emphasis on job creation and poverty reduction). The strategy is focused on five ambitious goals in the areas of employment, innovation, education, poverty reduction and climate/energy. (EC, 2015).

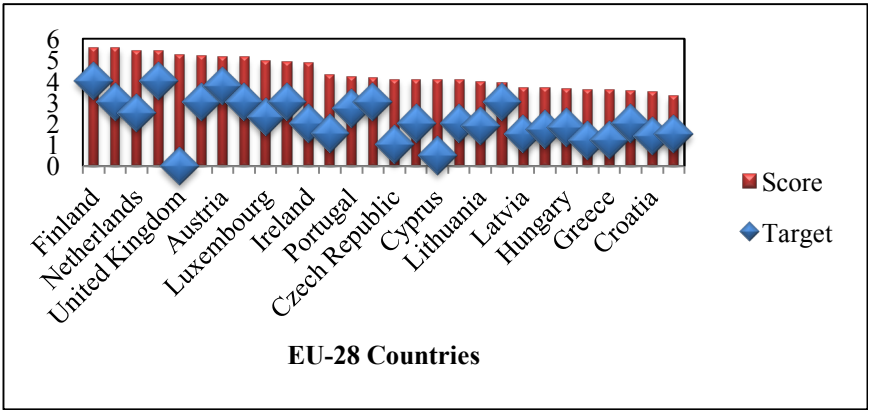
In 2000, the EU adopted the Lisbon strategy which failed in meeting the target of 3% of the GDP to be allotted for research and development. In 2010, the target was preserved (for 2020), but it has different values for the Member States, considering their evolution stage and development. For example, for Romania, the target is set at 2% of the GDP to be allotted for R&D by 2020. (Bria, 2015). Moreover, another target set for 2020 is to have an overall employment rate of 75% for people between 20 and 64 years old. Therefore, studying the evolutions of innovation and employment as assumed targets for the EU's strategy may lead to a in-depth analysis of the status of EU and the measures it took in order to fight the effects of the crisis.

Innovation Union, a flagship initiative under the Europe 2020 strategy, is an integrated innovation strategy built around 34 specific commitments. Based on a broad concept of innovation, regarding both the public and the private sector, the initiative aims to improve conditions and access to finance for research and innovation in Europe and to ensure that innovative ideas can be turned into products and services that create growth and jobs. (EC, 2011). The main issue of innovation at EU level is not considered to be the scientific

area, which provides valuable results, but the way these outcomes are integrated and transformed into industrial advantage.

This can impel productivity, resource efficiency and market shares. (EC, 2012).

Figure 1: Score of the Innovation pillar for EU-28 Countries



Source: (World Economic Forum, The Global Competitiveness Report 2014 - 2015)

2. Innovation and Competitiveness

Innovation and business sophistication are two of the 12 pillars included in the Global Competitiveness Index (GCI) prepared by the World Economic Forum. They both define the "Innovation and sophistication" sub-index. According to the GCI's methodology, the business sophistication refers to the quality of a country's overall business networks and the quality of individual firms' operations and strategies. The methodology also states that the innovation pillar focuses on technological innovation. Although substantial gains can be obtained by improving institutions, building infrastructure, reducing macroeconomic instability, or improving human capital, all these factors eventually run into diminishing returns. (WEF, 2015)

I was interested to see which is the status in the GCI, regarding the Innovation pillar, for all the EU-28 countries.

In the figure above, "Score" represents the aggregated score of the Innovation Pillar for the year 2014. Finland has the highest innovation score, 5,57 points, being ranked the third in the world, after Switzerland and Japan (score -5,68). Next, Germany, the second in the EU and the forth in the world, being followed by the Netherlands and so on. The backward countries are the

newest Member States of the EU, namely Romania (the 78th in the world, with an aggregate score of 3,53), Croatia (the 87th in the world, with an aggregate score of 3,47) and finally, Bulgaria (the 106th in the world with a score of 3,27).

The main competitors of the EU on the global market - the US (5th place), China (33rd place), Japan (2nd place) and South Korea (22nd place) are seriously challenging the competitiveness of the EU. Six EU countries reach the top 10 (Finland, Germany, Netherlands, Sweden, UK, Denmark), while 16 are out of top 30. It is worth mentioning that while our competitors take action as a single country, applying the same plans, policies and sharing the same market and having only one budget, the EU had to create an architecture in order to be more similar, as mechanisms, to a single economic area. The Innovation Union, as a policy paper and guideline, comes to enforce the vision of the 28 Member States in this field and to enhance the availability of resources of any kind. Nevertheless, the economic profile, the size, the history, the culture and the political factors of the Member States are different and these are real challenges faced by the EU every day.

According to the European Commission, this gap between EU and the others is caused by two main reasons. The first reason refers to the share of high-tech manufacturing sectors in the EU's economy which, compared to US', are decreasing. In addition, these sectors are less research-intensive in the EU. A slower speed of change generates a lower offer of investments. On the other hand, there has been registered an increase in the Chinese R&D intensity, growing 30 times quicker than Europe. (EC, 2011).

Also, in Figure 1 I introduced the "Target" indicator which aims to show which is the target for each EU-28 Member State for 2020 in terms of allotment to research and innovation from the GDP. As previously stated, the overall target is 3%. However 9 countries are at 3 and over 3% target (Finland, Sweden, Austria, and so on) and 11 are below 2% target (Cyprus, Slovakia, Greece and others). Regarding UK, there are no targets set, while for the Czech Republic there is a 1% target set only for the public sector.

The Global Competitiveness Index classifies the world economies in economies "factor driven" (countries compete based on their factor endowments-primarily unskilled labour and natural resources), "efficiency driven" (countries must begin to develop more efficient production processes and increase product quality because wages have risen and they cannot increase prices) and, finally, the third stage, "innovation driven" (when companies must compete by producing new and different goods using the most sophisticated

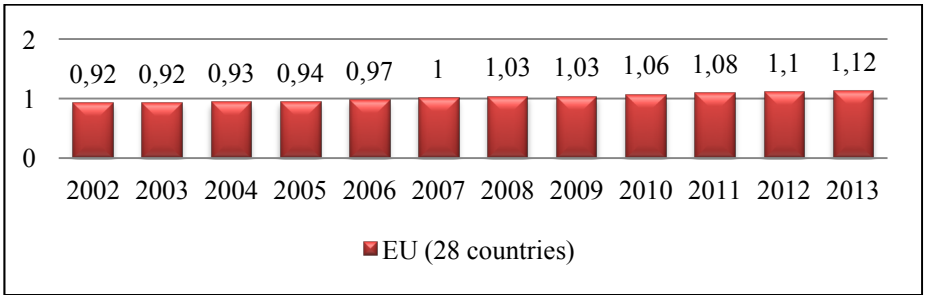
production processes and by innovating new ones). Between the three phases are two transition areas. For the EU-28 Member States, according to GCI, Romania and Bulgaria are in the "efficiency driven" economy phase, Lithuania, Latvia, Hungary, Poland and Croatia are in the "transition period" from the "efficiency driven phase" to the "innovation driven" phase. The other 21 Member States are the "innovation driven" economy phase, which indicates a high level of development and a push factor for the other countries.

3. Innovation and Employment

According to Innovation Union Competitiveness Report (EC, 2011), the EU should create at least 1 million new research jobs in order to reach its 3% 2020 target. Not only that there is a need for a 2/3 increase in the number of researchers, but they must adapt to the new market demands. The study also brings into the limelight the fact that the EU researchers are more involved in the public sector (54%) instead of private, as is the case in China (69%), Japan (73%) or the US (80%). (EC, 2011)

Next, as this paper aims to study innovation as a solution for growth in jobs and boosting opportunities for EU's workforce, it is interesting to find which is the involvement of the workforce in this domain. It is well-known that without qualified human resources able to cope with the new challenges, with the competition of the other large economies and with the technological change, the efforts may be futile.

Figure 2: The evolution of research and development personnel as a percent of the total workforce



Source: (Eurostat)

The above figure shows the evolution of the research and development personnel as a percent of the total workforce at EU level. According to this data from Eurostat, the percent of persons who worked in this area has grown every year and includes all persons employed directly on R&D, as well as those providing direct services such as R&D managers, administrators, and clerical staff. Eurostat considers the OECD definition of researchers as professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of the projects concerned.

4. Methodology and data analysis

It was developed an econometric model meant to test and explain the hypothesis that the evolution of the labour market is influenced by innovation. In order to have a more accurate analysis of the phenomena, I chose using the panel data analysis method which brings a double benefit: the behaviour of the cross-sectional series and the time dimension. I applied a multiple regression model for the panel data. The panel data analysis had the advantage of providing superior estimates of a trend in a variable or indicator, summarising into one coefficient the impact of a variable over a dependent variable group of time series, grouping the dependent variable into categories.

I considered the unemployment rate (*Unempl*) as the dependent variable, meant to capture the evolution of the labour market at EU level. During the economic crisis, the unemployment rate varied very much and can be a strong indicator for study. As independent variables, I took into consideration 8 factors that, according to the Innovation Union Scoreboard, define innovation performance as an aggregate of the relative strengths and weaknesses of the research and innovations systems (EC,2014). The first factor is Human Resources (*HR*) and is comprised of three sub-components: New doctorate graduates, Population aged 30-34 with completed tertiary education and Population aged 20-24 having completed at least upper secondary education. It measures the high-skilled workforce.

The second variable considered is Open, excellent and attractive research systems (*RS*) which is composed of the number of International scientific co-publications, Scientific publications among top 10% most cited and Non-EU doctorate students. It aims to aggregate the international competitiveness of the science base.

The next variable is the generic Finance and support (*FIN*) which reflects Public R&D expenditure and Venture capital and reflects the degree of financial support for research and innovation.

Firm investments (*INVEST*) are composed of Business R&D expenditure and Non-R&D innovation expenditure, showing the money invested by companies for this domain.

Linkages & entrepreneurship (*ENT*) has three components, namely SMEs innovating in-house, Innovative SMEs collaborating with others and Public-private co-publications, analysing the partnerships between SMEs and the public sector in terms of promoting innovation.

Intellectual Assets (*INTEL*) wants to summarise the intellectual property rights generated through PCT patent applications, PCT patent applications in societal challenges, Community trademarks and Community designs.

Innovators (*INNOV*) aims to measure the number of SMEs that introduced product or process innovations, that introduced marketing/organisational innovations and the Employment fast-growing firms of innovative sectors.

Finally, the Economic effects (*EFFECTS*) indicator reflects the output on the markets in terms of Employment in knowledge-intensive activities, Contribution of the medium and high tech product exports to trade balance, Knowledge-intensive services exports, Sales of new to market and new to firm innovations and Licence and patent revenues from abroad.

The data was collected from Eurostat and regards the EU 28 countries between 2006 and 2013, so that we can see the effect of the economic crisis over their evolution. The main advantage is that the data is comparable as it comes from the same source. The sample has 232 observations.

There are several types of panel data models, mostly used being the pooled model, the fixed effects model and the random effects model. The pooled model is the most simple, since it doesn't take into account the time dimension. The fixed effects model provides estimates of specific coefficients (for the constant term or for the independent variables) for each time series considered as dependent variable. It can be used for a simple approach regression. The random effects model is the most efficient of the three. It assumes that the individual specific effects are uncorrelated with the independent variables. The fixed effect assumption is that the individual specific effect is correlated with the independent variables. (Codirlasu; Chidesciuc, 2008).

For our analysis, we performed both the fixed and the random effects model. In the end, in order to decide which one reflects the best analysis on the available date, I performed the Hausman test for comparing the coefficient estimates.

The initial equation of the model is the following

$$UNEMPL = C(1) + C(2)*HR + C(3)*RS + C(4)*FIN + C(5)*INVEST + C(6)*ENT + C(7)*INTEL + C(8)*INNOV + C(9)*EFFECTS + \varepsilon \quad (1)$$

where C(1) is the free term, C(2) - C(9) represent the sensitivity of Unemployment in connection with the 8 factors taken into consideration as independent variables and ε – residual variable. The parameters C(2)-C(9) reflect with how many units Unemployment has changed while the independent variables grew with only one unit.

Figure 3: EViews output for the fixed effects model

Dependent Variable: UNEMPL
Method: Panel Least Squares

Sample: 2006 2013
Periods included: 8
Cross-sections included: 29
Total panel (balanced) observations: 232

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-4.805704	4.199484	-1.144356	0.2539
HR	7.634682	4.681942	1.630665	0.1046
RS	24.02979	4.938494	4.865814	0.0000
FIN	-8.984255	3.909928	-2.297806	0.0226
INVEST	1.420927	2.668328	0.532516	0.5950
ENT	-4.685105	3.643882	-1.285745	0.2001
INTEL	0.965567	4.582726	0.210697	0.8333
INNOV	-6.900544	3.984182	-1.731985	0.0849
EFFECTS	19.32704	4.115741	4.695885	0.0000

Effects Specification

Cross-section fixed (dummy variables)

R-squared	0.684960	Mean dependent var	8.931034
Adjusted R-squared	0.626798	S.D. dependent var	4.168308
S.E. of regression	2.546429	Akaike info criterion	4.852489
Sum squared resid	1264.438	Schwarz criterion	5.402184
Log likelihood	-525.8887	Hannan-Quinn criter.	5.074175
F-statistic	11.77690	Durbin-Watson stat	0.695425
Prob(F-statistic)	0.000000		

Source: (Own calculations)

As this output shows, R squared (the coefficient of determination) shows a strong correlation between unemployment in the EU-28 Member States and the 8 independent variables included in the analysis. 68,49% of the variation of unemployment is explained by these factors. However, some of the coefficients are not significant, since their p-value is above 0.05 level.

The regression equation is the following:

*UNEMPL = -4.805 + 7.634*HR + 24.029*RS - 8.984*FIN + 1.420*INVEST - 4.685*ENT + 0.965*INTEL -6.900*INNOV + 19.327*EFFECTS* (2)

To sum up, the unemployment varies opposite to the finance and support indicator which shows the degree of support in terms of funding received by the innovation sector. Also, the *RS* indicator (Open, excellent and attractive research systems) and the *EFFECTS* indicator (Economic effects) influence the variation of the unemployment at EU level.

With regard to the random effects model, the equation (1) is also used. The EViews output is the following:

Figure 4: EViews output for the random effects model

Dependent Variable: UNEMPL
Method: Panel EGLS (Cross-section random effects)

Sample: 2006 2013
Periods included: 8
Cross-sections included: 29
Total panel (balanced) observations: 232
Swamy and Arora estimator of component variances

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	7.420617	1.971764	3.763440	0.0002
HR	11.38006	3.310189	3.437889	0.0007
RS	10.67570	3.515784	3.036506	0.0027
FIN	-7.793303	2.961677	-2.631381	0.0091
INVEST	-3.137425	2.274405	-1.379449	0.1691
ENT	-5.654170	3.150611	-1.794627	0.0741
INTEL	-0.861924	3.219099	-0.267753	0.7891
INNOV	-9.825787	2.711055	-3.624340	0.0004
EFFECTS	8.470079	3.258322	2.599522	0.0100

Effects Specification	S.D.	Rho
Cross-section random	2.570248	0.5047
Idiosyncratic random	2.546429	0.4953

Weighted Statistics

R-squared	0.223133	Mean dependent var	2.952450
Adjusted R-squared	0.195263	S.D. dependent var	3.079663
S.E. of regression	2.762677	Sum squared resid	1702.021
F-statistic	8.006307	Durbin-Watson stat	0.514795
Prob(F-statistic)	0.000000		

Unweighted Statistics

R-squared	-0.023167	Mean dependent var	8.931034
Sum squared resid	4106.560	Durbin-Watson stat	0.213364

Source: (Own calculations)

As this output shows, R squared (the coefficient of determination) shows a rather weak correlation between unemployment in the EU-28 Member States and the 8 independent variables included in the analysis. 22,31 % of the variation of unemployment is explained by these factors. However, some of the coefficients are not significant, since their p-value is above 0.05 level. According to this model, the unemployment rate's variation depends on the *HR* (human resources), the *RS* indicator (Open, excellent and attractive research systems), *FIN* (Finance and support), *INNOV* (Innovators) and the *EFFECTS* indicator (Economic effects).

The regression equation is the following:

*UNEMPL = 7.429 + 11.380*HR + 10.675*RS - 7.793*FIN - 3.137*INVEST - 5.654*ENT - 0.861*INTEL - 9.825*INNOV + 8.470*EFFECTS* (3)

As mentioned before, the Hausman test will be used in order to decide which of the models is viable for this set of data. The output shows that there are significant differences between the coefficients of the fixed and random effects model and indicates the necessity of using the fixed effects model.

5. Conclusions

In a globalised economy, Europe is struggling to cope with the changes required after the economic crisis. The European Commission has put in place a series of policies meant to make this happen. Nevertheless, the results are still far from the targets and the unemployment is high in many countries. The particular profile of the European Union is one of the factors that may keep it from progressing in a faster pace. The major challenges such as climate change or ageing population require a holistic approach from the scientific and technological cooperation. In this paper, I aimed to analyse which is the status of innovation and its connection to the EU's competitiveness and also with the employment. The panel data models showed a link between the variables that compose the Innovation Union Scoreboard and the unemployment rate. Still, the link is not as strong as expected, yet the unemployment varies with two out of eight indicators included in the Scoreboard.

If we take into consideration previously proved models of economic growth, innovation is a clear and sure answer for enhancing success and creating new job opportunities, both by hiring workforce, but most by leading to new niches and domains to be developed.

6. References

- Archibugi, D.; Filippetti, A.; Frenz, M. (2013) Economic crisis and innovation: Is destruction prevailing over accumulation?, *Research Policy*, Volume 42, Issue 2, Pages 303–314.
- Baumol, W.J. (2002) The Free-Market Innovation Machine: Analysing the Growth Miracle of Capitalism, *Princeton University Press*.
- Bhidé, A. (2008) The Venturesome Economy: How innovation sustains prosperity in a more connected world, *Princeton University Press*.
- Bria, F. (2015) Growing a Digital Social Innovation Ecosystem for Europe, *European Commission, Directorate-General of Communications Networks, Content & Technology*. Available at http://www.nesta.org.uk/sites/default/files/dsireport.pdf
- Ciriaci, D.; Moncada-Paternò-Castello, P.; Voig, P. (2013) Innovation and Job Creation: A sustainable relation?, *Joint Research Centre.*
- Codirlaşu, A.; Chidesciuc, N.A. (2008) Econometrie aplicată utilizând EViews 5.1, Academia de Studii Economice.
- EC (1995) Green Paper on Innovation. Available at http://europa.eu/documents/comm/green_papers/pdf/com95_688_en.pdf
- EC (2011) *Innovation Union Competitiveness Report 2011.* Available at http://ec.europa.eu/research/innovation-union/index_en.cfm?pg=home&section=competitiveness-report&year=2011
- EC (2012) *A Stronger European Industry for Growth and Economic Recovery*. Available at http://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52012DC0582&from=EN
- EC (2014) Innovation Union Scoreboard, *Directorate-General for Enterprise and Industry*. Available at http://ec.europa.eu/enterprise/policies/innovation/files/ius/ius-2014_en.pdf
- EC (2014) Research and innovation as sources of renewed growth, *Directorate-General for Research and Innovation.*

- EC (2015) *Europe 2020 in a nutshell*. Available at http://ec.europa.eu/europe2020/europe-2020-in-a-nutshell/index_en.htm
- Eurostat (2015) How is the European Union progressing towards its Europe 2020 targets?, *Eurostat Press Office*.
- Grossman, G.; Helpman, E. (1994) Endogenous Innovation in the Theory of Growth, *Journal of Economic Perspectives* 8(1), p. 23-44.
- Jula N.; Jula D. (2013) *Modelarea economica: modele econometrice si de optimizare*, Bucuresti: Mustang.
- Mihai, M.; Ţiţan E. (2013) Education and Innovation in the Context of Economies Globalization, *Procedia Economics and Finance.*
- WEF (2014) *The Global Competitiveness Report 2014–2015*. Available at http://www3.weforum.org/docs/WEF_GlobalCompetitivenessReport_2014-15.pdf

Acknowledgement

This work was co-financed from the European Social Fund through Sectorial Operational Programme Human Resources Development 2007-2013, project number POSDRU/159/1.5/S/134197 „Performance and excellence in doctoral and postdoctoral research in Romanian economics science domain".