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# TECHNOLOGY TRANSFER, FDI AND ECONOMIC GROWTH IN THE EU TRANSITION COUNTRIES AND THE REPUBLIC OF CROATIA

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## *Abstract*

*The importance of technology in driving the economic growth has been the subject of many studies since technology is one of the key factors of economic growth. Foreign direct investments (FDI) are one of the most effective ways to transfer modern technology and have a positive effect on economic growth. This paper analyses the impact of FDI and indicators of technology transfer and competitiveness on economic growth in the EU Transition countries and Croatia in the period from 2001 to 2010. The analyzed variables were FDI, technology transfer indicators (granted patents, investment in R&D, investment in education) and their impact on GDP. The results showed that there is a positive relationship between FDI and technology transfer indicators on GDP as the key indicator of economic growth what is also related to the EU Transition countries and Croatia.*

***Key words: FDI, technology transfer, competitiveness, economic growth, EU Transition countries, Croatia***

# 1. INTRODUCTION

FDI are an important source of financing the capital needs of the receiving country and are also an effective way of technology and knowledge transfer from more developed countries to countries with a lower rate of economic development.

Technological progress plays an important role in the process of economic development (Nelson and Phelps, 1966; Jovanovic and Rob, 1989; Segerstrom, 1991). In Solow's model of economic growth, technological progress is viewed as an exogenous variable. Recent studies emphasize the dependence of economic growth on the level of technological progress of a country compared with the rest of the world. Modern technology provides a competitive advantage to its owner. Johnson (1970) believed that technology transfer was a crucial factor in FDI inflow.

Recent studies emphasize the importance of technological change in driving the economic growth (Grossman and Helpman, 1991; Barro and Sala-i-Martin, 1995). The rate of economic growth in less developed countries is highly dependent on the degree to which these countries can adopt and implement modern technology transferred from more developed countries. By adopting new technology, less developed countries may try to compensate technological gap, and an important channel through which this transfer can be realized are FDI.

The main motives of certain countries for inflows of FDI are bridging the investment gap, foreign exchange gap, technology gap, and reducing the budget deficit.

The availability of capital is certainly one of the factors of economic growth of a particular country which also represents one of the missing growth factors in transition countries. This investment gap may be bridged with an inflow of FDI from developed countries and create conditions for an increase in economic growth.

Great progress in economic growth may be achieved through transfer of modern technology through FDI, and thus bridge the technological gap of the receiving country. Given that technology is a basic factor of economic and social changes, transfer of technology through FDI achieves a positive macroeconomic impact on the receiving countries.

Another major motive refers to the fact that the transfer of modern technology through FDI achieves savings in resources needed for research and development as well as introduction of modern technologies so the available resources are thus used more efficiently.

Correlation between FDI and technology is very important in analyzing the effects of FDI on economic growth in recipient countries. Particular attention should be devoted to the manner in which technology is transferred in order to avoid the possibility that recipient countries cannot reap the benefits of this

technology. In the usual process of technology transfer the rate of economic growth of the receiving country depends on the possibility of adopting and implementing the modern technology what is mainly analyzed through the level of education of human capital.

Countries receiving FDI are in most cases motivated by the positive effects. From the perspective of transition countries, among which is the Republic of Croatia, the importance of FDI is not only reflected in the opening of new production facilities or the purchase of equipment, but also in the transfer of advanced technology from technologically more developed countries, what, ultimately, has a positive effect on economic growth.

This paper is structured as it follows. The next section provides theorethical and empirical review. The data and analysis are described in the section 3. Section 4 discusses results and concludes the paper.

## 2. THEORETICAL AND EMPIRICAL REVIEW

In explaining economic growth through inflows of FDI and technology transfer indicators it is necessary to reflect on neoclassical theories of economic growth and the theory of endogenous model of economic growth.

Neoclassical model of economic growth was established by American economist Robert Solow (1956) and Australian economist Trevor Swan (1956) for whom this model was called the Solow-Swan model of economic growth. According to their interpretation the economic growth rate is determined by technological progress. According to the Solow-Swan model of economic growth a long-term production growth is determined by the rate of technological progress and the level of technological progress is presented as an exogenous factor.

Contrary to the Solow-Swan model of economic growth a more recent endogenous growth theory provides a different explanation of economic growth. An important contribution to this theory was provided by Romer (1986), Lucas (1998), and Grossman and Helpman et al. (1991). According to this theory, economic growth is determined by the accumulation of knowledge. While in the neoclassical economic growth theory knowledge is viewed as a public good the endogenous growth theory recognizes knowledge that is treated as a market good (intellectual property, trade secrets, know-how…). This is the kind of knowledge that creates competitive advantages.

In the framework of endogenous growth models, there are three main ways in which foreign direct investment stimulate economic growth. Firstly, FDI increase accumulation of capital in the receiving country by introducing new inputs and technologies (Dunning, 1993). Secondly, FDI increase the level of knowledge and skills in the receiving country through the training of human

capital (De Mello, 1997 and 1999). Thirdly, FDI increase the competitiveness of the domestic economy while overcoming entry restrictions and reduction of market power of existing companies (monopolies).

Endogenous economic growth model states that FDI do not only contribute to economic growth through capital formation and technology transfer, i.e. knowledge (Bloomstrom et al., 1996; Borensztein et al., 1995), but also by increasing the level of knowledge through continuous education and training of the labor force (De Mello, 1997 and 1999).

Neoclassical theory and endogenous economic growth models provide the basis for most empirical research on impacts of FDI on economic growth. The connection between these two variables motivated many researchers to empirically determine the positive correlation among them by focusing their research on developed countries and developing countries.

In his study, Keller (1996) argues that access to modern technology itself will not increase economic growth rates. If the absorption capacity of the receiving country (analyzed through education level of human capital) remains unchanged there will not be an increase in the rate of economic growth.

In their study Glass and Saggi (1998) focused on the issue of quality of modern technology transferred through FDI. They emphasize that underdeveloped technological capabilities of recipient countries limit their ability to successfully adopt new technologies.

Borensztein, De Gregorio, and Lee (1995) analyzed the impact of inflow of FDI on economic growth between developed and 69 developing countries in the period between 1979 and 1989 by cross-country regressions. Results of their study showed that FDI are an important way of transferring knowledge and technology considering that they contribute more to economic growth than domestic investment. Furthermore, FDI will have a greater positive effect on economic growth the higher the level of educated human capital in the receiving country is. It can be concluded that education level of human capital is a necessary precondition for the adoption and implementation of new technologies.

The research conducted by Bloomstrom, Lipsey, and Zejan (1994) established great significance of inflow of FDI (as a form of transfer of intangible assets) in accelerating the economic growth of developing countries with higher income in the analyzed period from 1960 to 1980. They proved that the inflow of FDI has a positive effect on economic growth in the countries that have crossed a certain threshold of economic and technological development and could therefore successfully adopt and implement the transferred modern technology.

In his study De Mello (1997) pointed out two ways in which FDI affect economic growth. One ways is that FDI boost implementation of new technologies in the production process while the other way is that FDI stimulate knowledge transfer through education and acquiring new knowledge and skills of the labor force. A survey conducted by the OECD (2002) verifies De Mello's

hypotheses. Eleven of fourteen studies confirmed that FDI have a positive impact on the growth of income and productivity.

The increase in the inflow of FDI has a positive effect on economic growth and this effect is more pronounced in countries where institutions are more effective in protecting intellectual property rights (IPRs) and in which bureaucracy is more efficient, which indirectly facilitates the adoption of modern technologies (Olofsdotter, 1998). One of the most important roles in the process of transfer of modern technology is that of IPRs and it is, therefore, necessary to examine whether there is a need for limiting the system of protection of IPRs where such restrictions may stimulate or enhance the process of international transfer of modern technology.

Economic theory for a long time emphasized the importance of R&D, education, and acquired knowledge and skills of employees as important and necessary preconditions for competitiveness and economic growth (Aghion and Howitt, 1998). An educated labor force adopts and implements modern technology more easily and quickly, and there are many empirical researches that confirm this point. Barro and Sala-i-Martin (1995) proved that the level of education of the labor force and public sector investments in R&D have a positive impact on the growth of real per capita income. Benhabib and Spiegel (1994) concluded that level of education has a positive effect on economic growth, primarily through technological innovation and speed of adoption and implementation of new technologies. Improved educational structure of the population and labor force improves the attractiveness of a country to foreign investors (Sachs et al., 1999). Improved education of the labor force facilitates the adoption and development of modern technological and organizational solutions (Semjen and Toth, 2002). Tondl and Vukšić (2003) found in their study that in most of the transition countries in Central and Eastern Europe the higher level of secondary education has no significant impact on economic growth while tertiary education significantly facilitates the adoption and implementation of modern technology.

The role of R&D and education level of the labor force is different for developed and developing countries. Developed countries make greater investments in R&D and education what ultimately results in an increase in the number of innovations, i.e. protected intellectual property while in developing countries investments in these activities serve to facilitate the process of international transfer of technology (Bassanini et al., 2000). These hypotheses can also be applied on transition countries.

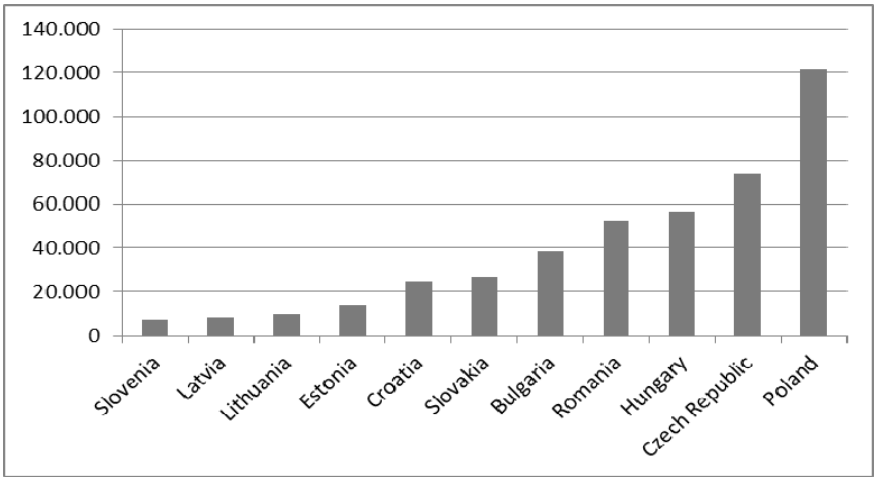
# 3. ANALYSIS OF FDI, TECHNOLOGY TRANSFER AND ECONOMIC GROWTH OF EU TRANSITION COUNTRIES AND THE REPUBLIC OF CROATIA

In this section of the paper the following variables were analyzed: FDI, technology transfer indicators (intellectual property – granted patents, registered trademarks, investments in R&D, investments by the public and private sector in education) in the EU Transition countries and the Republic of Croatia in the period from 2001 to 2010. For the purpose of the research presented in this paper, economic growth is observed through the impact of analyzed variables on the increase, i.e. decrease of the GDP, what represents the most general indicator of economic growth in a certain country.

The inflow of FDI in EU Transition countries and the Republic of Croatia in the period between 2001 and 2010 is presented in the following figure.

Figure 1

FDI in EU Transition countries and the Republic of Croatia from 2001 to 2010 (in mil. EUR)




*Source: Croatian National Bank, adapted by authors*

In the analyzed period Poland recorded the highest inflow of FDI, followed by the Czech Republic, Romania, Bulgaria, and Hungary. There was a significant increase in the total inflow of FDI observing individual countries or observing total inflow of all transition countries in the analyzed period. This can also be interpreted in the way that, after the year 2000, the EU Transition countries realized the potential benefits of inflows of FDI on economic growth and started to actively pursue policies of attracting FDI.

The Republic of Croatia is in the 7th place, and does not record a significant lag behind Slovakia which took the 6th place, but it significantly lags behind the Czech Republic, Romania, Bulgaria, and Hungary.

In the analysis of technology transfer many indicators can be used (indicators of innovation, intellectual property indicators, indicators of education, etc.) and the impact of these indicators also affects the economic growth of a particular country. For the purpose of this paper the selected indicators (granted patents, investment in R&D, and investment in education by the private and public sector) have been analyzed since these indicators are considered relevant for technology transfer process.

The number of granted patents in the EU Transition countries and the Republic of Croatia in the analyzed period from 2001 to 2010 is presented in the following table.

Table 1

Granted patents in the EU Transition countries and the Republic of Croatia from 2001 to 2010

| Country | Total (2001-2010) | % |
|---|---|---|
| Hungary | 416 | 29 |
| Czech Republic | 279 | 19 |
| Slovenia | 232 | 16 |
| Poland | 206 | 14 |
| **Croatia** | **104** | **7** |
| Slovakia | 73 | 5 |
| Bulgaria | 38 | 3 |
| Estonia | 34 | 2 |
| Romania | 30 | 2 |
| Latvia | 21 | 1 |
| Lithuania | 6 | 0 |
| **Total** | **1439** | **100** |

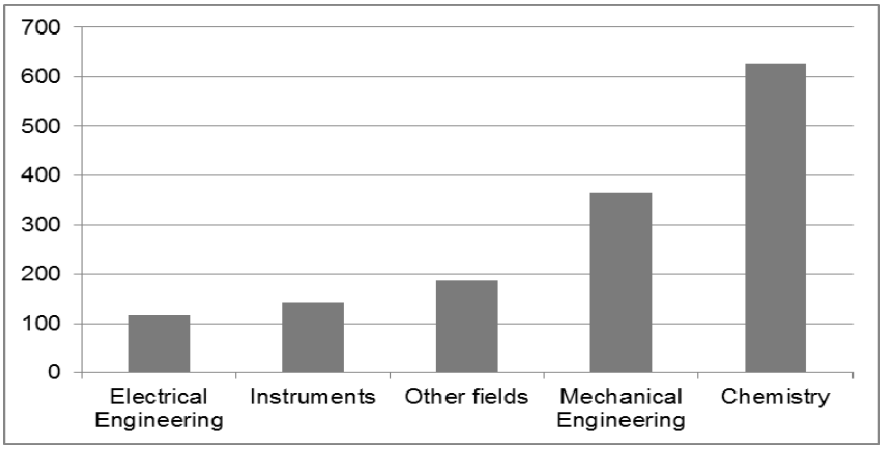
*Source: EPO; adapted by authors*

By far the greatest number of granted patents in the analyzed period was recorded in Hungary (416), followed by the Czech Republic (279), Slovenia (232), and Poland (206). With 104 granted patents Croatia is ranked among the top five countries just behind Poland, but with a large detachment from the next country on the list. With only six total granted patents Lithuania is at the very bottom of the list.

The following figure shows the number of granted patents by technology field in EU Transition countries and the Republic of Croatia in the analyzed period from 2001 to 2010.

Figure 2

Granted patents by technology field in the EU Transition countries and the Republic of Croatia from 2001 to 2010




*Source: EPO; adapted by authors*

It is evident that from the total of 1439 granted patents the largest number of granted patents comes from the field of chemistry (626) in relation to the fields of electrical engineering (117), instruments (142), mechanical engineering (366), and other fields (188).

The next analyzed indicator is total investment in R&D measured as a share of GDP. Investments in R&D of EU Transition countries and the Republic of Croatia in the analyzed period from 2001 to 2010 are presented in the following table.

Table 2

Total investment in R&D of the EU Transition countries and the Republic of Croatia from 2001 to 2010[1] (% of GDP)

| Country | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Slovenia | 1,49 | 1,47 | 1,27 | 1,39 | 1,44 | 1,56 | 1,45 | 1,65 | 1,86 | 2,11 | 1,57 |
| Czech Republic | 1,16 | 1,15 | 1,20 | 1,20 | 1,35 | 1,49 | 1,48 | 1,41 | 1,48 | 1,56 | 1,35 |
| Estonia | 0,70 | 0,72 | 0,77 | 0,85 | 0,93 | 1,13 | 1,08 | 1,28 | 1,43 | 1,62 | 1,05 |
| Hungary | 0,93 | 1,00 | 0,94 | 0,88 | 0,94 | 1,01 | 0,98 | 1,00 | 1,17 | 1,16 | 1,00 |
| **Croatia** | - | **0,96** | **0,96** | **1,05** | **0,87** | **0,75** | **0,80** | **0,89** | **0,83** | **0,73** | **0,78** |
| Lithuania | 0,67 | 0,66 | 0,67 | 0,75 | 0,75 | 0,79 | 0,81 | 0,79 | 0,83 | 0,79 | 0,75 |
| Poland | 0,62 | 0,56 | 0,54 | 0,56 | 0,57 | 0,56 | 0,57 | 0,60 | 0,68 | 0,74 | 0,60 |
| Slovakia | 0,63 | 0,57 | 0,57 | 0,51 | 0,51 | 0,49 | 0,46 | 0,47 | 0,48 | 0,63 | 0,53 |
| Latvia | 0,41 | 0,42 | 0,38 | 0,42 | 0,56 | 0,70 | 0,60 | 0,62 | 0,46 | 0,60 | 0,52 |
| Bulgaria | 0,46 | 0,48 | 0,48 | 0,49 | 0,46 | 0,46 | 0,45 | 0,47 | 0,53 | 0,60 | 0,49 |
| Romania | 0,39 | 0,38 | 0,39 | 0,39 | 0,41 | 0,45 | 0,52 | 0,58 | 0,47 | 0,47 | 0,45 |

*Source: Eurostat; adapted by authors*

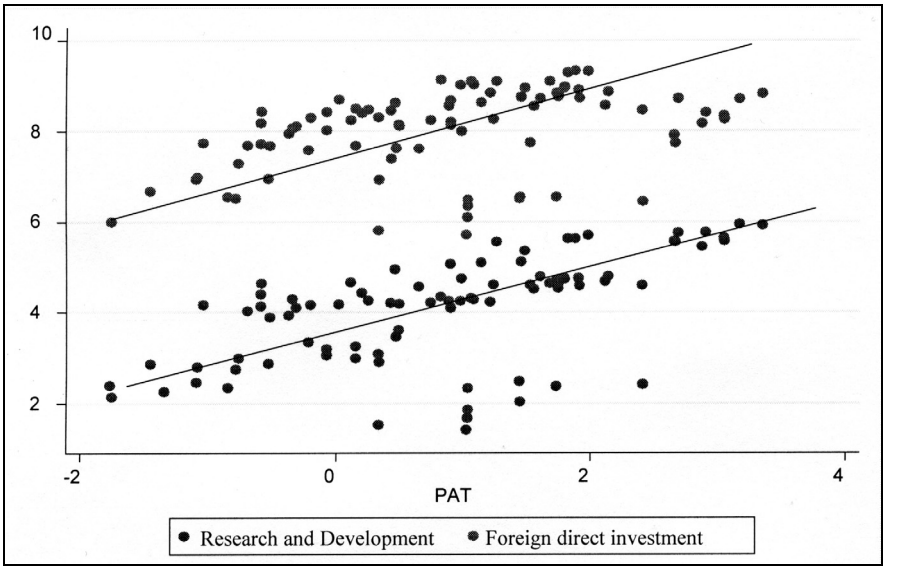
Slovenia realized the largest investments in R&D among the EU Transition countries and the highest investment occurred in 2010 (2,11% of total GDP) what is also the highest investment of all the individual EU Transition countries in the analyzed period. It is followed by the Czech Republic with 1,35%, Estonia with 1,05%, and Hungary with 1%. The Republic of Croatia is in the high fifth place with average allocation of 0,78% GDP in the analyzed period, but this still represents a relatively small share of investment in R&D. Investment in R&D is very important for every country because it creates new knowledge and technologies that indirectly affect economic growth.

The following figure presents the relationship between FDI, investment in R&D and the number of granted patents in the EU Transition countries and the Republic of Croatia.

[1] There are no available data for the Republic of Croatia in 2001.

Figure 3

Interdependence of FDI, investments in R&D and granted patents in the EU Transition countries and the Republic of Croatia from 2001 to 2010 (in logs)




*Source: Authors*

For both groups of countries there is a positive correlation between investment in R&D and FDI on the one hand and the number of granted patents as indicators of transfer of technology and technological level of certain countries on the other. The correlation coefficient of FDI over investments into R&D is 0,85 and for FDI over granted patents is 0,22. The correlation coefficient of granted patents over investments into R&D is 0,49.

The following analyzed indicator is investments in education of public and private sector of the EU Transition countries and the Republic of Croatia in the analyzed period from 2001 to 2010, which is presented in the following table.

Table 3

Investments of Public and Private Sector in education of EU Transition countries and the Republic of Croatia from 2001 to 2010 (% of GDP)

| **Country** | **PUBLIC SECTOR (2001 – 2010)** | **PRIVATE SECTOR (2001 – 2010)** |
|---|---|---|
| Bulgaria | 4,15 | 0,62 |
| Czech Republic | 4,16 | 0,47 |
| Estonia | 5,21 | 0,19 |
| **Croatia** | **3,58** | **0,21** |
| Latvia | 5,39 | 0,71 |
| Lithuania | 5,20 | 0,39 |
| Hungary | 5,36 | 0,36 |
| Poland | 5,27 | 0,55 |
| Romania | 2,83 | 0,15 |
| Slovakia | 3,97 | 0,53 |
| Slovenia | 5,63 | 0,76 |

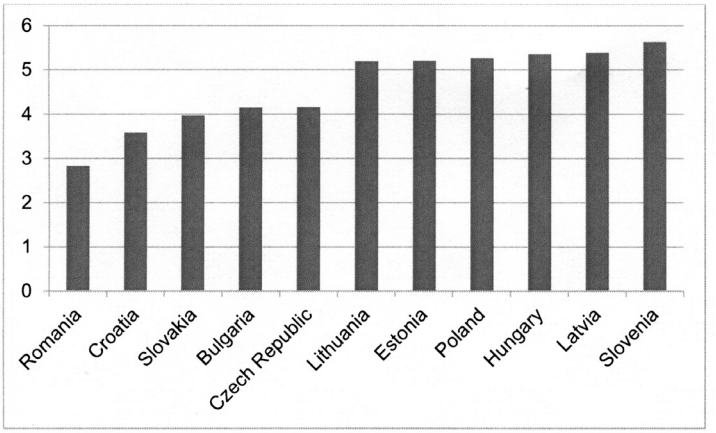
*Source: Eurostat; adapted by authors*

From the analysis of investment in education of the public and private sector of the EU Transition countries and the Republic of Croatia it is evident that they significantly lag behind other countries, except for Slovenia and Latvia which are ranked highly in terms of investments of the private sector in education. In comparison with other EU Transition countries the Republic of Croatia is at the very bottom in terms of investments of both public and private sector in education what can greatly affect its ability not only to acquire new knowledge and technologies, but also to create and develop them.

The following two figures clearly show which EU Transition countries, including the Republic of Croatia, realized the highest investments in education of public and private sector in the analyzed period from 2001 to 2010.

Figure 4

Investment in education of Public Sector of EU Transition countries and the Republic of Croatia from 2001 to 2010 (% of GDP)

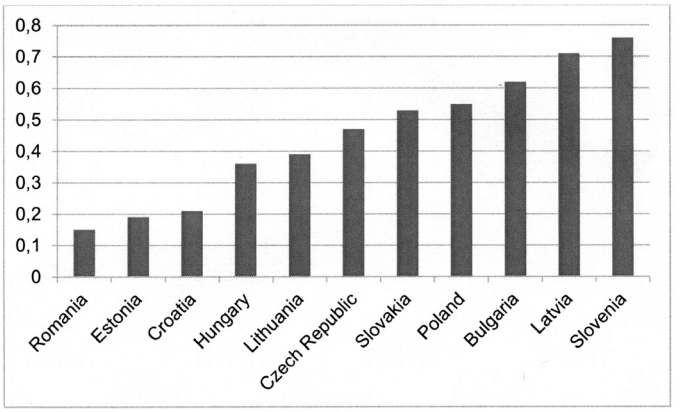



*Source: Eurostat; adapted by authors*

Among the EU Transition countries Slovenia takes the first place in terms of allocations of the public sector for education in the analyzed period with 5,63% of GDP. It is followed by Latvia with 5,39%, Hungary with 5,36%, Poland with 5,27%, Estonia with 5,21%, and Lithuania with 5,20% of GDP. These countries have in common that investments of the public sector in education in the analyzed period amounted over 5% of GDP. Croatia is at the penultimate**,** tenth place with 3,58% of GDP ahead of Romania, ranked last, who allocated only 2,83% of GDP.

Figure 5

Investment in education of the Private sector of the EU Transition countries and the Republic of Croatia from 2001 to 2010 (% of GDP)




*Source: Eurostat; adapted by authors*

As in the case with the public sector Slovenia is also at the first place in terms of investments of the private sector in education in the analyzed period with 0,76% of GDP. Latvia is at the second place with 0,71%, followed by Bulgaria with 0,62%, Poland with 0,55%, and Slovakia with 0,53% of GDP. Croatia is ranked at the bottom of the list also in terms of investments of the private sector, i.e. it is ranked 9th with only 0,21% of GDP.

The analyzed indicators also have an influence on the ranking of the EU transition countries and the Republic of Croatia on the global competitiveness list.

In the analysis of competitiveness of individual countries in the context of economic growth, one that should be taken into consideration is the Global Competitiveness Index published by the World Economic Forum.

The Global Competitiveness Index is based on the analysis of 12 pillars of competitiveness grouped into three different groups:

Group 1 – **Basic Requirements**: institutions, infrastructure, macroeconomic stability, health care and primary education;

Group 2 – **Terms of Efficiency**: higher education and training, market efficiency of goods and services, labor market efficiency, financial market development, technological readiness and market size; and

Group 3 – **Terms of Innovation**: business sophistication and innovation.[2]

The following table shows the ranking of transition EU Member States and the Republic of Croatia according to Competitiveness Index in the analyzed period from 2001 to 2010.

Table 4

Ranking of EU Transition countries and the Republic of Croatia according to the Global Competitiveness Index from 2001 to 2010

| Rank | Country | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 13 | Estonia | 29 | 26 | 22 | 20 | 20 | 25 | 27 | 32 | 35 | 33 |
| 18 | Slovenia | 31 | 28 | 31 | 32 | 32 | 33 | 39 | 42 | 37 | 45 |
| 19 | Czech Republic | 37 | 40 | 39 | 38 | 38 | 29 | 33 | 33 | 31 | 36 |
| 20 | Lithuania | 43 | 36 | 40 | 43 | 43 | 40 | 38 | 44 | 53 | 47 |
| 21 | Hungary | 28 | 29 | 33 | 39 | 39 | 41 | 47 | 62 | 58 | 52 |
| 23 | Slovakia | 40 | 49 | 43 | 41 | 41 | 37 | 41 | 46 | 47 | 60 |
| 24 | Poland | 41 | 51 | 45 | 51 | 51 | 48 | 51 | 53 | 46 | 39 |
| 25 | Latvia | 47 | 44 | 37 | 44 | 44 | 36 | 45 | 54 | 68 | 70 |
| **27** | **Croatia** | **-** | **58** | **53** | **62** | **62** | **51** | **57** | **61** | **72** | **77** |
| 28 | Romania | 56 | 66 | 75 | 67 | 67 | 68 | 74 | 68 | 64 | 67 |
| 29 | Bulgaria | 59 | 62 | 64 | 58 | 58 | 72 | 79 | 76 | 76 | 71 |

*Source: World Economic Forum, adapted by authors*

[2] According to the above-mentioned terms, ranks are determined (between 1 and 10) according to which the ranking of countries on global competitiveness list is further established.

Among the EU Transition countries comparing them according to their rank on the Global Competitiveness list the best-ranked are Estonia (the 13th place), Slovenia (the 18th place), Czech Republic (the 19th place), Lithuania (the 20th place), and Hungary (the 21st place). The Republic of Croatia is, unfortunately, at the very bottom of the list in the 27th place. The last ones are Romania (the 28th place), and Bulgaria, in the last, 29th place. The ranking of all EU Member States and the Republic of Croatia according to the Global Competitiveness Index in the analyzed period from 2001 to 2010 is presented in the table in the Appendix to this paper.

# 4. DISCUSSION AND CONCLUSION

In order to attract the FDI, the EU Transition countries and the Republic of Croatia should provide to foreign investors a stable macroeconomic environment, non-discriminatory regulatory environment, removal of administrative barriers, adequate infrastructure and human capital. It is also necessary to develop and implement policies that would benefit from the inflow of FDI in terms of technological progress. Therefore, there is a need to create an appropriate National Innovation System that should provide the basis and guidelines for future activities aimed at improving the innovation culture and innovation potential.

Investments in R&D are an important factor in a successful process not only of transfer of new knowledge and technology, but also of creating and developing one's own. R&D can create new knowledge and technologies that can be further protected by an adequate form of intellectual property (primarily by patents) if they are unique and specific products and services. In general, the EU Transition countries do not invest much in R&D in comparison with developed countries and, for this reason, the EU Transition countries as well as Croatia should increase their investments in R&D in both public and private sector in the areas in which they are able to gain competitive advantages. In order to fully achieve a maximum effect of investment in R&D of public and private sector it is necessary for the EU Transition countries and Croatia to make an in-depth analysis and thus gain an insight in the fields in which they can create competitive products and services and then focus their R&D thereon. Also, such a detailed analysis will determine whether the EU Transition countries and Croatia should invest more in basic or applied research.

Educational structure of the labor force in line with economic needs is an important factor of competitiveness and economic growth and is also an important precondition of international transfer of modern technology. A successful process of transfer of modern technology in a certain country, including the EU Transition countries and Croatia, largely depends on the quality and the possibilities for the adoption and implementation of new knowledge and

technologies. This primarily relates to the education level of the labor force as one of the main factors in the process of technology transfer. Either through the reform of the education system or by other measures the EU Transition countries and Croatia should encourage and guide those levels of education (secondary and tertiary) which will by their quality contribute to the achievement of a maximum effect not only of adoption of modern technologies, but also on creation of new ones through R&D.

Indicator of the competitiveness of a certain country is complex and based on several factors, including the factors analyzed in this paper. The EU Transition countries are, like Croatia, mainly in the lower part of the ranking list in comparison with other EU Member States. Therefore, in terms of competitiveness indicator each indicator should be analyzed in detail and from all aspects (competitiveness ranking is based on the analysis of 12 different pillars of competitiveness, and competitiveness index is calculated from 24 different indicators) in order to identify strengths and weaknesses of each indicator. Various stimulation measures and policies could thus have an influence on improvement of poor indicators, improvement of the position of EU Transition countries and Croatia, and then also on economic growth.

FDI are an important source of financing of capital needs of transition countries, and is also an effective way to transfer modern technology from more developed countries to countries with a lower rate of economic growth. The transferred technology does not only include capital and expertise, but also knowledge and skills necessary for the transferred technology to be adequately adopted and implemented and, ultimately, stimulate economic growth.

In order to fully realize the positive effects of FDI certain preconditions should be fulfilled. FDI will have a positive impact on economic growth in those countries that have a high level of appropriate educated human capital and where institutions are more effective in protecting IPRs. The educational structure of the labor force in line with the needs of the economy is an important factor of competitiveness and economic growth, but also an important precondition for international transfer of modern technology. Investments in R&D in public and private sector indirectly affect the increase in the number of protected intellectual property (particularly patents), what has a positive effect on GDP growth, i.e. the economic growth. In general, higher investments in education and R&D create new knowledge and technologies which can result in an increased number of protected intellectual property. Commercialization of protected intellectual property generates revenues affecting the increase in total revenues, and thus to an increase in GDP of a certain country i.e. economic growth.

FDI are extremely important for a successful process of transfer of modern technology in the EU Transition countries and Croatia due to the relatively undeveloped scientific research infrastructure and lack of budgetary resources to finance investments in R&D. It can therefore be concluded that the need for FDI as well as the process of transfer of modern technology in the EU

Transition countries and Croatia still exists, considering that these countries are still relatively low compared to the technological level of the developed EU Member States.

The impact and strengthening of the government institutions and the private sector is extremely important not only to improve the competitiveness and economic growth in EU Transition countries and Croatia, but also to encourage and facilitate the process of international transfer of modern technology.

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Appendix 1

Ranking of EU Member States and the Republic of Croatia according to the Global Competitiveness Index from 2001 to 2010[3]

| | 2001 | 2002 | 2003 | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | Average |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Finland | **1** | 2 | **1** | **1** | **1** | 2 | 6 | 6 | 6 | 7 | 3 |
| Sweden | 9 | 5 | 3 | 3 | 3 | 3 | 4 | 4 | 4 | 2 | 4 |
| Denmark | 14 | 10 | 4 | 4 | 4 | 4 | 3 | 3 | 5 | 9 | 6 |
| Netherlands | 8 | 15 | 12 | 11 | 11 | 9 | 10 | 8 | 10 | 8 | 10 |
| Germany | 17 | 14 | 13 | 15 | 15 | 8 | 5 | 7 | 7 | 5 | 11 |
| Norway | - | 9 | 9 | 9 | 9 | 12 | 16 | 15 | 14 | 14 | 11 |
| Great Britain | 12 | 11 | 15 | 13 | 13 | 10 | 9 | 12 | 13 | 12 | 12 |
| Austria | 18 | 18 | 17 | 21 | 21 | 17 | 15 | 14 | 17 | 18 | 18 |
| Luxembourg | - | - | 21 | 25 | 25 | 22 | 25 | 25 | 21 | 20 | 18 |
| France | 20 | 30 | 26 | 30 | 30 | 18 | 18 | 16 | 16 | 15 | 22 |
| Belgium | 19 | 25 | 27 | 31 | 31 | 20 | 20 | 19 | 18 | 19 | 23 |
| Ireland | 11 | 24 | 30 | 26 | 26 | 21 | 22 | 22 | 25 | 29 | 24 |
| Estonia | 29 | 26 | 22 | 20 | 20 | 25 | 27 | 32 | 35 | 33 | 27 |
| Cyprus | - | - | - | 34 | 34 | 46 | 55 | 40 | 34 | 40 | 28 |
| Spain | 22 | 22 | 23 | 29 | 29 | 28 | 29 | 29 | 33 | 42 | 29 |
| Portugal | 25 | 23 | 25 | 22 | 22 | 34 | 40 | 43 | 43 | 46 | 32 |
| Malta | - | - | 19 | 35 | 35 | 39 | 56 | 52 | 52 | 50 | 34 |
| Slovenia | 31 | 28 | 31 | 32 | 32 | 33 | 39 | 42 | 37 | 45 | 35 |
| Czech Republic | 37 | 40 | 39 | 38 | 38 | 29 | 33 | 33 | 31 | 36 | 35 |
| Lithuania | 43 | 36 | 40 | 43 | 43 | 40 | 38 | 44 | 53 | 47 | 43 |
| Hungary | 28 | 29 | 33 | 39 | 39 | 41 | 47 | 62 | 58 | 52 | 43 |
| Italy | 26 | 39 | 41 | 47 | 47 | 42 | 46 | 49 | 48 | 48 | 43 |
| Slovakia | 40 | 49 | 43 | 41 | 41 | 37 | 41 | 46 | 47 | 60 | 45 |
| Poland | 41 | 51 | 45 | 51 | 51 | 48 | 51 | 53 | 46 | 39 | 48 |
| Latvia | 47 | 44 | 37 | 44 | 44 | 36 | 45 | 54 | 68 | 70 | 49 |
| Greece | 36 | 38 | 35 | 46 | 46 | 47 | 65 | 67 | 71 | 83 | 53 |
| **Croatia** | **-** | **58** | **53** | **62** | **62** | **51** | **57** | **61** | **72** | **77** | **55** |
| Romania | 56 | 66 | 75 | 67 | 67 | 68 | 74 | 68 | 64 | 67 | 67 |
| Bulgaria | 59 | 62 | 64 | 58 | 58 | 72 | 79 | 76 | 76 | 71 | 68 |
| EU average | 24 | 27 | 28 | 31 | 31 | 30 | 34 | 35 | 35 | 37 | 31 |

*Source: World Economic Forum, adapted by authors*

[3] Due to the unavailability of data for certain countries for certain years (Norway, Luxembourg, Cyprus, Malta, and Croatia), there was the possibility of changing the order; however, after the analysis was conducted, it was established that unavailability of data had no significant impact on the ranking of countries.

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# TRANSFER TEHNOLOGIJE, IZRAVNA STRANA ULAGANJA I GOSPODARSKI RAST U ZEMLJAMA U TRANZICIJI U EUROPSKOJ UNIJI I U REPUBLICI HRVATSKOJ

***Sažetak***

*Važnost tehnologije u poticanju gospodarskog rasta bila je predmet mnogih istraživanja s obzirom da je tehnologija jedan od ključnih čimbenika gospodarskoga rasta. Inozemne direktne investicije predstavljaju jedan od najučinkovitijih način transfera suvremene tehnologije i imaju pozitivan učinak na gospodarski rast. U ovom radu analiziran je utjecaj inozemnih direktnih investicija i pokazatelja transfera tehnologije i konkurentnosti na gospodarski rast tranzicijskih zemalja članica EU i Republike Hrvatske u razdoblju od 2001. do 2010. godine. Analizirane su varijable inozemnih direktnih investicija, pokazatelji transfera tehnologija (varijable, priznati patenti, ulaganja u istraživanje i razvoj, ulaganja u obrazovanje) i njihov utjecaj na varijablu bruto domaćeg proizvoda (BDP). Rezultati su pokazali da postoji pozitivna veza između inozemnih direktnih investicija i pokazatelja transfera tehnologije na BDP, kao temeljnog pokazatelja gospodarskog rasta, što se odnosi i na tranzicijske zemlje članice EU i Republiku Hrvatsku.*

***Ključne riječi: inozemne direktne investicije, transfer tehnologije, konkurentnost, gospodarski rast, tranzicijske zemlje, Republika Hrvatska***

***JEL klasifikacija: F21, O32***